

THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Legal Compilation

Statutes and Legislative History

Executive Orders

Regulations

Guidelines and Reports



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JANUARY 1973

WILLIAM D. RUCKELSHAUS
Administrator

U.S. Environmental Protection Agency
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FOREWORD

It has been said that America is like a gigantic boiler in that once the fire is lighted, there are no limits to the power it can generate. Environmentally, the fire has been lit.

With a mandate from the President and an aroused public concerning the environment, we are experiencing a new American Revolution, a revolution in our way of life. The era which began with the industrial revolution is over and things will never be quite the same again. We are moving slowly, perhaps even grudgingly at times, but inexorably into an age when social, spiritual and aesthetic values will be prized more than production and consumption. We have reached a point where we must balance civilization and nature through our technology.

The U.S. Environmental Protection Agency, formed by Reorganization Plan No. 3 of 1970, was a major commitment to this new ethic. It exists and acts in the public's name to ensure that due regard is given to the environmental consequences of actions by public and private institutions.

In a large measure, this is a regulatory role, one that encompasses basic, applied, and effects research; setting and enforcing standards; monitoring; and making delicate risks—benefit decisions aimed at creating the kind of world the public desires.

The Agency was not created to harass industry or to act as a shield behind which man could wreak havoc on nature. The greatest disservice the Environmental Protection Agency could do to American industry is to be a poor regulator. The environment would suffer, public trust would diminish and instead of free enterprise, environmental anarchy would result.

It was once sufficient that the regulatory process produce wise and well-founded courses of action. The public, largely indifferent to regulatory activities, accepted agency actions as being for the "public convenience and necessity." Credibility gaps and cynicism make it essential not only that today's decisions be wise and well-founded but that the public know this to be true. Certitude, not faith, is *de rigueur*.

In order to participate intelligently in regulatory proceedings, the citizen should have access to the information available to the agency. EPA's policy is to make the fullest possible disclosure of information,

without unjustifiable expense or delay, to any interested party. With this in mind, the EPA Compilation of Legal Authority was produced not only for internal operations of EPA, but as a service to the public, as we strive together to lead the way, through the law, to preserving the earth as a place both habitable by and hospitable to man.

WILLIAM D. RUCKELSHAUS,
Administrator
U.S. Environmental Protection Agency

PREFACE

Reorganization Plan No. 3 of 1970 transferred 15 governmental units with their functions and legal authority to create the U.S. Environmental Protection Agency. Since only the major laws were cited in the Plan, the Administrator, William D. Ruckelshaus, requested that a compilation of EPA legal authority be researched and published.

The publication has the primary function of providing a working document for the Agency itself. Secondly, it will serve as a research tool for the public.

A permanent office in the Office of Legislation has been established to keep the publication updated by supplements.

It is the hope of EPA that this set will assist in the awesome task of developing a better environment.

LANE WARD, J.D.,
Assistant Director for Field Operations
Office of Legislation
U.S. Environmental Protection Agency.

ACKNOWLEDGMENT

The idea of producing a compilation of the legal authority of EPA was conceived and commissioned by William D. Ruckelshaus, Administrator of EPA. The production of this compilation involved the cooperation and effort of numerous sources, both within and outside the Agency. The departmental libraries at Justice and Interior were used extensively; therefore we express our appreciation to Marvin P. Hogan, Librarian, Department of Justice; Arley E. Long, Land & Natural Resources Division Librarian, Department of Justice; Frederic E. Murray, Assistant Director, Library Services, Department of the Interior.

For exceptional assistance and cooperation, my gratitude to: Gary Baise, formerly Assistant to the Administrator, currently, Director, Office of Legislation, who first began with me on this project; A. James Barnes, Assistant to the Administrator; K. Kirke Harper, Jr., Special Assistant for Executive Communications; John Dezzutti, Administrative Assistant, Office of Executive Communications; Roland O. Sorensen, Chief, Printing Management Branch, and Jacqueline Gouge and Thomas Green, Printing Management Staff; Ruth Simpkins, Janis Collier, Wm. Lee Rawls, James G. Chandler, Jeffrey D. Light, Randy Mott, Thomas H. Rawls, and John D. Whittaker, Peter J. McKenna, Linda L. Payne, John M. Himmelberg, and Dana W. Smith, a beautiful staff who gave unlimited effort; and to many others, behind the scenes who rendered varied assistance.

LANE WARD, J.D.,
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Office of Legislation
U.S. Environmental Protection Agency.

INSTRUCTIONS

The goal of this text is to create a useful compilation of the legal authority under which the U.S. Environmental Protection Agency operates. These documents are for the general use of personnel of the EPA in assisting them in attaining the purposes set out by the President in creating the Agency. This work is not intended and should not be used for legal citations or any use other than as reference of a general nature. The author disclaims all responsibility for liabilities growing out of the use of these materials contrary to their intended purpose. Moreover, it should be noted that portions of the Congressional Record from the 92nd Congress were extracted from the "unofficial" daily version and are subject to subsequent modification.

EPA Legal Compilation consists of the Statutes with their legislative history, Executive Orders, Regulations, Guidelines and Reports. To facilitate the usefulness of this composite, the Legal Compilation is divided into the eight following chapters:

- | | |
|----------------|------------------|
| A. General | E. Pesticides |
| B. Air | F. Radiation |
| C. Water | G. Noise |
| D. Solid Waste | H. International |

WATER

The chapter labeled "Water" and color coded blue contains the legal authority of the Agency as it applies to water pollution abatement. It is well to note that any law which is applicable to more than one chapter of the compilation will appear in each of the chapters; however, its legislative history will be cross referenced into the "General" chapter where it is printed in full.

SUBCHAPTERS:

Statutes and Legislative History

For convenience, the Statutes are listed throughout the Compilation by a one-point system, i.e., 1.1, 1.2, 1.3, etc., and Legislative History begins wherever a letter follows the one-point system.

Thusly, any 1.1a, 1.1b, 1.2a, etc., denotes the public laws comprising the 1.1, 1.2 statute. Each public law is followed by its legislative history. The legislative history in each case consists of the House Report, Senate Report, Conference Report (where applicable), the Congressional Record beginning with the time the bill was reported from committee.

Example: 1.4 Amortization of Pollution Control Facilities, as amended, 26 U.S.C. §169 (1969).

1.4a Amortization of Pollution Control Facilities, December 30, 1969, P.L. 91-172, §704, 83 Stat. 667.

- (1) House Committee on Ways and Means, H.R. REP. No. 91-413 (Part I), 91st Cong., 1st Sess. (1969).
- (2) House Committee on Ways and Means, H.R. REP. No. 91-413 (Part II), 91st Cong., 1st Sess. (1969).
- (3) Senate Committee on Finance, S. REP. No. 91-552, 91st Cong., 1st Sess. (1969).
- (4) Committee of Conference, H.R. REP. No. 91-782, 91st Cong., 1st Sess. (1969).
- (5) Congressional Record, Vol. 115 (1969):
 - (a) Aug. 7: Debated and passed House, pp. 22746, 22774-22775;
 - (b) Nov. 24, Dec. 5, 8, 9: Debated and passed Senate, pp. 35486, 37321-37322, 37631-37633, 37884-37888;
 - (c) Dec. 22: Senate agrees to conference report, p. 40718;*
 - (d) Dec. 22: House debates and agrees to conference report, pp. 40820, 40900.

This example not only demonstrates the pattern followed for legislative history, but indicates the procedure where only one section of a public law appears. You will note that the Congressional Record cited pages are only those pages dealing with the discussion and/or action taken pertinent to the section of law applicable to EPA. In the event there is no discussion of the pertinent section, only action or passage, then the asterisk (*) is used to so indicate, and no text is reprinted in the Compilation. In regard to the situation where only one section of a public law is applicable, then only the parts of the report dealing with same are printed in the Compilation.

Secondary Statutes

Many statutes make reference to other laws and rather than have this manual serve only for major statutes, these secondary statutes have been included where practical. These secondary statutes are indicated in the table of contents to each chapter by a bracketed cite to the particular section of the major act which made the reference.

Citations

The United States Code, being the official citation, is used throughout the Statute section of the compilation. In four Statutes, a parallel table to the Statutes at Large is provided for your convenience.

TABLE OF STATUTORY SOURCE

	STATUTES	SOURCE
1.1	River and Harbor Act of 1899, 33 U.S.C. §§403, 407, 411 (1899).	E.O. 11574 sets out EPA's function under this Act.
1.2	Federal Water Pollution Control Act, as amended, 33 U.S.C. §1151 <i>et seq.</i> (1970).	Transferred to EPA in Reorg. Plan No. 3 of 1970.
1.3	Pollution of the Sea by Oil, as amended, 33 U.S.C. §1001 <i>et seq.</i> (1966).	Implements the Convention of
1.4	Advances of Public Moneys, Prohibition Against, as revised, 31 U.S.C. §529 (1946).	Referred to in the Federal Water Pollution Control Act at §1155(g) (3) (A).
1.5	Public Contracts, Advertisements for Proposals for Purchases and Contracts for Supplies or Services for Government Departments; App Application to Government Sales and Contracts to Sell and to Government Corporations, as amended, 41 U.S.C. §5 (1958).	Referred to in Federal Water Pollution Control Act in §1155(g) (3) (A).
1.6	Courts of Appeals, Certiorari; Appeal; Certified Questions, as amended, 28 U.S.C. §1254 (1948).	Referred to in the Federal Water Pollution Control Act at §1157(g) (2).
1.7	Davis-Bacon Act, as amended, 40 U.S.C. §276a-275a-5 (1964).	Referred to in the Federal Water Pollution Control Act at §1158(g).
1.8	Per Diem, Travel and Transportation Expenses; Experts and Consultants; Individuals Serving Without Pay, as amended, 5 U.S.C. §5703 (1966).	Referred to in the Federal Water Pollution Control Act at §1159(a) (2) (B), 1160(c) (4), (i).
1.9	1909 Boundry Waters Treaty Between Canada and the United States, and the Water Utilization Treaty of 1944 Between Mexico and the United States, 36 Stat. 2448 (1909), 59 Stat. 1219 (1944).	Referred to in the Federal Water Pollution Control Act at §1160(d) (2).

	STATUTES	SOURCE
1.10	Disclosure of Confidential Information Generally, as amended, 18 U.S.C. §1905 (1948).	Referred to in the Federal Water Pollution Control Act at §§1160(f) (2), (k), (1), 1163(g) (3).
1.11	Convention on the Territorial Sea and the Contiguous Zone, Article XXIV, 5 U.S.T. 1612, 1613 (1958).	Referred to in the Federal Water Pollution Control Act at §1161(a) (9).
1.12	International Convention for the Prevention of Pollution of the Sea by Oil, 1954, Article IV, as amended, 17 U.S.T. 1528 (1954).	Referred to in the Federal Water Pollution Control Act at §1161(b) (2) (A).
1.13	Granting Clearances, as amended, 46 U.S.C. §91 (1951).	Referred to in the Federal Water Pollution Control Act at §1161(b) (5).
1.14	Outer Continental Shelf Lands Act, as amended, 43 U.S.C. §1331 <i>et seq.</i> (1953).	Referred to in the Federal Water Pollution Control Act at §1161(i) (2).
1.15	Administrative Procedure Act, as amended, 5 U.S.C. §§551-559, 701-705 (1968).	Referred to in the Federal Water Pollution Control Act at §§1162(b), 1163(e).
1.16	Higher Education General Provision, Definitions, as amended, 20 U.S.C. §1141 (1970).	Referred to in the Federal Water Pollution Control Act at §1169(1) (B).
1.17	National Environmental Policy Act of 1969, 42 U.S.C. §4321 <i>et seq.</i> (1970).	Direct reference in the Reorg. Plan No. 3 of 1970.
1.18	Public Health Service Act, as amended, 42 U.S.C. §§241, 243, 246 (1970).	Directly cited in Reorg. Plan No. 3 of 1970.
1.19	The Water Resource Planning Act, as amended, 42 U.S.C. §1962 <i>et seq.</i> (1970).	E.O. 11613.
1.20	Appalachian Regional Development Act of 1965, as amended, 40 App. U.S.C. §§212, 214 (1971).	All functions of the Secretary of the Interior and the Department of the Interior administrative to the Federal Water Quality Administration, all functions which were transferred to the Secretary of the Interior by Reorg. Plan No. 2 of 1966, and all functions vested in the Secretary of the Interior of the Department of the Interior by the Federal Water Pollution Control Act were transferred to the Administrator of the Environmental Protection Agency by Reorg. Plan No. 3 of 1970.
1.21	The Disaster Relief Act, 42 U.S.C. §4401 <i>et seq.</i> (1970).	Direct reference made to the Water Quality Administration at the Department of the Interior by E.O. 11490, §§703(3), 1102(1), 1103(2), etc., this administration being transferred to EPA through Reorg. Plan No. 3 of 1970.
1.22	Department of Transportation Act, 49 U.S.C. §1653(f) (1968).	The Federal Water Pollution Control Act in section 1153 regarding the preservation of fish and wildlife.

STATUTES	SOURCE
1.23 Federal Aid Highway Act, as amended, 23 U.S.C. §109(h) (1970).	The Act at §109(h) requires the Secretary of Transportation to consult with the appropriate agency dealing with water pollution, in this case, the Administrator of EPA, before promulgating guidelines for any proposed project on any federal aid system.
1.24 Amortization of Pollution Control Facilities, as amended, 26 U.S.C. §169(d) (1) (B), (3) (1969).	The section cited in the Act refers directly to the Federal Water Pollution Control Act and the Federal certifying authority requirement filing to the Secretary of the Interior in the case of water pollution, both functions being transferred through Reorg. Plan
1.25 Airport and Airway Development Act, 49 U.S.C. §§1712(f), 1716(c) (4), (e) (1970).	Direct reference made to water pollution and the appropriate agency to deal with same in the Act.
1.26 Interest on Certain Government Obligations, as amended, 26 U.S.C. §103 (1969).	The sections of the Act provide a tax relief on industrial development bonds for sewage or solid waste disposal facility and water pollution control facilities, at the section cited.
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Executive Orders

The Executive Orders are listed by a two-point system (2.1, 2.2, etc.). Executive Orders found in General are ones applying to more than one area of the pollution chapters.

Regulations

The Regulations are noted by a three-point system (3.1, 3.2, etc.). Included in the Regulations are those not only promulgated by the Environmental Protection Agency, but those under which the Agency has direct contact.

Guidelines and Reports

This subchapter is noted by a four-point system (4.1, 4.2, etc.). In this subchapter is found the statutorily required reports of EPA, published guidelines of EPA, selected reports other than EPA's and inter-departmental agreements of note.

UPDATING:

Periodically, a supplement will be sent to the interagency distribution and made available through the U.S. Government Printing Office in order to provide an accurate working set of EPA Legal Compilation.

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**4.2b OUR WATERS AND WETLANDS: HOW THE CORPS OF
ENGINEERS CAN HELP PREVENT THEIR DESTRUCTION
AND POLLUTION, COMMITTEE ON GOVERNMENT
OPERATIONS**

H.R. REP. No. 91-917, 91st Cong., 2d Sess. (1970)

**OUR WATERS AND WETLANDS: HOW THE CORPS OF
ENGINEERS CAN HELP PREVENT THEIR DESTRUCTION
AND POLLUTION**

MARCH 18, 1970.—Committed to the Committee of the Whole House on the
State of the Union and ordered to be printed

Mr. DAWSON, from the Committee on Government Operations,
submitted the following

TWENTY-FIRST REPORT

**BASED ON A STUDY BY THE CONSERVATION AND NATURAL
RESOURCES SUBCOMMITTEE**

On March 17, 1970, the Committee on Government Operations approved and adopted a report entitled "Our Waters and Wetlands: How the Corps of Engineers Can Help Prevent Their Destruction and Pollution." The chairman was directed to transmit a copy to the Speaker of the House.

The natural environments of our Nation's bays, estuaries, and other water bodies are being destroyed or threatened with destruction by water pollution, alteration of river courses, landfilling of the shallow and marshland areas, sedimentation, dredging, construction of piers and bulkheads, and other manmade changes. Many of these water areas, including some located near densely populated urban areas, serve public needs for recreational opportunities and provide feeding, habitat, and nesting or spawning grounds for migratory waterfowl, fish, shellfish, and other wildlife. Many Federal agencies participate in, or authorize work and activities which contribute to, the destruction of these water areas, and some agencies have specific responsibilities for preventing such pollution and destruction.

This report examines several aspects of the Corps of Engineers'

role in carrying out its responsibilities for protecting the Nation's water areas, and recommends how the Corps can stop or minimize this pollution and destruction.

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1. THE CORPS OF ENGINEERS, WHICH IS CHARGED BY CONGRESS WITH THE DUTY TO PROTECT THE NATION'S NAVIGABLE WATERS, SHOULD, WHEN CONSIDERING WHETHER TO APPROVE APPLICATIONS FOR LANDFILLS, DREDGING AND OTHER WORK IN NAVIGABLE WATERS, INCREASE ITS CONSIDERATION OF THE EFFECTS WHICH THE PROPOSED WORK WILL HAVE, NOT ONLY ON NAVIGATION, BUT ALSO ON CONSERVATION OF NATURAL RESOURCES, FISH AND WILDLIFE, AIR AND WATER QUALITY, ESTHETICS, SCENIC VIEW, HISTORIC SITES, ECOLOGY, AND OTHER PUBLIC INTEREST ASPECTS OF THE WATERWAY

The River and Harbor Act of 1899 (act of March 3, 1899, c. 425, 30 Stat. 1151), authorizes the Corps of Engineers to regulate or prevent the filling of land submerged by water at high tide. That act forbids the creation of "any obstruction not affirmatively authorized by Congress to the navigable capacity of any of the waters of the United States" (sec. 10; 33 U.S.C. sec. 403), or the discharge or deposit in navigable water or its tributaries of "any refuse matter of any kind or description whatever other than that flowing from streets and sewers and passing therefrom in a liquid state" (sec. 13; 33 U.S.C. 407), unless such work, discharge or deposit is done under a permit from the Corps of Engineers approved by the Secretary of the Army.

For many years, the Corps of Engineers administered the River and Harbor Act of 1899 with primary or exclusive emphasis on how the proposed structure or fill would affect navigation. Indeed, until about 2 years ago, the Corps' public notices announcing the filing of applications for permits to fill, dredge or construct works in navigable waters, defined the Corps' interest as being confined to issues of navigation, and requested comments from the public only on such issues.

That restricted view of the 1899 act, however, was not required by the law. As early as 1933 the Supreme Court ruled that under the 1899 act the Department of the Army may properly deny a permit to erect a structure (or to make a fill) in the Potomac River, if such permit would interfere with the public interest in having a parkway or recreation area. *United States ex rel. Greathouse v. Dern*, 289 U.S. 352 (1933).

The scope of the 1899 act was further amplified by the Fish and Wildlife Coordination Act (as amended by the act of August 12, 1958, 72 Stat. 563, Public Law 85-624; 16 U.S.C. 661). This act enunciates a national policy of "recognizing the vital contribution of our wildlife resources to the Nation, the increasing public interest and significance thereof due to expansion of our national economy and other factors, and to provide that wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs. * * *" (Sec. 1; 16 U.S.C. 661.)

To carry out that policy, section 2(a) of the act (16 U.S.C. 662(a)) directs that "whenever the waters of any stream or other body of water are proposed * * * to be impounded, diverted, the channel deepened,

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or * * * otherwise controlled or modified for any purpose whatever * * * by any public or private agency under Federal permit or license * * * such * * * agency first shall consult with the United States Fish and Wildlife Service, Department of the Interior * * * with a view to the conservation of wildlife resources by preventing loss or damage to such resources * * *."

Subsection 2(b) of the act further provides that the "reports and recommendations of the Secretary of the Interior on the wildlife aspects of such projects * * * based on surveys and investigations conducted by the United States Fish and Wildlife Service * * * for the purpose of determining means and measures that should be adopted to prevent the loss of or damage to such wildlife resources, as well as to provide concurrently for the development and improvement of such resources, shall be made an integral part of any report prepared or submitted * * * to any agency * * * having the authority * * * to authorize the construction of water-resource development projects. * * * Recommendations of the Secretary of the Interior shall be as specific as is practicable with respect to features recommended for wildlife conservation and development, * * * the results expected, and shall describe the damage to wildlife attributable to the project and the measures proposed for mitigating or compensating for these damages." The section further requires that "full consideration" must be given to the Secretary's report and recommendations "on the wildlife aspects."

The Corps' obligation to consider all facets of the public interest in protecting estuaries, rivers, lakes, and other navigable waters also arises from the national policy and directives expressed in many other statutes and Executive orders designed to minimize pollution, maximize recreation, protect esthetics, preserve natural resources, and

promote the comprehensive planning and use of water bodies to enhance the public interest rather than private gain.¹

This national policy is emphasized and more fully expounded in the National Environmental Policy Act of 1969 (Public Law 91-190, 83 Stat. 852), signed by the President on January 1, 1970. In section 102 of that act, Congress mandates (1) that “the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies” of the National Environmental Policy Act, and (2) that “all agencies of the Federal Government shall” develop procedures which will “insure that presently unquantified environmental amenities and values” be given “appropriate consider-

¹ Some of these statutes and orders are:

Federal Water Power Act of 1920, as amended (16 U.S.C. 791, et seq.);

Oil Pollution Act of 1924, as amended (33 U.S.C. 431, et seq.);

Federal Water Pollution Control Act (33 U.S.C. 466, et seq.) as amended by Water Quality Act of 1965 (Public Law 89-234; 79 Stat. 903) and Clean Water Restoration Act of 1966 (Public Law 89-753; 80 Stat. 1246);

Delaware River Basin Compact Act of September 27, 1961 (Public Law 87-328; 75 Stat. 688);

Bureau of Outdoor Recreation Act of May 28, 1963 (Public Law 88-29, 77 Stat. 49; 16 U.S.C. 460 1);

Section 212, Appalachian Regional Development Act of March 9, 1965 (79 Stat. 5, 16; Public Law 89-4; 40 U.S.C. App. sec. 212);

Water Resources Planning Act of July 22, 1965 (Public Law 89-80; 79 Stat. 244; 42 U.S.C. 1962a);

Section 702, Housing and Urban Development Act of August 10, 1965 (79 Stat. 451, 490; Public Law 89-117; 42 U.S.C. 3102);

Section 106, Public Works and Economic Development Act of August 26, 1965 (79 Stat. 552, 554; 42 U.S.C. 3136; Public Law 89-136);

Estuarine Study Act of August 3, 1968 (Public Law 90-454; 82 Stat. 625; 16 U.S.C. 1221);

National Water Commission Act of September 26, 1968 (Public Law 90-515; 82 Stat. 868; 42 U.S.C. 1962a, note);

Executive Order 11288 of July 2, 1966 (3 C.F.R. 423); superseded by Executive Order 11507 of February 4, 1970 (35 F.R. 2573), (prescribing requirements for control and abatement of air and water pollution at Federal installations).

Executive Order 11472 of May 29, 1969 (34 F.R. 8693), as amended by Executive Order 11514 of March 5, 1970 (35 F.R. 4247), (prescribing responsibilities of Federal agencies and the Council on Environmental Quality under the National Environmental Policy Act of 1969, *supra*).

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ation in decisionmaking along with economic and technical considerations.” Section 102 also requires “all agencies of the Federal Government” to prepare a “detailed statement” to be included in “every recommendation or report” concerning “Federal actions significantly affecting the quality of the human environment.” That detailed statement must include each of the following matters:

- (i) The environmental impact of the proposed action;
- (ii) Any adverse environmental effects which cannot be avoided should the proposal be implemented;
- (iii) Alternatives to the proposed action;
- (iv) The relationship between local short-term uses of man’s

environment and the maintenance and enhancement of long-term productivity; and

(v) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

The act, following the precedent of the consultation requirement in the Fish and Wildlife Coordination Act, also requires that the Federal official making the detailed statement must first "consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved." Copies of such statement and comments "shall accompany the proposal through the existing agency review processes." (Sec. 102.)

The combined effect of the 1899 statute, the Coordination Act, the National Environmental Policy Act of 1969, and the many other statutes and executive orders concerning the protection of our waters and other natural resources, is to charge the Corps of Engineers with a responsibility that is analogous to that of the Federal Power Commission in considering an application for a hydropower license. In such cases, the Commission "must include as a basic concern the preservation of natural beauty and of national historic shrines, keeping in mind that, in our affluent society, the cost of a project is only one of several factors to be considered." *Scenic Hudson Preservation Conference v. Federal Power Commission*, 354 F. 2d 608, 624 (C.A. 2, 1965), cert. den., 384 U.S. 941 (1966).

This broad scope of the Corps' duty arises from its power to permit the alteration or destruction of a navigable river or waterway (which Justice Holmes memorably described as "more than an amenity, it is a treasure").² The breadth of that duty was further emphasized in 1967 by the Supreme Court of the United States in *Udall v. Federal Power Commission*, 387 U.S. 428 (1967). In that case, the Court, in reversing the Commission's grant of a hydropower license, stated (at p. 450):

The question whether the proponents of a project "will be able to use" the power supplied is relevant to the issue of the public interest. So, too, is the regional need for additional power. But the inquiry should not stop there. A license under the Act empowers the licensee to construct, for its own use and benefit, hydroelectric projects utilizing the flow of navigable waters and thus, in effect, to appropriate water resources from the public domain. The grant of authority to the Commission to alienate Federal water

² *New Jersey v. New York*, 283 U.S. 336, 342 (1931).

resources does not, of course, turn simply on whether the project will be beneficial to the licensee. Nor is the test solely whether the region will be able to use the additional power. The test is whether the project will be in the public interest. And that determination can be made only after an exploration of all issues relevant to the "public interest," including future power demand and supply, alternate sources of power, the public interest in preserving reaches of wild rivers and wilderness areas, the preservation of anadromous fish for commercial and recreational purposes, and the protection of wildlife.

It is clear that the 1899 act must be read, as the Supreme Court of the United States said in *United States v. Republic Steel Corp.*, 362 U.S. 482, 491 (1960), "charitably in light of the purpose to be served" and not with "a narrow, cramped reading."

Increasing public awareness of the devastation being wrought through indiscriminate filling, dredging and other work in our Nation's waterways has caused the Corps to reexamine and give greater recognition to its responsibilities for the protection of bays, estuaries, and other waterways and to acknowledge that its duty goes beyond simply the question of whether a proposed fill or other work will adversely affect navigation.

On July 13, 1967, the Secretary of the Army and the Secretary of the Interior entered into a memorandum of understanding, establishing procedures whereby the Corps would obtain advice from the Interior Department concerning all effects on fish and wildlife, recreation, pollution, natural resources, or the environment which may arise from dredging, filling or other work authorized by the Corps under the 1899 act.³

In 1968, the Corps revised its regulations to state that the Corps, in considering an application for a permit to fill, dredge, discharge or deposit materials, or conduct other activities affecting navigable waters, will evaluate "all relevant factors, including the effect of the proposed work on navigation, fish and wildlife, conservation, pollution, esthetics, ecology, and the general public interest." 33 CFR 209.120(d)(1).⁴ The Corps applied this policy when it recently rejected the efforts of land developers to fill in a major part of Boca Ciega Bay, near St. Petersburg, Fla. See *Zabel v. Tabb*, 296 F. Supp. 764 (D.C. M.D. Fla., Tampa Div., Feb. 17, 1969), now on appeal to the U.S. Court of Appeals, Fifth Circuit, No. 27555.

The committee commends the Corps for recognizing its broader responsibilities to protect against unnecessary fills and other alteration of water bodies. However, the committee is concerned whether the Corps carries out in practice what its new regulations so properly

state. There have been recent instances where there appeared to be a substantial gap between promise and performance. E.g., see the committee's report of March 24, 1969 (H.Rept. 91-113), entitled "The

³ The Memorandum of Understanding is reprinted in 33 CFR 209.120(d) (11) and H. Rept. 91-113, pp. 61-62.

⁴ This regulation, which became effective December 18, 1968, revised the Corps regulation of December 7, 1967, which had read (sec. 209.330(a)):

"The decision as to whether a permit will be issued will be predicated upon the effects of the permitted activities on the public interest including effects upon water quality, recreation, fish and wildlife, pollution, our natural resources, as well as the effects on navigation. . . .

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Permit for Landfill in Hunting Creek: A Debacle in Conservation." The committee therefore recommends as follows:

The Corps of Engineers should instruct its district engineers and other personnel involved in considering applications for fills, dredging, or other work in estuaries, rivers, and other bodies of navigable water to increase their emphasis on how the work will affect all aspects of the public interest, including not only navigation but also conservation of natural resources, fish and wildlife, air and water quality, esthetics, scenic view, historic sites, ecology, and other public interest aspects of the waterway.

The committee also believes that the Corps of Engineers must make an about-face in its handling of applications for new landfills, dredging, or other work in navigable water. The Corps has often routinely approved such applications unless the *opponents* of the permit clearly showed that substantial damage to the public interest will result. The committee believes that the Corps should place on the *applicant* the burden of proving that the filling, dredging, or other work is indisputably in accord with the public interest. The Corps should be sure that the environment will not be substantially harmed; or that there is no feasible and prudent alternative to such work and that all possible measures will be taken to minimize the resulting harm. In arriving at such judgment, the Corps should evaluate the relationship of the proposed work to the entire waterway and the total environment. Therefore the committee recommends as follows:

The Corps of Engineers should permit no further landfills or other work in the Nation's estuaries, rivers and other waterways except in those cases where the applicant affirmatively proves that the proposed work is in accord with the public interest, including the need to avoid the piecemeal destruction of these water areas.

II. THE "HARBOR LINE" PROCEDURES HERETOFORE FOLLOWED BY THE CORPS OF ENGINEERS DID NOT ADEQUATELY PROTECT AGAINST THE FILLING OF SUBSTANTIAL AREAS OF SUBMERGED LANDS SHOREWARD OF THE HARBOR LINES, AND VIOLATED THE FISH AND WILDLIFE COORDINATION ACT

Section 11 of the River and Harbor Act of 1890 (33 U.S.C. 404) authorizes the Secretary of the Army to establish "harbor lines," whenever he deems them "essential to the preservation and protection of harbors." The same section states that "beyond" such lines "no piers, wharves, bulkheads, or other works shall be extended or deposits made, except under such regulations" as he prescribes.

The Corps of Engineers and the Secretary of the Army have established three types of harbor lines:

- (1) Pierhead lines, to mark the limits of open-pile work;
- (2) Bulkhead lines, to mark the limits of solid fill;
- (3) Pierhead-bulkhead lines, shoreward of which either open or solid construction is permissible.

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The Corps' regulations state that the establishment of such harbor lines "implies consent to riparian owners to erect structures to the line without special authorization * * * " 33 CFR 209.150(i).⁵

There are large areas of submerged lands which are shoreward of established bulkhead lines and pierhead-bulkhead lines. For example, the committee's hearings on San Francisco Bay disclosed that the area of such lands in the bay exceeds 19 square miles. Under the Corps' regulation the owners of these 19 square miles are apparently at liberty to fill them without seeking a permit from the Corps of Engineers.

The committee believes that the Corps' largely laissez-faire policy concerning landfills and construction on submerged lands and tidelands landward of harbor lines violated its statutory responsibility to protect all aspects of the public interest in those lands. Furthermore, the Corps' failure to consult with the Fish and Wildlife Service on all proposed work which modifies or affects those lands violated the intent of the Fish and Wildlife Coordination Act. That act, as amended in 1958, requires the Corps to review and consult with the Federal and State agencies having jurisdiction over wildlife resources "whenever the waters of any * * * body of water are * * * to be impounded, diverted * * * or * * * controlled or modified for any purpose whatever * * *" and makes no exception as to submerged lands shoreward of harbor lines. (16 U.S.C. 662(a)).

In areas of navigable waters where harbor lines do not exist the Corps has announced its intention to comply with the policies and procedures enunciated in this act and in the 1967 Memorandum of Understanding which the Secretary of the Army and the Secretary of the Interior entered into to better effectuate those policies.

Large sections of the submerged lands shoreward of established harbor lines have characteristics which, hydrologically and ecologically, are substantially similar to those of many areas of submerged lands where harbor lines do not exist. Hence, it seems incredible that the Corps has not followed the same procedures with respect to all submerged lands regardless of harbor lines.

The committee questions whether the Corps' practice of allowing anyone to fill or construct structures landward of harbor lines without a permit has been valid since 1890.

Congress first provided for the establishment of harbor lines under Federal authority in section 12 of the act of August 11, 1888 (25 Stat. 425),⁶ which read as follows:

Where it is made manifest to the Secretary of War that the establishment of harbor lines is essential to the preservation and protection of harbors, he may, and is hereby, authorized to cause such lines to be established, beyond which no piers or wharves shall be extended or deposits made except under such regulations as may be prescribed from time to time by him.

⁵ However, the Corps' regulations also warn that the harbor lines do "not imply consent to operations of every kind landward of the line," and mention dredging work as an example of operations which "will ordinarily require the authorization of the Department to insure that operations are conducted under proper restrictions." 33 CFR 209.150(i)(1). In addition, the regulations direct the district engineers to "keep informed * * * of operations landward of harbor lines" and to require advance submission of plans where "proposed structures are to touch or closely approach the harbor line." *Ibid.* subparagraph (2).

⁶ An earlier law (act of Aug. 5, 1886, c. 929, sec. 2, 24 Stat. 329, 33 U.S.C. 407a) authorized the Secretary of War "in places where harbor lines have not been established" to establish lines limiting dump grounds for "debris of mines or stamp works" in navigable water. The "harbor lines" referred to in this statute were those established under State or local law. See *Engs v. Peckham*, 11 R.I. 210, 224 (1875).

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The legislative history of the 1888 act shows that Congress enacted section 12 to overrule the Supreme Court's ruling in *Willamette Iron Bridge Co. v. Hatch*, 125 U.S. 1 (March 19, 1888), that existing Federal law did not prohibit obstructions to navigable waters within a single State. It was intended to provide Federal legal protection for the open harbors which the Supreme Court had held to be lacking. It did not grant any legal right to owners of land shoreward of a harbor line to fill or erect structures. It simply did not deal with the areas shoreward of a harbor line.

In 1890 Congress went further, and reversed the *Willamette Iron*

Bridge rule completely, by providing, in section 10 of the River and Harbor Act of September 19, 1890 (26 Stat. 454),⁷ as follows:

That the creation of any obstruction, not *affirmatively* authorized by law, to the navigable capacity of any waters, in respect of which the United States has jurisdiction, is hereby prohibited. [Emphasis supplied].

Sections 6 and 7 of the 1890 act authorized the Secretary of War to issue permits for certain proposed structures, or for depositing refuse, in any navigable water, *irrespective of where a harbor line might be*. However, instead of repealing section 12 of the act of 1888, Congress reenacted it in section 12 of the 1890 statute, adding a criminal penalty.

Nine years later, Congress codified the Federal laws relating to navigable waters as sections 9 to 20 of the River and Harbor Act of 1899 (act of March 3, 1899, 30 Stat. 1151–1155). Despite their apparent incongruity, both the section of the 1890 law forbidding “any obstruction not affirmatively authorized” and the harbor line section (which does not give “affirmative” authorization for obstructions shoreward of the harbor lines) were incorporated, with revisions, as section 10 and section 11 of the 1899 act, respectively. Both these sections are still in force. (33 U.S.C. 403, 404).

The 1899 act was infelicitously drafted and its ambiguities and overlapping language have caused much litigation and required much judicial creativeness.⁸ The incongruity of the harbor lines language, insofar as concerns the validity of landfills or structures landward of the harbor lines, caused at least one court of appeals to say:⁹

The argument is not without force that while this authorization to the Secretary of War is negative in form, yet when it is taken in connection with the power conferred on him to grant permission, under regulations prescribed by him, to erect structures beyond the harbor line, it implies affirmative authorization to the riparian owner to erect structures to the harbor line without special authorization.

Nevertheless, the court rejected the contention that such authorization gives the riparian owner a vested right to keep his fill or structures where he has placed them or to demand compensation from the Government if the harbor line is changed. The rule was stated by the Attorney General as follows (22 Ops. Atty. Gen. 501, 510, June 8, 1899):

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It is doubtless true that the establishment by the Government of a harbor line, within and out to which wharves, docks, et cetera, may be built by riparian owners, is an invitation and

authority by the Government for the erection of such structures in aid of commerce. But, in view of this continuing power and duty of Congress to regulate this detail of commerce, it must be taken that such structures are erected in view of, and subject to the exercise of, this power at some future time. And, in view of the frequently changing conditions which require changes of harbor lines, it cannot be claimed that the establishment of such a line gives to anyone a vested right in its permanent continuance. Doubtless the existence of such structures under such circumstances and by such authority, their cost, size, character, and sufficiency, and the effect upon them of the establishment of a different line, are important factors to be considered and balanced against the needs of commerce for such change in determining whether such change shall be made.

But this does not affect the power, and if, after looking at both sides, it is deemed that the needs of commerce require such change, I cannot doubt the power to make it, even though its exercise should affect injuriously riparian owners and their property.

It is therefore quite clear that the establishment of a harbor line does not constitute an abandonment of the Federal interest in the water area shoreward of the harbor line.

The committee does not believe it is necessary to explore fully the ambiguities of this "implied authorization," because the Corps has ample power, under section 11 of the 1899 act (33 U.S.C. sec. 404) to revise its harbor line regulations.

The Corps of Engineers has, over the past 80 years, established harbor lines primarily to identify existing and prospective needs of navigation and to aid the orderly development of port facilities. In most instances, particularly those where harbor lines were established many years ago, the Corps emphasized navigation and port uses, and gave little or no attention to such matters as fish and wildlife, air and water pollution control, esthetics, ecology, conservation of natural and scenic resources, recreation needs, and other matters of public interest. The increasing impairment and degradation of the environment which is affecting our country has brought an increasing awareness that the mounting pressure for fills and construction of structures in water areas landward of established harbor lines may result in pollution, adversely affect fish and wildlife, change the ecology of the waters, impair the esthetic values of the area, and otherwise result in harm to the public interest.

The harbor lines themselves serve the useful purpose of showing the outer limits beyond which no bulkheads or piers will be allowed and thus aid in the planning of future developments of waterfront

property and in protecting the harbor. However, these purposes do not require continuation of the Corps' general practice of allowing all fills and construction shoreward of the harbor lines without a

⁷ The legislative history of sec. 10 is reviewed in *United States v. Republic Steel Corp.*, 362 U.S. 482 (1960), and *United States v. Standard Oil Co.*, 384 U.S. 224 (1966).

⁸ See e.g., *United States v. Republic Steel Co.*, 362 U.S. 482 (1960); *United States v. Standard Oil Co.*, 384 U.S. 224 (1966); *Wyandotte Transportation Co. v. United States*, 389 U.S. 191 (1967). The 1899 act was drafted in the office of the Chief of Engineers (see H. Doc. 293, 54th Cong., second sess.).

⁹ *Garrison v. Greenleaf Johnson Lumber Co.*, 215 F. 576, 580 (CCA 4th, 1914), aff'd. 237 U.S. 251 (1915).

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permit from the Corps. The Corps' witnesses testified as follows at the committee's San Francisco Bay hearings:

Mr. REUSS. I am still puzzled. While it is entirely proper for the Corps to grant a fill permit for dock or pier purposes shoreward of the harbor line, it would seem to me the Corps is not doing its ecological job if it does not even ask that people come in and ask for a permit for housing, a non-waterborne industry, a junkyard, or whatever else somebody wants to build.

Colonel BOERGER. Yes, sir; that is an inconsistency. (Hearings, May 15, 1969, p. 119.)

* * * * *

Mr. REUSS. * * * Referring just to the area shoreward of the harbor lines, both in the San Francisco Bay and everywhere else within the jurisdiction of the Corps of Engineers, why doesn't the Corps immediately abandon its present self-imposed rule that it will have nothing to say about what happens shoreward * * * of a harbor line * * *?

Why cut yourself off from a complete review simply by reason of the fact that in certain areas you happen to have erected harbor lines in the past for good and sufficient reasons?

Colonel MEANOR. I follow your line of questioning. I think it is something that we have got to start doing. * * * (Hearings, May 15, 1969, pp. 131-132.)

* * * * *

Mr. REUSS. At any rate there is a tremendous area back of the bulkhead lines, much of it of great ecological significance. And it seems to me vital that the Corps in San Francisco Bay and nationally assert its power to weigh and consider and protect the public environmental interest and not permit fills—whether they are back of a harbor line or not back of a harbor line—which are going to ruin the environment. Would you not agree?

General GLASGOW. I would, Mr. Chairman. (Hearings, August 20, 1969, p. 63.)

The committee does not believe it is necessary for the Corps to abolish all existing harbor lines, or even to go through a procedure (which would necessarily be lengthy and time-consuming) of reexamining and, after public hearings, revalidating, the existing harbor lines. Instead, the committee believes, and recommends as follows:

The Corps of Engineers should revise its regulations to (a) make harbor lines merely guidelines defining the offshore limits of bulkheads, fills, piers, and other structures, and (b) require anyone planning to do any work (including filling) shoreward of a harbor line to apply and obtain a permit for such work, subject to such conditions as the Corps deems necessary to protect the public interest. In reviewing all applications for such permits, the Corps should comply with the same interdepartmental review and consultation procedures as are used in considering applications for permits for similar work in waters where harbor lines are not established.

The committee understands that the Corps is now proceeding to amend its regulations in conformity with the foregoing recommendation.

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III. THE CORPS OF ENGINEERS HOLDS PUBLIC HEARINGS, WHENEVER THERE IS SUFFICIENT PUBLIC INTEREST, ON APPLICATIONS FOR PERMITS TO FILL, DREDGE OR CONSTRUCT STRUCTURES IN NAVIGABLE WATERS, BUT AVOIDS SUCH HEARINGS IN CONNECTION WITH APPLICATIONS TO ESTABLISH OR MODIFY HARBOR LINES WHICH, UNDER PRESENT CORPS PRACTICE, CAN RESULT IN LANDFILLS OR CONSTRUCTION OF STRUCTURES LANDWARD OF THE HARBOR LINE WITHOUT FURTHER CORPS REVIEW

The Corps has an eminently sound policy concerning public hearings on applications for landfills, dredging, and other proposed work in navigable waters. Its regulations state (33 CFR 209.120(g)(1)):

“(g) *Public hearing.* (1) It is the policy of the Chief of Engineers to conduct his civil works program in an atmosphere of public understanding, trust, and mutual cooperation, and in a manner responsive to public needs and desires. To this end, public hearings are helpful and will be held whenever there appears to be sufficient public interest to justify such action. *In case of doubt, a public hearing will be held.* (Emphasis added).

Oddly, however, the Corps' regulations enunciate a contrary position with respect to the establishment of harbor lines. Although subparagraph (1) of the Corps' regulation (33 CFR 209.150(e)) requires that public notices of applications for establishment or modification of harbor lines must be issued "to all known interested parties," subparagraph (2) specifies as follows:

Public hearings in connection with harbor lines *will be kept to a minimum and will be the exception rather than the rule.* A hearing will be held at the discretion of the district engineer only if he deems a public hearing essential, as in a known controversial case or when response from the public notice indicates that a public hearing should be held. (Emphasis added.)

If a public hearing is warranted in cases where there is demonstrated public interest over the issuance of dredging or fill permits (and the committee believes it is), then it is equally important to hold such hearings when harbor lines are established or changed. The importance of such a hearing is especially evident in view of the fact that, as the Corps regulation expressly notes, "the establishment of a bulkhead line has been frequently followed by solid filling to the limit and by requests thereafter from riparian owners to push the limit farther toward the channel" (33 CFR, sec. 209.150(a)(5)).

The impact of the Corps' grudging policy concerning public hearings when harbor line changes are involved is illustrated by the Corps' treatment of protests against the proposal by the Port of Oakland in 1965 that the Corps modify the bulkhead lines on the east side of the San Francisco Bay. Such modification would have enabled the Port of Oakland to fill 140 acres of bay to expand its Seventh Street Marine Terminal.

The California State Department of Fish and Game and over 80 other organizations and persons filed protests against the proposed

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harbor line revision and fill. The Fish and Game Department particularly urged that the fill would adversely affect fish and wildlife resources and that further harbor development should be consistent with a comprehensive bay plan. Later, the Governor designated the California Resources Agency as his spokesman on this harbor line application. The director of that agency informed the Corps "that it was in the best interest of the public to construct the terminal" on the filled area. The district engineer's letter to the division engineer on this project noted that all differences were resolved, but did not mention the protest of the State Fish and Game Department.

In response to a question by Chairman Reuss in his letter of July 31,

1969, the Corps stated that "because of the resolution of these differences, it was not considered necessary that a public hearing be held." (Hearings, Part 2, August 20, 1969, pp. 7-8.) The Corps apparently simply ignored the other 80 protests which, the Corps said, were "of a general nature * * * primarily from individuals interested in conservation." General Glasgow testified as follows at the subcommittee's San Francisco Bay hearings (hearings, *ibid*, pp. 73-74):

General GLASGOW. These letters, as I stated, were primarily from persons who had interests in conservation, many of whom were opposed to fill of the Bay for any reason or any purpose. These views, we felt, were also considered in the views of the State of California Resources Agency, and you will recall I stated that we also met with them, that the director of the Resources Agency had been designated by the Governor of the State to represent fish and game as well as other interests of the State. We felt that when the State of California Resources Agency then withdrew their objection that we then were aware of the opposition of people. We were aware of the basis of their opposition—

Mr. Moss. How?

General GLASGOW. —and that the State had determined, in balancing these concerns against economic advantages to the State and so forth, and they told us to proceed in favor of the fill.

Mr. Moss. They couldn't tell you to proceed, they could merely indicate that their objections—

General GLASGOW. They withdrew their objections, that is right, sir.

* * * * *

Mr. Moss. The 80 letters you regarded as being so biased as not to constitute a basis for public hearing?

General GLASGOW. No, sir. No, sir.

Mr. Moss. Well, you have stated there was a clear—it was quite clear, that the majority were opposed to a fill for any reason. Therefore, you were inferring that there was a bias.

General GLASGOW. I would hesitate to use that term. I was saying that in our judgment the concerns of those 80 letters or protests were considered and reflected in the concern of the California State Department of Fish and Game, and that in balance it was the State's judgment that they would withdraw their objection, and we accepted that withdrawal of the objection.

The Corps thus accepted the State Resources Agency's judgment concerning the needs of the public as superior to that of 80 individual

protestors who, the Corps apparently believed, were "opposed to
[p. 12]

fill of the bay for any reason or any purpose." The Corps gave them no opportunity to air their views in a public hearing. As Congressman Moss stated during the hearing (*ibid*, p. 75):

* * * I think there is a matter of transcendent importance here; namely, the public right of protest, and the right to have the protest heard with reasonable impartiality.

The absence of a public hearing was compounded by the district engineer's failure to include in his letter to the division engineer any mention of the protest by the California State Fish and Game Department, thus further submerging the fish and wildlife interest when the harbor line proposal was reviewed by the district engineer's superiors.

The committee believes that the protection of the Nation's estuaries and other bodies of water requires that public hearings be held and encouraged whenever there is sufficient public interest in the establishment or modification of a harbor line, and that any doubts as to the sufficiency of the public interest in the harbor line procedure be resolved in favor of holding a hearing. The committee also believes that the Corps officers who must decide these problems should have the full record before them. The committee therefore recommends as follows:

a. The Corps of Engineers should promptly revise its regulations to require and encourage public hearings on proposals to establish or modify harbor lines whenever there is sufficient public interest in such proposals.

b. The Corps of Engineers should make sure that the record on each application for a permit, harbor line change, or other action contains all recommendations and objections received by the Corps.

This recommendation is in accord with the President's recent Executive Order (No. 11514, March 5, 1970, 35 F.R. 4247) directing all Federal agencies to develop procedures for public hearings on activities affecting the quality of the environment. Sec. 2(b).

IV. AT THE COMMITTEE'S REQUEST, THE CORPS OF ENGINEERS IS AMENDING ITS REGULATIONS TO REQUIRE THAT APPLICANTS FOR PERMITS TO CONSTRUCT SEWER OUTFALLS INTO NAVIGABLE WATERWAYS MUST FURNISH INFORMATION ADEQUATELY DESCRIBING THE EFFLUENT TO BE DISCHARGED THROUGH THE OUTFALL

The Corps' present regulations state that every application for a permit to fill, dredge, or do other work in navigable waters will be

evaluated in light of "all relevant factors, including the effect of the proposed work on navigation, fish and wildlife, conservation, pollution, esthetics, ecology, and the general public interest." 33 CFR 209.120(d). However, applicants for permits to construct sewer outfalls "which may affect the navigable capacity of a waterway" have not been required to furnish adequate information concerning the effluent to be discharged from the proposed sewer outfall. The present regulation has required only information on the amount of sand or sediments to be discharged. 33 CFR 209.130(b)(18)(iii). Such information would enable the Corps to evaluate the possibility that such sediments will silt up the navigation channels. But it would hardly enable the Corps to fully evaluate the potential effect of the sewer outfall on fish and wildlife, pollution, esthetics, ecology, and other [p. 13]

public interests which may be affected by nonsedimentary effluents (such as chemicals) discharged through the proposed outfall, or whether vessels would be corroded, or seamen's lives endangered, by corrosive or inflammable chemicals.

In the fall of 1969, Dr. Joel W. Hedgpeth, director of the Marine Science Center, Oregon State University, Newport, Oreg., complained to this committee that he had been unable to obtain information concerning the chemical wastes that would be discharged from a proposed sewer outfall which Virginia Chemicals, Inc., desired to construct in the Columbia River. Chairman Reuss thereupon wrote to the Chief of Engineers pointing out that the Corps' regulation governing the information required from the applicant was inadequate for both the Corps' evaluation of the application and the public's right to know the composition and amount of wastes to be discharged into the public waterways through the proposed sewer outfall. On December 17, 1969, the Acting Chief of Engineers acknowledged that "an applicant is not specifically required to identify the effluent that will be discharged," and stated that the Corps' regulation would be revised to "eliminate this imprecision" and "particularize the requirement."

The committee commends the Corps on this progressive step to assure that it will more effectively carry out its responsibilities to evaluate the potential effects which new sewer outfalls may have on water quality, fish and wildlife, esthetics, ecology, and other public interests in the waterways receiving waste discharges from such outfalls. The information which will be required under the revised regulation will also enable Federal and State water pollution control agencies to do their job more effectively.¹⁰

The committee recommends as follows:

Before granting a permit to construct a sewer outfall, the Corps of Engineers should:

(a) require the applicant to furnish full information concerning the nature, composition, amount and degree of treatment of the wastes which will be discharged from the outfall, and to demonstrate that such discharges will not adversely affect the quality of the receiving waters;

(b) consult with the appropriate Interior Department agencies (Federal Water Pollution Control Administration, Fish and Wildlife Service, etc.) as to whether, and under what conditions, the permit should be granted; and

(c) specify in the permit that the permittee shall furnish, upon the Government's request, full information from time to time concerning the wastes discharged through the outfall and comply with all requirements concerning protection of the quality of the receiving waters.

V. THE CORPS OF ENGINEERS CAN SUBSTANTIALLY HELP TO PREVENT POLLUTION OF OUR NATION'S WATERS BY VIGOROUSLY ENFORCING THE REFUSE ACT OF 1899 WHICH PROHIBITS DISCHARGE OF REFUSE INTO NAVIGABLE WATERS, AND DEPOSIT OF POLLUTING MATERIALS ON THEIR BANKS

Section 13 of the River and Harbor Act of 1899 (30 Stat. 1151, 33 U.S.C. 407), although enacted nearly three quarters of a century

¹⁰ See this committee's report entitled "The Critical Need for a National Inventory of Industrial Wastes (Water Pollution Control and Abatement)," H. Rept. 1579, 90th Cong., June 24, 1968.

[p. 14]

ago, constitutes a potentially powerful, but only sporadically used, weapon for combatting the pollution of our Nation's navigable waters. Section 13, commonly called the Refuse Act, states:

It shall not be lawful to throw, discharge, or deposit, or cause, suffer, or procure to be thrown, discharged, or deposited either from or out of any ship, barge, or other floating craft of any kind, or from the shore, wharf, manufacturing establishment, or mill of any kind, any refuse matter of any kind or description whatever other than that flowing from streets and sewers and passing therefrom in a liquid state, into any navigable water of the United States, or into any tributary of any navigable water from which the same shall float or be washed into such navigable water; and it shall not be lawful to deposit, or cause, suffer, or procure to be deposited material of any kind in any place on the bank of any navigable water, or on the bank of any tributary of any navigable water, where the same shall be liable to be washed

into such navigable water . . . whereby navigation shall or may be impeded or obstructed . . .¹¹

Judicial interpretation over the years has enhanced the usefulness of the Refuse Act in controlling and abating pollution of our waterways. Thus, the courts have ruled that the offense of discharging refuse into navigable waters is not limited, as is the offense of depositing material on the banks of navigable waters, by the language "whereby navigation shall or may be impeded or obstructed."¹²

The prohibition against depositing "refuse" in navigable waters has been held to apply to industrial fuels or chemicals which were commercially valuable at the time they were deposited into the navigable waters.¹³ The Supreme Court in 1966 stated flatly:

The word "refuse" includes *all foreign substances and pollutants* apart from those "flowing from streets and sewers and passing therefrom in a liquid state" into the watercourse. (Emphasis supplied.)¹⁴

Furthermore, the latter exception has been narrowly construed. Thus, the Supreme Court, in holding that the Refuse Act was violated by a discharge through non-municipal sewers of industrial wastes containing suspended solids which settled into navigable waters, said: "Refuse flowing from 'sewers' in a 'liquid state' means to us 'sewage'."¹⁵

Moreover, the Refuse Act has been used successfully against companies whose employees dumped garbage from a ship,¹⁶ or allowed oil to spill from shore storage tanks and flow "indirectly" (i.e. over land by force of gravity) into navigable waters.¹⁷ The violation occurs

¹¹ A proviso of Section 13 authorizes the Secretary of the Army to permit deposit of material in navigable water "under conditions to be prescribed by him," if the Chief of Engineers advises that "anchorage and navigation will not be injured," and specifies that "whenever any permit is so granted the conditions thereof shall be strictly complied with, and any violation thereof shall be unlawful."

¹² *The La Merced* (*United States v. Alaska Southern Packing Co.*), 84 F. 2d 444, 445-446 (C.A. 9, 1936).

¹³ *The La Merced*, *supra* (oil discharged from a ship); *United States v. Ballard Oil Co. of Hartford, Inc.*, 195 F. 2d 369, 372 (C.A. 2, 1952) (oil overflowing from an on-shore tank into the Connecticut River); *United States v. Standard Oil Co.*, 384 U.S. 224 (1966) (accidental discharge of commercially valuable 100 octane aviation gasoline into the St. John's River, Florida). Similar rulings were made in *The Albania*, 32 F. 2d 727 (D.C. S.D. N.Y. 1928) and *The Columbo*, 42 F. 2d 211 (C.A. 2, 1930), with respect to the discharge of oil, under the Act of June 29, 1888 (25 Stat. 209, 33 U.S. Code 441), which prohibits discharge of "refuse" into New York Harbor.

¹⁴ *United States v. Standard Oil Co.*, 384 U.S. 224, 230 (1966).

¹⁵ *United States v. Republic Steel Corp.*, 362 U.S. 482, 490 (1960).

¹⁶ *The President Coolidge* (*Dollar S.S. Co. v. United States*), 101 F. 2d 638 (C.A. 9, 1939) (garbage dumped from ship by employee in disregard of company's orders and without knowledge of ship's officers).

¹⁷ *United States v. Ballard Oil Co. of Hartford, Inc.*, 195 F. 2d 369 (C.A. 2, 1952); *United States v. Esso Standard Oil Company of Puerto Rico*, 375 F. 2d 621 (C.A. 3, 1967).

even though the discharge was not done intentionally, negligently or knowingly.¹⁸

It is apparent that the Refuse Act, which prohibits the discharge or deposit into navigable waters of "all foreign substances and pollutants," as the Supreme Court put it—including oil but not sewage—is a broad charter of authority and a powerful legal tool for preventing the pollution of all navigable waters.

Its present usefulness is not reduced by more recent water pollution control legislation. The Federal Water Pollution Control Act specifically states (33 U.S. Code sec. 466k) that it "shall not be construed as (1) superseding or limiting the functions, under any other law—of any other officer or agency of the United States, relating to water pollution, or (2) affecting or impairing the provisions of . . . sections 13 through 17 of the" River and Harbor Act of 1899, as amended (i.e., the Refuse Act).¹⁹

The Federal Water Pollution Control Act authorizes the Secretary of the Interior to promote the control and abatement of water pollution by a wide variety of methods, including encouraging interstate cooperation and uniform State laws; sponsoring research, training and development of means of pollution control; studying estuarine areas; granting funds to the States for research and development, and administration of pollution control programs, and to municipalities for construction of water treatment facilities; approving and enforcing State water quality standards for interstate waters; holding conferences and public hearings for abating pollution; and, in certain circumstances, requesting the Attorney General to bring injunction suits against polluters.

However, the Federal Water Pollution Control Act contains various limitations on its scope and enforcement powers. For example, it requires water quality standards only for interstate waters. Furthermore, it provides that discharges of wastes into interstate waters which reduce their quality below established water quality standards are subject to abatement only after notice and a waiting period of at least 180 days. The abatement proceedings may be instituted only upon the Governor's consent unless the pollution "is endangering the health or welfare of persons in a State other than that in which the discharge or discharges . . . originate". Moreover, the court in such abatement proceedings need not confine itself to examining the issues of law and facts, but is authorized to give "due consideration to the practicability and to the physical and economic feasibility of complying" with the established water quality standards as well as reviewing the standards themselves.²⁰

Similarly, the Oil Pollution Act, 1924,²¹ specifically provided that it "shall be in addition to other laws for the preservation and protec-

tion of navigable waters of the United States and shall not be construed as repealing, modifying, or in any manner affecting the provisions of such laws." (33 U.S. Code, Supp. IV, sec. 437). This Act is a narrowly drawn criminal statute prohibiting, with certain exceptions,²² only the "grossly negligent, or willful" discharge of oil from a boat or vessel into navigable waters. Violators of the statute must clean up their oil spills or pay the United States for the cost of doing

¹⁸ *United States v. Interlake Steel Corp.*, 297 F. Supp. 912 (D.C., N.D. Ill. E.D. 1969); *The President Coolidge*, *supra*.

¹⁹ *United States v. Interlake Steel Corp.*, *supra*, at 916.

²⁰ 33 U.S.C. 466g (c) (5) and (g). On February 10, 1970, the President proposed legislation that would partially modify this enforcement procedure. See H.R. 15872, 91st Cong.

²¹ Oil Pollution Act, 1924, as amended by the Clean Water Restoration Act of November 3, 1966 (Sec. 211, Public Law 89-753; U.S. Code, Supp. IV, sec. 431 et seq.).

²² See 33 U.S. Code, sec. 433.

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so. They are subject to a \$2,500 fine or one year's imprisonment or both, and the master of the vessel may have his license revoked. The Corps of Engineers, Coast Guard, and Bureau of Customs assist the Department of the Interior in enforcing the statute.

The proposed Water Quality Improvement Act now being considered by House-Senate conferees (H.R. 4148) will enact new sections in the Federal Water Pollution Control Act to govern oil pollution and hazardous substances and repeal the Oil Pollution Act, 1924.

The Refuse Act, which prohibits discharges of all foreign material except sewage into any navigable water of the United States,²³ is not subject to many of the limitations present in the Federal Water Pollution Control Act and the Oil Pollution Act, 1924, and therefore provides protection against pollution of waterways in many circumstances where the other acts are more circumscribed.

The committee therefore recommends:

The Corps of Engineers should vigorously enforce the Refuse Act of 1899 which prohibits discharge of refuse into navigable waters and deposit of polluting materials on their banks.

There are several methods which the Corps can utilize under the Refuse Act to prevent pollution of waterways:

1. Violations of the Refuse Act are subject to criminal prosecution and penalties of fine not exceeding \$2,500 nor less than \$500, or imprisonment for not less than 30 days nor more than one year, or both such fine and imprisonment (33 U.S. Code 411). Officers and employees of the Corps of Engineers are authorized "to arrest and take into custody" and request prosecution of, and it is "the duty of United States attorneys to vigorously prosecute all offenders" of the Refuse Act. (33 U.S. Code 413.²⁴) The law further specifies

that "one-half of said fine" shall be "paid to the person or persons giving information which shall lead to conviction." This provision buttresses the Corps' efficacy in carrying out the Refuse Act in two ways:

(a) The informer payment provides a monetary incentive to citizens to furnish information to the Corps concerning violations of the Refuse Act.

(b) The Supreme Court has ruled that where a statute provides for a reward to the informer, the statute authorizes him, if the Government has not previously instituted a prosecution against the violator,²⁵ to institute his own suit in the name of the United States (a *qui tam* action) to collect his moiety of the penalty.²⁶ Such *qui tam* statutes, vesting in an informer the right to recover a moiety of a penalty for a violation in which he otherwise would have no financial interest, "have been in existence for hundreds of years in England, and in this country

²³ The Courts have held that navigable waters include waterways which either in their natural or improved condition are used, or can be used, for floating light boats or logs, even though the waterway may be obstructed by falls, rapids, sand bars, currents, etc., and even though the waterway has not been used for navigation for many years. *United States v. Appalachian Electric Power Co.*, 311 U.S. 377, 407-410, 416 (1940); *Wisconsin Public Service Corp. v. Federal Power Commission*, 147 F. 2d 743 (CA 7, 1945), *cert. den.* 325 U.S. 880; *Wisconsin v. Federal Power Commission*, 214 F. 2d 334 (CA 7, 1954), *cert. den.* 348 U.S. 883 (1954); *Namekagon Hydro Co. v. Federal Power Commission*, 216 F. 2d 509 (CA 7, 1954); *Puente de Reynosa, S.A. v. City of McAllen*, 357 F. 2d 43, 50-51 (CA 5, 1966); *Rochester Gas and Electric Corp. v. Federal Power Commission*, 344 F. 2d 594 (CA 2, 1965).

²⁴ The Coast Guard assists the Corps in detecting and reporting violations of the Refuse Act. The duty of the U.S. Attorney to prosecute offenders under the Refuse Act is not dependent on whether the prosecution is requested by the Corps of Engineers, or by any other Federal agency or employee, or whether the alleged offense was contrary to any water quality standards set by a State agency under the Water Quality Act of 1965. *United States v. Interlake Steel Corp.*, *supra*, pp. 914, 916.

²⁵ *Francis v. United States*, 72 U.S. (5 Wall.) 338 (1866).

²⁶ *Adams, qui tam v. Woods*, 6 U.S. (2 Cranch) 336 (1805); *United States ex rel. Marcus v. Hess*, 317 U.S. 537, 541 (1943).

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ever since the foundation of our Government."²⁷ By making the violator subject to action by private persons stimulated by the hope of a reward, such provisions help to insure against laxity by public officials in enforcing statutes effectuating important public policies.

2. The Supreme Court has ruled that the Federal Government may obtain injunctions requiring a polluter, who has discharged into a navigable waterway a foreign substance or pollutant prohibited by the Refuse Act, to cease future discharges and to remove the polluting substance already discharged.²⁸ The Federal Government has rarely sought injunctions as a method of controlling or abating pollution. However, the committee believes that the Nation's fight against water pollution would be greatly strengthened and advanced by more

frequent use of this authority under the Refuse Act which is not subject to the limitations of the Federal Water Pollution Control Act.

The committee therefore recommends:

Both the Corps of Engineers and the Federal Water Pollution Control Administration should request the Attorney General to institute injunction suits against all persons whose discharges or deposits (except minor ones) violate the Refuse Act and are not promptly cleaned up or stopped by the polluter.

3. In addition to using criminal sanctions to punish for past discharges, and injunctions to preclude future discharges and remove pollutants already discharged, the Government can protect the Nation's navigable waters from pollution or degradation by calling upon the polluter to clean up the discharge voluntarily. If the polluter does not do so, the Government can itself do the clean up work and then, if the polluter's discharges were willful or negligent, bill the polluter for the Government's costs in doing such clean up work.²⁹ The use of this remedy, of course, entails expenditure of Government funds to perform clean up work. The Corps may sometimes find it difficult to perform such clean up promptly, because of limited appropriations. Furthermore, any reimbursement received by the Government would be covered into the Treasury instead of replenishing the funds available to the Corps. However, in many cases clean up by the Corps may be the only way to achieve prompt removal of pollutants discharged into a waterway or deposited on its banks.³⁰

The committee therefore recommends:

The Corps of Engineers should proceed to increase its capability, including seeking the necessary contingency funds, to enable it to promptly remove or clean up pollutional discharges and deposits and to seek reimbursement of the costs thereof from persons who willfully or negligently made or caused such discharges or deposits.

²⁷ *Marvin v. Trout*, 199 U.S. 212, 225 (1905); *United States ex rel. Marcus v. Hess*, 317 U.S. 537, 541 (1943).

²⁸ *United States v. Republic Steel Corp.*, 362 U.S. 482 (1960); *Wyandotte Transportation Co. v. United States*, 389 U.S. 191, 203-204, fnnt. 15 (1967).

²⁹ *Wyandotte Transportation Co. v. United States*, 389 U.S. 191 (1967).

³⁰ The proposed Water Quality Improvement Act (H.R. 4148), now being considered by House-Senate conferees, would establish a revolving fund to finance the Government's clean up and removal of oil and hazardous substances from waterways, and would require polluters to reimburse the fund.

4.2c QUI TAM ACTIONS AND THE 1899 REFUSE ACT

Citizen Lawsuits Against Polluters of the Nations Waterways, House Subcommittee on Conservation and Natural Resources of the Committee on Government Operations, 91st Cong., 2d Sess. (1970)

LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
CONSERVATION AND NATURAL RESOURCES SUBCOMMITTEE
OF THE COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D.C., August 13, 1970.

Hon. CHET HOLIFIELD,
*Acting Chairman, Committee on Government Operations,
House of Representatives, Washington, D.C.*

DEAR MR. CHAIRMAN: On March 18, 1970, the Committee on Government Operations issued its twenty-first report entitled "Our Waters and Wetlands: How the Corps of Engineers Can Help Prevent Their Destruction and Pollution" (H. Rept. 91-917). This report, particularly that part discussing the possible use of a *qui tam* action to implement the Refuse Act of 1899, has generated tremendous interest among both Members of Congress and private citizens.

In response to inquiries from Members of Congress the subcommittee staff has prepared memorandums discussing more fully the nature of the *qui tam* action and its applicability to the Refuse Act. The subcommittee believes that these memorandums will substantially aid Members of Congress, as well as private citizens, in gaining fuller understanding of, and performing additional research and investigation into, the *qui tam* action as a basis for implementing the Refuse Act of 1899. We therefore recommend that you approve publication of these memorandums as a committee print.

Sincerely,

HENRY S. REUSS,
Chairman, Conservation and Natural Resources Subcommittee.
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PREFACE

On March 18, 1970, the Committee on Government Operations issued a report entitled "Our Waters and Wetlands; How the Corps of Engineers Can Help Prevent Their Destruction and Pollution"

(House Report No. 91-917). This report analysed how the Corps of Engineers might more adequately fulfill its responsibilities under the River and Harbor Act of 1899 (act of March 3, 1899, c. 425, 30 Stat. 1151), including those statutory provisions more commonly known as the Refuse Act (33 U.S. Code 407, 411, 413). In discussing the latter, the report stated as follows:

"1. Violations of the Refuse Act are subject to criminal prosecution and penalties of fine not exceeding \$2,500 nor less than \$500 or imprisonment for not less than 30 days nor more than 1 year, or both such fine and imprisonment (33 U.S. Code 411). Officers and employees of the Corps of Engineers are authorized "to arrest and take into custody" and request prosecution of, and it is "the duty of United States attorneys to vigorously prosecute all offenders" of the Refuse Act. (33 U.S. Code 413.) The law further specifies that "one-half of said fine" shall be "paid to the person or persons giving information which shall lead to conviction." This provision buttresses the Corps' efficacy in carrying out the Refuse Act in two ways:

(a) The informer payment provides a monetary incentive to citizens to furnish information to the Corps concerning violations of the Refuse Act.

(b) The Supreme Court has ruled that where a statute provides for a reward to the informer, the statute authorizes him, if the Government has not previously instituted a prosecution against the violator, to institute his own suit in the name of the United States (a *qui tam* action) to collect his moiety of the penalty. Such *qui tam* statutes, vesting in an informer the right to recover a moiety of a penalty for a violation in which he otherwise would have no financial interest, "have been in existence for hundreds of years in England, and in this country ever since the foundation of our Government." By making the violator subject to action by private persons stimulated by the hope of a reward, such provisions help to insure against laxity by public officials in enforcing statutes effectuating important public policies."¹

¹ H. Rept. 91-917—"Our Waters and Wetlands: How The Corps of Engineers Can Help Prevent Their Destruction and Pollution," pp. 17-18.

The committee's report, particularly that part quoted above, has generated tremendous interest. Since its publication numerous Members of Congress and thousands of citizens have asked the subcommittee for additional information concerning the nature of the *qui tam* action and how it can be used to effectuate the Refuse Act. The subcommittee staff prepared two memorandums on these sub-

jects. These memorandums will undoubtedly be helpful to Members of Congress and the public interested in further research into the origins,

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judicial precedents, and scope of the *qui tam* action, and its possible use in implementing the Refuse Act of 1899.² These memorandums amplify and complement the legal analyses upon which the committee based its views in House Report 91-917, *supra*, concerning the *qui tam* cause of action in connection with the Refuse Act. However, the details of the memorandums do not necessarily embody any judgments of the committee, or any of its Members, beyond the views expressed in that report.³

² The staff memorandums here reprinted are equally applicable to the Act of June 29, 1888 (25 Stat. 209, secs. 1, 3:33 U.S.C. 441, 444), prohibiting discharge of refuse in New York Harbor and adjacent waters, which has provisions similar to those of the Refuse Act.

³ The committee's report was cited, quoted, and relied on by the U.S. Court of Appeals for the Fifth Circuit in *Zabel v. Tabb*, —F.2d—, 1 Env. Rep. 1449 (No. 27555; July 16, 1970) to "judge the ebb and flow of the national tide" of concern about the degradation of our Nation's waterways.

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STAFF MEMORANDUM A

The *Qui Tam* Action and Its Possible Use in Implementing the Refuse Act of 1899

I. CORPORATIONS OR PERSONS WHO VIOLATE THE REFUSE ACT ARE GUILTY OF A MISDEMEANOR PUNISHABLE BY A FINE OF \$500 TO \$2,500. PERSONS ARE ALSO SUBJECT TO THE ALTERNATIVE SANCTION OF IMPRISONMENT. INFORMERS ARE ENTITLED TO ONE-HALF OF ANY FINE IMPOSED

Corporations or persons who discharge or deposit refuse matter onto the banks of or into the navigable waters of the United States or their tributaries, without a permit, or in violation of the terms of a permit, from the Corps of Engineers, violate section 407 of the Refuse Act. 33 United States Code section 411 provides that such persons or corporations:

* * * shall be guilty of a misdemeanor, and on conviction thereof shall be punished by a fine not exceeding \$2,500, nor less than \$500, * * * or by imprisonment (in the case of a natural person) for not less than 30 days nor more than one year, or by both such fine and imprisonment, in the discretion of the court, one-half of said fine to be paid to the person or persons giving information which shall lead to conviction.

II. MAY A CITIZEN WHO FINDS A VIOLATION OF THE REFUSE ACT BRING A *Qui Tam* CIVIL ACTION AGAINST THE VIOLATOR?

A *qui tam* action is a civil action brought by a citizen to collect a fine, penalty, or forfeiture, a share (usually one-half) of which he is allowed to keep for himself by the statute imposing the fine or penalty. The action's name is derived from the Latin, "*qui tam pro domino rege quam pro se ipso sequitur*," meaning "who brings the action as well for the king as for himself."

The issue is whether a citizen who possesses information of a violation of the act sufficient to lead to conviction, can bring a *qui tam* action to impose the fine on the violator and collect one-half thereof.

III. *Qui Tam* ACTIONS ARE CIVIL ACTIONS BROUGHT BY CITIZENS UNDER PENAL STATUTES WHOSE SANCTION IS A FINE, PENALTY OR FORFEITURE OF WHICH CITIZENS ARE ENTITLED TO A SHARE

Bouvier's Law Dictionary (3d ed.) defines "*qui tam*" to mean:

An action under a statute which imposes a penalty for the doing or not doing an act, and gives that penalty in part to whomsoever will sue for the same, and the other part to the commonwealth, or some charitable, literary, or other institution, and makes it recoverable by action. The plaintiff describes himself as suing *as well* for the commonwealth * * * as for himself * * *. [Emphasis in original.]

Blackstone in his "Commentaries," vol. III, writes:

But, more usually these forfeitures [meaning forfeiture of goods, fine, or penalty] created by statute are given at large, to any common informer; or, in other words,

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to any such person or persons as will sue for the same: and hence, such actions are called *popular* actions, because they are given to the people in general. Sometimes one part is given to the king, or to the poor, or to the public use, and the other part to the informer or prosecutor; and then the suit is called a *qui tam* action * * *.¹

Henry Stephen, in his "New Commentaries on the Laws of England," vol. III (1844), elaborated as follows:

We have now sufficiently considered the injuries which affect such things in action as arise out of contracts, but there are some things in action which cannot properly be said to have that origin, and the withholding of which will nevertheless constitute a wrong or injury, viz. such debts as result from the obligation to pay money pursuant to a sentence of the law, or an enactment of the legislature; as when in a court of law, judgment is obtained by one man against another, for a specific sum of money; or when by an act of parliament, of that class called penal statutes, a pecuniary forfeiture is inflicted for committing some specified offense, and such forfeiture is made recoverable, as it usually is, by the crown, or the party aggrieved, or a common informer, as the case may be. This obligation or liability to pay a specific sum of money constitutes * * * a *debt*, so that the party against whom the judgment is obtained is immediately considered as owing to his adversary the amount awarded, and the party who transgresses the penal statute is immediately owing to the crown, the party aggrieved, or the common informer, as the case may be, the amount of the penalty. The remedy for the recovery of such debt, or chose in action, when withheld, is by action of debt on the judgment, or on the penal statute respectively; and in the latter case this remedy is generally designated as a penal action, or, where one part of the forfeiture is given to the crown, and the other part to the informer, a * * * *qui tam* action because it is brought by a person *qui tam pro domino rege quam pro se ipso sequitur*.²

IV. ENGLISH GOVERNMENTS FROM THE 14TH THROUGH THE 19TH CENTURIES FREQUENTLY RELIED UPON CITIZEN PARTICIPATION IN LAW ENFORCEMENT BY PASSING CRIMINAL STATUTES AUTHORIZING *Qui Tam* ACTIONS

Because of the absence of adequate professional police forces and an adequate prosecutorial administration³ until well into the 19th century and, during certain periods, because of Parliament's lack of confidence in the Crown's intentions to enforce the law,⁴ citizens in

England were frequently given the right to enforce criminal statutes.

Sir William Holdsworth writes in his "History of English Law":

We have seen that in the Middle Ages [14th and 15th centuries] it was a common expedient to give the public at large an interest in seeing that a statute was enforced by giving to any member of the public the right to sue for the penalty imposed for its breach, and allowing him to get some part of that penalty. This expedient was largely used by the legislature in [the 16th and 17th centuries] both in the case of * * * statutes dealing with trade, and in the case of statutes dealing with many other subjects * * *.

* * * * *

¹ Blackstone, Commentaries, vol. III, at p. 160. (Emphasis in original.)

² At pp. 535-6.

³ Viscount Simon, in presenting the common informers bill to the House of Lords for second reading, stated (Parliamentary debates (Lords), Apr. 3-June 7, 1951, vol. 171, at p. 1052):

If we go back to the old days when there was no efficient police force, when, indeed, in some parts of the country there was no police force at all, and consider the importance of enforcing the law against criminal offenses, it would seem that it was not altogether unnatural for our ancestors * * * to set up the system of common informers * * *

⁴ Viscount Simon in the same speech stated (Ibid., at p. 1052):

There may be another class of case where it [the system of common informers] would have been justified. If we lived in an age when the authorities could be suspected of refusing, out of favouritism or fear, to prosecute a particular kind of person, it might be a very useful thing to have this machinery of the common informer to secure that in proper cases a man would be brought to book * * *.

Mr. Hollis, in the debate during the second reading of the common informers bill before the House of Commons, stated (Parliamentary Debates (Commons), Jan. 23-Feb. 9, 1951, vol. 483 at p. 2098):

The second historical reason [for the common informer suit] is this. The reason for such legislation as the Act of Uniformity was because at a certain time, during the reigns of the last two Stuart Kings, Parliament had very little confidence in the will of the Executive to enforce the law that it had seen fit to pass. The Government were thought to be less keen on enforcing the Act of Uniformity than Parliament wished them to be.

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The number of statutes, old and new, in which the public at large was encouraged to enforce obedience to statutes by the promise of a share of the penalty imposed for disobedience was very large.⁵

Professor Radzinowicz writes of a later period:

Throughout the 18th century, and in the early years of the 19th, a number of statutes were passed, which so widened the activity of common informers that *an important section of criminal law came to depend upon them for its enforcement*. It was hoped to extend their usefulness and vigilance to all the lesser infringements of the law * * *.⁶ [Emphasis added.]

* * * * *

Much reliance was placed upon common informers to secure the enforcement of laws affecting public order and safety * * *.⁷

* * * * *

[T]he common informer, stimulated by his share in the penalty, was expected to play a considerable part in setting the machinery of justice in motion with regard to lesser infringements of the law. Thousands of these were committed every day, and although *most of them were nonindictable offences or misdemeanors*, they had nevertheless considerable social significance * * *. [Emphasis added.]

* * * * *

The incentive of the "moiety of the appointed penalty" was not confined to a few isolated penal statutes selected at random. *It formed part of the deliberate and consistent policy of the legislature and pervaded the entire body of the criminal law.* It acquired the character of a regular system in process of continual expansion. The result was a social situation in which the common informer was expected to act as a policeman, and a protector of the community against a vast mass of delinquency.⁸ [Emphasis added.]

Even during the later years of the 19th century, as police administration became more sophisticated in England, the common informer's "status as an adjunct of criminal justice was so generally accepted that * * * laws still continued to be enacted giving [him] powers and privileges * * *".⁹

V. IN THIS COUNTRY CONGRESS HAS OFTEN EXPRESSLY GIVEN CITIZENS THE RIGHT TO BRING *Qui Tam* ACTIONS TO IMPLEMENT THE CRIMINAL LAWS

The Supreme Court of the United States observed in 1905:

Statutes providing for actions by a common informer, who himself has no interest whatever in the controversy other than that given by statute, have been in existence * * * in this country ever since the foundation of our Government.¹⁰

Still later, in 1943, the Court, in rejecting the view of the third circuit court of appeals that informer actions "have always been regarded with disfavor," stated:

Qui tam suits have been frequently permitted by legislative action . . .¹¹

Among the Federal statutes authorizing a *qui tam* action by the common informer are the following:

Act of September 2, 1789, 1 Stat. 65, 67 (sec. 8), now 31 U.S.C. section 155, 163, 1003 (re abuse of office by Treasurer, or Secretary of Treasury);

⁸ Sir William Holdsworth, "A History of English Law," vol. IV, at pp. 355-6.

⁹ Leon Radzinowicz, "A History of English Criminal Law and its Administration," from 1850, vol. 2, at p. 142.

¹ *Ibid.*, at p. 143.

⁶ *Ibid.*, at pp. 146-147.

⁹ *Ibid.*, at p. 155.

¹⁰ *Marvin v. Trout*, 199 U.S. 212, 225 (1905).

¹¹ *U.S. ex. rel. Marcus v. Hess*, 317 U.S. 537, 541 (1943).

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Act of March 3, 1791, 1 Stat. 199, 209 (sec. 44) (re collection of duties on liquor);

Act of March 22, 1794, 1 Stat. 347, 349 (sec. 2, 4), now 46 U.S.C. sections 1351-1356 (re slave trade);

Act of June 30, 1834, 4 Stat. 729, 733 (sec. 27), now 25 U.S.C. section 201 (re trade and intercourse with Indian tribes);

Act of August 30, 1852, 10 Stat. 61, 75 (sec. 41) (re regulation of steamboats);

Act of August 5, 1861, 12 Stat. 292, 296 (sec. 11) (re collectors of revenue);

Act of March 2, 1863, 12 Stat. 696, 698 (sec. 4), now 31 U.S.C. 231, 232, 233 [re defrauding the Government];

Act of July 8, 1870, 16 Stat. 198, 203 (sec. 39), later 35 U.S.C. section 50 (now repealed) [re falsely marking article as patented];

Act of February 26, 1885, 23 Stat. 332, 333 (sec. 3) [re importation of alien labor];

Cf Act of June 17, 1930, 46 Stat. 590, 758 19 U.S.C. section 1619 [re enforcement of customs and navigation laws].

VI. CITIZENS CAN BRING *Qui Tam* ACTIONS TO COLLECT FINES OR PENALTIES IMPOSED BY CRIMINAL STATUTES WHERE THE STATUTES DO NOT EXPRESSLY AUTHORIZE OR FORBID THE CITIZENS' SUITS

The Refuse Act of 1899 states that "one-half of [the] fine [imposed for violation of the Act is] to be paid to the person or persons giving information which shall lead to conviction." The issue is whether Congress by the use of this language has allowed citizens the right to bring *qui tam* actions to enforce the Refuse Act. The Act does not explicitly state that citizens have such a right. But, it does not explicitly deny to citizens this right.

There is American case law which supports the proposition that where a statute providing for a reward to informers does not specifically either authorize or forbid the informer to institute a *qui tam* action, such statute is to be construed as authorizing such suit.

In *U.S. ex. rel. Marcus v. Hess*, 317 U.S. 537 (1942) an informer brought an action under R.S. 5438 and R.S. 3490-93, 31 U.S.C. 231 et. seq., the *Informer's Act* (prior to its 1943 amendments). Section 5438 made certain efforts to defraud the Government a crime punishable by fine and imprisonment. Section 3490 separately provided that whoever committed "any" of the prohibited acts should "forfeit and pay to the United States the sum of two thousand dollars, and in addition, double the amount of damages * * * sustained * * *; and such forfeiture and damages [should] be sued for in the same suit." Under sections 3491 and 3493, the suit for the fine and double damages could be instituted by "any person" in behalf of the Government, and, when successfully brought, the person instituting suit could keep one half the judgment.

The Supreme Court held in this case that an informer could bring suit under R.S. 3491 against certain parties, which had defrauded the Government by engaging in collusive bidding on PWA projects in Allegheny County, Pa., even though the informer relied for his information on an indictment filed by the Department of Justice in a previous uncontested criminal action. In reaching its result the

Court rejected the view of the Court of Appeals, Third Circuit, that the statute (31 U.S.C. 231, et seq.) should be construed "with utmost

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strictness" as *qui tam* actions "have always been regarded with disfavor" (127 F. 2d at 233). The Supreme Court retorted: "*Qui tam* suits have been frequently permitted by legislative action, and have not been without defense by the courts" (at p. 541).

The Supreme Court further stated:¹²

Statutes providing for a reward to informers which do not *specifically* either authorize or forbid the informer to institute the [*qui tam*] action are construed to authorize him to sue, *Adams v. Woods*, 2 Cranch 336. (*Italics added.*)

In *Adams, qui tam, v. Woods*, 6 U.S. (2 Cranch) 336 (1805) an informer brought an action of debt under the second section of the act of Congress of 22d March 1794, "to prohibit the carrying on the slave trade from the United States to any foreign place or country," 1 U.S. Stat. 347. This section provided that violators "shall forfeit and pay the sum of two thousand dollars; one moiety thereof to the use of the United States, and the other moiety to the use of him or her who shall sue for and prosecute the same." The issue in the case was whether the 2-year statute of limitations period set out in section 32 of the act of Congress of April 30, 1790, 1 U.S. Stat. 119, applied not only to indictments and informations but also to the informer's debt action to enforce a criminal statute. Section 32 of 1 U.S. Stat. 119 provided:

* * * nor shall any person be prosecuted, tried or punished for any offense not capital, nor for any fine or forfeiture under any penal statute, unless the indictment or information for the same shall be found or instituted within two years from the time of committing the offense, or incurring the fine or forfeiture * * *

In holding the above statute applicable to the informer's civil action, Chief Justice Marshall stated:

[I]n the statute under consideration, a distinct member of the sentence, describing one entire class of offenses [i.e., ones where the sanction is fine or forfeiture], would be rendered almost totally useless, by the construction insisted on by the attorney for the United States. Almost every fine or forfeiture under a penal statute, may be recovered by an action of debt, as well as by information;¹³ and to declare that the information was barred, while the action of debt was left without limitation, would be to attribute a capriciousness on this subject to the legislature, which could not be accounted for; and to declare that the law did not apply to cases on which an action of debt is maintainable, would be to overrule express words, and to give the statute almost the same construction which it would receive, if one distinct member of the sentence [i.e., "no person shall be prosecuted, tried or punished"] was expunged from it. *In this particular case, the statute which creates the forfeiture does not prescribe the mode of demanding it; consequently, either debt or information would lie.* It would be singular, if the one remedy should be barred and the other left unrestrained.¹⁴ (*Emphasis added.*)

Thus, although the 1794 act did not specifically either authorize or forbid the informer to institute a *qui tam* action, Chief Justice Marshall construed it to authorize such a procedure.

In *United States v. Laescki*, 29 Fed. 699 (D.C., N.B. Ill., 1887), the United States sought an indictment under secs. 5188 and 3708 of the revised statutes which stated:

It shall not be lawful to design, engrave, print or in any manner make or execute or to utter, issue, distribute, circulate, or use, any business or professional card,

¹² 317 U.S. at p. 541, footnote 4.

¹³ At common law the informer could bring either a civil action of debt *qui tam* or an information *qui tam*. Edward Deacon stated in *A Digest of The Criminal Law of England*, vol. 1 (1831): "Informations are of two sorts; first, those which are partly at the suit of the king, and partly at that of a subject; and secondly, such as are only in the name of the king. The former * * * are usually brought before justices of the peace upon penal statutes, which inflict a penalty upon conviction of the offender—one part of the use of the king, and another to the use of the informer—and are, in fact, a sort of *qui tam* action, only carried on by a criminal, instead of a civil, process" (at p. 671).

¹⁴ 6 U.S. at p. 341. Justice Marshall also held that the 1790 statute applied to prosecutions under criminal statutes enacted after, as well as before, the act of limitations was passed.

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notice, placard, circular, hand-bill or advertisement, in the likeness or similitude of any circulating note, or other obligation or security, of any banking association organized or acting under the laws of the United States, which has been or may be issued under this title, or any act of congress, or to write, print, or otherwise impress upon any such note, obligation, or security, any business or professional card, notice, or advertisement * * * of any matter or thing whatever. *Every person who violates this section shall be liable to a penalty of one hundred dollars, recoverable, one-half to the use of the informer.* (Emphasis added.)

In sustaining defendant's motion to quash the indictment the court stated:

It is well settled that when a statute makes it unlawful to do an act, and a penalty is given for doing such act, and no special mode of enforcing the penalty is provided, such penalty may be recovered in an action of debt, or by indictment or information; but when the statute creates the offense, prescribes the penalty, and the mode of enforcing it, it would seem that the penalty can only be enforced in the mode provided by the statute (at p. 699).

These statutes, in effect, say to all persons: "If you print or stamp upon a United States note or bond, or a national bank-note, any business card or advertisement, you are liable to a penalty of one hundred dollars, recoverable at the suit of an informer,"—and do not say that the offender can be indicted by a grand jury, and tried as a criminal (at p. 701).

Although the word "recoverable" might suggest a civil proceeding was intended for the collection of the \$100 penalty,¹⁵ nevertheless, the statute did not specifically or explicitly authorize the informer to initiate that civil proceeding. The Court construed the statute to authorize a *qui tam* action despite the absence of language expressly giving such authorization.

In *United States v. Stocking*, 87 Fed. 857 (D. Mont., 1898), the

United States brought an indictment to enforce R.S. 2148, the act of August 18, 1856, 11 Stat. 80, sec. 2, which read:

That if any person who has been removed from the Indian country under the provisions of the tenth section of the act of Congress approved the 30th of June, 1834 * * * shall thereafter at any time return or be found within the Indian territory, such offender shall forfeit and pay the sum of one thousand dollars.

Under the same title (28) as R.S. 2148 was R.S. 2124, formerly the act of June 30, 1834, 4 Stat. 733, sec. 27, which stated:

That all penalties which shall accrue under [this title] shall be sued for and recovered in an action of debt in the name of the United States before any court having jurisdiction of the same in any state or territory in which the defendant shall be arrested or found, one half to the use of the informer, and the other half to the use of the United States; except where the prosecution shall be first instituted on behalf of the United States, in which case the whole shall be to their use.

The defendant argued that an indictment did not lie to enforce R.S. 2148, as R.S. 2124 only authorized a civil debt action for the penalty. In rejecting this argument the court stated:

In order to justify a court in holding that congress has by any act narrowed the rights of the United States in any particular as to any remedy, that intention ought to clearly appear. The cases of *U.S. v. Payne*, 22 F. 426, and *In re Seagraves*, (Okl.), 48 P. 272, are based upon the view that section 2124 applies only to an action by the United States, and does not establish the rights and remedy of an informer, and that the United States alone can maintain the action named therein. I do not believe a correct interpretation of that section will support this view. The first clause of that section evidently refers to what is termed a "*qui tam* action," and the government does not maintain *qui tam* actions (at p. 862).

Earlier in the opinion the court stated.

Upon the examination of title 28, I find no express provisions that an informer would be entitled to any portion of the penalties named therein. Under the provi-

¹⁵ *United States v. Atlantic Fruit Co.*, 206 Fed. 440 (1913).

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sions of said section 2124, an informer is entitled to one-half of the penalty sued for, unless the action is first prosecuted by the United States. *Any words of a statute which show that a part of the penalty named therein shall be for the use of an informer will entitle him to maintain an action therefor* if he complies with the conditions of the statute * * *. While there is no express provision of the Revised Statutes * * * which gives an informer any part of the penalties named in title No. 28, yet I think the provisions of section 2124 impliedly give him one-half of the said penalties. *If he has this right, then this section gives him, in my judgment, the right to sue therefor in the name of the United States.* * * *. If an informer is given no right, under * * * section 2124, it is difficult to discover its meaning (at pp. 861-2).

Although the language in Rev. Stat., sec. 2124 "except where the prosecution shall be first instituted on behalf of the United States" might imply that another mode of prosecution was available under

the statute, and the court found this language helpful in construing the statute to authorize an informer action, nevertheless Revised Statutes 2124 did not specifically authorize or prohibit a *qui tam* action. The opinion supports the Supreme Court's position in *U.S. ex rel. Marcus v. Hess*, *supra*.

In *Chicago and Alton R.R. Co. v. Howard*, 38 Ill. 415 (1865), the Supreme Court of Illinois sustained a lower court ruling that plaintiff Howard could sue *qui tam* to collect a \$1,000 penalty for defendant's violations of an act requiring a railroad to blow a whistle or ring a bell at and near railroad crossings. One section (38) of the act in question provided for payment of "a penalty of \$50 for each neglect to be paid by the corporation owning the railroad, one-half thereof to go to the informer, and the other half to the State" (sec. 38, act of Nov. 5, 1849). Another section (42) stated that "all penalties imposed by this act *may* be sued for by the District Attorney." In upholding the *qui tam* suit the court stated:

If the 42d section had contained the only provision for bringing suit, then it would have to be brought by the State's attorney, and in the name of the people. But under the 38th section a common informer may sue, in the common law mode, in his own name, as well as on behalf of the people (at p. 418).

Here also, although the statute in question did not specifically authorize an informer's *qui tam* action, the court construed it to authorize such an action.

VII. ENGLISH STATUTES NOT SPECIFICALLY AUTHORIZING OR FORBIDDING CITIZENS TO BRING *Qui Tam* ACTIONS HAVE BEEN UNDERSTOOD TO AUTHORIZE SUCH ACTIONS

In England, also, statutes, like the Refuse Act, which neither specifically authorize nor forbid informers to bring *qui tam* actions, have been understood to authorize such actions.

For example, the Apothecaries Act of 1815, 55 Geo. 3 c. 194 (Halsbury's "Statutes of England," 2d ed., vol. 15, pp. 3-66), which prohibited persons from practicing as apothecaries without a license, provided (sec. 26):

All penalties and forfeitures * * * shall [if greater than £5] be recovered by action * * * in the name of the master wardens, and society of the art * * * of apothecaries of the city of London * * * [or, if less than £5], * * * by distress and sale of the goods and chattels of the offender.

It further provided (sec. 25):

All sums * * * arising from convictions and recovery of penalties * * * shall be * * * disposed of in manner following: one-half thereof to the informer or informers, * * *

This statute has been understood to authorize a *qui tam* action by the informer.¹⁶

Another example is the Universities (Wine Licenses) Act of 1743, 17 Geo. 2. c. 40 (Halsbury's "Statutes of England," 2d ed., vol. 13, at p. 118), which prohibited the sale of liquor on the campuses of Oxford and Cambridge Universities without a license from the chancellor of either university. Violation of the act subjected one to a forfeiture of "five pounds, one moiety to the use of his Majesty * * * and the other moiety to the informer" (sec. 11).

Section 11 further provided:

all persons offending against this Act shall * * * be prosecuted * * * in the courts of the chancellors * * * of the said universities * * * in a summary way * * *

The summary enforcement procedures set forth in the act make no reference to participation by informers. This statute also has been understood to authorize *qui tam* actions by informers.¹⁷

VIII. SECTION 413 OF TITLE 33 OF THE UNITED STATES CODE DOES NOT SPECIFICALLY FORBID THE INFORMER FROM INSTITUTING A *Qui Tam* ACTION UNDER THE REFUSE ACT

It has been assumed so far in this memorandum, without discussion, that the Refuse Act does not specifically forbid a *qui tam* action by the informer. Is this the case?

Section 413 of 33 U.S.C. states in part:

The Department of Justice shall conduct the legal proceedings necessary to enforce the provisions of sections 401, 403, 404, 406, 407, 408, 409, 411 * * *, and it shall be the duty of United States attorneys to vigorously prosecute all offenders against the same whenever requested to do so by the Secretary of Army or by any of the officials hereinafter designated * * *

This section quite plainly says that the Department of Justice shall conduct the criminal proceedings to *enforce* the act. It does not prohibit the informer from conducting civil *qui tam* proceedings to recover his moiety of the penalty. Thus, in *United States v. Griswold*, 5 Sawy. 25, Fed. Cas. No. 15,266 (D.C., D. Oregon, 1877), an informer sued to enforce the Informers Act of March 2, 1863, 12 Stat. 696, later set forth as R.S. 5438, 3490-3493, cited above as one of numerous Federal statutes authorizing *qui tam* actions.¹⁸ The Informer Act established two modes of prosecuting those who filed false claims or otherwise committed fraudulent acts against the United States Government. One mode was a criminal action prosecuted by the Government for fine and imprisonment. The second mode was an informer action for a monetary forfeiture of \$2,000 plus double the damages sustained by the United States. R.S. 3491 specifically stated that suit "to recover the forfeiture and damages may be brought and carried on by any person, as well for himself as the United States."

The informer could keep one-half the amount recovered.

In *United States v. Griswold* the court denied defendant's motions to (a) strike the complaint because not properly subscribed, and (b)

¹⁶ See schedule of statutes attached to the Common Informers Act, 14 and 15 Geo. 6, c. 39, 22d June 1951, Halsbury's *Statutes of England*, 3d ed., vol. 8, at p. 391. See also Radzinowicz, vol. II, at p. 145, set forth in footnote 17, *infra*.

¹⁷ See schedule of statutes attached to the Common Informers Act, cited in note 16, *supra*. See also Radzinowicz, vol. II, at p. 145; "Common informers were also empowered to bring an action against anyone who * * * retailed wine within the precincts of the Universities of Oxford and Cambridge without a license from the Chancellor or the Vice Chancellor (citing 17 Geo. 2, c. 40, s. 11) * * * or practised as an apothecary without the necessary certificate (citing 55 Geo. 3, c. 194)."

¹⁸ See pt. V, *supra*.

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vacate the writ of arrest because improperly issued. In ruling on the first motion the court observed that, as a private citizen could bring the action in the name of the United States, his attorneys were the attorneys for the United States and proper subscription of the complaint merely required their, and not the district attorney's, signature(s). After noting that the action was one *qui tam*, the court stated (26 Fed. Cas. at p. 44):

When, as in this case, a statute imposed a penalty for the commission of an act, and also gave such penalty in part to whoever would sue for it, and the remainder to the king or other public use, the action to recover such penalty, if brought by a private person, was brought in his own name and subject to his control. Although a judgment obtained therein was for the benefit of the king or other public use as well as the plaintiff, yet the action was, to all intents and purposes, the private action of the latter. 3 Blackstone, Commentaries 160.

The court also stated (*Id.*, p. 44):

For all purposes, except the discontinuance of the action, the attorney employed by the informer to commence and conduct the same is the attorney of the United States therein. *Neither does the fact that the district attorney is required to be diligent to enforce the statute against persons violating it, make him the attorney of the United States in that action* * * * [W]hichever—the informer or the district attorney—first commences an action for a particular violation of the statute, thereby excludes the other from so doing. (Emphasis added.)

The court concluded (*Id.*, p. 44):

Neither does the provision in section 771 of the Revised Statutes ¹⁹ *which makes it the duty of the "district attorney to prosecute in his district * * * all civil actions in which the United States are concerned," authorize or require him to act as attorney for the plaintiff in this action.* This section is general in its terms and necessarily qualified and restrained by the sections above cited [i.e., the Informer Act], which relate to the commencement and conduct of this particular action. For that matter the United States is concerned in all *qui tam* actions, whether brought in its own name or that of a private person, because it is entitled to a share of the penalty or forfeiture that may be recovered therein. But the rule of law is, and the practice always has been, that a *qui tam* action is the action of the party who brings it, and the sovereign, however much concerned in the result

of it, has no right to interfere with the conduct of it, except as specially provided by statute. [Emphasis added.]

Section 5 of the Informers Act instructed the U.S. attorneys "to be diligent in inquiring into *any* violation of the provisions of this act * * * and to cause [persons liable to suit] to be proceeded against."²⁰ The court, nevertheless, held that the private citizen could bring a *qui tam* action to enforce the act and that the U.S. attorney could not interfere with this action.

Thus, in light of the *Griswold* opinion, section 413 of the Refuse Act of 1899, directing the U.S. attorneys "to vigorously prosecute all offenders," does not bar the private citizen from hiring his own counsel and bringing a *qui tam* action. Nor does this language of section 413 authorize the U.S. attorneys to assume control of civil litigation begun by the citizen to recover the penalty provided in section 411.

IX. PUBLIC POLICY ARGUMENTS STRONGLY FAVOR THE RIGHT OF THE PRIVATE CITIZEN TO BRING A *Qui Tam* ACTION UNDER THE REFUSE ACT

The Refuse Act of 1899 prohibits the discharge or deposit into the navigable waters of the United States of "refuse matter of any kind * * * other than that flowing from streets and sewers and

¹⁹ Provision in current law similar to R.S. 771 is sec. 4(c), 80 Stat. 618, 28 U.S.C. 547(2).

²⁰ Sec. 5, 12 Stat. 696 (emphasis added).

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passing therefrom in a liquid state," unless such discharge or deposit is done in accordance with a permit from the Corps of Engineers. The Supreme Court has defined "refuse" as including "all foreign substances and pollutants" apart from municipal sewage.²¹ Other language of the act has been interpreted with similar broad scope.²²

The usefulness of the Refuse Act has been substantially increased by liberal judicial interpretation over the years together with the passage of many statutes and the issuance of Executive orders designed to minimize pollution, maximize recreation, protect esthetics, and preserve natural resources to enhance the public interest rather than private gain.²³ It is apparent that the Refuse Act is a broad charter of authority and a powerful legal tool for preventing the pollution of all navigable waters.

Its present usefulness is not reduced by more recent water pollution control legislation. The Federal Water Pollution Control Act specifically states (33 U.S.C. 466k) that it "shall not be construed as (1) superseding or limiting the functions, under any other law, of * * * any other officer or agency of the United States, relating to water

pollution, or (2) affecting or impairing the provisions of * * * sections 13 through 17 of" the River and Harbor Act of 1899, i.e., the Refuse Act.

However, the executive branch of the Federal Government has indicated it does not intend to enforce the Refuse Act against many polluters. In response to inquiries to Attorney General John Mitchell from Congressman Henry S. Reuss, chairman of the House Conservation and Natural Resources Subcommittee, Assistant Attorney General Shiro Kashiwa wrote on June 2, 1970:

In our opinion, it would not be in the genuine interest of the Government to bring an action under the Refuse Act to secure a criminal sanction against a company *which admittedly is discharging refuse into the navigable waters of the United States*, but which, pursuant to a program being conducted by the Federal Water Quality Administration, is spending significant amounts of money to secure the abatement of that pollution. (Emphasis added.)

The Justice Department has formalized this position in a directive to all U.S. attorneys entitled "Guidelines for Litigation Under the Refuse Act" adopted July 10, 1970.

²¹ See *United States v. Standard Oil Co.*, 384 U.S. 224, 230 (1966) and *United States v. Republic Steel Corp.* 362 U.S. 482, 490 (1960).

²² See "Our Waters and Wetlands: How the Corps of Engineers Can Help Prevent Their Destruction, and Pollution," H. Rept. 91-917, 91st Cong., 2d sess., pp. 15-16; *Zabel v. Tabb*, — F. 2d —, 1 Env. Rep. 1449, No. 27555 (U.S. Ct. of App., 5th Circ., July 16, 1970).

²³ Some of these statutes and orders are:

Federal Water Power Act of 1920, as amended (16 U.S.C. 701, et seq.);

Federal Water Pollution Control Act (33 U.S.C. 466, et seq.) as amended by Water Quality Act of 1965 (Public Law 89-234; 79 Stat. 903); Clean Water Restoration Act of 1966 (Public Law 89-753; 80 Stat. 1246); Water Quality Improvement Act of 1970 (Public Law 91-224; 84 Stat. 91);

Delaware River Basin Commission Act of Sept. 27, 1961 (Public Law 87-328; 75 Stat. 688); Bureau of Outdoor Recreation Act of May 28, 1963 (Public Law 88-29, 77 Stat. 49; 16 U.S.C. 460 l);

Section 212, Appalachian Regional Development Act of Mar. 9, 1965 (79 Stat. 5, 16; Public Law 89-4; 40 U.S.C., App., sec. 212);

Water Resources Planning Act of July 22, 1965 (Public Law 89-80; 79 Stat. 244; 42 U.S.C. 1962a);

Section 702, Housing and Urban Development Act of Aug. 10, 1965 (79 Stat. 451, Public Law 89-117; 42 U.S.C. 3102);

Section 106, Public Works and Economic Development Act of Aug. 26, 1965 (79 Stat. 552, 554; 42 U.S.C.: 3136; Public Law 89-136);

Estuarine Study Act of Aug. 3, 1968 (Public Law 90-454; 82 Stat. 625; 16 U.S.C. 1221);

National Water Commission Act of Sept. 26, 1968 (Public Law 90-515; 82 Stat. 868; 42 U.S.C. 1962a, note)

National Environmental Policy Act of 1969 (Public Law 91-190; 83 Stat. 852);

Fish and Wildlife Act of 1956, as amended (16 U.S.C. 742a-742j);

Migratory Bird Conservation Act, as amended (16 U.S.C. 715, et seq.).

Executive Order 11288 of July 2, 1966 (3 C.F.R. 423); superseded by Executive Order 11507 of Feb. 4, 1970 (35 F.R. 2573) (prescribing requirements for control and abatement of air and water pollution at Federal installations).

Executive Order 11472 of May 29, 1969 (34 F.R. 8693), as amended by Executive Order 11514 of Mar. 5, 1970 (35 F.R. 4247), (prescribing responsibilities of Federal agencies and the Council on Environmental Quality under the National Environmental Policy Act of 1969, *supra*).

The Justice Department's position is contrary to the mandate of the 1899 act which forbids discharges without a Corps permit.

If the U.S. attorney fulfills his duty to vigorously enforce the Refuse Act, the polluter who wants to continue discharging refuse will have to obtain a permit from the Corps. Section 21(b) of the Federal Water Pollution Control Act, as amended by the Water Quality Improvement Act of 1970 (Public Law 91-224; 84 Stat. 91, 108), specifies that the applicant for such permit must first obtain a certification from the appropriate State agency that the applicant will conduct this activity "in a manner which will not violate applicable water quality standards." Thus, proper enforcement of the Refuse Act is essential to, rather than in conflict with, the Federal Government's water pollution abatement program under the Federal Water Pollution Control Act.

As noted above one reason why English Parliaments established criminal statutes authorizing *qui tam* suits was their lack of confidence in the Crown's willingness to enforce the statutes passed. Viscount Simon pithily expressed this reason during debate in Parliament in 1951²⁴:

If we lived in an age when the authorities could be suspected of refusing, out of favouritism or fear, to prosecute a particular kind of person, it might be a very useful thing to have this machinery of the common informer to secure that in proper cases a man would be brought to book * * *

In this country today, when the Justice Department is apparently reluctant to vigorously enforce the Refuse Act, the citizen informer who brings a civil *qui tam* suit under that Act performs a very useful and essential function.

Even if the Department of Justice did "vigorously prosecute" violators of the Refuse Act, as it is directed to do by section 17 of the act, the citizen informer could substantially aid the Government. For the Corps of Engineers, which investigates alleged violations of the Refuse Act, and the Department of Justice, which prosecutes violators, do not have the funds and personnel to do battle in court with the thousands of industries in this country which are unlawfully discharging wastes into our navigable waters without a permit from the Corps of Engineers. The Corps has testified before Congress regarding its lack of funds and personnel.²⁵ *Qui tam* statutes were first passed in circumstances such as this, where the police and prosecutorial forces of the government are inadequate to secure proper enforcement of the law.

The active participation of America's citizenry can help to bring a

halt to the degradation and irrevocable alteration of our waters and environment.

²⁴ See footnote 4.

²⁵ See Corps of Engineers fact sheet of Aug. 4, 1970, set forth in Cong. Rec. of Aug. 24, 1970 (p. S 13993), and referred to in Senator Hart's letter of Aug. 7, 1970, appended to speech of Congressman Henry S. Reuss in Cong. Rec. of Aug. 14, 1970 (p. H 8362 at p. H 8364).

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X. AT A TIME WHEN THE FEDERAL COURTS ARE INCREASINGLY WILLING TO ALLOW CITIZENS TO ACT AS PRIVATE ATTORNEYS GENERAL TO ENFORCE POLICIES OF VARIOUS FEDERAL STATUTES BEARING ON ENVIRONMENTAL QUESTIONS, THE COURTS SHOULD NOT HESITATE TO BRING *Qui Tam* ACTIONS UNDER THE REFUSE ACT

In recent years the Federal courts have shown an increased willingness to allow suits by private citizens interested in seeing that the policies of various Federal statutes bearing on environmental questions are properly carried out.

In *Scenic Hudson Preservation Conference v. FPC*, 354 F. 2d 608 (C.A. 2, 1965), several conservation organizations, together with three towns, petitioned the second circuit court of appeals to set aside orders of the Federal Power Commission authorizing Consolidated Edison Company of New York to construct a pumped storage hydroelectric project on the west side of the Hudson River at Storm King Mountain in Cornwall, N.Y. The court, in allowing the citizen organizations the right to challenge the FPC's decision that construction of the pumped storage plant was consonant with the policies of the Federal Power Act, stated:

In order to insure that the Federal Power Commission will adequately protect the public interest in the esthetic, conservational, and recreational aspects of power development, those who by their activities and conduct have exhibited a special interest in such areas, must be held to be included in the class of "aggrieved" parties under sec. 313(b) [of the Federal Power Act, 16 U.S.C. sec. 825(b)]. We hold that the Federal Power Act gives petitioners a legal right to protect their special interests.²⁶

Subsequently, in *Road Review League, Town of Bedford et al v. Boyd*, 270 F. Supp. 650 (S.D.N.Y., 1967), a Federal district court upheld the right of the Road Review League, a nonprofit association concerned with community problems (primarily those involving the location of highways), the town of Bedford, and others to challenge the location of an interstate highway. In allowing the citizens and citizen groups the right to question whether the Secretary of Transportation had followed the directive in the Federal Highways Act (23 U.S.C. 138) to "use maximum effort to preserve Federal, State, and local government parklands and historic sites and the beauty

and historic value of such lands and sites," the court stated:

towns, local civic organizations, and conservation groups are to be considered "aggrieved" by agency action which allegedly has disregarded their interests. I see no reason why the word "aggrieved" should have a different meaning in the Administrative Procedure Act from the meaning given to it under the Federal Power Act.²⁷

In *Gandt et al. v. Hardin* (N.D. Mich., N. Div., Dec. 11, 1969), civil action 1334, the Federal district court followed the *Scenic*

²⁶ *Scenic Hudson Preservation Conference v. FPC*, 354 F. 2d 608, 616 (C.A. 2, 1965), cert. denied, 384 U.S. 941. In *Association of Data Processing Service Organizations, Inc. v. Camp*, 397 U.S. 150, 153, 90 S. Ct. 827, 830 (Mar. 3, 1970), the Supreme Court, citing the *Scenic Hudson* case, noted that the legal interests of a person aggrieved by agency action within the meaning of a relevant statute to whom the Administrative Procedure Act (5 U.S. Code 702) grants the right of judicial review "may reflect aesthetic, conservational, and recreational as well as economic values." See also Kenneth Culp Davis, "The Liberalized Law of Standing," 37 Univ. Chi. L. Rev. 450 (Spring 1970); *Environmental Defense Fund v. Department of Health, Education, and Welfare*, — F. 2d — (No. 23,812, C.A. D.C. May 28, 1970), 1 Env. Rep. 1341; *Environmental Defense Fund v. Hardin*, — F. 2d — (No. 23,813, C.A. D.C. May 28, 1970), 1 Env. Rep. 1347; *Citizens Committee for the Hudson Valley v. Volpe*, 425 F. 2d 97 (C.A. 2d Apr. 16, 1970).

²⁷ 270 F. Supp. at p. 661. The court also pointed out (p. 661) that the "plaintiffs were not [as in *Scenic Hudson*] previously parties in a formal sense to any administrative proceedings, although as a practical matter they participated actively in attempting to secure an administrative determination favorable to their interest."

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Hudson and Road Review League precedents, holding that conservation organizations and private citizens (nonabutting landowners) could challenge the Forest Service's decision to change the Sylvania portion of the Ottawa National Forest in Michigan from a primitive forest area into a managed recreation area.

In *Citizens to Preserve Overton Park, Inc. et al. v. Volpe, et al.*, 309 F. Supp. 1189 (W.D. Tenn., W.D., Feb. 26, 1970), citizens of Memphis organized as the Citizens to Preserve Overton Park, Inc., together with two national conservation organizations and two individual residents of Memphis, sought to enjoin the Secretary of Transportation from releasing Federal funds to the highway department of the State of Tennessee for construction of part of an expressway in the city of Memphis through Overton Park, a zoological garden and recreational area. The court held that the plaintiffs had the right to question whether the Secretary's planned action accorded with policies and procedures set forth in the Department of Transportation Act, 49 United States Code 1653 (f) and 23 United States Code 128, 138, and a memorandum of the Bureau of Public Roads.²⁸

Given the Federal courts' recent willingness to entertain civil suits by citizens acting as private attorneys general to enforce the policies of Federal statutes applicable to projects significantly affecting this Nation's natural environment, the courts should readily allow citizens

to bring civil *qui tam* actions to implement the prohibitions of the Refuse Act.

XI. THE *Pressprich* CASE

In *United States ex rel. Pressprich Son Co. v. James W. Ewell & Co.*, 250 Fed. 939 (CA 2d, 1918), a suit in admiralty was instituted to recover a penalty for violation of sec. 5 of the Carriage of Goods by Sea Act (Harter Act, 49 U.S.C. 194), which provided:

For a violation of any of the provisions of sections 190-193 of this title the agent, owner, or master of the vessel guilty of such violation, and who refuses to issue on demand the bill of lading provided for, shall be liable to a fine not exceeding \$2,000. The amount of the fine and costs for such violation shall be a lien upon the vessel, whose agent, owner, or master is guilty of such violation, and such vessel may be libeled therefor in any district court of the United States, within whose jurisdiction the vessel may be found. One-half of such penalty shall go to the party injured by such violation and the remainder to the Government of the United States.

Judge Learned Hand, speaking for a unanimous court of appeals, stated (250 Fed. at p. 941):

We think that the District Court had no jurisdiction in admiralty over the collection of a penalty by proceedings in personam. * * * Nevertheless, we have no doubt that the fine might be collected by a *qui tam* action in the District Court * * * and that the jurisdiction of the District Court over the subject-matter was, therefore, complete. It is quite true that an indictment will also lie under the Harter Act * * *, but our decision in *United States v. Atlantic Fruit Co.* * * * is to be taken as holding that the United States has the option in such cases of suing in what would have been in earlier times an action of debt, despite the unliquidated character of the recovery. We see no reason to make a distinction between an action by the United States to collect the fine and an action *qui tam* like that at bar.

The language of section 5 entitling the informer to sue *qui tam* for one-half the penalty is essentially the same as in the Refuse Act.

²⁸ A similar case is *Nashville I-40 Steering Committee v. Ellington*, 387 F. 2d 179 (C.A. 6, 1967), cert. denied, 390 U.S. 921, 88 S. Ct. 857 (1968). See also *Izaak Walton League v. Hardin*, — F. Supp. —, 1 E.R. 1401 (No. 5-69 Civ. 70; June 1, 1970).

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XII. OUTLINE OF CITIZEN ACTION UNDER THE 1899 REFUSE ACT

1. *What is Prohibited and Where.*—The 1899 Refuse Act is a powerful, but little used, weapon in our Federal arsenal of water pollution control enforcement legislation. Section 13 of the act (33, U.S. Code 407) prohibits *anyone*, including any individual, corporation, municipality, or group, from throwing, discharging, or depositing any refuse matter of any kind or type from a vessel or from a shore-based building, structure, or facility into either (a) the Nation's navigable lakes, rivers, streams, and other navigable bodies of water, or (b) any tributary to such waters from which the refuse floats or is washed into the navigable water, unless he has first obtained from the Corps of Engi-

neers a permit to do so. Courts have held that streams and bodies of water which are sufficient, at high water, to float boats, canoes, or rafts of logs in commerce are navigable waters. This section of the Act applies to inland waters, coastal waters, and waters that flow across the boundaries of the United States into Canada and Mexico.

The term "refuse" has been broadly defined by the Supreme Court to include all foreign substances and pollutants. It includes solids, oils, chemicals, and other liquid pollutants. The only materials excepted from this general prohibition are those flowing from streets, such as from storm sewers, and from municipal sewers, which pass into a waterway in liquid form.

In addition, the section prohibits anyone, without a corps permit, from placing on the bank of any navigable waterway, or of any tributary to such waterway, any material that could be washed into waterways by ordinary or high water, or by storms or floods, or otherwise, and would result in the obstruction of navigation.

2. *Permits to Discharge.*—Section 13 of the act authorizes the Secretary of the Army, acting through the Corps of Engineers, to permit the deposit of material into navigable waters under conditions prescribed by him. Regulations governing the issuance of permits are published in title 33 of the Code of Federal Regulations, part 209.

3. *Penalty for Violations.*—Violations of the Refuse Act are subject to criminal prosecution and penalties of a fine of not more than \$2,500 nor less than \$500 for each day or instance of violation, or imprisonment for not less than 30 days nor more than 1 year, or both a fine and imprisonment (33 U.S. Code 411). A citizen who informs the appropriate U.S. Attorney about a violation and gives sufficient information to lead to a conviction is entitled to one-half of the fine set by the court.

4. *Procedure for Citizen to Seek Enforcement of the Refuse Act.*—

A. The citizen having information about any discharge of refuse into navigable waters or tributaries thereof should first ascertain whether the discharge is authorized by corps permit. If a permit is in effect, the citizen should ascertain whether the permittee is complying with its terms. This information can be obtained from the appropriate office of the Corps of Engineers with jurisdiction over the particular waters into which the discharge occurs. Such information is available under the Freedom of Information Act (5 U.S. Code 552; Public Law 90-23).

B. The Refuse Act specifically directs that the appropriate U.S. attorney shall "vigorously prosecute all offenders" (33 U.S.C. 413). In order to do so he needs adequate information to prove that the discharges were made and that they violated the law or the condi-

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tions of the permit. Furthermore, the statute specifies that the citizen's right to one-half of the fine is conditioned on his providing to the U.S. attorney information sufficient to lead to a conviction of the violator.

In providing information to the U.S. attorney, the citizen should make a detailed statement, sworn to before a notary or other officer authorized to administer oaths, setting forth:

1. The nature of the refuse material discharged.
2. The source and method of discharge.
3. The location, name, and address of the company, person, or persons causing or contributing to the discharge.
4. The name of the waterway into which the discharge occurred.
5. Each date on which the discharge occurred.
6. The names and addresses of all persons known to the citizen, including himself, who saw or knows about the discharges and could testify about them if necessary.
7. A statement that the discharge is not authorized by corps permit. If a permit was granted, the statement should set forth facts showing that the alleged violator is not complying with one or more of the conditions of the permit.
8. The navigability of the waterway at the area of discharge. If the waterway into which the discharge occurred is not commonly known as "navigable," or is a tributary to a navigable waterway, the statement should set forth facts to show its status as a navigable waterway or tributary thereof.

Where possible, photographs should be taken, and samples of the pollutants or foreign substance collected in a clean jar which is then sealed. These should be labeled with information showing who took the photograph or sample, where, and when, and how, and who retained custody of the film or jar.

Where the material is liable to float or to be washed into the waterway from its bank, in violation of the act, similar information should also be provided to the U.S. attorney.

C. When a citizen furnishes information to the U.S. attorney for the purpose of aiding in the prosecution of violators of the Refuse Act for past discharges, the citizen may also point out to the U.S. attorney that injunctions may be sought under the same act (i) to preclude future discharges; (ii) to require the dischargers to remove pollutants already discharged; and (iii) to require the discharger to apply to the Corps of Engineers for a permit unless he promptly ceases all discharges.

5. *Qui tam suits*.—As shown in this staff memorandum, the informer has a financial interest in the fine and therefore can institute

a *qui tam* suit to recover it. The U.S. district courts have exclusive jurisdiction to hear and decide such a suit, 28 U.S.C. 1355. In such suit, the citizen plaintiff must prove that the alleged violator did, in fact, violate the Refuse Act. Since the suit is a civil action, the proof of such violation need be only by a preponderance of the evidence, rather than beyond a reasonable doubt as is required in a criminal case. *United States v. Regan*, 232 U.S. 37 (1914); *Hepner v. United States*, 213 U.S. 103 (1909); *United States v. Zucker*, 161 U.S. 475 (1896).

If the citizen loses his *qui tam* suit, he would have to bear his lawyer's fees and costs, and may be required to pay all court costs, including such costs of the defendants as the judge may include within the taxable court costs.

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STAFF MEMORANDUM B

Issue 1: Whether *Qui Tam* Action Can Be Used To Implement a Penal Statute Which Gives a Share of the Penalty to the Informer but Does Not Specifically Authorize His Suit To Collect That Share

I. CASES SUPPORTING *Qui Tam* ACTION

A. CASES HOLDING *Qui Tam* ACTION CAN BE BROUGHT

1. *United States v. Laescki*, 29 F. 699 (N.D. Ill., 1887). Indictment by United States to enforce R.S. 5188.

Statute construed: (R.S. 5188): "It shall not be lawful to design, engrave, print or in any manner make or execute, or to utter, issue, distribute, circulate, or use, any business or professional card, notice, placard, circular, handbill or advertisement, in the likeness or similitude of any circulating note, or other obligation or security, of any banking association organized or acting under the laws of the United States, which has been or may be issued under this title, or any act of congress, or to write, print, or otherwise impress upon any such note, obligation, or security, any business or professional card, notice, or advertisement of any matter or thing whatever. *Every person who violates this section shall be liable to a penalty of one hundred dollars, recoverable, one-half to the use of the informer.*" (Emphasis added.)

Holding: Penalty set forth in Rev. Stat., sec. 5188 is recoverable *only* by a *qui tam* action, so indictment by United States does not lie.

Reasoning: "[W]hen the statute creates the offense, prescribes the penalty, and the mode of enforcing it, it would seem that the penalty

can only be enforced in the mode provided by the statute.”¹

“These statutes, in effect, say to all persons: ‘If you print or stamp upon a United States note or bond, or a national bank-note, any business card or advertisement, you are liable to a penalty of one hundred dollars, recoverable at the suit of an informer,’—and do not say that the offender can be indicted by a grand jury, and tried as a criminal.”²

2. *Chicago and Alton R.R. v. Howard*, 38 Ill. 415 (Sup. Ct. Ill. 1865). Informer’s action under statute requiring railroads to blow whistle or ring bell at or near crossings.

Statute construed: A bell of at least 30 pounds weight, or a steam whistle, shall be placed on each locomotive engine, and shall be rung or whistled, at the distance of at least 80 rods from the place where the said road shall cross any other road or street, and be kept ringing or whistling until it shall have crossed said road or street, *under a penalty of \$50 for each neglect*, to be paid by the corporation owning the railroad, *one-half thereof to go to the informer*, and the other half to the State, and also be liable for all damages which shall be sustained by any person by reason of neglect. (Sec. 38, Illinois Act of November 5, 1849) (emphasis added). “All penalties imposed by this act *may* be sued for by the District Attorney, and in the name of the people of the State of Illinois * * *

(Sec. 42, Illinois Act of November 5, 1849) (emphasis added).

¹ 29 Fed. at p. 699.

² 29 Fed. at p. 701.

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Holding: Informer can bring *qui tam* action to collect penalties for alleged violations of section 38.

Reasoning: “It is declared by the 42d section that all penalties imposed by the act may be sued for by the State’s Attorney, and in the name of the people of the State. It is insisted that the word *may* in this act must be construed to mean *shall*. That such is its meaning in all cases where the public, alone, have an interest, or the duty is imposed upon a public officer, there seems to be no question * * *

* * * * *

“If the 42d section had contained the only provision for bringing suit then it would have to be brought by the State’s attorney, and in the name of the people. But under the 38th section a common informer may sue, in the common law mode, in his own name, as well as on behalf of the people.”³

B. OTHER CASES SUPPORTING *Qui Tam* ACTION

1. *U.S. ex rel. Marcus v. Hess*, 317 U.S. 537 (1943). Informer’s

action under R.S. 5438, 3490-3493.

Statutes construed: R.S. 5438. "Every person who makes or causes to be made, or presents or causes to be presented, for payment or approval, to or by any person or officer in the civil, military, or naval service of the United States, any claim upon or against the Government of the United States, or any department or officer thereof, knowing such claim to be false, fictitious, or fraudulent [or who commits other fraudulent acts against the Government] shall be imprisoned at hard labor for not less than 1 nor more than 5 years, or fined not less than \$1,000 nor more than \$5,000."

R.S. 3490. "Any person not in the military or naval forces of the United States, or in the militia called into or actually employed in the service of the United States, who shall do or commit any of the acts prohibited by any of the provisions of section [5438] shall forfeit and pay to the United States the sum of \$2,000, and, in addition, double the amount of damages which the United States may have sustained by reason of the doing or committing such act, together with the costs of suit; and such forfeiture and damages shall be sued for in the same suit."

R.S. 3491. "* * * Such suit may be brought and carried on *by any person, as well for himself as for the United States*; the same shall be at the sole cost and charge of such person, and shall be in the name of the United States, but shall not be withdrawn or discontinued without the consent, in writing, of the judge of the court and the district attorney, * * *." (Emphasis added.)

SEC. 3492. "It shall be the duty of the several district attorneys of the United States for the respective districts, for the District of Columbia, and for the several territories, to be diligent in inquiring into any violation of the provisions of section 3490 by persons liable to such suit, and found within their respective districts or territories, and to cause them to be proceeded against in due form of law for the recovery of such forfeiture and damages. And such person may be arrested and held to bail in such sum as the district judge may order, not exceeding the sum of \$2,000, and twice the amount of the damages sworn to in the affidavit of the persons bringing the suit."

³ 38 Ill. at pp. 417-18.

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SEC. 3493. "The person bringing said suit and prosecuting it to final judgment shall be entitled to receive one-half the amount of such forfeiture, as well as one-half the amount of the damages he shall recover and collect; and the other half thereof shall belong to and be paid over to the United States; and such person shall be entitled to receive to his own use all costs the court may award

against the defendant * * *: *Provided*, That such person shall be liable for all costs incurred by himself in the case, and shall have no claim therefor on the United States."

Holding: Collusive bidding for P.W.A. contracts with local governmental units in Allegheny County, Pa., constituted violation of R.S. 5438. Informer could bring civil suit under the statute, even though he relied for his information on an indictment previously filed by the Federal Government wherein the defendants pleaded nolo contendere.

Reasoning: "Statutes providing for a reward to informers which do not specifically either authorize or forbid the informer to institute the action are construed to authorize him to sue. *Adams v. Woods*, 2 Cranch 336." ⁴

2. *United States v. Stocking*, 87 F. 857 (D. Mont., 1898).

Indictment by United States to enforce R.S. 2148.

Statutes Construed: R.S. 2148 (Act of August 18, 1856): "That if any person who has been removed from the Indian country under the provisions of the tenth section of the act of congress approved the 30th of June, 1834 * * * shall thereafter at any time return or be found within the Indian territory, such offender shall forfeit and pay the sum of one thousand dollars."

Under the same title (28) as R.S. 2148 was R.S. 2124, formerly the act of June 30, 1834, sec. 27, 4 Stat. 733, which stated:

"That all penalties which shall accrue under [this title] shall be sued for and recovered in an action of debt in the name of the United States before any court having jurisdiction of the same in any state or territory in which the defendant shall be arrested or found, one half to the use of the informer, and the other half to the use of the United States; *except where the prosecution shall be first instituted on behalf of the United States, in which case the whole shall be to their use.*" [Emphasis added.]

Holding: Indictment valid. R.S. 2124 did not limit United States to civil debt action to recover penalty set forth in R.S. 2148.

Reasoning: Act of August 18, 1856, prior to incorporation into the Revised Statutes, was enforceable by action of debt, information, or indictment. Inclusion of act of June 30, 1834, together with act of August 18, 1856, under title 28 of Revised Statutes and change of language of act of June 30, 1834, from "That all penalties which shall accrue under this act * * *" to "That all penalties which shall accrue under this *title*" did not result in limiting the remedies available to the United States for recovery of the penalty provided by R.S. 2148. In revising and consolidating the laws, Congress here did not clearly express an intent to change the procedures for enforcement of R.S. 2148 (act of August 18, 1856).

The court noted that R.S. 2124 not only refers to civil actions by the

United States, but also authorizes *qui tam* actions by informers.

⁴ 317 U.S. at p. 541, footnote 4. See also 28 U.S.C. 2461 (a): "Whenever a civil fine, penalty or pecuniary forfeiture is prescribed for the violation of an Act of Congress, without specifying the mode of recovery or enforcement thereof, it may be recovered in a civil action." In adding sec. 2461 (a) to the Judicial Code in 1948, the code revisers cited *U.S. ex rel. Marcus v. Hess*, *supra*.

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"Under the provisions of said section 2124, an informer is entitled to one-half of the penalty sued for, unless the action is first prosecuted by the United States. *Any words of a statute which show that a part of the penalty named therein shall be for the use of an informer will entitle him to maintain an action therefore if he complies with the conditions of the statute.*"⁵

3. *Bradlaugh v. Clarke*, 8 App. Cas. 354, 1 Eng. Rul. Cas. 667 (1883). Informer's suit for penalties imposed by the statute 29 and 30 Vict., c. 19 upon a member of House of Commons sitting and voting without having taken the oath prescribed by the statute.

Statute construed: "If any member of the House of Peers votes * * * in the House of Peers, or sits as a Peer during any debate in the said House, without having made and subscribed the oath hereby appointed, he shall for every such offense be subject to a penalty of £500, to be recovered by action in one of Her Majesty's superior courts at Westminster; and if any member of the House of Commons votes as such in the said House, or sits during any debate after the Speaker has been chosen, without having made and subscribed the oath hereby appointed, he shall be subject to a like penalty for every such offense." (29 and 30 Vict. C. 19)

Holding: Informer had no right of action under this statute. (It should be noted that the statute says nothing about any part of the penalty being payable to the informer.)

Reasoning: "It was acknowledged [by the lower court], as an incontestable proposition of law, that "where a penalty is created by statute, and nothing is said as to who may recover it, and it is not created for the benefit of a party grieved, and the offense is not against an individual, it belongs to the Crown, and the Crown alone can maintain a suit for it. * * * It rests on a very plain and clear principle. No man can sue for that in which he has no interest; and a common informer can have no interest in a penalty of this nature, *unless it is expressly, or by some sufficient implication, given to him by statute.* The Crown, and the Crown alone, is charged generally with the execution and enforcement of penal laws enacted by public statutes for the public good, and is interested, *jure publica*, in all penalties imposed by such statutes, and therefore may sue for them in due course of law, where no provision is made to the contrary.

The *onus* is upon a common informer to show that the statute has conferred upon him a right of action to recover the particular penalty which he claims.

*"I do not agree * * * that for such a purpose express words are necessary. If an intention to confer such a right ought to be implied from what the legislature has said, upon any sound principle of construction, that implication cannot, in my opinion, be excluded by reasons derived from the special prerogatives of the Crown.*

*"Express words, giving a right of action to anyone who may sue for the penalty, are certainly not found in this statute. Nor is there anything from which, upon ordinary principles of construction, such a right of action can be implied * * *."*⁸

4. *Colburn v. Swett*, 42 Mass. 232 (1840). Informer's action under Mass. Stats. 1833, ch. 151, as amended by Mass. Stats. 1837, ch. 99.

Statute construed.—"Any person, who shall keep, have or possess any gunpowder within the city of Boston, contrary to the provisions

⁸ 87 Fed. at p. 861 (emphasis added).

⁹ 1 Eng. Rul. Cas. at pp. 670-671 [emphasis added].

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of the [1833 act] or to the rules and regulations of the board of engineers therein mentioned, or who shall sell any gunpowder in said city, without having a license therefor * * * shall forfeit a sum not less than \$100, and not exceeding \$500, for each offense." (Sec. 1, Mass. Stat. 1837, ch. 99.)

*"The several fines, penalties, and forfeitures, mentioned in this act, and in the [1833 act] shall enure to the sole use of the board of engineers of the fire department of said city of Boston * * *."* (Sec. 2, Mass. Stat., 1837, ch. 99.)

Holding.—Informer cannot bring action to collect the penalty provided in above statute.

Reasoning.—A section of the 1833 statute giving a moiety of all fines, penalties, or forfeitures "to the use of any person or persons who shall prosecute for the same" had been repealed by the 1837 statute, thus destroying the basis for an informer action.

*"Whether an action would lie in the name of the engineers [of the city of Boston] we give no opinion. It seems to be held, that when a penalty is given wholly to one or more persons, an action will lie for it in the name of those persons, although no express authority to sue for it is contained in the statute."*¹

5. *Adams, Qui tam v. Woods*, 2 U.S. (2 Cr.) 336 (1805). This case was cited in footnote 4 of *U.S. ex rel. Marcus v. Hess*, 317 U.S. 537, 541 (1942), which stated: "Statutes providing for a reward to informers which do not specifically either authorize or forbid the

informer to institute the [*qui tam*] action are construed to authorize him to sue." The *Adams* case involved a *qui tam* civil action by an informer under section 2 of the act of Congress of March 22, 1794 (1 Stat. 347).

Statute construed.—"Sec. 2. That all and every person, so building, fitting out, equipping, loading, or otherwise preparing, or sending away, any ship or vessel, knowing or intending that the same shall be employed in such [slave] trade or business, contrary to the true interest and meaning of this act, or any ways aiding or abetting therein, shall severally forfeit and pay the sum of \$2,000, one moiety thereof to the use of the United States, and *the other moiety thereof to the use of him or her who shall sue for and prosecute the same.*" [Emphasis added.]

"[N]or shall any person be prosecuted, tried or punished for any offense not capital, nor for any fine or forfeiture under any penal statute, unless the indictment or information for the same shall be found or instituted within 2 years from the time of committing the offense, or incurring the fine or forfeiture aforesaid * * *." (Sec. 32, act of Congress of April 30, 1790, 1 Stat. 119.)

Holding.—Section 32 of act of April 30, 1790, barred a *qui tam* civil action under section 2 of the act of March 22, 1794, not brought within the 2-year period of limitations.

Reasoning.—"Almost every fine or forfeiture under a penal statute, may be recovered by an action of debt, as well as by information; and to declare that the information was barred, while the action of debt was left without limitation, would be to attribute a capriciousness on this subject to the legislature, which could not be accounted for; and to declare that the law did not apply to cases on which an

¹ 42 Mass. at pp. 234-235. [Emphasis added.]

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action of debt is maintainable, would be to overrule express words, and to give the statute almost the same construction which it would receive, if one distinct member of the sentence [i.e., "no person shall be prosecuted, tried or punished"] was expunged from it. *In this particular case, the statute which creates the forfeiture does not prescribe the mode of demanding it; consequently either debt or information would lie.*⁸ It would be singular, if the one remedy should be barred and the other left unrestrained".⁹

The 1794 act discussed in the *Adams* case did not specifically indicate whether the informer's suit should be a civil action or a criminal information. Chief Justice Marshall read the act to authorize either procedure.

II. DISTINGUISHABLE CASE CONTAINING UNFAVORABLE LANGUAGE

Wheeler v. Goulding, 79 Mass. 539 (1859). Petition by informer to be admitted as party to carry forward suit initiated by treasurer of city of Worcester against alleged violator of Mass. Stat., 1843, ch. 98.

Statute construed.—"If any shareholder shall fraudulently transfer any share in either of the corporations mentioned in the first section of this act, for the purpose of avoiding taxation, he shall forfeit one-half of the par value of the shares thus transferred, *to be recovered* in any court of competent jurisdiction, *by the treasurer of the city or town* in which such shareholder may reside; one-half of the amount so recovered for the use of the town, and the other half for the use of the person or persons furnishing the necessary evidence in the case." (Sec. 3, Mass. Stat, 1843, ch. 98). (Emphasis added.)

Holding.—Informer cannot join as party to prosecute violation of Mass. Stat., 1843, ch. 98. Only treasurer of city of Worcester can sue for penalty provided by the statute.

Reasoning.—"It is perfectly clear * * * that no other person but the treasurer of the city of Worcester could sue for this penalty. We are all of opinion that, except so far as he may be bound to act under such orders and directions of the city government, or is disposed to exercise his discretionary power, in subordination to such directions, not only the right to institute such suit is vested in such treasurer, but the right to prosecute and discontinue it * * *. The right of the petitioner does not arise until some penalty has been recovered." ¹⁰

Dicta.—"This action is quite distinguishable from a *qui tam*. That is a well established remedy, known to and regulated by the common law, as a mode of securing the execution of penal laws, *where it is expressly given by statute*, * * * *But it can be used only in cases where it is expressly given*." ¹¹

⁸ At common law an *informer* could bring either a civil action or criminal information *qui tam*. See Edward Deacon, *A Digest of the Criminal Law of England*, vol. 1 (1831): "Informations are of two sorts; first, those which are partly at the suit of the king, and partly at that of a subject; and, secondly, such as are only in the name of the king. The former * * * are usually brought before justices of the peace upon penal statutes, which inflict a penalty upon conviction of the offender—one part to the use of the king, and another to the use of the informer—and are, in fact, a sort of *qui tam action*, only carried on by a criminal, instead of a civil process" (at p. 671).

⁹ 2 U.S. at p. 341 (emphasis added).

¹⁰ 79 Mass. at pp. 542-543.

¹¹ 79 Mass. at p. 542 (emphasis added).

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III. CASES HOLDING *Qui Tam* ACTION DOES NOT LIE

1. *Omaha and Republican Valley Railway Co. v. Hale*, 45 Neb. 418 (1895). Informer's *qui tam* action under section 104, Compiled Statutes of Nebraska (1893).

Statutes construed.—"A bell of at least 30 pounds weight or a steam whistle shall be placed on each locomotive engine, and shall be rung or whistled at the distance of at least 80 rods from the place where the said railroad shall cross any other road or street, and be kept ringing or whistling until it shall have crossed said road or street, under a penalty of \$50 for every neglect * * * one-half thereof to go to the informer, and the other half to this state * * *" (Sec. 104, ch. 16, Compiled Statutes of Nebraska, 1893).

"If any informer, under a penal statute, to whom the penalty, or any part thereof, if recovered, is given, shall dismiss his suit or prosecution, or fail in the same, he shall pay all costs accruing on such suit or prosecution, unless he be an officer whose duty it is to commence the same." (Sec. 617 of Nebraska Code of Civil Procedures.)

Holding.—Informer cannot bring *qui tam* action under above statute.

Reasoning.—"[The] authorities, we think, without serious conflict, recognize this rule, an informer cannot maintain an action in his own name to recover a penalty unless authorized so to do by statute. The statute on which this action is based does not expressly authorize the penalty denounced by said statute to be sued for and recovered by an informer, nor does the statute contain any language from which such an authority may be inferred. The act provides that the penalty shall be paid by the corporation owning the railroad. Paid to whom? We think, paid to the State" * * * ¹²

The court further held that section 617 of the Nebraska Code of Civil Procedures provided no independent basis for the informer's *qui tam* action.

2. *Smith v. Look*, 108 Mass. 139 (1871). Informer's *qui tam* action under Mass. Stat., 1869, ch. 384.

Statute construed.—"One-half of the money recovered as a penalty, in any case arising under the laws relating to inland fisheries, shall be paid to the person making the complaint in the case in which the same is recovered, and the remainder to the Commonwealth." (Sec. 33; Mass. Stat., 1869 ch. 384.)

Holding.—Informer cannot maintain *qui tam* action under above statute.

Reasoning.—(After reviewing numerous Massachusetts statutes): "In the few cases in which any special provision is made for * * * disposition of * * * forfeitures [to someone other than the Commonwealth], the language is explicit, and the phraseology is, 'recoverable in an action of tort to the use of the party suing therefor,' or 'to the use of any person suing for the same,' or 'recoverable in an action of tort by selectmen to the use of the town or city,' etc. We find no case in which a right of action to any private person in

his own name is given in terms less explicit * * *."

"The statute in question does not in express terms give a right to any private prosecutor to bring an action in his own name, nor does it, in our judgment, by any necessary implication. * * * A *qui tam*

¹² 45 Neb. at p. 423.

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action is a well established remedy, which is to be resorted to only in cases where it is expressly given."¹³

3. *O'Kelly v. The Athens Manufacturing Co.*, 36 Ga. 51 (1876). Informer's *qui tam* action under Act of December 9, 1862, Georgia Laws.

Statute construed: Section 1: "That all companies chartered under the laws of this State for the manufacture of cotton or woolen goods, or cotton yarn or thread, shall be required to have published twice during each year, in a public gazette nearest to their respective places of business, a list containing the names of each and every stockholder, with the amount of stock owned by him or her.

Section 2: "Any such corporation failing to have such publication made, shall forfeit, for each failure to have published, the sum of \$5,000, to be recovered by action in the superior court of the county in which the business of said company or companies may be located, one-half to go to the informer, and the other half to go to the county where suit may be instituted." (Act of Dec. 9, 1862, Georgia Laws.)

Holding: *Qui Tam* action does not lie under above statute.

Reasoning: "[W]e have a distinct statutory provision in our code, section 3178, which prescribes that in penal actions allowed in pursuance of public justice under particular laws, if no special officer is authorized by such particular laws to be *the plaintiff* therein, the State, or the Governor,¹⁴ or the Attorney or Solicitor General, may be the plaintiff * * * The suit here was instituted since this enactment. Neither the pleading nor testimony show O'Kelly to be such an officer, or to be authorized by the act which imposed the forfeiture sued for, to be the plaintiff in the suit."¹⁵

Issue 2: Whether the Informer's *Qui Tam* Action Is Barred Because 33 U.S.C. 413 States That "The Department of Justice Shall Conduct the Legal Proceedings Necessary To Enforce the [Refuse Act]" and "It Shall Be the Duty of U.S. Attorneys To Vigorously Prosecute All Offenders Against the Same * * *"

I. CASE SUPPORTING ARGUMENT THAT SECTION 413 DOES NOT BAR THE *Qui Tam* ACTION

United States v. Griswold, 5 Sawyers 25, Fed. Cas. No. 15,266 (D. Oregon, 1877). Informer's suit under Informer's Act of March 2, 1863, R.S. 5438, 3490-3493.

Statutes construed: See R.S. 5438, 3490-93, set forth in discussion of U.S. *ex rel. Marcus v. Hess*, *supra*.

Holding: Plaintiff/informer's complaint did not have to be signed by the U.S. attorney. Statutory direction to the U.S. attorney to be diligent in enforcing the Informer's Act and to prosecute all civil actions in which the United States is concerned did not authorize the U.S. attorney to interfere with informer's action.

Reasoning: "When, as in this case, a statute imposed a penalty for the commission of an act, and also gave such penalty in part to whoever would sue for it, and the remainder to the king or other

¹³ 108 Mass. at p. 141 (emphasis added).

¹⁴ The Governor was allowed under sec. 3178 to sue on behalf of the informer and the county school fund in *McDaniel, Governor v. The Gate City Gas Light Co.*, 79 Ga. 58 (1887).

¹⁵ 36 Ga. at p. 53 (emphasis added).

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public use, the action to recover such penalty, if brought by a private person, was brought in his own name and subject to his control. Although a judgment obtained therein was for the benefit of the king or other public use as well as the plaintiff, yet the action was, to all intents and purposes, the private action of the latter. 3 Blackstone, Commentaries 160".¹⁶

The court also stated: "For all purposes, except the discontinuance of the action, the attorney employed by the informer to commence and conduct the same is the attorney of the United States therein. *Neither does the fact that the district attorney is required to be diligent to enforce the statute against persons violating it, making him the attorney of the United States in that action * * * [W]hichever—the informer or the district attorney—first commences an action for a particular violation of the statute, thereby excludes the other from so doing*".¹⁷

The court concluded: "*Neither does the provision in section 771 of the Revised Statutes which makes it the duty of the 'district attorney to prosecute in his district * * * all civil actions in which the United*

*States are concerned,' authorize or require him to act as attorney for the plaintiff in this action. This section is general in its terms and necessarily qualified and restrained by the sections above cited [i.e., the Informer Act], which relate to the commencement and conduct of this particular action. For that matter the United States is concerned in all qui tam actions, whether brought in its own name or that of a private person, because it is entitled to a share of the penalty or forfeiture that may be recovered therein. But the rule of law is, and the practice always has been, that a qui tam action is the action of the party who brings it, and the sovereign, however much concerned in the result of it, has no right to interfere with the conduct of it, except as specially provided by statute".*¹⁸

II. CASES WHICH BAR Qui Tam ACTION BUT WHICH ARE DISTINGUISHABLE

1. *Williams v. Wells Fargo Co.*, 177 Fed. 352 (C.A. 8, 1910), Informer action under R.S. 4059.

Statutes construed: "Unless a different disposal is expressly prescribed, one-half of all penalties and forfeitures imposed for violations of law affecting the [Post Office] Department, its revenues or property, shall be paid to the person informing and prosecuting for the same * * * (R.S. 4059).

"[A]ll suits arising under the postal laws, shall be brought in the name of the United States. (R.S. 919) (emphasis added).

"The Sixth Auditor [of the Treasury] shall superintend the collection of * * * all penalties and forfeitures imposed for any violation of the postal laws * * * and take all such other measures * * * to enforce * * * the recovery of such penalties and forfeitures" (R.S. 292). (Emphasis added.)

Holding: R.S. 919 and 292 evince congressional intent that only the United States can bring actions to enforce the postal laws. Informer's *qui tam* action, therefore, does not lie.

Reasoning: "[W]hile the language employed in section 4059, 'one-half to the use of the person informing and prosecuting for the same,' would, in the absence of any statutory provision to the contrary, by

¹⁶ 26 Fed. Cas. at p. 44.

¹⁷ 26 Fed. Cas. at p. 44 (emphasis added).

¹⁸ 26 Fed. Cas. at p. 44 (emphasis added).

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necessary implication, authorize the informer to bring and maintain this action as a private citizen in his own name and to the use of himself and the government, yet, as has been seen, this is beyond all peradventure a suit to recover a penalty arising under the postal laws as provided in section 919 above quoted, and as that section

forms a part of the procedure act in the federal courts, and as it in express terms commands that all such suits shall be brought "in the name of the United States," we are inclined to the opinion no other person than the United States may bring and prosecute an action to recover the penalty prescribed * * *."

* * *

"[T]he lawmaking power, in its wisdom, deemed wise that the lawfully constituted authorities of the government should act on their official responsibility in cases of violation of the postal laws, as would seem to be indicated by the terms of section 292 above quoted."¹⁹

2. *Rosenberg v. Union Iron Works*, 109 Fed. 844 (D.C., N.D. Calif., 1901). Informer's action (suing for self alone) under Alien Contract Labor Law of February 26, 1885, (23 Stat. 332), as amended.

Statute construed: "That * * * it shall be unlawful for any person, company, [etc.] * * * to prepay the transportation, or in any way assist or encourage the importation or migration of any alien or aliens * * * into the United States * * * under contract * * * made previous to the importation * * * (Sec. 1, 23 Stat. 332).

"That for every such violation of any of the provisions of section one of this act the person, [etc.] * * * shall forfeit and pay for every such offense the sum of one thousand dollars, which may be sued for and recovered by the United States or by any person who shall first bring his action therefor * * * as debts of like amount are now recovered in the circuit court of the United States; the proceeds to be paid into the Treasury of the United States * * * And it shall be the duty of the district attorney * * * to prosecute *every such suit at the expense of the United States.*" (Sec. 3, 23 Stat. 332) [Emphasis added.]

"[The Secretary of the Treasury shall] pay to an informer who furnishes original information that the law has been violated such share of the penalties recovered as he may deem reasonable and just, not exceeding fifty per centum, when it appears that the recovery was had in consequence of the information thus furnished." [25 Stat. 565, 567.]

Holding: Only the United States can enforce 23 Stat. 332 as amended. The informer's action does not lie.

Reasoning: "The act provides that the penalty therein given 'may be sued for and recovered by the United States, or by any person who shall first bring his action therefor.' If this language stood alone, the right of the plaintiff to recover the judgment sought would be clear * * *; but it does not, and is qualified by the clause immediately following, which provides that any penalty recovered shall be paid into the Treasury of the United States, and by the further provision making it the duty of the district attorney * * * 'to prosecute

every such suit at the expense of the United States' * * *. The statute is highly penal, and it was the evident intention of congress that no prosecutions should be had thereunder unless commenced by

¹⁹ 177 Fed. at p. 356.

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the United States district attorney * * *. [T]he only interest which any person can have in the penalty which may be recovered in an action under this act * * * is that given by the [1888 amendment which] authorizes the Secretary of the Treasury 'to pay to an informer who furnishes original information * * * such share of the penalties recovered as he may deem reasonable and just,' * * *".²⁰

²⁰ 109 Fed. at p. 846.

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4.2d CLEAN WATER FOR THE 1970's,

A Status Report, U.S. Department of the Interior, Federal Water Quality Administration, June 1970

FOREWORD

"America, the Beautiful" is not just a song. It is an ideal that Americans have long cherished—and taken for granted. During the 1960's, we realized with growing alarm that this ideal was being threatened by pollution from an increasing number of sources. We began to understand that the benefits of technology would hold little value unless they could be enjoyed in decent and healthy surroundings. President Nixon expressed the national concern for environmental quality when he declared that "the 1970's absolutely must be the years when America pays its debt to the past by reclaiming the purity of its air, its waters and our living environment. It is literally now or never."

Awareness of the danger to our way of life has created a climate for constructive action by all levels of government, industry and private citizens. The Department of the Interior is the agency of the Federal government charged with the major responsibility for managing and conserving our Nation's natural resources. Department programs encompass a wide range of environmental concerns and directly affect fish and wildlife, water, minerals, land, parks and other resources. Increasing population and growing per capita demands on these natural resources call for careful and imaginative management.

Among Interior's varied missions, water pollution control is one of the most important and demanding. Over the past year, much of the

Department's efforts and my own energies have been devoted to meeting this responsibility. We have been involved in formulating the President's legislative program; in working with student organizations concerned about environmental enhancement; in mapping out protective programs for the Great Lakes; and in controlling oil spills. We have focussed on important environmental issues across the Nation to prevent further damage to our national heritage. The Department has had a major role in reviewing the development of Alaska's vast petroleum resources, and in assuring that proper measures will be taken to protect the sensitive tundra and other environmental values. At the other end of the Nation, the Department is studying ways to protect the South Florida environment as increasing development occurs and to preserve the State's unique Everglades in the face of construction of a large jetport. Water quality protection and enhancement has been of central concern in all these issues.

Even greater challenges for enhancing water quality will face the Department of the Interior and the Federal Water Quality Administration in the years ahead. We must continue to revamp existing programs to make more effective use of our present authorities. We must prepare to implement the Water Quality Improvement Act of 1970 and to carry out the Department's responsibilities under the National Environmental Policy Act of 1969. We must also be ready to respond to new responsibilities stemming from the President's legislative proposals.

This status report of the Federal Water Quality Administration describes the agency's past activities and future plans. The entire field of water pollution control is changing so rapidly that some aspects of the report may be outdated almost before printing is completed. It is a snapshot of the situation at this point in time, of a situation which is dynamic and fluid. Nevertheless, I believe this report will be of great use to the Congress and the American people in describing the point of departure from which we are moving to rescue our water resources in the decade of the 1970's.

WALTER J. HICKEL.

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INTRODUCTION

Many signs point to the 1970's as the "environmental" decade—when the American people and their institutions begin to take full stock of the precious environmental resources of this Nation and to measure some of the cost of the Nation's economic and social growth in terms of the destruction of those resources. The challenge of the 1970's will be to demonstrate that society can have the benefits of urban and industrial growth without necessarily having to live with the destruction.

This challenge is one which is uniting increasing numbers of Americans—old and young, rural and city dwellers. As President Nixon has said, "The environmental problems we face are deep-rooted and widespread. They can be solved only by a full national effort embracing not only sound, coordinated planning, but also an effective follow-through that reaches into every community in the land."

Water pollution control is one of the major aspects of environmental protection and enhancement. Congressional recognition of the importance of water quality protection was reflected in the passage of the first permanent Federal legislation, the Federal Water Pollution Control Act, in 1956 and the subsequent strengthening amendments in 1961, 1965 and 1966. Since 1966, the primary responsibility for carrying out the Federal programs in water pollution has rested with the Federal Water Pollution Control Administration, operating under comprehensive legislation embodied in the Federal Water Pollution Control Act, as amended. Originally part of the Public Health Service and subsequently a separate office in the Department of Health, Education and Welfare, in 1966 the program was transferred to the Department of the Interior. This added new vitality to the ties of water pollution control with other resource management programs in the Department of the Interior and with the effort to provide greater opportunities for all Americans to enjoy outdoor recreation, fishing and parks. Passage of the Water Quality Improvement Act of 1970 resulted in a new name for the agency, the Federal Water Quality Administration (FWQA), which stresses the more positive aspects of the program.

Secretary Walter J. Hickel has stressed his commitment to cleaning up polluted waters and preventing further pollution as one of the primary tasks facing the Department of the Interior. In an appearance before the Committee on Public Works, House of Representatives, in March 1969, the Secretary stated that, with "improved legislation, effective and imaginative administration, adequate financing and tough enforcement, the objectives as outlined by Congress (to achieve positive protection and enhancement of the Nation's waters) can and

will be attained.” The Secretary also promised to the Committee that he would direct FWQA to prepare a report to be submitted to the Congress each year outlining the progress that had been made by the Federal government working in cooperation with its partner agencies in the States and localities.

The purpose of this first annual progress report is to provide a groundwork for understanding the nature of the Federal and State water pollution control programs, to detail the progress which has been made during the first year of the Nixon Administration, and to assess the measures which will be required to fulfill the challenge of the 1970's.

An important part of this assessment is the impact of the significant new water pollution control legislation that has been proposed by President Nixon, as well as that of the recent enactment by the Congress of the Water Quality Improvement Act of 1970. This new and proposed legislation will greatly increase the capability and responsibilities of the Federal water pollution control program.

In many ways, the first year of the Nixon Administration may be considered a time of analyzing progress and capabilities—of taking stock of the Federal water pollution control program and determining what significant new measures or legislation would be needed. This process resulted in several major proposals aimed at strengthening the Federal program and improving the quality and scope of Federal assistance to the States and localities, which President Nixon described to the Congress in his 1970 Environmental Message. These proposals reflect the major new thrusts needed in the Nation's effort to abate and prevent pollution in the coming decade.

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WATER POLLUTION AND THE ENVIRONMENT

Almost any day, in the waters near any large population center in the United States and, increasingly, in the countryside, we can see the signs of water pollution. It comes from many sources and exists in many forms to assail the eyes and the nose and the taste buds. Standing by the banks of an urban river—if one can actually get past the warehouses and wharfs and weeds to see the river—pollution may appear as surface oil slicks, in which old tires and debris and someone's picnic remnants are trapped and float sluggishly by, or as the public health notices warning the citizen not to swim or wade in the water at his feet. Pollution may be manifested in less obvious ways by masses of aquatic weeds and bad taste in the drinking water supplies. Even more subtle will be the—often unseen—changes in the aquatic life of the river, the loss of sport fish and the ascendance of

sludge worms and other "tolerant" life-forms such as carp.

This urban example is repeated throughout the Nation. As our society and economy have grown, the wastes generated by our population and our technology have caused staggering amounts of pollution. Use of our waters to receive and carry away wastes has seriously damaged our ability to enjoy other water uses, such as swimming and boating, sport and commercial fishing. Other water uses, such as domestic, agricultural and industrial water supply, are possible, but often only after considerable advance treatment. Growing public awareness and concern with mounting pollution of the Nation's streams, lakes and coastal waters have stimulated a vast and vigorous national effort to control and abate water pollution.

Water quality problems caused by pollution are prevalent in every region of the country. The two areas where water quality and uses have been most seriously damaged are in the Northeastern States and the Great Lakes. In the Northeast, tremendous urban and industrial growth occurred during the 19th and early 20th centuries when little or no provision was made to control municipal or industrial waste flows to surface waters; the water was expected to "purify itself" and the wastes would float on downstream to become someone else's problem. The result was a legacy of pollution. The Northeastern States have the largest amount of untreated municipal and industrial waste discharges and the largest backlog of waste treatment facility needs.

In the Great Lakes, the discharge of large volumes of wastes, principally from municipal and industrial sources, has greatly accelerated the natural aging process of lakes. The most

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seriously affected of the lakes, Lake Erie, is now in a state of advanced eutrophication or aging—choked with plants, algae and other organic material. Although Lake Erie is not, as some experts have asserted, "dead," it is certain that very great expenditures for water pollution abatement are necessary to restore the fishery of the lake and reopen beaches closed because of pollution.

There are a number of other pollution problems caused by certain industries and sectors of the economy which have led to serious water quality damage in other parts of the country. Animal wastes from feedlots or runoff from irrigated and fertilized fields and areas where pesticides are used are an increasing cause of pollution, particularly in the Midwest and Southwest. The Colorado River becomes more saline every year as a result of irrigation return flows full of salts leached from the fields. The Annual Federal Water Quality Administration (FWQA) report on *Pollution Caused Fish Kills*

chronicles the tremendous aquatic life mortality from agricultural pollution in Kansas and Missouri.

Acid drainage from abandoned mines has destroyed life in many streams in Appalachia and the Ohio Basin generally. Domestic and vessel wastes have polluted many coastal waters where sensitive shellfish were harvested; each year more areas are closed to private and commercial harvesting. Oil spills from vessels and leaks from offshore oil drilling facilities have resulted in several spectacular oil pollution incidents in the last few years, among them the TORREY CANYON and OCEAN EAGLE spills, the Santa Barbara offshore well leaks and the recent fire and oil leaks from drilling in the Gulf of Mexico. Less spectacular oil spills are occurring almost daily in navigable waters across the Nation.

HOW HAS ALL THIS POLLUTION HAPPENED?

Population growth is one major factor. In 1967, the Nation's population passed the 200 million mark. This number of people is expected to double in the next 50 to 60 years. Staggering demands will be placed on our natural resources to support this population. Waters are needed for consumptive purposes, such as public water supply, food production and processing, and some industrial uses, as well as for non-consumptive uses, such as reaction, industrial cooling, and sport and commercial fishing. At the same time that demands for water will increase, so will production of wastes that threaten the environment.

Not only the rate but the pattern of population growth concentrates and magnifies pollution. Urban and suburban sprawl covers green spaces and reduces clean environment in the very areas where people most need it. Intensive development has occurred particularly along the Nation's coastline, in the very estuarine areas that are most sensitive to environmental degradation.

Higher individual incomes and expectations have led to increasing demands for food and consumer goods, for better housing and highways, for a whole range of conveniences. In most cases, production of wastes is "built in" to our technology; as industrial production increases, with attendant demands for water, so does the per capita production of wastes. The public's demand for "throw-away" containers and other convenience items, as well as the tendency toward planned obsolescence, further accelerate this trend.

Consumer use and production of goods have greatly increased the demand for electric power—power production has doubled every ten years since World War II and this rate is expected to increase. Great amounts of water are used in producing electricity, and waste heat from both fossil fueled and nuclear generating plants constitutes a

serious, and increasing, threat to the Nation's waters. For example, the famous salmon runs of the Pacific Northwest are threatened by thermal pollution.

Not only is the volume of industrial production increasing, but the very complexity of the products and wastes creates severe challenges for waste treatment technology. New chemical products are coming on the market every day, most often without sufficient research into the environmental consequences of using them. Widespread use of detergents has led to great increases in the release of phosphate nutrients to the waters, stimulating tremendous and noxious growths of aquatic weeds which cause severe problems in many areas. Radioactive and physiologically-active chemicals, which pose vexing problems, can only increase. Effects which cannot be predicted may be profound and irreversible.

Mining and transporting natural resources also pose increasing dangers for the environment. Greater use of supertankers and pipelines to transport oil and other materials, as well as increasing use of offshore and underwater mining, will greatly increase the dangers of accidental oil pollution and other hazards.

The growing popularity of deep well disposal of wastes presents yet another serious threat to our water resources. Although in some cases carefully controlled deep well injection may contribute to groundwater management, im-

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properly carried out, this method of disposal may result in the contamination of groundwater or interconnected surface water supplies. The greatest problem in dealing with subsurface disposal is that the effects of underground pollution and the fate of the injected materials are uncertain with the limited knowledge available today.

Production of greater quantities of better quality food for American citizens has caused increasing pollution problems. Higher agricultural productivity has been based on irrigation and use of chemical fertilizers and pesticides. Runoff carries salts and chemicals, many of which are highly toxic and have long-lasting environmental effects, into streams. These diffuse waste sources are most difficult to control or treat. The possibility of irreparable and disastrous ecological consequences, particularly from persistent pesticides, has led to increasing demands for controlling or eliminating their use; no one can predict with certainty the impact of such a move on agricultural productivity.

Population growth and greater prosperity have brought a rising demand for beef and other meats. To increase productivity and profits, the trend has been toward raising heavier livestock and

concentrating animals in large feedlots, thereby increasing and concentrating the agricultural waste problems.

In summary, neither the institutions nor the technology of our society has been effectively utilized to prevent widespread pollution from occurring. To provide a better understanding of the specific challenges that control of pollution involves, the sources of pollution are discussed in greater detail in the following sections. These discussions will provide some indication of the magnitude of these sources of pollution and the estimated dimension and costs of clean-up.

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MUNICIPAL WASTES

The two largest sources of waste discharges to the Nation's waters are sewered municipal wastes and industrial wastes. Besides being a large source of organic material, which lowers the dissolved oxygen content of water and increases the concentration of bacteria, municipal waste also contains nutrients that fertilize algae and thus accelerate eutrophication of lakes.

Today, the number of sewered communities in the United States is just under 13,000; 68% of the Nation's population lives in such communities. Raw or inadequately treated sewage from millions of people still flows into our streams. Fortunately, we have the technological knowledge to deal effectively with municipal wastes. However, this technology has not been applied to the extent needed to prevent pollution. Although many communities have been installing and improving their waste treatment facilities, over 1000 communities outgrow their treatment systems every year.

The economic analyses contained in the FWQA's annual report to the Congress on the costs of clean water indicate that only about 40% of the Nation's treatment systems are adequate. An estimated 46% of the sewered population is now served by treatment plants that are overloaded or in need of major upgrading. Seven percent of the sewered population lives in communities which provide no treatment.

Generally speaking, the greatest municipal waste problems exist in the areas with the heaviest concentrations of population. Past neglect, however, has led to a greater backlog of waste treatment facility needs in the Northeast than in other parts of the Nation. The six New England States, New York, and Pennsylvania contain just over 20% of the Nation's population but 52% of the sewered population that is not provided with waste handling facilities.

The cost studies indicate that a major investment, totalling about \$10 billion, will be necessary over the next five years to overcome this legacy of neglect and achieve adequate levels of treatment for the

Nation's municipal wastes. After that, significant annual investments will still be necessary to expand and replace plants as population growth continues. Treatment of domestic-type wastes from Federal facilities will also require significant expenditures by Government agencies; the waste treatment needs for sanitary and other wastes generated by Federal sources have been estimated at \$246.5 million.

The waste loads from municipal systems are expected to increase nearly four times over the next 50 years. Even if municipal and industrial

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waste loads are substantially reduced through treatment, pollution problems may continue to exist in densely populated and highly industrialized areas where the assimilative capacity of receiving waters is exceeded. In these areas, higher and higher levels of treatment, approaching 100%, will probably be necessary, and water supply demands will lead to ever increasing use of renovated wastewaters.

Other municipal waste problems that will become more apparent as conventional treatment reduces the load of organic wastes are those caused by storm or combined sewers and by nutrients which are not removed by conventional treatment. Many cities have combined sewers which discharge raw sewage along with street runoff directly to streams when sewer overloads occur during storm or thaw periods. Although combined sewer problems exist to some extent in most regions of the country, the distribution of severe problems is heaviest in the Northeast, Midwest and, to some degree, in the Far West. In the older cities of the Northeast and Midwest, principally New York, Rochester, Detroit, Cleveland, Chicago and Boston, which have high population densities and are heavily industrialized, the problems are the most difficult and the most costly to solve. Even where sewers are separated, pollution may result from storm sewer discharges carrying a variety of wastes from the streets.

The most vexing problem in water quality management is the condition that results from the addition of excessive amounts of nutrients, principally nitrogen and phosphorus compounds. Although these elements are needed in small quantities to produce food for aquatic animals, excess amounts result in overfertilization and alteration of the aquatic system. The resulting algae blooms are particularly noticeable in lakes and in streams where water moves slowly.

Although some nutrients reach waters from agricultural runoff, municipal wastes contribute the major load. Already nutrient pollution has led to the imposition of very high treatment requirements for waste discharges to the Great Lakes and several other areas; the cost

of meeting these requirements is included in the investment totals noted above. In future years, the need for nutrient removal at other cities will greatly increase the costs of waste treatment.

INDUSTRIAL WASTES

Industries discharge the largest volume and most toxic of pollutants. Industrial waste discharges are the source of an enormous variety of materials found in our water. Our 1969 report, *The Cost of Clean Water and Its Economic Impact*, listed a total of fifty-one agents being introduced into our Nation's waters as a result of industrial processes—and the list is known to be partial rather than comprehensive. For purposes of quantification, the common substances can be reduced to two general classes of materials, settleable and suspended solids and oxygen demanding organic materials. Major water-using industries are believed to discharge, on the average, about three times the amount of each class of waste as is discharged by all of the sewered persons in the United States.

There are over 300,000 water-using factories in the United States. Although there is as yet no detailed inventory of industrial wastes, general indications are that over half the volume of the wastes discharged to water comes from four major groups of industries—paper manufacturing, petroleum refining, organic chemicals manufacturing and blast furnaces and basic steel production.

The areas where the greatest quantities of industrial wastes are discharged to water are the Northeastern States, the Ohio River Basin, the Great Lakes States and the Gulf States. Lesser, but significant, volumes of industrial wastes are discharged in some areas of the Southeast and in the Pacific Coast States. Like municipal wastes, industrial waste sources are concentrated in certain areas, for factories, like people, tend to be found in clusters.

The volume of industrial wastes is growing several times as fast as that of sanitary sewage as a result of the growing per capita output of goods, declining raw materials concentrations and increasing degrees of processing per unit of product. Given the necessary expenditures, a large percentage of this volume can be treated efficiently, much of it, after pre-treatment in some cases, in the municipal treatment system. Whereas factories which used large volumes of water traditionally discharged wastes directly back to the stream, more stringent pollution control requirements and cost factors have led to increasing use of public treatment systems by a variety of industries. Most wastes from food-processing industries can be treated in public plants, and wastes from paper and pulp mills, chemical, pharmaceutical, plastics, textile and rubber plants have successfully been treated in municipal plants. Some combinations of municipal and industrial wastes ac-

tually improve the treatment process by, for instance, reducing the nutrients in waste discharges.

Increased use of joint municipal-industrial treatment systems will facilitate abatement of industrial pollution, and feasible treatment

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processes have been developed for many types of industrial wastes. Although the lack of an industrial waste inventory makes estimates difficult, the increasing level of investment in industrial treatment facilities appears indicative of progress towards meeting water quality standards. FWQA's economic studies have estimated the annual investment need for manufacturing industries at \$650 million for each of the next five years.

Although, overall, this continued level of investment for treatment of present industrial pollution is encouraging, certain types of industrial pollution present much more complex abatement problems. The trends towards increasing production and use of complex chemical products and radioactive materials have greatly increased the possibility of releasing exceedingly dangerous wastes to the environment. Many of the new chemicals are a challenge to detect, much less control. There is fear that too little caution and study precede the processing or marketing of these materials.

THERMAL POLLUTION

The growing demands for electric power will require a tremendous expansion of power generating facilities. Water is used in the production of almost all electric power now generated—whether by hydroelectric, fossil fueled or nuclear power plants. Two of these generating methods, fossil and nuclear fueled steam electric plants, produce large amounts of waste heat.

As the amount of waste heat from steam electric power plants discharged to water bodies has increased, concern over thermal pollution and its effects has increased. As usually defined, thermal pollution means the addition of heat to natural waters to such an extent that it creates adverse conditions for aquatic life; accelerates biological processes in the streams, reducing the dissolved oxygen content of the water; increases the growth of aquatic plants, contributing to taste and odor problems, or otherwise makes the water less suitable for domestic, industrial, and recreational uses. Not the least important of the effects of heated wastewater is the reduced utility of the water for further cooling. An increasing number of authorities are beginning to believe that this waste heat may be the most serious contemporary source of water pollution.

The electric power industry is one of the most dynamic industries

in the United States, and it has had a growth rate which has exceeded that of the gross national product for a number of years. The technology of electric power generation and distribution is changing rapidly. Larger-sized units have become economically feasible because of load growth and the increasing inter-connection and co-ordination of power systems via extra high voltage transmission facilities. In recent years, a large number of nuclear fueled plants have been planned and put under construction.

The principal use of water in steam electric generating plants is for condenser cooling purposes. The amount of water required for condenser flows depends upon the type of plant, its efficiency, and the designed temperature rise within the condensers. The temperature rise of cooling water condensers is usually in the range of 10° to 20° F, and the average rise is about 13° F. Currently, large nuclear steam electric plants require about 50% more condenser water for a given temperature rise than fossil fueled steam electric plants of equal size. It is estimated that by 1980, the electric power industry will use the equivalent of one-fifth of the total fresh water runoff of the United States for cooling.

Both fresh and saline water are used for

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cooling; in some cases, sewage effluents are used. Water for condenser use may be withdrawn from rivers, lakes, reservoirs, canals, tidewater, or groundwater. When adequate water supplies are available and allowable discharge temperatures permit, the water is usually passed through the condensers once and returned to the source body of water. The economic desirability of once through cooling has traditionally been a factor in locating power plants. Sites have usually been selected where large quantities of water were available for cooling at all times. Such sites in inland areas, however, are limited in number, and the increasing density of power plants on rivers and estuaries will require utilities to find effective means of controlling thermal discharges. Two factors can limit the adverse environmental effects of new power plants: better selection of sites and improved design of plants and equipment to reduce the discharge of heated wastewaters.

With the tremendous pollution potential of projected power production, it is exceedingly fortunate that waste heat from power generation is amenable to treatment or control at a reasonable cost. The amount of waste heat discharged to waterways can be reduced by improving the efficiency of the thermal plants, by making productive use of heat, or by using cooling towers, cooling ponds or spray ponds. The impact of thermal pollution control on the consumer cost of

electricity is relatively minor.

The selection of appropriate sites for locating power plants so as to minimize environmental damage poses a significant challenge to both the industry and government. Environmental concerns will necessitate the consideration of many more factors in the planning of power production facilities than has been the practice in the past. In addition to thermal pollution control, a number of other critical selection factors make siting very complicated—aesthetic impact, availability of water supply, safety (for example, potential of earthquakes), air pollution control, access to transportation and others. These factors compete in some ways, and the tendency in the past was to give primary attention to producing power at low cost to the consumer rather than to environmental considerations. Installation of facilities, such as long discharge lines or cooling towers to control thermal pollution will affect cost factors and require more space for the plant and may make it more difficult to meet aesthetic goals. The increasing use of nuclear power adds another potential hazard to the environment—radiation. Siting is likely to become an increasingly difficult and controversial factor in the continued growth of power production.

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OIL AND HAZARDOUS SUBSTANCES

Dumping and accidental spilling of oil and other hazardous materials continue to increase each year and constitute major pollution threats to the water resources of the Nation. Pollution by oil and other hazardous substances may occur in any of our waterways and coastal areas, or on the high seas as a result of deliberate dumping, accidental spills, leaks in pipelines, drilling rigs and storage facilities, or the breakup of transportation equipment.

Damages caused by oil pollution are both significant and diverse. Such pollution can destroy or limit marine life, ruin wildlife habitat, kill birds, limit or destroy the recreational value of beach areas, contaminate water supplies, and create fire hazards. Damages caused by other hazardous substances can be just as significant and diverse as those caused by oil pollution. The sheer volume of oil transported or used, however, makes oil the largest single source of pollution of this type.

The majority of oil spills exceeding 100 barrels involve discharge from vessels. Approximately one-third of the incidents involve pipelines, oil terminals, bulk storage facilities, etc.

Reported Oil Spills in U.S. Waters

	Over 100 barrels	
	1968	1969
Vessels	347	532
Shore facilities	295	331
Unidentified	72	144
Total	714	1007

Oil pollution may come from several different sources. Gasoline service stations dispose annually of 350 million gallons of used oil. Two hundred thousand miles of pipelines carry more than a billion tons of oil and hazardous substances. The pipelines cross waterways and reservoirs and are subject to cracks, punctures, corrosion, and other causes of leakage. Offshore oil and gas exploration and production occur mainly in the Gulf of Mexico, Southern California coastal waters, Cook Inlet in Alaska, the Great Lakes, and the East Coast. The blowout of wells, the dumping of drilling muds and oil-soaked wastes, and the demolition of offshore drilling rigs by storms and vessel collisions are significant potential pollution sources. In 1969 a massive oil spill occurred off Santa Barbara, California, with severe damage to the coastline, waterfowl and beaches. More recently a fire and subsequent oil blowout on an offshore production well in the Louisiana Gulf presented a serious threat to our marine environment.

Vessel casualties, too, are a prime source of oil pollution, and the damage can be extensive when several million gallons of oil enter the water at one time. The largest spill to date was over 30 million gallons in 1967 from the TORREY CANYON. England, alone, spent \$8 million on clean-up following this casualty. In Tampa Bay on February 13, 1970, the tanker DELIAN APOLLON ran aground and spilled over ten thousand gallons of fuel oil into the bay, and some 100 square miles of area were contaminated as a result. Discharge of either oily ballast water or "slop oil" recently occurred offshore of Alaska, causing extensive

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waterfowl mortalities and contamination of fur seals and sea lions.

Hazardous substances can enter our waters in many of the same ways as oil. Spills caused by accidents or ruptures of containers are important sources. For example, a train wreck on January 2, 1968, at Dunreith, Indiana, spilled a cyanide compound into Bucks Creek, a tributary of the Big Blue River. The cyanide moved with the flow of the stream and an estimated 1,600 pounds passed the town of Carthage on the Big Blue River, downstream from the site of the accident. The cyanide caused fish kills in the affected streams; more than 25 cattle were reported killed; at least one industrial plant

temporarily ceased operations; and groundwater supplies were contaminated.

Incidents similar to the cyanide spill are not uncommon and can cause serious consequences in the affected areas. Presently, an estimated 10,000 spills of oil and hazardous materials occur annually in the navigable waters of the Nation. With the increasing volumes of these materials being transported, the number of spills may grow. Some increase in the number of spills reported can be expected since discovery and notification systems are improved continually and spills, that heretofore have gone unreported, will now be recorded. Unfortunately, the potential magnitude of each individual spill will increase as the size of the carrier increases. For instance, the *UNIVERSE IRELAND*, a ship launched in August, 1968, has a cargo capacity of over 90 million gallons of oil. The construction of even larger ships is under consideration. The potential pollution from a ship of that capacity is about three times greater than that resulting from the *TORREY CANYON* spill.

MINE DRAINAGE

Mine drainage, one of the most significant causes of water quality degradation and destruction of water uses in Appalachia and the Ohio Basin States, as well as in some other mining areas of the United States, degrades water primarily by chemical pollution and sedimentation. Acid formation occurs when water and air react with the sulfur-bearing minerals in the mines or refuse piles to form sulfuric acid and iron compounds. The acid and iron compounds then drain into ponds and streams. About 60 percent of the mine drainage pollution problem is caused by mines which have been worked and then abandoned. Coal mines idle for 30 to 50 years may still discharge large quantities of acid waters.

Although acid pollution is usually limited to coal field areas, suspended solids and sedimentation damage can extend much further downstream. Mine drainage pollution may degrade municipal and industrial water supplies; reduce recreational uses of waters; lower the aesthetic quality of waterbodies and corrode boats, piers and other structures. During 1967, over a million fish were reported killed by mine discharges, ranking mine drainage as one of the primary causes of fish kills in the United States.

Total unneutralized acid drainage from both active and unused coal mines in the United States is estimated to amount to over 4 million tons of sulfuric acid equivalent annually. Although about twice this amount of acid is actually produced, roughly one-half is neutralized by natural alkalinity in mines and streams. In Appalachia alone, where an estimated 75 percent of the coal mine drainage problem

occurs, approximately 10,500 miles of streams are reduced below desirable levels of quality by acid mine drainage. About 6,700 miles of these streams are continuously degraded; the remainder are degraded some of the time. Acid mine drainage problems also occur from other types of mining throughout the Nation, such as phosphate, sand and gravel, clay, iron, gold, copper and aluminum mines.

It is estimated that 3.2 million acres of land in the United States had been disturbed by surface (strip and auger) mine operations prior to January 1, 1965. Of these 3.2 million acres, approximately 2 million acres are either unreclaimed or only partially reclaimed. An additional 153,000 acres have since been disturbed each year, only part of which are reclaimed annually. In addition to contributing to the acid pollution problem, surface mines also contribute large quantities of sediment to the Nation's streams.

Sediment yields from strip-mined areas average nearly 30,000 tons per square mile annually—10 to 60 times the amount of sedimentation from agricultural lands. At this rate, the 2 million acres of strip-mined land in need of reclamation could be the source of 94 million tons of sediment a year.

In addition to mine drainage, refuse piles, tailings ponds and washery preparation residues are also important indirect sources of pollution from mining. For many minerals, such as phosphate, the pollution from processing operations exceeds that resulting directly from the mining operation. The pollution from coal mines in Indiana and Illinois, for example, stems primarily from refuse piles, tailings ponds and preparation plants. No national estimates are available, however, which show the volume or relative importance of pollution from these sources.

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Prevention of acid and sediment drainage from surface mines can be accomplished through renovation of the mined area. Regrading and revegetation can be very effective means of mine drainage control, and reclaimed mining areas can be used for recreation and other beneficial uses. Other methods of control may involve sealing mines, diversion and/or control of underground drainage and use of chemicals or biological inhibitors to reduce the formation of acid. Neutralization is the most common method of treating acid drainage.

Although many methods have been applied and others are being tested, the problems of mine drainage have been very difficult to deal with, largely because of the costs involved in achieving significant levels of control. Recent cost estimates for pollution control and land reclamation in the mining States total as much as \$7 billion. Moreover, the distribution of the mine pollution problem is such that a large percentage of this investment would have to be made in some

of the most economically depressed areas in the Nation, involving mines that are no longer operating or producing any revenues.

SEDIMENTATION AND EROSION

Sediments produced by erosion are the most extensive pollutants of surface waters. It is estimated that suspended solids loadings reaching our waters are at least 700 times the loadings from sewage discharge. The dirty brown or gray appearance of a river or reservoir after a rainstorm is due to sediments washed in from croplands, unprotected forest soils, overgrazed pastures or the bulldozed "developments" of urban areas. The presence of sediment generally increases the cost of water purification and reduces the value of water recreation, and nutrients adsorbed on sediment particles contribute to undesirable conditions in lakes.

Sediments adversely affect commercial and game fish habitats, power turbines, pumping equipment and irrigation distribution systems. Deposited during floods, sediments damage crops and, if coarse-textured, may reduce the productivity of the soil. Channels and drainage facilities may be impaired, and the clean-up and removal of sediments from residential and other developed areas is costly. Sediments are also depleting the capacity of artificial reservoirs in this country, and potential storage sites to replace these depleted reservoirs are limited.

Erosion rates of lands are increased 4 to 9 times by agricultural development, and may be increased as many as 100 times by construction activities. Paving and drainage facilitate flushing of urban areas. The 470,000 miles of rural and secondary roads in the United States also contribute significantly to sediment pollution. Erosion is a serious problem on at least 300,000 miles of the Nation's stream banks and along many of the 470,000 miles of rural and secondary roads. As has been discussed, sedimentation from stripped mining lands is also considerable.

Construction is a large contributor to the sedimentation problem if erosion control is not provided. According to the 1969 report, *The Cost of Clean Water and Its Economic Impact*, the average sediment yield during a rainstorm at highway construction sites is about 10 times greater than that for cultivated land, 200 times greater than for grass areas, and 2000 times greater than for forest areas, depending upon the rainfall, land slope and the exposure of the bank. Similar rates of sediment production occur from commercial and industrial construction in urban areas. The Potomac River Basin discharges about 2.5 million tons of sediment a year into the Potomac estuary, a large share due to disturbance of land surfaces by construction in urban areas.

Sources of sediment are diffuse and therefore often difficult or costly to control. Where fea-

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sible, erosion prevention provides the most effective method for sediment control. In certain remote arid areas of United States, however, such measures would be extremely expensive, and on certain construction sites, completely impractical.

With regard to agricultural land, erosion control by such means as contour cultivation or crop rotation may achieve many benefits—reduction of sediment pollution of streams and damage to water uses, and conservation of productive soil and vegetation resources. Gully erosion may require costly measures of filling, seeding or damming.

Excessive sediment runoff from highway construction can be controlled by reducing the amount of time ground is exposed and/or using measures such as grassing or channeling to prevent sediment from reaching streams. Similar control measures can be used to prevent erosion at other types of construction sites.

Erosion control practices may add about \$1000 to the cost of each mile of new highway and \$1000 per highway construction project for overhead. For the 470,000 miles of secondary and rural roads which need erosion control measures, costs may range from \$275 up to \$15,000 per mile, with an additional \$50 per mile per year required for maintenance. In total, the initial costs to control erosion from roads may range from \$130 million to \$7 billion, with annual maintenance thereafter costing \$23 million. Much of the construction costs and all the maintenance costs would be non-Federal.

Control of erosion at urban construction projects could cost from \$100 to \$1000 per project depending on size and location. Thus preventing water pollution from construction activities may add somewhat to the cost of buying a house.

Control of streambank and streambed erosion may require construction of special stabilization structures, riprap of streambanks and sloping and vegetating eroded banks. These measures, however, may not be compatible with other water uses. Estimates of the cost of renovating the eroded streambanks in the United States range from \$200 million to \$3 billion.

In summary, the sources of water pollution from sedimentation are exceedingly diverse and diffuse. Much can be done to reduce this cause of pollution, but control and prevention will be very costly.

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FEEDLOT POLLUTION

Both the increasing number of animals raised and the modern methods of raising these animals contribute to the increased pollution

of waters from animal wastes. Beef cattle, poultry and swine feeding operations, along with dairy farms, are the major sources of actual or potential water pollution from animal wastes.

In the past two decades production of animal products has been increasing rapidly. The technology of this increasing production requires that animals be confined in a minimum space and fed a concentrated ration, both of which increase the pollution potential of animal wastes. The heavy concentration of wastes precludes their natural decomposition and assimilation on pastures as is the case where animals are more dispersed. The heavy concentration also makes it difficult to find nearby farmland that can use manure as an economical source of fertilizer. In addition to being heavily concentrated in small areas, wastes from concentrated feeding operations have a high oxygen demand when they are being degraded, and they may contain a high proportion of roughages.

When animal wastes find their way into water, they can contribute to pollution in several ways. Heavy concentrations of animal wastes in water may: add excessive nutrients that unbalance natural ecological systems, causing excessive aquatic plant growth and fish kills; load water filtration systems with solids, complicating water treatment; cause undesirable tastes and odors in waters; add chemicals that are detrimental to both man and animals; increase consumption of dissolved oxygen, producing stress on aquatic populations and occasionally resulting in septic conditions; and add microorganisms that are pathogenic to animals and to man.

The magnitude of the livestock pollution problem is primarily dependent upon the number of animals that are needed to meet the demand for their products. The average population increase in the United States is about 2.5 million people per year. At 1966 consumption rates, each additional million people will require another 172,000 beef cattle, 24,500 dairy cattle and 433,000 hogs. Thus, it can be seen that if these consumption rates continue, the amount of animal wastes will continue to increase significantly. In addition, the trend toward increased use of confined feeding and concentrated rations will continue to add to the pollution potential of the animal wastes.

Agricultural waste sources are scattered across the country, with large amounts of cattle being produced in the Midwest, West and

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Southeast; poultry in the South and some of the Middle Atlantic States; and hogs in the Midwest and South. Although there have been few detailed assessments of the distribution of agricultural waste problems, feedlot pollution appears to be a particularly severe water pollution problem in certain parts of the States where large cattle

feedlots are located.

A number of waste handling and control methods are available, which vary widely in complexity and cost. Many States are just beginning to survey feedlot operations and other agricultural operations to determine the pollution potential and necessary measures to deal with the problem.

OTHER AGRICULTURAL WASTES

Other pollution problems are caused by farming operations, in addition to those related to erosion and animal wastes which have been discussed. There is increasing concern about the short- and long-term environmental effects of runoff from farmlands which contains a variety of chemicals including pesticides, herbicides, insecticides and fertilizers. The soil conservation methods discussed earlier in relation to sediment control also help to control runoff. A number of Federal agencies are cooperating on research devoted to the search for chemicals, or biological control methods, which will sustain agricultural productivity while reducing the possibility of environmental damage and destruction of aquatic life and wildlife.

In some areas, serious water quality degradation has occurred as a result of runoff from irrigated lands. Water returned from irrigated areas usually has a much higher concentration of dissolved solids than does streamflow, because the diverted water leaches additional solids from the canals and fields, and because evaporation from the soil and transpiration by the crops concentrates these dissolved solids into a smaller flow of water. Thus, as the concentration of dissolved solids in surface water increases with each irrigation diversion and drainage return, the quality of the water deteriorates and its suitability for further irrigation diversion or other beneficial uses is impaired. This degradation of water quality is evident in many of the river basins where irrigation is practiced and must be taken into account in consideration of any further development.

Particular problems have been encountered in the Colorado River Basin. While agricultural productivity in parts of the Basin has been impressive as a result of irrigation, the Colorado River is becoming more saline every year. Its agricultural usefulness in parts of the lower basin has been seriously impaired.

Some methods to control leaching by irrigation, such as lining canals, are available, and in some areas the possibility of using desalination plants is being studied. Overall, however, the water quality problems caused by irrigation return flows are difficult and expensive to control. Degradation by agricultural practices of the water resource on which that agricultural development depends may

place previously unconsidered limitations on the extent to which further massive irrigation schemes are practicable.

WASTES FROM WATERCRAFT

The problems of water pollution incidents, often spectacular, caused by vessel accidents which release oil or other hazardous materials has been discussed. But vessels (and marinas) also contribute to pollution of the Nation's waters in a number of other ways. It has been determined that approximately 46,000 Federally registered commercial vessels, 65,000 unregistered commercial fishing vessels, 1600 Federally owned vessels and 8 million recreational watercraft use the navigable waters of the United States. The potential pollution from sewage from these vessels is estimated to be equivalent to just over 500,000 persons, comparable to a city the size of San Diego. In major harbors such as the Hampton Roads, Virginia area, sewage discharges from vessels contribute significantly to water pollution, damaging shellfish harvesting and recreation.

At the present time, a very small percentage of watercraft are equipped with sewage treatment devices. Sewage equipment for use aboard watercraft is available in the form of holding tanks which collect sewage for disposal onshore, incinerators and biological treatment facilities. Estimates of the costs to install control devices on vessels to prevent sewage pollution come to about \$660 million.

Other significant pollution from vessels is often evident where ships discharge bilge and ballast water containing oils and a variety of other substances. Poor "housekeeping" practices may cause a good deal of environmental degradation. Even if vessels go beyond the territorial waters to discharge bilge and ballast and solid wastes in the open ocean, aesthetic and other damages often result, as witnessed by Thor Heyerdahl and his crew aboard the RA.

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A WATER POLLUTION CONTROL PROGRAM FOR THE 1970's

Water pollution control has traditionally been a multi-agency, multi-program effort with the localities and industries having the principal responsibility for installing and operating pollution control facilities; the State water pollution control agencies having the basic regulatory programs; and the Federal government backing up the localities with treatment facility grants and backing up the States with additional enforcement authority, technical, financial and planning assistance, training and research and development. These basic arrangements have provided for a valuable division of effort and responsibility to build on and strengthen for the future. In looking to the future, it is necessary to keep in mind this wide basic under-

pinning of pollution programs and intergovernmental relations that has been established over the years. These ongoing activities, which will be fully described in this report, provide the basis and the background for the areas of acceleration—those major program thrusts—which are now necessary to meet the challenge of the 1970's.

These major program thrusts are aimed at immediate implementation of the technology available today to substantially reduce municipal and industrial pollution over the next few years. While research and technical studies must continue on methods of dealing with other complex pollution problems, immediate emphasis must be given to the regulatory and financial assistance programs needed to abate urgent municipal and industrial problems without further delay. Thus, far-reaching proposals to strengthen both of these basic programs within the context of the existing Federal-State-local partnership represent the keystone of the Nixon Administration's water pollution control program.

BETTER FINANCING OF MUNICIPAL TREATMENT

The proposed legislative program for the 1970's calls for strengthening the present construction grants program with a major new investment in municipal waste treatment facilities, providing a strong and guaranteed program of Federal waste treatment works construction grants. Economic estimates by the Federal Water Quality Administration (FWQA), have pointed to a need for at least \$10 billion worth of investment in municipal facilities to achieve the treatment goals contained in the water quality standards all across the Nation. The proposed Federal share would be \$4 billion—\$1 billion over each of the next four years. The States would be encouraged to share the total cost of projects with the Federal government and the localities in the present grant program, through continuation of the incentives that allow projects to receive a larger Federal share if the States contribute funds, and through new provisions in the proposed formula for allocating funds.

In addition to providing for more Federal funds for waste treatment works construction, the proposals would also strengthen the capacity of the construction grants program to assure that facilities are built according to the best designs and in accordance with basin and regional planning requirements. The formula for

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allocating grant funds would be revised to permit more funds to be spent for plant construction in areas where the need is greatest and where the greatest improvements in water quality will be realized.

The Secretary of the Interior has recently published proposed reg-

ulations in the Federal Register, which will help assure that the treatment plants constructed with Federal assistance will be well-built and well-maintained through more stringent requirements for design, operation and maintenance. Moreover, the regulations will require comprehensive river basin programs that would relate construction of treatment facilities to the magnitude and types of other pollution problems. In other words, the aim would be to assure that municipal treatment plants are built in areas where there is a positive program to clean up other kinds of water pollution. In line with this kind of comprehensive approach, the grants program would encourage development of regional treatment facilities that handle municipal and other wastes on an area-wide basis and which provide for treatment of many kinds of industrial wastes, as well as municipal sewage.

BETTER STANDARDS AND ENFORCEMENT AUTHORITY

One of the chief mechanisms for achieving an accelerated pollution abatement program is effective use of regulatory powers. The Federal government has had an enforcement program since 1956; its accomplishments will be discussed in this report. The present authority, however, is limited, and the procedures under present law are time-consuming. Although Federal-State water quality standards have been set which contain abatement requirements for all municipal and industrial waste sources on interstate waters, the Federal government does not have jurisdiction to enforce standards without the permission of the Governor if pollution occurs in only one State.

Legislation has been proposed to apply the regulatory provisions of the Federal Water Pollution Control Act expressly to boundary waters, as well as to interstate and navigable waters, the tributaries of these waters, ground-waters, the waters of the Contiguous Zone and, under certain circumstances, the high seas. Water quality standards, which now consist of water quality criteria and a plan for their implementation and enforcement, would include a third element: water quality requirements controlling discharges, or effluent requirements. The abatement authority would be made directly applicable to discharges which violate water quality standards in any or all of their three elements. A Governor's consent would no longer be required in cases of intrastate standards violations, nor in cases of enforcement conferences and postconference court action involving intrastate standards violations, nor in cases of enforcement conferences and postconference court action involving intrastate pollution. The court could impose a penalty on violators in both types of actions of up to \$10,000 a day, and the second stage in the present three-stage enforcement process, the public hearing, would be eliminated. In addition, the Secretary of the Interior could seek an im-

mediate injunction in an emergency situation in which there is an imminent and substantial danger to the health or welfare of persons or possible irreparable damage to water quality or the environment. The Administration's proposal would also provide other new enforcement tools.

The proposed legislation is not meant to override the responsibility of the State agencies to enforce pollution control regulations; rather, it is intended to provide a backstop to the States' authorities. The Federal government will continue to encourage the States to carry out their responsibilities by providing better financial and technical assistance to the States, in addition to the promise of Federal involvement when the States fail to act.

BETTER ASSISTANCE TO THE STATES

The challenge of carrying out an accelerated pollution control program and implementing water quality standards has placed increased responsibilities for monitoring, enforcement and technical activities on the States, as well as on the Federal government. The responsibilities of the States will further be increased by the recently enacted legislation which requires State certification on Federally-licensed activities; and acceleration of waste treatment works construction will place yet another heavy burden on State pollution control agencies.

For some years, the Federal government has assisted in supporting the administrative expenses of the State and interstate water pollution control programs through program grants, which are now at a \$10 million level. To aid the States in expanding their programs, the proposed legislation would increase the authorization for State program grants each year on a sliding scale from \$12.5 million in FY 1971 up to \$30 million in FY 1975. Emphasis for using the augmented grant funds would be placed on certain program improvements, such as establishing effective waste discharge permit systems, improving sewage treatment facilities programs, and setting up programs for training and developing water pollution control personnel.

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Besides providing financial assistance, the Federal government will continue to help the States through joint water quality monitoring activities, technical support and training programs for State personnel.

BETTER PROGRAMS FOR PREVENTION AND ABATEMENT OF POLLUTION FROM FEDERAL FACILITIES

One of the primary tasks of the Federal government in pollution control is to assure that the facilities owned by the government and activities carried out or licensed by the government do not contribute to

water or air pollution. In a move to strengthen the Federal commitment to pollution control, President Nixon issued a new Executive Order on pollution control from Federal facilities on February 4, 1970. This Order requires that all projects or installations owned or leased by the Federal government be designed, operated and maintained in conformance with present and future water quality standards. The Executive Order provides for strict compliance and establishes a deadline by which existing facilities must comply with environmental standards. This comprehensive plan for pollution abatement includes control, not only of water pollution, but also of air pollution by Federal facilities.

In a subsequent Executive Order issued on March 7, implementing the landmark National Environmental Policy Act of 1969, the President set forth additional procedures to assure that Federal programs will meet national environmental goals. He directed that attention be given to Federal policies, including administration of loans, grants, contracts, and licenses, to minimize their pollution impact.

Enactment by the Congress of the Water Quality Improvement Act of 1970 adds further force to this effort by requiring that applicants for Federal permits, for activities such as construction of nuclear facilities or reservoirs, meet applicable water quality standards.

PROGRAMS TO DEAL WITH EMERGING PROBLEMS

At the same time that a massive effort to employ present technology to clean up municipal and industrial water pollution is being initiated, the water pollution control program for the 1970's looks to expanding its capacity to deal with other complex pollution problems. One of the most significant emerging programs is in oil pollution control, where substantial expansion of Federal prevention, control and enforcement activities is called for under the 1970 Act. In conjunction with development of plans to prevent and control oil spills, planning has been undertaken to handle accidents of other hazardous substances.

Increased attention has been given to methods of preventing and controlling pollution caused by vessels. The Water Quality Improvement Act provides for Federal performance standards for water pollution control equipment on commercial and private vessels.

With the greatly increased growth of electric power producing facilities, thermal pollution control has emerged as a major pollution problem. The water pollution program for 1970's anticipates much more stringent controls on the discharge of heated effluents, a greater research effort to improve thermal standards and abatement technology, and an active participation in planning studies to locate power facilities in areas where environmental damage would be minimized.

Another problem which is becoming increasingly significant is that of pollution caused by persistent pesticides. Under the 1970 Act, the FWQA will be developing, within the next two years, the scientific knowledge necessary for the development of water quality criteria for pesticides. This will require increased research on the effects of pesticides and the search for less harmful pesticides, expanded monitoring and investigation to identify critical areas and closer interagency coordination with the Departments of Agriculture and Health, Education and Welfare to assure full utilization of regulatory authorities to achieve environmental protection.

The expanded use of deep-well and other subsurface waste disposal practices poses a new challenge, particularly for protecting the purity of groundwater supplies. Meeting this challenge will require increased research on groundwater quality and movement and on the effects of wastes, investigations of present disposal sites and tighter regulation of subsurface waste disposal practices.

The activities and problems just described will receive increasing emphasis in the coming months. How these areas fit into the full water pollution control program will be described in greater detail below. As noted at the beginning of this section, the financial assistance and regulatory programs must rest upon a broad base of planning and research, technical studies, manpower development and other programs. It must also be clear that the Federal program is but one aspect of a nationwide network of State, local and, increasingly, regional activities. The greatest challenge of the 1970's may well be intergrating these programs to form a comprehensive nationwide attack on pollution of our environment.

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PROGRAMS FOR WATER POLLUTION CONTROL

REGULATORY PROGRAMS

Strong, effective, and equitable regulatory activity is the most essential element in the nationwide pollution control effort. President Nixon in his environmental message has declared that "strict standards and strict enforcement are necessary—not only to assure compliance, but also in fairness to those who have voluntarily assumed the often costly burden while their competitors have not." Such effective nationwide enforcement requires a complementary State-Federal regulatory effort.

From the initiation of the Federal water pollution control program, the Congress has recognized the basic role of the States in implementing and enforcing water pollution control regulations. The Federal Act, however, asserts broad jurisdiction for the application of Federal

regulatory authority to back up the States and to assure effective pollution control. Over the years, this Federal regulatory role has been expanded and strengthened to include: water pollution enforcement authority on interstate and, under certain circumstances, navigable waters; authority to establish and enforce water quality standards on interstate waters; and administration of the Oil Pollution Act of 1924. In addition, there has been a growing emphasis on control of pollution from Federal facilities.

Through its role in administering or participating in these programs, the Federal Water Quality Administration (FWQA) has emerged as the principal water pollution regulatory agency in the Federal government. Recently enacted and proposed legislative changes will further strengthen FWQA's regulatory authority. Passage of the Water Quality Improvement Act of 1970 adds significantly to Federal authority to control vessel and oil pollution and to requirements for control of water pollution from Federally licensed activities. Equally significant, the Administration's legislative proposal would result in far-reaching improvements designed to provide a comprehensive, swift and equitable regulatory authority. These measures will vastly strengthen the Federal government's capacity to control water pollution.

Water Quality Standards and Enforcement

Federal enforcement authority on interstate and navigable waters has been strengthened over the years since initial enactment of the Federal Water Pollution Control Act in 1956. The most significant increase in these authorities stemmed from the Water Quality Act of

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1965, authorizing the establishment and enforcement of water quality standards for interstate waters, including coastal waters.

Today, action to abate pollution of interstate or navigable waters which endangers the health or welfare of persons may be taken at State request or on Federal initiative. The Governor's request is required in cases of intrastate pollution of such waters. However, action may be taken on Federal initiative to abate pollution, whether inter- or intrastate, of such waters which impairs the marketing in interstate commerce of shellfish or shellfish products. Action to abate international pollution may be taken under certain circumstances.

Two abatement procedures are provided in the Act. A three-stage enforcement procedure is set out in the law—conference, public hearing, court action—the succeeding stage to be reached only if adequate progress is not made at the previous stage. In a case of violation of water quality standards, direct court action may be sought 180 days from the date of notification of violation: the 180-day period is to be

used for obtaining voluntary compliance if at all possible.

The water quality standards authorized by the 1965 legislation are the keystone of America's clean water program. The Act called upon the States to establish standards for their interstate waters. These State standards could then be accepted as Federal standards by the Secretary of the Interior. To set standards, the States had to make crucial decisions involving the desired uses of their water resources, the quality of water to support these uses and specific plans for achieving such levels of quality. The standards are, in effect, blueprints for the national program.

Water quality standards are composed of two parts: the criteria designed to protect present and future water uses of interstate waters through establishment of quality levels which must be maintained, and a plan of implementation which outlines the pollution abatement measures which will be required to meet those criteria. First responsibility for implementing and enforcing water quality standards rests with the States. But, once accepted by the Secretary of the Interior, the standards become Federal standards and are subject, if necessary, to Federal enforcement. In the absence of timely and acceptable action by a State to adopt water quality standards on interstate streams, the Secretary of the Interior can initiate action to establish Federal standards.

The standards of all of the States have now been approved by the Secretary of the Interior. With the establishment of these standards, there is for the first time a specified set of conditions for the enhancement and protection of the water quality of interstate waters throughout the country to which waste dischargers must adhere. The goal of providing nationwide, systematic and comprehensive water quality standards, however, which are tailored to the particular use and quality of the specific waters, is far from being accomplished.

The Secretary excepted from initial approval portions of the standards of over half the States, where certain aspects of the standards were not stringent enough to assure adequate water quality protection. For example, the temperature criteria of a number of States have been excepted, because they did not provide adequate safeguards against thermal pollution. In other cases, implementation plans have not received approval because the abatement measures required or schedules established were deemed inadequate.

During the past year, heavy emphasis has been placed on resolving these exceptions so that State standards can be fully approved. Negotiations have been underway with the States concerned and a number of States have agreed to improve their standards. In two instances,

where such agreement could not be reached, the Secretary has taken initial action toward direct establishment of Federal standards, under procedures specified by the Act. A conference to consider the establishment of water quality standards for certain interstate waters of Iowa convened at Davenport on April 8 and at Council Bluffs on April 15, 1969. Regulations setting forth the Federal standards have been published in the Federal Register and will be adopted if the State does not adopt acceptable standards within the specified time period. A conference to consider the establishment of water quality standards for Virginia's interstate waters was called for December 9-11, 1969, and subsequently postponed when the State Water Control Board indicated it would act on the Secretary's recommendations. During the year ahead, a principal objective will be elimination of the exceptions from the standards of all the States, by agreement or direct Federal action.

Even where standards have been approved, there is a need to refine and improve certain of the water quality criteria to assure that the criteria applied will adequately protect the intended water uses. Continued emphasis must be given to improving our knowledge of water quality characteristics and requirements and incorporating this information in approved criteria.

Towards this end, FWQA, the Atomic Energy Commission and the Department of Health, Education and Welfare are working together to develop standard radiological criteria for natural waters. The radiological criteria currently established in water quality standards possess certain shortcomings insofar as providing complete coverage of all radioactive pollutants and maximum protection for all water uses. These established criteria do provide reasonably adequate protection from the sources of radiological wastes currently in place, but with the expected growth of the nuclear power industry, the nuclear fuel reprocessing industry and other peaceful uses of nuclear materials, such as those being developed through Operation Plowshare, much more precise and restrictive criteria for water will be required. The radiological criteria being developed are aimed at this objective. Also, they will complement the radiological effluent and emission standards presently set by the Atomic Energy Commission for nuclear power plants and other users of nuclear materials.

The increasing impact of pesticides on the environment has pointed to the need for both stricter regulation of pesticide uses and the establishment of specific, quantified pesticide criteria for natural waters. Under the Federal Insecticide, Fungicide and Rodenticide Act, the authority to regulate the uses and labeling of pesticides resides with the Secretary of Agriculture. An interdepartmental agreement has recently been established among the Departments of Agriculture,

Interior and Health, Education and Welfare through which environmental, fish and wildlife, and public health interests in pesticide uses are factored into the Department of Agriculture's registrations. With respect to pesticide criteria for interstate waters, this responsibility and authority rests with the Secretary of the Interior under the Federal Water Pollution Control Act.

General criteria on all toxic materials have been incorporated in all of the water quality standards adopted and approved pursuant to the Act; however, specific quantified criteria for the various pesticides in current use have not been made a part of these standards. Under a provision of the Water Quality Improvement Act of 1970, FWQA will be developing specific and quantified information on pesticides to be subsequently incorporated into water quality standards.

Most important, a vigorous State and Federal enforcement program is needed to obtain compliance with water quality standards and to assure that treatment schedules are being met. Development of strengthened and accelerated enforcement efforts has been a major objective during the past year. Where the States are prepared to exercise their authorities, FWQA stands ready to provide any assistance they may require. A number of States are moving aggressively against polluters. Illinois has not hesitated to initiate proceedings against the very giants of industry. Pennsylvania successfully

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carried through on the first test of its Clean Stream Law. And, with the passage of the Porter-Cologne Water Quality Act in 1969, California has vastly strengthened and stepped up its regulatory activity.

At the Federal level, the record of enforcement activity compiled under the new Administration reflects a commitment to a vigorous enforcement program equally and fairly applied.

In this same year, FWQA initiated the first enforcement actions to abate violations of water quality standards under procedures provided by the Water Quality Act of 1965. As mentioned before, the procedure provided in the law is direct court action, preceded by a 180-day notice to the alleged violator. On August 30, 1969, the Secretary issued such 180-day notices to six alleged violators. The first involved the Eagle-Picher Industries, Inc., whose mining operations resulted in discharges violating water quality standards established for Spring River in Kansas and Oklahoma. The other five actions were taken to abate violations of Lake Erie water quality standards and involved the City of Toledo and Interlake Steel on the Maumee River and Republic Steel Co., U.S. Steel, and Jones and Laughlin on the Cuyahoga River. Hearings were held with all six

of the alleged violators. All six sources have indicated that they will comply.

FWQA's enforcement conference activity under previously established procedures has also been stepped up. The initiation of the Biscayne Bay conference in February, 1970, brought to 50 the total of such actions taken since 1956. Five of these—Lake Superior, Escambia River Basin, Perdido Bay, Mobile Bay, and Biscayne Bay—have been held since January 1, 1969. In addition, eight conferences were reconvened and three progress meetings held to put renewed emphasis on progress in obtaining compliance.

The enforcement conference has been an effective mechanism for the solution of complex and long-standing pollution situations. At the recently reconvened Potomac River conference, for example, agreement was reached on cooperative programs of remedial action which include the most stringent waste treatment requirements yet fixed for a metropolitan area. The Lake Michigan conference, reconvened in 1969 and again in March, 1970, has dealt with control of the more diffuse wastes, such as nutrients, thermal pollution, and agricultural wastes.

More recently, in February, 1970, a Federal-State enforcement conference was held at Biscayne Bay, Florida, regarding local damages to aquatic plant and animal populations of lower Biscayne Bay attributed to the heated effluent from the Turkey Point plant of the Florida Power and Light Company. Because of the selection of the site of the plant at Turkey Point, considerable technical difficulties are being encountered in the disposal of the heated cooling water. Present and proposed treatment measures were found to be inadequate and the conferees have recommended that the excessive waste heat load being discharged from the Turkey Point power plant be reduced to specified levels so that the quality of the waters, including the biological balance of Biscayne Bay, will not be impaired to the detriment of the full enjoyment and use of the Bay.

Subsequently, Secretary Hickel requested the Attorney General to bring suit against the Florida Power and Light Company on the basis of Section 13 of the River and Harbor Act of 1899, known as "The Refuse Act," and other authorities for injunctions against discharges contrary to the heat criteria of the applicable water quality standards, and to restrain construction and operation of power plants which would cause such discharges.

The character of the pollution situation governs the application of the Federal Water Pollution Control Act's authorities and procedures. The Mobile Bay conference of December, 1969, was called under the "shellfish" authority of the Act. Shellfishing areas at Mobile have been closed by the State of Alabama for eight of the past sixteen

years. Through this conference, a specific regulatory program for control of municipal and industrial wastes polluting the Bay is being developed.

The Refuse Act, administered by the Secretary of the Army through the Corps of Engineers, extends Federal authority to intermittent discharges of waste into navigable waters and provides a valuable additional enforcement tool. FWQA and the Corps of Engineers coordinate the enforcement of the Refuse Act with the enforcement of the Federal Water Pollution Control Act. Through this coordination and the use of the Refuse Act, regulatory authority can be extended to intrastate waters where no Federal water quality standards apply, as well as to interstate standards violations. The Refuse Act has also been used effectively against "one-time" dumpings of pollutants.

There are limitations in existing enforcement authority which prevent the Federal government from playing a fully effective role. The Federal government may act on its own or at State request to enforce the abatement of pollution which is interstate. In the case of pollution of interstate or navigable waters which occurs

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only in one State and has its effects only in that State, however, Federal enforcement assistance must be requested by that State. This important distinction results in real complications. Enforcement action on Lake Superior was initiated by the Secretary on his own authority on the basis of interstate pollution which was occurring in tributary border streams. The principal pollution source to Lake Superior, however, was the Reserve Mining Company taconite operations at Silver Bay, Minnesota. To establish enforcement conference jurisdiction over this source, it was necessary to show interstate effects of the pollution from Reserve's operations. If the interstate effect had not been established through FWQA studies, the enforcement conference would have had no jurisdiction over the taconite discharges.

The procedures for enforcement actions also present several limitations on Federal authority. At the conference stage, no direct Federal relation is established with individual polluters. Such parties may not even be compelled to be present at the conference, as no subpoena authority is provided. The Federal authority deals directly with the polluter at the public hearing stage, but, again, there is no subpoena authority to compel the presence of witnesses.

During the post-conference and post-public hearing periods, the States are directed to obtain compliance under their own laws and authorities. The Act directs that a reasonable time, which cannot

be less than six months, must be provided to the States for obtaining such compliance. This means that in bringing a recalcitrant polluter to terms, the Federal government's hands initially are tied for at least a whole year. This year stretches to a minimum of 18 months when the time needed to prepare the filing of court action is taken into account.

Despite the acceleration in Federal enforcement activity, deficiencies in the existing legislation have become increasingly apparent. To further strengthen the Federal regulatory role, the Secretary of the Interior has proposed legislative changes in the Act which would provide substantial new authority for FWQA enforcement activities.

Specifically, water quality standards would be strengthened by the addition of effluent requirements and by extending the applicability of these standards to all navigable as well as interstate and certain other waters. These discharge requirements would be established by the States as were the original water quality standards. If the Secretary of the Interior determined that these requirements met the requirements of the Federal Act, they would be enforceable as an element of the Federal, as well as the State standards. The extension of the water quality standards program in terms of more specific requirements and in terms of waters included is a logical progression, building upon the water quality criteria and plans of implementation already in force in all fifty States.

Another significant change would be the extension of geographic coverage of enforcement authority to include all navigable and certain other waters. As has been pointed out, under existing law an enforcement action may not be taken in the absence of an interstate pollution effect without the request of the Governor of the State. Under these circumstances, the availability of Federal enforcement authority depends on the geographic accidents of pollution crossing interstate boundaries. The Administration's proposal would remove the distinction between interstate and intrastate waters and pollutional effect. Federal enforcement authority would be available in any case where the Secretary of the Interior believes water quality standards are being violated or the health or welfare of persons is being endangered.

In addition, the new proposal would extend the coverage of the Act to include the authority to set and enforce standards for groundwaters and for ocean waters beyond the Territorial Sea, two important components of the water environment that need increasing protection.

Furthermore, at the conclusion of an enforcement conference, remedial measures could be required directly of individual polluters. The hearing board phase of enforcement would be eliminated and the

government could proceed directly to court enforcement. Fines of up to \$10,000 a day for violation of water quality standards or enforcement conference requirements would be authorized. Substantial investigatory authorities would be provided to permit the Secretary to subpoena records and witnesses, to enter and inspect plants and installations and to require testimony. Further, the Secretary would be authorized to request the Attorney General to bring suit under a new injunctive authority to stop waste discharges immediately in cases of serious damages, real or threatened.

Even though the proposed legislation would increase FWQA's regulatory authority, it is intended to back up the enforcement activity of the States, which continue to have primary responsibility. Though at a much accelerated pace and with a much larger scope of enforcement activity, FWQA and the States would continue to work as partners to obtain cleaner waters.

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Control of Oil Pollution

With the grounding of the TORREY CANYON in 1967, the breakup of the OCEAN EAGLE in Puerto Rican waters in 1968, and the Santa Barbara offshore oil well leak in 1969, oil pollution has become recognized as a serious national and worldwide problem. These incidents were spectacular in terms of the damages they caused, the control and clean-up efforts and expenditures they necessitated, and the public concern they generated. Of even greater significance, however, is the fact that these major disasters are matched by the aggregate of large and small incidents that occur every day throughout the Nation's coastal and inland waters.

It is estimated that there are annually over 10,000 spills of polluting materials into our Nation's waters. About three-fourths of these spills are oil; the remainder are other hazardous materials, such as chlorine and anhydrous ammonia. The sources of these incidents are vessels, pipelines, rail and highway carriers, land- and water-based storage tanks, refining and other manufacturing operations, the jettisoning of fuel tanks by aircraft, on and offshore petroleum loading and unloading terminals, on and offshore petroleum drilling and production operations, and various other facilities and activities. The problem of accidental spills of oil is further compounded by discharges of oily ballast waters from tankers and other vessels. Pollution from oil and hazardous materials is an everyday occurrence and affects all our waters.

Of particular significance are the potentially large and damaging oil spill accidents that might easily result from the increase in shipping and pipeline transport of oil. The emergence of supertankers

as the prime oceanic movers of crude oil imports, the construction of a large pipeline, such as the Trans-Alaska Pipeline System from the new Alaska North Slope oil fields, and the greater development of offshore oil are all contributing factors to the oil spill problem. This rapid increase of oil traffic and the expansion of the offshore production of oil only intensifies the possibility of more frequent and larger accidents and of significantly greater damage to the environment.

Presently, the technology for coping with oil and hazardous materials spills is woefully inadequate. Prevention of accidents is the only sure way of protecting the environment. The Santa Barbara incident and subsequent similar spill situations have shown conclusively that no completely effective techniques are available to control oil spills in the open ocean or lake waters. Wind and wave actions neutralize the effectiveness of oil spill containment devices, such as floating booms. Vacuum or scoop equipment to remove floating oils from the water does not accomplish the job, being effective only in rarely occurring calm seas. Chemical dispersants, sinking agents, and other materials are often ineffective and frequently very toxic to marine and wildlife. Common straw, which soaks up oil so that it can be removed, is still the standard material for fighting and cleaning up oil spills.

Compounding these technological shortcomings, the legal and institutional devices available for handling oil and hazardous material spills have been less than adequate. The Oil Pollution Act of 1924, as amended—the principal Federal legislation in this area of pollution control—prohibited and provided penalties for only the “grossly negligent and willful” spilling or discharging of oils and oily materials. This restrictive legal language essentially precluded enforcement of the Act. This has been rectified by passage of the Water Quality Improvement Act of 1970, which repeals the 1924 Act and greatly increases the regulatory controls for oil pollution incidents. Many State and local governments, however, are still lacking in oil pollution control authority.

In addition to lack of adequate legal tools, well-organized and well-equipped governmental forces have not always been available to respond in a timely manner to oil pollution incidents. Many of the smaller incidents go undiscovered or ignored by local, State, and Federal agencies; only the larger incidents generally receive the type of response necessary to assure adequate control and clean-up. The usual procedure is to encourage or require the party responsible for the spill to procure the equipment, materials and personnel and to bear the expense of control and clean-up. In some cases, these resources may not be available in the local area, adding yet another problem.

Since the TORREY CANYON incident, and particularly during the aftermath of the Santa Barbara incident, FWQA has played a principal role in organizing and coordinating the Federal, State, and local effort in the control of oil and hazardous materials pollution. This has included development of contingency plans and reporting and response capabilities, pursuit of research and development of new and improved technology, study of potential oil pollution threats—as in the case of proposed exploration and production of oil in Lake Erie—and participating in strengthening of the Federal regulations covering the drilling for and production of oil and gas on the Outer Continental Shelf.

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During 1969 and early 1970, the National Multi-Agency Oil and Hazardous Materials Contingency Plan was re-assessed and revisions to strengthen it were undertaken. The first Plan was prepared in 1968, at the request of the President by the Departments of the Interior, Transportation, Defense and Health, Education and Welfare and by the Office of Emergency Preparedness. Together with the supplementary regional contingency plans, the National Plan provides the organizational and communications mechanisms for welding Federal, State and local efforts into a coordinated response to oil and hazardous materials incidents. The Secretary of the Interior has been responsible for the preparation and administration of the National Plan, and FWQA has acted as the lead agency in carrying out this responsibility. The National and regional plans provide for on-scene commanders, operating teams, communication centers, lines of responsibility and other organizational features necessary to bring about an immediate and effective response to major pollution disasters and lesser incidents. The National and regional plans were put into effect during the Santa Barbara incident and proved to be decidedly important in the control and clean-up of that disaster. FWQA is continuing to provide guidance in extending the coverage of contingency plans, particularly in local areas, such as harbor and oil on-loading/off-loading areas, where the threat of oil pollution is greatest. The contingency plans have and are continuing to overcome the institutional shortcomings for coping with spills; and they are becoming increasingly more effective in ensuring that the supply of equipment, materials and other resources, including communications and technical advice, needed to combat oil and hazardous materials accidents becomes immediately available.

In the implementation of the contingency plans in coastal waters, the Great Lakes and the major inland navigable waters, the Coast Guard has provided the on-scene commanders and the principal operating resources, including personnel, ships, equipment and com-

munications systems. FWQA participates by providing advice on containment and clean-up techniques, including the use of dispersants and other chemicals. In other waters of the Nation, FWQA has the lead operating role.

Another important accomplishment during 1969 was the strengthening of the regulation covering the exploration and production of oil and gas on the Outer Continental Shelf. The Secretary of the Interior is authorized to lease lands on the Shelf for oil, gas and mineral extraction and is responsible for regulating these operations, which are in the coastal waters outside of State jurisdiction. The Santa Barbara incident clearly indicated that adequate consideration had not been given to the environmental impact of offshore oil operations. In recognition of this, Secretary Hickel ordered the suspension of pending lease offerings and revisions of the Federal regulations applicable to offshore leasing.

The revisions made call for, among other things, the evaluation of potential environmental effects of offshore oil operations prior to lease offerings. Under this feature, FWQA and other Federal agencies concerned with the protection of marine resources are given the opportunity to assess the impact of offshore oil and gas activities. The Secretary of the Interior is authorized to make appropriate decisions on leasing and lease requirements based upon these recommendations. Other revisions of the regulations pertain to the inclusion of the National Contingency Plan and to lessee's responsibilities for pollution prevention, control and clean-up, for the reporting of spills and for the provision of equipment, materials and resources to cope with pollution incidents. The aim of the Department of the Interior is to assure adequate water and environmental quality protection in its management of the Outer Continental Shelf lands and waters, and the strengthened regulations promulgated by Secretary Hickel are directed toward this objective.

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With regard to offshore oil and gas regulations, it is also important to note that Secretary Hickel recently recommended to the Justice Department that a grand jury be convened to investigate the violations of Federal regulations by a lessee off the Louisiana coast. The reported failure to provide storm chokes and other protective features required by the regulations is believed to have led to the oil well fires and the large oil discharge from several wells operated by the Chevron Oil Company.

In the area of research and development, the Federal agencies have divided among themselves the work necessary to find new and improved technology to deal with oil and hazardous materials pollution. FWQA has taken on the primary tasks pertaining to prevention, con-

tainment and clean-up in sheltered and inland waters, the fate and ecological effects in these waters, and the technology for cleaning oil contaminated beaches. The Departments of Transportation, Defense and Health, Education and Welfare, as well as other agencies of the Department of the Interior, are assuming primary responsibility for other pertinent areas of research, including the combating of oil pollution in open waters.

FWQA's research activities are being carried out under grants and contracts, as well as through in-house work centered in its laboratory at Edison, New Jersey. One project consists of investigating the use of gelling agents. These could be released into the oil cargo of a tanker to form a semi-solid material when an accident causes a rupture in the vessel. This material either would not leak out of the ruptured tanks or, if released, could more easily be contained and picked up. Other efforts are aimed at developing and demonstrating oil containment and recovery equipment, barrier devices to protect marinas and other water areas from incoming oil slicks, and techniques for cleaning oil from beaches and disposing of the material removed.

In its day-to-day operations, FWQA operates a teletype communications system covering the Headquarters and Regional Offices to handle reports and information on oil and hazardous materials spills, as well as other emergency situations, such as fish kills. Under the contingency plan, to the extent possible, personnel in Regional and field offices respond to pollution incidents by inspecting and collecting samples and information on the situation, by providing technical advice on control techniques, and by participating in the direction of control activities. In these activities, particularly in coastal waters, FWQA and the Coast Guard and/or the Corps of Engineers work together—each agency performing those tasks which it is best organized and equipped to handle.

Although FWQA has not had the resources to respond to most spill incidents, it has responded to all major episodes. Substantial on-scene effort was put into the Santa Barbara disaster. This was followed by responses to the many serious pollution problems resulting from Hurricane Camille; to the large release of oil from a ruptured storage tank at Seawarren, New Jersey; to a number of oil spill incidents in Alaska, including the recent oil disaster affecting 1,000 miles of shoreline along the coast of Kodiak Island; and to some 130 other incidents, about 40 of which were hazardous materials situations.

Although a considerable amount of attention is devoted to reporting and response activities, a

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significant effort has been and is directed to other program activities. These include contingency planning; evaluation of potential pollu-

tion situations and impacts, including those associated with offshore oil drilling and production; testing of hazardous materials and the neutralizing or combating agents needed to deal with them when a spill occurs; participation in international meetings on oil spill prevention; and technical assistance to State and local agencies and other groups.

Along these lines, several significant actions were undertaken in 1969. The bunker oil from the grounded motorship, NORDMEER, which threatened to rupture and spill its contents into Lake Huron, was removed to prevent a serious incident. This was the first effort of its kind by FWQA.

In the case of the Kodiak Island incident, Secretary Hickel has appealed to ten major oil companies to enter into a voluntary "no discharge" agreement to halt the oil production caused by vessels pumping their oily ballast waters into the high seas outside of the 50 mile limit. These areas are not addressed under international controls. Investigations by FWQA have shown that the oil-contaminated ballast waters released by commercial tankers enroute to terminal facilities in Cook Inlet were the most probable cause of the Kodiak Island disaster, which involved the destruction of an estimated 10,000 waterfowl. The discharge of oily ballast waters on the high seas is a frequent source of pollution. Many stretches of shoreline along both coasts are affected by oil believed to have drifted in from offshore ballast water pumping operations and it is the goal of the Department of the Interior to prevent these incidents by proper handling of ballast waters.

Proposed drilling for oil and gas in Lake Erie was studied, and, as a result, recommendations were made to the State of New York and the International Joint Commission opposing oil production and encouraging the strictest regulation of gas production in order to protect the valuable water supply, fishery and other uses of the Lake. Considerable attention has also been devoted to a study of the Alaska North Slope oil development and the Trans-Alaska Pipeline System to assure that adequate consideration for maximum protection of the unspoiled environment is taken in the design, construction and operation of these facilities. Along similar lines, technical assistance was given to the State of Maine in its preparation of comprehensive regulations for the prevention and control of potential pollution in all types of oil operations.

These activities and others were essentially wholly aimed at pollution prevention, a goal which FWQA believes must be ultimately achieved through fail-safe systems and practices if real control of oil pollution is to be attained.

The recent passage of the Water Quality Improvement Act of 1970

substantially strengthens the Federal law and authority to prevent and control oil pollution. Most importantly, this new legislation removes the restrictive definition of illegal spills and discharges and provides notification requirements and substantial penalties and liabilities for oil spills. These features, including the requirement for the showing of financial responsibility—or liability insurance—will promote greater care and effort on the part of the oil and oil transportation industries in the prevention of spills. Other provisions authorize greater effort by the Federal agencies in developing strengthened contingency plans, directing or fully undertaking the containment and clean-up of oil spills and providing a revolving fund to cover the costs of the latter. FWQA recently created the Office of Oil and Hazardous Materials and is expanding its staff to handle the increased work load resulting from the new legislation.

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Control of Vessel Wastes

The discharge of wastes from ships, barges, houseboats, pleasure craft and other types of watercraft has been receiving increased attention in the nationwide effort to clean up polluted waterways and preserve clean streams, lakes and coastal waters. Until recently, the effect of vessel wastes has been obscured by the pollution resulting from municipal and industrial waste discharges and other causes. With the progress anticipated in abating municipal and industrial waste discharges, the significant increase in the number of toilet and galley equipped vessels—particularly pleasure craft—plying the Nation's waterways and lakes, and the greater demands for high quality recreation and sport fishery waters in those areas most used by both commercial and non-commercial watercraft, vessel wastes have emerged as significant source of water quality impairment. Accordingly, vessel waste discharges are currently a concern in the navigable waters of this country, including even mountain lakes where the intensity of vessel use is relatively low but the need for the protection of the high quality water is great.

In June 1969, FWQA completed a report of its San Diego Bay Vessel Pollution Study Project following intensive field and laboratory activity. The purpose of this project was to determine the magnitude, extent and kinds of pollutional effects to be expected from the discharges of shipboard sanitary wastes and the pollution abatement measures required to reduce or eliminate these discharges. The findings were illustrative of this problem: vessel waste discharges were found to cause serious bacterial pollution, to be responsible for bottom sludge deposits and floating waste material and to cause violations of the water quality standards established for San Diego Bay. The

pollution was directly attributable to the high numbers of military, commercial and pleasure vessels using the Bay.

Investigations by State agencies and FWQA have discovered similar conditions in other bodies of water across the United States. Bacterial pollution and the attendant impairment of recreational water uses are the principal adverse effects of untreated vessel waste discharges, but the occurrence of aesthetically displeasing floating material follows close behind in pollutorial importance.

It will not be an easy task to remedy vessel waste pollution. The weight and volume of waste treatment devices or waste handling tanks cause considerable installation problems, particularly on existing vessels, especially if they are military. The expense of control devices, particularly to pleasure craft owners, is also a factor. A considerable amount of research and development is underway by Federal agencies including FWQA, the Navy and the Coast Guard to find adequate and adaptable waste control systems. Consideration is being given to incineration devices, modified versions of conventional waste treatment methods, recirculation systems, chemical-toilets—such as are used on commercial aircraft—and other devices. Good progress is being made, and there appears to be little doubt that American ingenuity can and will develop the technology required to adequately handle vessel waste pollution problems.

Within recent years, many of the States have enacted or strengthened their legislation or regulations pertaining to the control of vessel

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wastes. Unfortunately, the non-uniformity of the waste treatment and control requirements imposed by these States has presented some significant compliance problems for vessels which travel between States. Also, in many cases the State regulations do not apply to or are ineffective in their coverage of interstate and international carriers and Federal vessels. In response to these basic problems, the Congress recently enacted comprehensive Federal legislation—the first legislation of this type—covering the control of vessel wastes.

The Water Quality Improvement Act of 1970 provides for the establishment of performance or effluent standards for the sanitary waste discharges from all classes of watercraft. These standards are to be set by the Secretary of the Interior. The amendment further provides for the establishment and enforcement of regulations to implement these standards by the Secretary of Transportation, under whose administration the Coast Guard comes. This Federal statute applies to new and existing vessels and provides for penalties for the failure of vessel owners and manufacturers to provide adequate shipboard treatment or control of sanitary wastes. Importantly, this new legis-

lation provides for uniform, nationwide regulation of watercraft waste discharges. This will promote a comprehensive attack on vessel pollution problems by FWQA and the Coast Guard, who will join in carrying out this task.

During the past year, FWQA has been preparing for its role under the new legislation. Research, development and demonstration of vessel waste treatment devices have been pursued and considerable assistance has been given to other Federal agencies, including the Navy, the Corps of Engineers and the Coast Guard, in the development, testing and installation of treatment and control equipment on Federal vessels. With the enactment of the new legislation, FWQA's activities in the vessel wastes area will be expanded. FWQA is planning to consult with the boating industry, the manufacturers, and others concerned with treatment devices and will hold public hearings prior to the establishment of standards. In addition, assistance will be given to the Coast Guard in establishing both the regulations necessary to implement the performance standards and an adequate certification program. Finally, assistance will be provided Federal agencies in equipping Federal vessels with adequate control equipment. The new legislation provides the means to fully abate the pollution arising from watercraft sanitary wastes, and FWQA plans to move rapidly forward to meet this objective.

Control of Pollution from Federal Activities

The Federal government is involved in many activities which have an impact on the quality of our Nation's waters. These operations include the maintenance of Federal facilities, such as military bases, lighthouses and post offices; management of Federal lands; and diverse activities, such as dredging, nuclear energy development, and pest control. Today, in the United States, there are approximately 20,000 Federal real properties, many of which have an impact on the environment. In addition, Federal lands comprise one-third of the United States, and the use of these lands has a bearing on progress in achieving national goals of clean water and a quality environment.

Abatement and prevention of pollution from these sources is a major Administration goal. On February 4, 1970, the President issued Executive Order 11507, establishing a new and aggressive approach to the problem of keeping the Federal house clean. The Order superceded earlier Executive Orders on water and air pollution control.

In issuing this Order, the President gave more specific direction to Federal agencies in the conduct of their activities with regard to environmental protection than had any previous Order. To establish the Federal government as a true leader in the battle to save the en-

vironment, he required that all projects or installations owned by or leased to the Federal government would have to be designed, operated and maintained so as to conform with water and air quality standards. For the first time, a conformance date for Federal compliance, December 31, 1972, was established and written into the Order. The Presidential statement accompanying the Order set forth a \$359 million program for obtaining this objective. To insure that these funds, once appropriated, were utilized for the purposes intended, the Order contained a section which, in effect, prevented use of the appropriated funds for purposes other than pollution control.

FWQA has an important role to play in working with the other Federal agencies concerned to assure that the objectives of the Executive Order are met. FWQA has primary responsibility for reviewing and approving permissible limits of waste discharges from such installations and for coordinating the water pollution control activities of Federal, State, and local programs. The new order contains important provisions to insure this role will be an effective one and to correct some of the administrative problems brought about by earlier Orders. Rather than have professional staff at all

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levels of government review plans and specifications for improved abatement facilities, the Order requires that specific performance requirements for each facility be set by the agency and approved by the Secretary of the Interior. In evaluating the adequacy of the performance requirements, the Secretary is to take into consideration water quality standards where such standards exist. The Secretary is also given, for the first time, the authority to issue regulations establishing water quality standards for the purposes of the Order where such do not exist. More importantly, the Secretary is also authorized to establish more stringent requirements for Federal facilities than contained in existing standards. Both of these actions are to be taken after consultation with appropriate Federal, State, interstate and local agencies.

FWQA has taken a number of steps to meet these and related responsibilities. The staff assigned to work with the other Federal agencies has been restructured and enlarged. Increased emphasis has been placed on better channels of communication and cooperative relationships with the other Federal agencies. Fruitful meetings and seminars have been held at which Federal programs have been reviewed, information exchanged, and advice both sought and given.

FWQA conducts on-site inspections of waste-water treatment and disposal practices at Federal installations to advise the agencies concerned as to the adequacy and effectiveness of such measures. This

information is used by agency planners to develop and update plans for corrective actions. Whenever possible, these inspections are conducted jointly with State officials to promote better Federal-State relationships.

From the information collected on such inspections, a system of recording and reporting information on Federal installations and their waste treatment needs and accomplishments was developed in 1969. This system will be the basis for a comprehensive inventory of Federal installations, which will streamline the review process and provide better information on which to recommend nationwide priorities to the Bureau of the Budget and Congress.

To facilitate budgeting for corrective measures, Federal agencies are required to present to the Bureau of the Budget a plan for installing improvements needed to meet the target date. FWQA reviews the agencies' plans and recommends priorities for funding to the Bureau of the Budget. Each project is ranked in the order of its priority to ensure that the most significant problems will receive first attention.

Emphasis has been placed on conferences to ensure that information on improvements in waste treatment technology would be available to Federal agencies. In this regard, a seminar was held for representatives of other agencies on new advances in waste treatment technology and was geared to problems routinely faced at Federal installations. Attendance of agency personnel at seminars conducted by FWQA's Research and Development program has been encouraged. A field trip was arranged for officials of the Department of Defense in order to familiarize them with the new treatment technology being developed at the Blue Plains sewage treatment plant in Washington. Reports of completed FWQA research projects are being made available to the appropriate Federal agencies for their consideration in the development of new facilities, and incorporation of these newly developed techniques in remedial work is being highly encouraged.

Correction of conventional municipal and industrial waste problems from Federal facilities is only a part of the job in ensuring that the wide-ranging activities of the Federal establishment have a minimum impact on the environment. New opportunities for pollution abatement are continually being brought to the attention of other agencies. As the wastes from conventional point sources are brought under control or eliminated, the wastes from nonpoint sources come to the forefront as significant problems.

One such area receiving recent attention was related to management practices on Federal lands. In the past year FWQA chaired a Department of the Interior task force established to assess the effect of

Federal land management practices on water quality. A pilot review study conducted in Oregon showed a major need and opportunity to reduce water pollution associated with Federal land management practices and conservation measures. The report, *Federal Land Management Practices and Water Quality Control*, found serious damage to the environment stemming from long-established practices, as well as from more recent practices involving pesticides, fertilizers, and other chemical applications. The report specifically identified 12 kinds of land management practices and 22 conservation measures having an impact on water quality. These would be reviewed by agencies and altered whenever necessary to conform with national environmental goals.

Operation Plowshare, the Atomic Energy

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Commission's program to develop peaceful uses of atomic energy, represents another activity which must be carefully monitored and controlled to avoid unwanted effects on the environment. This program has and will involve nuclear explosions designed to stimulate gas production in oil and gas bearing formations, to fracture mineral formations to enable extraction by leaching, to develop storage for water or other materials. To assure that the program, as planned, provides adequate safeguards for water quality, FWQA provides review and advice to the Commission concerning these experiments. Careful planning of the program, as well as pre- and post-detonation surveillance, is essential because of the potentially great hazards involved.

The Corps of Engineers' dredging activities in the Great Lakes and elsewhere are yet another cause for concern. For more than 100 years the Corps of Engineers has been dredging material from the harbors of the Great Lakes and depositing most of the dredged material in designated dumping areas in the open waters. Growing concern over the resulting effect on the Lakes led to completion last year of a Corps of Engineers' pilot program related to dredging and water quality problems in the Great Lakes. Among the conclusions of the Corps' study were that heavily polluted sediments when transported to the open waters must be considered presumptively undesirable because of their possible long-term effects on the ecology of the Great Lakes, as evidenced by bio-assays of the effects on bottom organisms and plankton, and that disposal in diked areas would be the least costly effective method of withholding pollutants associated with dredgings from the Lakes.

On April 15, the President sent a message to the Congress, proposing legislation to discontinue open water disposal of polluted dredge spoil in the Great Lakes. The legislation would authorize the

Corps to construct and maintain contained disposal facilities, in cooperation with States and other non-Federal interests. Dredge spoils from Federal and non-Federal operations would be disposed of in these enclosed areas under appropriate cost-sharing arrangements.

We also must be increasingly alert to the environmental impact of such diverse activities as Forest Service timber sales in Alaska, use of persistent pesticides for quarantine control at Federal airports, and proposed development of oil shale lands in Colorado, Wyoming, and Utah. FWQA will place increasing emphasis on working with the agencies concerned to correct deficiencies and to prevent environmental problems from arising in the future.

Control of Pollution from Federally Licensed and Supported Activities

Closely related to pollution resulting from direct Federal activities, is the environmental impact of the various functions conducted under loans, grants, contracts, leases and permits from the Federal government. These diverse activities range from the nuclear power plants receiving licenses from the Atomic Energy Commission to urban renewal projects financed by the Department of Housing and Urban Development. Combined, these Federally supported and licensed activities constitute a real and potential threat to the environment, which cuts across the full spectrum of the Nation's economic life. They also reflect an unusual opportunity for the Federal government to extend the exercise of its responsibilities for pollution control.

Two landmark pieces of legislation and an implementing Executive Order promise effective action. The National Environmental Policy Act of 1969 called for all agencies of the Federal government to give full attention to environmental protection in their planning activities and decision making. In furtherance of this legislation, the President issued an Executive Order on March 5, 1970. This Order directed the heads of all Federal agencies to review their statutory authority, administrative regulations, policies and procedures, including those relating to loans, grants, contracts, leases, licenses or permits, in order that they might identify deficiencies and inconsistencies which keep each agency from full compliance with the national

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environmental goals established by the Act. The Order requires a report to the Council on Environmental Quality on the results of this review along with corrective actions taken and planned.

Recent enactment of the Water Quality Improvement Act of 1970 gave further impetus to this trend. The Act provides that any applicant for a Federal permit or license to construct or operate any facility which may result in any discharge into the navigable waters of the United States shall provide certification from the State in which the

discharge originates that such facilities or related activities can be expected to comply with applicable water quality standards. The Act further provides that no license or permit shall be granted without such certification and such conditions as the State may reasonably require, including but not limited to provision for suspension or termination of any issued license or permit for failure to be in compliance with applicable water quality standards. It also provides special conditions under which the views of an adjacent State will be obtained; or an interstate agency or the Secretary of the Interior, if appropriate, may provide the certification.

The legislation is clear in its intent that the States are to exercise primary responsibility for the administration of the water quality standards for their waters and for the assurance that State-Federal water quality standards are met by anyone who uses these waters, and that FWQA is to cooperate with other Federal agencies, with State and interstate agencies, and with water users in assuring that appropriate control measures are applied to meet the water quality standards. The legislation provides that the Secretary of the Interior shall provide, upon the request of any Federal department or agency, or State or interstate agency or applicant, any relevant information on applicable water quality standards and comment on any methods of complying with such standards.

The major and most significant activities to receive immediate attention under this legislation are those of the Atomic Energy Commission, which issues construction permits and operating licenses for nuclear power plants; those of the Federal Power Commission which licenses hydroelectric power plants and whose approval must be secured before changes can be made in those projects, including use of project waters and construction across project lands; and those of the Corps of Engineers which issue permits for dredging and construction in the navigable waters of the United States (except where hydroelectric power production is contemplated and licensed by the Federal Power Commission).

Prior to the enactment of recent legislation and the issuance of the Executive Order, cooperative arrangements had been made with the Atomic Energy Commission, the Federal Power Commission and the Corps of Engineers to review materials submitted in request of Federal permits or licenses for activities which could result in water pollution. These reviews have been conducted in coordination with other Department of the Interior agencies concerned with environmental protection. FWQA has reviewed these applications to determine the possible effects of the activity, as proposed, upon water quality. Recommendations have been

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made as to the need for additional control facilities and any provisions which should be included in the permit or license to ensure that water pollution would be controlled. These activities have led to an increasingly well-coordinated and cooperative effort to ensure that water pollution control measures are considered in connection with the issuance of a Federal license.

These arrangements have been satisfactory, however, only in part. For example, there has been a serious inadequacy in procedures for review of environmental factors in design and site selection for new fossil fueled or nuclear power plants.

With respect to nuclear plants, the Atomic Energy Commission receives comments on environmental factors from the Department of the Interior in accordance with established administrative procedures. These comments are forwarded to the applicants for consideration. The Atomic Energy Commission, however, has held that it lacks regulatory authority to incorporate in its licenses for nuclear plants requirements for measures to protect the environment beyond radiation safety hazards. This position has been supported by the Department of Justice and also affirmed in a court decision.

Fossil fueled plants are licensed by State regulatory authorities and require no Federal license whatever. With public concern about the environmental impact of power developments running high, a number of utilities have entered into voluntary discussions of projects under consideration with concerned State and Federal agencies. There has been, however, little or no opportunity for the Department of the Interior to require environmental protection measures in the plans for power plants, both nuclear and fossil fueled, unless they used water from the reservoir of a licensed hydroelectric project.

By contrast, there have been adequate procedures for environmental review in the category of hydroelectric power plants. Over the years, the Federal Power Commission prior to issuing a license for the construction of hydro plants has increasingly incorporated environmental protection requirements. These have included, for example, minimum flows for fisheries and water quality below licensed dams, fish screens and spawning channels, and the making available of project lands for public recreation.

Many proposals for incorporating these measures come from Department of the Interior agencies. FWQA has the opportunity to review license applications made to the Federal Power Commission and to propose changes in construction and operation plans on behalf of water quality improvement. It has received excellent cooperation from the Federal Power Commission in incorporating recommended measures in its licensing procedures.

A prime example of the application of this policy is the Blue Ridge

case on West Virginia's Kanawha River. Although this case is still pending before the Federal Power Commission, the preliminary finding provided for the development of a project which would require the power company to provide flows for maintenance of water quality in the downstream reaches of the Kanawha River.

The activities involving dredging and construction in navigable waters of the United States and requiring permits from the Corps of Engineers constitute another category of pollution. The discharge of dredged materials into the Great Lakes by private dredgers is directly comparable in effect to the discharge of dredgings from Corps operations. This illustrates the importance of applying the same stringent environmental controls to Federally licensed activities as to the Federal agencies themselves.

FWQA and the other Interior agencies concerned review thousands of applications for such permits annually. Comments to the Corps of Engineers have resulted in inclusion of provisions to protect water quality in some permits and in the withholding of other permits. However, major difficulties have remained. The inclusion of specific provisions relative to control of pollution in Corps of Engineers' permits has been contested in the courts. A lower court decision that the Corps of Engineers is not authorized to include such restrictions in its permits is being contested by the Corps of Engineers.

Enactment of the Water Quality Improvement Act of 1970 represents a major improvement in procedures and methods. The Act's emphasis on compliance with water quality standards as the basic mechanism for ensuring water quality protection is of great significance. Nevertheless to adequately ensure the effectiveness of these new requirements, FWQA must place continued emphasis on development of adequate standards. At present, there are no standards that adequately ensure protection of water quality from the impacts of dredging, and the temperature standards of many States remain unimproved. In order to provide effective implementation of the Water Quality Improvement Act, within the concepts outlined by the Congress, FWQA must and will accelerate its efforts to obtain adequate water quality standards.

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ASSISTANCE PROGRAMS

From the very start of the water pollution control program, the Congress has made it clear that the responsibility for preventing and controlling water pollution begins at the State and local levels. And, although the Federal government has been given an increasingly greater hand in dealing with the problem, the States and communities continue to bear a major share of the responsibility.

The job of controlling pollution, as indicated earlier, is an enormous one both in terms of costs and in terms of manpower requirements. Few, if any, State and local governments have revenues large enough to meet the many and increasing demands, including water pollution control, confronting them. The largest share of the Federal program's resources are therefore spent for direct assistance to States and communities—grants for treatment plant construction and program development, technical assistance, and manpower development—to help meet the national goal of clean water.

President Nixon has proposed in his program of "New Federalism" that State and local governments play an increasingly important role in meeting national needs. At the same time, he has recognized the need for vigorous Federal leadership, through solid backup of State and local actions, in restoring the environment.

To ensure more effective working relationships, the President has directed nine Federal departments and agencies to work together to modernize the management of their presently complex systems of providing financial and technical assistance to State and local governments. The Department of the Interior is working to implement the objectives and goals of the Federal Assistance Review (FAR) program. One of the primary objectives sought is the simplification of the Department's grant programs—streamlining of the application process and organizational structure of assistance programs for efficiency, economy, and responsiveness to State and local needs. The Federal Water Quality Administration (FWQA) has responded to the challenge. A detailed analysis of the administrative requirements of the Construction Grants and the State and Interstate Pollution Control Grants programs is currently underway.

Secretary Hickel has also stressed the need to improve Federal working relationships with the States. In order to improve communications with States, FWQA representatives are attending public meetings of the State water pollution control boards and other appropriate meetings, such as those of legislative committees. Technical assistance is also being increased to make more of an effort to meet State needs within available resources. Increasing emphasis will be placed on coordinating State and Federal program planning to ensure the most effective pooling of resources.

Assistance to Municipalities

Rapid growth of population and its continuous trend toward urban centers has resulted in a tremendous increase in the volume of municipal wastes and in the need for an enormous investment in waste treatment facilities. National attention was focused on this problem in 1956, when the Congress, in the first permanent Federal Water

Pollution Control Act, initiated the program to provide Federal grant assistance to communities to improve or build sewage treatment facilities. Amendments since that time have helped step up construction activity by making more money available and on a more liberal basis.

Under today's legislation, a community can get financial help in the construction of a municipal waste treatment plant with a Federal grant of at least 30 percent of the construction cost. Under certain conditions, such as matching State financial aid, approved water quality standards, and a comprehensive plan for approaching the problem, the Federal share may be much higher.

Since 1957, the Federal government has provided nearly \$1.5 billion for construction and expansion of over 10,000 municipally owned and operated sewage treatment facilities. These funds have assisted the States and communities in the construction of \$6.4 billion of treatment works.

In the thirteen years in which such grants have been available, the population served by some degree of waste treatment has increased by more than 51 million persons. More than 92 percent of the population served by sewers is connected to a waste treatment plant, as contrasted with 57 percent in 1956. These represent significant accomplishments.

Despite this progress, the Nation still lags far behind in providing modern waste treatment for its cities. Many of the works constructed were designed to provide levels of treatment which subsequently have proved inadequate to protect receiving waters. Other works have become overloaded and need major expansion. Improper operation and maintenance of many of these plants has resulted in discharge of wastes little

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reduced in polluting content and in breakdown and early obsolescence of facilities. Other plants have been poorly located and have resulted in fragmented, rather than systematic, regional solutions. Population growth has added additional needs; during the same years that the construction grants program was underway, the population connected to sewers for which treatment must be provided increased by 37.5 million persons. Increasing standards of living and the rising use of household chemicals and appliances, such as garbage grinders, have added an additional dimension. In many river basins, progress in treating the wastes from some of the communities has been offset by failure to deal with other waste sources.

Construction needs have far outpaced Federal, State and local funds and there have been recent efforts to increase available funds. A number of States have enacted measures to financially assist their

communities. At the Federal level, the Congress this year appropriated a record \$800 million to finance the Federal share of doing the job. It will not be enough, however, to merely provide additional funds under existing formulas and methods. A number of basic improvements are needed.

The FWQA has become increasingly aware that major revisions in this key program—its legislative structure, funding, regulations, and administration—are necessary if the nationwide goals of providing adequate waste treatment and meeting water quality standards are to be accomplished efficiently and in the near future. A major objective over the past year has been to review the program in depth to determine what changes were needed. The General Accounting Office has also had the program under review and has made a number of recommendations for improvement.

Our review contributed to the formulation of the proposed new legislation and regulations to administer the program on a more systematic basis. These are an essential element of the Administration's environmental program. This review clearly indicated that there were three basic objectives which should be met to achieve an equitable and fully effective Federal financing program. First, the level of financing should be adequate to enable the Nation's communities to get abreast of their pollution problems. Second, the method of financing should be an assured one, in order to enable State and local governments and the construction industry to plan and gear up for the necessary effort. Third, the program must be designed to ensure that the funds will be spent efficiently to achieve the best results in cleaning up our waters.

The legislation proposed to the Congress by Secretary Hickel is designed to provide funds adequate to do the job. The legislation calls for a four-year Federal contribution of \$4 billion in a construction program of \$10 billion, the Federal share to be matched by \$6 billion in State and local funds.

This is based on the determination, through FWQA's recently completed cost studies, that a \$10 billion investment in waste treatment facilities is needed to meet the country's municipal waste treatment needs in the years immediately ahead. Although these cost studies, the most comprehensive ever completed, indicate that \$10 billion will be enough, President Nixon has said more money would be available if necessary. The proposed legislation provides for a reassessment in 1974 to evaluate needs for the following five years. The legislative proposal would also revise the present method of allocating grants to permit a higher degree of flexibility in directing funds to areas where the need is greatest and where they can be most effectively used.

The proposed legislation also stresses measures to provide assur-

ance to States and communities that Federal funding will be forthcoming as planned. The lag between Federal authorization and appropriations in the present legislation created a condition of confusion and uncertainty that has hampered the engineering and construction industry from gearing up for a sustained level of effort.

Ensured funding is a key component of the

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proposed legislation; it would enable the Federal government to enter "grant agreements" with municipalities at the rate of \$1 billion a year for four years. Pursuant to these agreements, the Federal government would be obliged to appropriate funds to satisfy obligations under these grant agreements, just as the Federal government must satisfy any other of its debt obligations. This change would assure communities of full Federal support and allow planning and construction to proceed without the traditional gap between funds authorized and funds appropriated.

The Administration has further emphasized its intent to provide assurance of funding and to alleviate State and local uncertainty by resolving the reimbursement issue. To permit States and communities to move ahead with construction of waste treatment works before full Federal funding became available, the 1966 amendments to the Act provided that the allotments of a State could be used for reimbursement of projects which went ahead with less than the full Federal share and on which construction was initiated after June 30, 1966, provided that such projects met all other Federal requirements. As a result of this provision, a number of the States went ahead with bond issues or other provisions for prefinancing the Federal share on those projects which proceeded with either no Federal funds or less than the full Federal share. As of December 31, 1969, a total of 880 such projects had proceeded. The amounts earned for Federal reimbursement were \$322 million. When all these projects are completed, eligible reimbursements will be about \$814 million.

Federal intentions with respect to repayment of these funds has been one of the vexing problems facing States and communities which had moved ahead on their own. In addressing the State Governors' Conference in Washington this February, President Nixon expressed his position regarding repayment of these funds. He stated that, "any State that went forward after the Clean Water Restoration Act of 1966 relying on what the Federal government had indicated, went forward in its own program, should not be penalized because it took that initiative. As a matter of fact, it should be rewarded."

Under the proposed legislation, reimbursement would be accomplished through the larger appropriations; through improvements in

the reallocation procedure which would more quickly funnel funds to areas of greatest need; and through use of discretionary authority, which would permit the Secretary to assign a

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portion of each year's available funds to such areas.

An additional element of the Administration's program will help assure that State and local bodies will be able to borrow the necessary funds to do their share. The Department of the Interior's proposed legislation would be supplemented by a Treasury Department proposal to establish an Environmental Financing Authority (EFA). EFA would have authority to buy the waste treatment bonds of those municipalities who are unable to sell their bonds on the open market. EFA would ensure the availability of local financing for construction of waste treatment plants, so all communities would be able to participate in the construction grants program.

Higher appropriations and revised legislation are only part of the answer in accelerating the systematic construction of municipal waste treatment plants to achieve effective results in cleaning up pollution. Development of measures to ensure efficient use of funds to achieve that result has been a key element of FWQA's new approach to the administration of the program.

Secretary Hickel has said, "The job ahead will be costly. We want to ensure that the Federal funds invested in the clean-up will be spent effectively and fairly." Towards this end he has published proposed regulations in the Federal Register. The proposed new rules are that:

—Comprehensive river basinwide programs for pollution abatement must be developed, and new treatment works must fit in with such programs, as well as with metropolitan and regional plans, to be eligible for Federal aid.

—In evaluating new applications, the FWQA may demand detailed data on all sources of pollution in the entire river basin, including the volume of discharge from each source, character of effluent, present treatment, water quality effect and other items.

—If some industrial wastes are to be treated as part of a municipal system's operations, industry must pretreat those wastes if they would interfere with efficient operation of the community system. Further, a system of "cost recovery" must be required if some industrial wastes are to be treated in a new plant built with Federal aid. Such cost recovery by the municipality would assess the industries a share of the operating costs and costs of amortizing the debt, in proportion to their contributions to the cost of waste treatment.

—State water pollution control agencies must inspect new Federally-aided facilities for efficiency and economy at least once each

year for the first three years of operation and periodically thereafter under standards set by FWQA.

—Design of any new Federally-aided treatment plant would have to be approved in advance as being economical, efficient, and effective under FWQA requirements.

In addition to these changes in the substantive elements of the construction grants program, FWQA has established a study project to review grant procedures and to determine any changes necessary to streamline those procedures to assure efficient and effective grant administration. A task force including management consultants and FWQA personnel is in the process of preparing a report concerning needed improvements.

All together, the proposed legislation, the amended regulations and the continued efforts to streamline administrative procedures will result in an overall improvement of the construction grants program and will provide financial assistance to the Nation's communities, which will be fully adequate to meet the needs of the years ahead.

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Assistance to Industry

With the acceleration of the Nation's clean-up program, industries are faced with major pollution control expenditures. Although there are no specific Federal assistance programs directly geared to provide funds for industrial waste treatment equivalent to the Federal assistance for construction of municipal treatment plants, there are several Federal incentive programs which provide encouragement and support for industries to meet their treatment requirements.

FWQA is encouraging and supporting the treatment of industrial wastes in municipal treatment plants; municipal systems designed to receive industrial wastes are eligible for support under the construction grants program.

The practice of treating industrial wastes in municipal treatment plants has a number of advantages. First and foremost, it provides for more effective pollution control by encouraging regionalization of the waste treatment system. A community that maintains effective treatment of its sanitary wastes can still be a polluter if industrial waste discharges from its borders are uncontrolled. Joint treatment is effective too because it locates responsibility for operation and maintenance within a single authority. In addition, complementary characteristics of sewage and industrial wastes, if properly controlled, can often permit more effective waste reduction within the plant.

Joint treatment facilities offer significant advantages to both communities and industries in terms of lower treatment costs through economies of scale. The inclusion of industrial wastes in municipal

plants also offers special incentives to industry, as these joint facilities can be built with the help of a Federal construction grant. Industry thus can pay for its waste treatment through operating costs, rather than having to make the extensive capital investment involved in the construction of treatment facilities.

Joint treatment of municipal and industrial wastes is increasing, as is the development of technology to handle a variety of complex wastes. For example, metropolitan Seattle has adopted an ambitious program to provide treatment for all liquid wastes that occur within its extended area of jurisdiction. More and more communities are designing their facilities to accommodate a larger portion of the total waste load that is produced by factories, with the cost of construction shared by the community, industry and the Federal, and sometimes State, government.

At the same time, as part of the overall reform of construction grants requirements, FWQA is moving to eliminate certain abuses of joint treatment and to ensure that municipal and industrial systems will operate effectively. First, through pretreatment requirements in the new regulations, the discharge of wastes which would make municipal systems nonoperative or reduce their effectiveness will be controlled. Second, industries are required to reimburse the municipality concerned for the added cost which treatment of their wastes imposes; this will ensure that the municipality will have sufficient revenues to provide adequate waste treatment on a continuing basis.

FWQA also provides assistance to industry through its research and development program. Since 1966, the Federal Water Pollution Control Act, as amended, has authorized grant support of industrial demonstration projects aimed at improving waste management. Although not intended as a direct form of assistance in defraying the costs of constructing waste treatment plants, projects supported by these grants have demonstrated methods of treating industrial wastes more economically and of recovering certain portions of wastes for reuse. Other grants have been used to show the feasibility of joint treatment of municipal and industrial wastes.

Tax write-offs provide further assistance to industry. Although a number of States have enacted tax measures designed to encourage industrial waste treatment facilities, until recently

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there was no comparable measure in effect at the Federal level. In enacting the Tax Reform Act of 1969, however, the Congress included provisions for accelerated amortization of air and water pollution control facilities for Federal income tax purposes.

Under this law, a taxpayer is entitled to a deduction with respect to the amortization of certified air and water pollution control facilities. A certified pollution control facility is defined as a new, identifiable treatment facility which is used, in connection with a plant or other property in operation before January 1, 1969, to abate or control water or atmospheric pollution or contamination by removing, altering, disposing, or storing of pollutants, contaminants, wastes, or heat . . . and which, in the case of water pollution control facilities, is certified by the State water pollution control agency as meeting State water pollution control requirements and by the Secretary of the Interior as meeting Federal water pollution control requirements. The Secretary may not certify facilities to the extent that the cost of such a facility will be recovered over its useful life.

Regulations are being prepared by the Department of the Interior and the Department of Health, Education, and Welfare in consultation with the Treasury Department to implement the Federal certifying responsibilities.

Assistance to State and Interstate Programs

State agencies are the first line of defense in the national water pollution control effort. Many States have been able to strengthen their pollution control programs to meet the growing problems thrust on them in the past several years. Others, however, have not had adequate laws and resources to do the job. Federal program grants are available to State and interstate agencies to help them bear the costs of needed preventive and control measures. These grants are intended as realistic incentives for the State and interstate agencies to expand and improve their programs.

The program started in 1957 with an annual authorization of \$2 million. The annual figure has grown to \$10 million today, and the State and interstate agency expenditures have increased more than six times during that same timeframe. Many of the States have substantially strengthened their programs. Funds have been used for employing needed technical personnel, for purchasing special laboratory and field equipment, for waste treatment plant inspection programs, for more aggressive enforcement of State laws, for expanded monitoring and surveillance programs, and for training.

Many States improved their programs in the last year by passing new laws or strengthening existing authorities to provide for a more vigorous clean-up effort. For example, in Oregon, water pollution control became part of a newly created Department of Environmental Quality. A feature of this new Department is its ability to conduct an extremely successful enforcement program. With this new authority, Oregon is carrying on an aggressive abatement program for

both industrial and municipal waste sources.

Also in the Pacific Northwest, the State of Washington's 1969 Legislature inserted a requirement that after July, 1974, no applicant can receive a Federal construction grant unless the project conforms to a comprehensive drainage basin plan for water pollution control. This requirement places a burden of urgency upon the State to give planning a very high priority. This change is consistent in purpose with the Secretary's recent proposals for a more systematic and comprehensive administration of the construction grants program.

In Connecticut, legislation enacted during FY 1969 furthered the Connecticut Water Resources Commission's leadership role in several ways:

1. Bonding authorization for pollution control facilities, including pre-financing of Federal grants, was raised from \$100 million to \$250 million.

2. To promote regionalization, the Commission is authorized to issue orders to polluters jointly after a determination that such pollution can best be abated by the action of two or more adjacent municipalities.

3. New statutes were enacted, covering all phases of oil pollution removal and prevention and containing a provision for strict liability on spillage.

Two other highlights of State accomplishments in recent years are found in New York and Pennsylvania. New York provides reimbursement to municipalities for 1/3 of the cost of operation and maintenance of sewage treatment plants when they are operated according to established standards. Every municipal sewage treatment plant is comprehensively inspected at least once each year by a sanitary engineer and a chemist to evaluate operation and maintenance and laboratory work and to determine quality parameters for raw waste, treated effluent and receiving waters. In Pennsylvania, the Department of Health regulates and administers annual payments to municipalities of 2% of construction costs toward opera-

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tion of sewage treatment facilities. About 685 applications are now being processed for payment of approximately \$8.1 million in 1969. Payment is toward the operation, maintenance, repairs, replacements, and other expenses relating to sewage treatment plants.

New York and Pennsylvania are two of the States that have been fortunate enough to have the resources to support their water pollution control programs. In many States this is not the case, and it is perhaps here that the impact of Federal program grants is most significant.

As a basis for receiving a Federal program grant, each State and eligible interstate agency must prepare a plan describing how the grant will be used to strengthen its pollution control program. To assure the most effective utilization of these funds, the Federal Water Quality Administration (FWQA) has developed guidelines which set forth the essential elements of an effective State and interstate program plan.

In addition to constituting a request for grant assistance, the Program Plan serves several other important purposes.

1. It provides the State's annual report on progress in implementing water quality standards.

2. It provides information essential to FWQA in developing assistance and coordinating other grants to the State or interstate agency under other provisions of the Federal Act.

3. It identifies and discusses problems and issues in extending or improving the State or interstate agency's water pollution control program and helps in evaluation and program planning.

The FWQA has worked closely with the States in this planning process. Several Regional Offices have, in response to State requests, initiated joint review and evaluation studies of individual State programs. Last year such studies were completed in South Carolina and Idaho; additional studies are planned this year. Through these studies the Federal and State agencies work together in identifying problems and needs and in proposing action programs. As a result of the South Carolina study, the program was presented to the Governor and the legislature for consideration by the General Assembly. It is anticipated that these recommendations will result in additional staff and resources for South Carolina's program and in general provide an improved program for the State.

In order to provide maximum assistance to the States, a new approach for analyzing and evaluating the effectiveness of State program performance is being tested in cooperation with State water pollution control agencies. The proposed new system will be oriented to accommodate inclusion of such detailed information as necessary to permit an objective evaluation of program performance. The State program appraisal will form the basis for evaluating basic State program resources, such as State policy, legislative authority, rules and regulations, organization, staffing, and budget; performance in terms of resource utilization; and accomplishments, such as stream miles or estuarine acres brought into compliance with water quality standards.

In addition, the system will identify State program needs and translate those needs into priorities and objectives in pollution control. The appraisal procedure will define and identify the minimum

criteria governing Federal financial assistance to State programs. It will provide for a continuous review of State programs in order to enhance coordination of State and Federal activities and will permit relating accomplishments to established goals. Finally, the appraisal system will provide for a meaningful comparison of State program performance among States.

The FWQA is also supporting a number of special activities which demonstrate the utilization of advanced techniques by State and interstate agencies. For example, the agency is giving funds to Pennsylvania to help develop a Statewide pollution information system designed to handle all water quality data. This system will provide a modern management tool to help the State systematically administer its program. A modern, automatic monitoring system of water quality parameters and the telecommunicating of information to a central processing location have been expanded by the Ohio River Valley Water Sanitation Commission using FWQA support.

The accelerated drive for clean water stemming from strengthened Federal regulatory and financing programs will also demand an increased capability on the part of the water pollution control agencies of many States. For this reason, proposed legislation to provide additional grants to State and interstate agencies is an important element of the Administration's program. The new legislation would increase the authorization each year on a sliding scale from \$12.5 million for fiscal year 1971 up to \$30 million for fiscal year 1975. Emphasis would be placed on development, performance, and substantial improvements to State programs. The basic grant program contained in the present Act would remain, but three new categories of grants would be authorized: program develop-

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ment grants, program improvement grants, and special project grants.

The new amendments are essential to increase support to States and interstate agencies to enable them to carry out and accelerate programs of water quality standards enforcement and implementation, the implementation of the Department's proposed construction grant requirements, and the accelerated construction of needed treatment facilities.

From both a long and short-range viewpoint, the State program grants are a good investment. National pollution control efforts can move ahead only as fast as the State and interstate agencies respond with imaginative and thorough programs to meet their responsibilities.

Technical Assistance

Technical assistance is another key program available to help States solve pollution problems. A great many of the water pollution prob-

lems facing the Nation call for technical study to determine the sources or causes of the pollution and to find the most appropriate abatement measures to remedy the situation. Often, the problem is complex and requires extensive field and laboratory study. Acid mine drainage, coastal and estuarine pollution, groundwater contamination, and pesticide and toxic chemical pollution are examples of pollution problems for which the most effective and appropriate corrective action is frequently unknown and for which specific technical study is necessary before abatement action can be pursued.

Federal Water Quality Administration (FWQA) assists the State and interstate water pollution control agencies in developing their technical capabilities and provides financial assistance for this purpose through the program grants previously described. These agencies conduct a great many of the technical investigations required to carry out an effective water pollution control program, but frequently they find it necessary to call for outside assistance to handle problems which exceed their capabilities. To meet these needs FWQA provides technical assistance of various kinds ranging from technical advice and consultation to extensive, long-term field and laboratory studies. Within the limits of available resources, this assistance is provided on request, primarily to the State and interstate water pollution control agencies, but also to other public agencies, including other Federal agencies.

During 1969, FWQA responded to over 300 major requests for technical assistance and numerous requests for advice, information, reviews and comments on technical problems. The following examples will serve to illustrate the program:

During the last quarter of 1969, FWQA conducted intensive water quality and waste source surveys on Perdido and Escambia Bays and tributary river basins. The study on Perdido Bay was requested by the State of Alabama to determine the cause of the declining fishery and of the occurrence of unsightly brown foam in many parts of the Bay. The work on Escambia Bay was made in response to a request by the State of Florida to determine the cause of the dozen or more fish kills that occurred in the Bay during the summer of 1969. Both studies identified offending waste sources and the remedial measures required. Upon completion of the two studies, the respective State governors re-

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quested Federal enforcement action, and, in response, enforcement conferences were held early this year. These resulted in specific abatement recommendations and time schedules. The State of Florida has begun implementing these recommendations through

the issuance of clean-up orders, and FWQA is continuing to provide technical assistance and support for these efforts.

In other cases, States have applied the findings of FWQA technical assistance directly under their own authorities. The water quality study of Hillsborough Bay, Florida, which was completed in 1969, is a good example. This study was addressed to a long-standing obnoxious odor problem resulting from the death and decay of marine algae. Discharges of municipal wastes from the City of Tampa and industrial wastes from several chemical and fertilizer plants were shown to be adding sufficient nutrients to the Bay to cause the enhanced growth of marine algae. The cause of the massive amounts of dead and decaying algae giving rise to the odor problem was thus traced back to the waste discharges. Other aspects of water quality degradation were also identified together with their causes. The findings of the study were presented in a public hearing held by Florida Air and Water Pollution Control Board in February of this year. The abatement recommendations of the study report were adopted, and the State agency has begun issuing implementation directives. The affected companies, the City of Tampa and the other local agencies have initiated the planning of remedial facilities and practices, thus demonstrating positive follow-through action based on FWQA's technical assistance study.

Another recent example of technical assistance is a field investigation of the James River below Springfield, Missouri, completed last year. This study was conducted in response to a request from the State of Missouri and was aimed at determining the causes of and corrective measures for the severe water pollution and frequent fish kills occurring in the River below Springfield. Several waste sources were identified as the cause of the problem, and abatement measures to be taken by these sources were recommended. On the basis of these findings, the State and the polluters have initiated remedial actions, some of which have been completed, and significant improvements in water quality have already been achieved.

To aid the State of Wyoming in assessing the pollutorial impact of a uranium mining operation on Little Medicine Bow River, FWQA developed a radiological monitoring network and schedule for the State and performed the radio-analysis on the samples collected by the State during the summer of 1969. Radio-analysis assistance will be given again in 1970. The State intends to use the data collected to determine the need for waste treatment or control by the mining operation. This exemplifies a type of assistance widely provided by FWQA—the performance of complex analytical and bioassay tests, such as those for pesticides, organic chemicals, heavy metals, various toxicants and radionuclides.

As these examples illustrate, most of FWQA's technical assistance is devoted to investigating specific problems and finding the appropriate available corrective measures. These studies are not directed to research or development of new and improved technology; however, in some cases these studies indicate that corrective measures are not apparent. Thus fruitful topics for research are often identified and these are referred to FWQA's research and development program for follow-up.

To carry out its technical assistance activities, FWQA relies on the basic staffs of engineering, scientific and technical personnel and support laboratory facilities and equipment in each of its nine Regions. Each Region is equipped to conduct intensive field studies involving chemical, biological, microbiological, hydrologic and other disciplines. The coastal Regions are equipped to undertake oceanographic investigations in addition to other types, and the Great Lakes Region has special capabilities for performing lake investigations.

Requests for technical assistance can be expected to continue to rise in the future, despite the expanding capability of many State pollution agencies. The problem areas of subsurface and ocean waste disposal; pesticide and radiological pollution; animal feedlot, sediments, salinity and other aspects of agricultural pollution; and the complex interacting problems of environmental quality protection will require much greater attention than they have had to date. For many individual States these problems do not occur frequently enough to justify maintenance of special skills and equipment on a permanent basis. However, they arise often enough across the country to warrant attention at the national level, and the experience gained in solving pollution problems in one part of the country can be useful in dealing with similar problems elsewhere. FWQA is prepared to give continuing help to State, interstate, and local agencies so they can carry out their remedial programs.

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PLANNING AND BASIC STUDIES

Just as any structure needs a good foundation, the nationwide effort to control pollution requires a variety of supporting programs to provide a sound basis for action. These basic support programs help to ensure that our action programs are soundly conceived and will yield clean water results adequate to meet present and future needs. Planning, data systems, and economic studies, all play a supporting role in the battle for clean water.

Need for such basic underpinning is clearly illustrated in the problem of assuring adequate environmental protection in connection with location of major electric power generating facilities. Strengthened

procedures authorized by the Water Quality Improvement Act of 1970 to ensure that Federally-licensed power plants will meet water quality standards have been discussed. Although these procedures only apply to one aspect of the environmental impact of power production, they represent major progress.

So long as such review takes place relatively late in the process of designing a plant, however, it cannot be fully effective. There is still a major need—recognized both by the Federal government and by enlightened sectors of the electric utility industry—to provide for consideration of environmental factors in the early stages of site selection. More effective means of planning must be found, which will provide the public with full assurance of environmental protection, and which will enable the utility industry to meet growing power needs without confusion and serious last-minute delay.

The Federal Water Quality Administration (FWQA) and other Federal agencies with an interest in the development or regulation of electric power have been working with the Office of Science and Technology on a comprehensive study and evaluation of power plant siting. In December, 1968, a report, *Considerations Affecting Steam Power Plant Site Selection*, was published. Since that time, the above agencies have been giving attention to the appropriate roles of the Federal, State and other public agencies in the regulation of power plant site planning.

At the Regional level, FWQA is participating with the New England River Basins Commission (NERBC) in developing criteria for siting power plants for New England. The NERBC power/environment program got off to a positive start in late 1969 with an in-depth look at the environmental impact of the proposed Seabrook nuclear power plant site in New Hampshire. FWQA assisted in preparing the water quality impact section of the study. The Agency is participating in a similar activity in the Columbia River Basin.

Environmental Planning

Although a major part, water pollution control is but one facet of the overall program for preserving and enhancing our environment. One of the most significant occurrences during the past year has been the greatly increased awareness on the part of public officials and citizens of the interrelationships among programs to clean up air and water pollution, to manage solid wastes and conserve natural resources, and to provide parks and increased recreational opportunities.

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To focus on major environmental issues that may involve actions of a number of interrelated Federal, State and local agencies, Pres-

ident Nixon established on May 29, 1969, a Council on Environmental Quality comprised of Federal Cabinet officers and Citizens' Advisory Committee. Subsequently, the Congress enacted legislation giving comprehensive expression to these concerns—the National Environmental Policy Act of 1969. This Act authorized a new Council on Environmental Quality, whose members have been recently appointed, and the former Council has been redesignated the Cabinet Committee on the Environment. The Environmental Quality Improvement Act of 1970, just recently enacted, further provides for the establishment of an Office of Environmental Quality to serve as staff to the Council.

To strengthen its capability in environmental planning and to provide a focus for coordination with the new Council, as well as with other agencies, the FWQA is establishing an Office of Environmental and Program Planning.

Environmental planning concepts, with the emphasis on long-range consideration of the effects of certain waste disposal practices, and the realization that site location practices are as vital as pollution control facilities, are increasingly incorporated in the policies and activities of a number of FWQA programs. Through effective participation in environmental planning, FWQA can best come to grips with such difficult pollution issues as thermal pollution control, including the previously discussed need for better selection of sites for power generation facilities to protect environmental values; protection of groundwaters and control of underground disposal methods; reducing the impact on waters of salinity resulting from irrigation practices and water development projects; location of oil refineries and future offshore loading facilities relating to the prevention and control of oil pollution; and decreased use of phosphates in detergents.

Other needs that have been identified include development of criteria for evaluating potential airport and highway sites; studying ways in which FWQA could help improve Federal, State and local mechanisms for land-use planning, particularly in critical estuarine areas; and ways in which marshlands could be protected from indiscriminate filling and development.

Development of policies on waste handling and treatment to avoid water pollution must be

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carried out with the realization that, ultimately, effective waste disposal must involve integrated consideration of air and water pollution control and solid waste management. Water pollution control policies must avoid creating air pollution or solid waste problems and seek, instead, ways of combining methods for maximum reduction of waste

loads. Further emphasis must be placed on effective waste management through recycling, recovery and reuse of the by-products of our technology.

Continued thought and effort must be placed on developing means of making so-called "technology assessment"—identifying the possible environmental consequences of new technology before they become widespread problems to be cured after the fact. A major challenge is finding the means whereby we will not have to wait until products, such as the phosphate-based detergents or hard pesticides, become a cause for major concern before we turn our attention to safeguards or substitute methods.

To improve the system for identifying potential or existing environmental problems, Secretary Hickel established an "Environmental Early Warning System" in the Department, clarifying the channels through which any member of the Department can highlight situations that need attention from government. FWQA has established coordinating mechanisms to work with this System and thus far has participated in studies of a number of issues.

FWQA is actively cooperating with the Forest Service and Bureau of Outdoor Recreation in evaluating a number of rivers for inclusion in the National Wild and Scenic Rivers System. This System affords a mechanism for protecting waters of unusually high quality or scenic value from degradation. Some rivers have already been designated for inclusion in the System, and measures for protecting the quality of these rivers will involve both FWQA and the State water pollution control agencies, as well as the Federal agencies which have been designated to administer these areas (Bureau of Land Management, National Park Service, Forest Service).

During the past year, FWQA has participated actively in several interagency planning efforts aimed at studying the impact of development on several areas and seeking measures to mitigate the effects of that development on the environment. One of the most significant involved plans for large-scale development of petroleum resources on the North Slope of Alaska. FWQA made significant input into establishment of guidelines on practices which the oil companies would have to use in construction of facilities, in use of pipelines and other means for transporting the oil, and in carrying out production, so that the resource could be developed without severely damaging the environment, particularly the sensitive and complex tundra areas.

Other issues have involved industrial and housing development in areas along the Eastern Coast. There is increasing realization that the harmful effects of poorly located developments on the quality of coastal waters; on sensitive aquatic resources, such as shellfish; and on marshlands and beaches are too high a price to pay for short-term

economic gains in coastal areas, and that many of these effects could be avoided by better consideration of alternative locations and methods of waste handling. In one case, serious shortcomings with the location of an oil refinery near the Chesapeake Bay were brought to light in FWQA investigations, and the company subsequently changed its development plans.

A case currently being studied involves the location of a chemical complex on the South Carolina coast in an area of extremely high natural and recreational value. A German chemical company, BASF, purchased land near Hilton Head, South Carolina, to construct a large petrochemical plant; this project has received nationwide attention and has caused considerable concern to environmental agencies. After reviewing the company's proposal and the conditions of the area, Secretary Hickel wrote to BASF on March 24, 1970, to express his concern that waste discharges from such a plant or transportation of materials might damage the high quality waters and the shellfishery which are now protected by Federal-State water quality standards, and that dredging of any navigation channels would destroy very valuable aquatic habitat. He stated that the Department would oppose any action which would result in degradation of that water quality and would oppose any proposal for channel dredging which would cause environmental damage. Subsequently, on April 7, 1970, BASF announced suspension of its plans pending further consideration of necessary measures to avoid these damages.

These and other issues point strongly to the need for better ways of assessing public values and of planning development in consonance with protecting the environment.

The Big Cypress Swamp is another significant issue where FWQA resources are being used in conjunction with those of other agencies to protect an area faced with development. This swamp is a vital source of water for the Ever-

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glades National Park, and both the Everglades and Big Cypress form a unique and very valuable natural resource. Proposed construction of a jetport in the swamp has been halted; however, the larger challenge of controlling development in South Florida and providing needed facilities for a rapidly growing population and economy while still protecting the Florida environment is just beginning to be faced by a variety of Federal, State and local agencies. In a sense, South Florida is an early and compelling example of conflicts on the use of resources which we may face in many parts of the Nation before long. The beautiful Florida environment has attracted the very forces that endanger the survival of that environment, and that survival must

depend, it appears, on effective long-range planning and control of development.

The above examples have concerned areas where development is threatening a high quality environment. Some of the greatest challenges and potential rewards for water pollution control are also in areas which have been degraded and where pollution clean-up may bring great recreational and other opportunities. This is particularly the case in increasing the opportunities for inner-city residents to swim, fish, picnic and enjoy the outdoors in urban areas. For example, FWQA assisted the National Park Service and Bureau of Outdoor Recreation in planning for the proposed Gateway National Recreational Area near New York City. Full use and enjoyment of this area will depend on effective pollution control.

Other proposals of this kind have been or will be increasingly explored. One FWQA research plan is to clean up pollution from combined sewers discharging to the Anacostia River within Washington, D.C., and develop a large inner-city swimming and boating area. Yet another approach—Project Cure, developed jointly by FWQA and the Bureau of Outdoor Recreation—is being considered for application in some areas, based on experience in Santee, California, with total wastewater renovation and use of the treated wastewater for recreation. One of the features of the Santee project is a series of five lakes which have been created below the treatment plant and filled with essentially pure effluent. Because of the high quality of treated wastewaters, these lakes are used for a host of recreational activities such as boating, fishing, and picnicking.

Basin and Regional Planning

Basin and regional planning is an essential element in pollution control. As President Nixon has pointed out: "A river cannot be polluted on its left bank and clean on its right. In a given waterway, abating *some* of the pollution is often little better than doing nothing at all, and money spent on such partial efforts is

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largely wasted." Clean water results will only be achieved by systematically controlling pollution in entire river basins. Further, we must be sure that these results are lasting ones, that our actions today are adequate to meet the needs of the future, and that we make provision for future growth of waste loads, population, industry, and water use. Otherwise, these future developments may more than offset any gains that our action programs in the years immediately ahead will achieve.

For these reasons, planning is an important element of the FWQA program. FWQA is participating in basin and regional planning in

cooperation with State and other Federal agencies and is financially supporting regional planning activities at the State and local level.

The long-term impact of river basin development will be a major factor in keeping the Nation's rivers clean and useful. Changes in stream flows cause temperature increases and other water quality effects. Sustained stream flows are essential for maintaining water quality even where a high degree of treatment is practiced. Irrigation diversion and other developments often deplete these needed flows and return them in lesser quantity and quality.

A major part of the planning responsibility is to ensure that water pollution control and water quality are adequately considered in all Federal water resource development activities, such as planning or construction of reservoirs or irrigation projects. FWQA is participating in broad-scale water resource planning in association with other Federal and State water resources agencies in basin planning studies coordinated by the Water Resources Council. These inter-agency studies result in comprehensive water and land related resource plans, laying out a future framework for river basin development. These plans are presented by the Water Resources Council to the President and the Congress to be considered in authorizing Federal water resource development projects. FWQA participates in these framework studies to ensure that water pollution control is an integral part of the development and management of the Nation's waters.

Last year, for example, a study of the White River in Arkansas and Missouri completed under this program provided for an intensive program of development and management of water and land resources while emphasizing the continued protection and enhancement of the environment. The plan provides for the clean-up of polluted sections of the River and the maintenance of other sections at their present high quality. In addition to specific treatment facilities at present and anticipated waste sources, the plan provides for the inclusion of storage in specific Federal reservoirs to regulate stream flows to assist in the maintenance of water quality.

In addition to participation in these framework studies, FWQA is involved in a number of more specific water resource planning activities. In the Central Valley of California, where agricultural development threatens water quality in San Francisco Bay and the San Joaquin Delta, FWQA is participating with the Corps of Engineers and the Bureau of Reclamation in long-range planning studies to determine the overall regional impact of continued water development on the environment and the necessary measures to ensure protection of future quality over the long run. In the Delaware

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River Basin, FWQA has participated with the Delaware River Basin Commission in the development of a plan and program for the use and upgrading of the highly polluted Delaware estuary. This program has involved the development and utilization of pioneering systems analysis techniques to model the Delaware and show the most effective and systematic approach to achieving improved water quality.

In addition to its basinwide resources planning activities, FWQA reviews proposed water resource projects on an individual basis to ensure that these projects do not have an adverse effect on water quality and that, when it can contribute to the economical control of pollution, storage for water quality is included in Federal reservoirs. As an example, plans for a Federally-assisted project on the Alcovy River, Georgia, were changed considerably after it was shown that the removal of vegetation along the stream channel would adversely affect water quality and be detrimental to fish and wildlife. Revisions made will result in maintaining much of the stream channel and its present cover, greatly reducing the amount of dredging and providing additional safeguards to minimize the removal of vegetation along the river bank.

FWQA also makes recommendations to Federal construction agencies for inclusion of storage for water quality management in proposed projects. Higher sustained streamflows are sometimes needed, in addition to adequate treatment of wastes and other controls, to meet water quality standards.

River basin planning can yield important results in developing solutions to complex pollution problems that must be dealt with along the lines of entire basins and that cannot be solved without a coordinated effort by all parties involved. The information collected and the plans developed under this program have served as a springboard for a number of State clean-up programs. For example, a mine drainage study conducted as part of a comprehensive water pollution planning effort in the Pennsylvania portion of the Susquehanna River Basin has resulted in a substantial State program to abate mine drainage pollution. The study resulted in the locating of over 1,000 mine drainage discharges causing gross water quality degradation in 1,200 miles of stream. It was found that restoration of streams polluted with mine drainage could be accomplished through a program which included mine sealing, neutralization, land treatment, and water regulation and diversion. Selective implementation of action called for by the water quality management study is underway with the aid of a conservation bond issue adopted by the Pennsylvania legislature which provides \$150,000,000 for the reclamation of areas disturbed by mining and the abatement of mine drainage pollution.

In addition to direct planning activities, FWQA is supporting regional planning through grants to planning agencies at the State and local level. These grants are designed to stimulate the kind of State and local planning which is important to the implementation and improvement of water quality standards along river basin lines. This program was initiated in 1967, and 12 studies are underway with total Federal costs of over \$2.5 million. The Federal share is limited to 50 percent of the costs of developing the plan. These grants afford agencies at the State and local level a unique opportunity to participate in solving their pollution problems on a coordinated, long-range basis.

Under this program, the Santa Anna Watershed Planning Agency in California is developing a pollution control plan which will provide for eventual reuse of the reclaimed water. In this watershed, available surface water flows are almost completely developed and large quantities of Colorado River water are being imported. In areas near the coast, because of heavy pumping, groundwaters are threatened by salt water intrusion. The plan being developed will consider both surface and groundwaters and provides for pollution control and wastewater reclamation and reuse as an integral part of the water supply program in the watershed.

The Miami Conservancy District in Ohio is also conducting a planning study partially funded by an FWQA planning grant. The study is utilizing an extremely sophisticated systems analysis technique to relate water quality, flood control, and other factors involved in water quality management decisions in the basin. The plan will consider the whole range of effects on water quality of such alternatives as in-stream aeration, use of abundant groundwater supplies to augment streamflow, and the regionalization of waste treatment facilities.

FWQA is also assisting a planning effort in Puerto Rico. The Commonwealth planning is aimed at developing programs to encourage industrial growth while maintaining and enhancing water quality. The Island's development has centered around the recreation industry for which water quality is obviously vital. The plan will provide for the protection of these recreational amenities in the face of future industrial development.

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The emphasis in the President's environmental message and Secretary Hickel's recently published regulations on conformance of waste treatment plant construction with basin programs and regional planning to ensure speedy and coordinated pollution abatement will require increased emphasis on the part of FWQA on implementing

effective short-term planning and appraisals. The new regulations will require that, within a river basin, each treatment facility be part of a basinwide plan for pollution abatement and within a given city, each treatment plant be included in a metropolitan or regional waste treatment plan. The Agency's planners are developing a procedure to evaluate grant applications to help the States meet the requirements of the regulations and to better integrate planning and facilities construction, so that in the near future planning can be used to efficiently and effectively guide waste treatment installation. This will place additional and immediate demands on FWQA's planning capacity.

Towards this end, FWQA is increasing the emphasis upon quick appraisals of the status of comprehensive and coordinated programs in each river basin and preparing to make quick evaluations of the adequacy of and need for planning within metropolitan areas. In the latter regard, FWQA is working with the Department of Housing and Urban Development. Last year FWQA's Northeast Regional office, working with Housing and Urban Development, developed a joint set of comprehensive guidelines for regional sewerage systems. These guidelines can be used in preparing plans for metropolitan sewerage systems and are sanctioned by both Housing and Urban Development and the FWQA.

To assist in basin and regional planning, FWQA has developed a highly sophisticated systems analysis capability. Models have been developed to show the relationships between various stream flows, waste loads, water uses, and other factors that influence water quality. These models can handle up to fifteen sections of stream, fifteen reservoirs, ten discharge points and natural pollutants. Although relatively new, these models have been used successfully on the Sabine River, Texas; Skunk River, Iowa; Scioto River, Ohio; James River, Virginia; Broad River, South Carolina, and many others. For a given river basin, the models can provide information to determine how management practices influence water quality and what changes in management could be expected to provide a certain water quality and the cost of that quality.

Models have also been developed for the Delaware Estuary, and these are now being applied to the Potomac River-Chesapeake Bay system. These models help to relate tidal effects to water pollution. The Delaware model has provided a tool for determining the needed releases from upstream to protect Philadelphia's water intake from excessive salinity intrusion during periods of drought.

Another systems technique was applied in the San Joaquin Master Drain study in California. Here the model required inclusion of economic information, as well as the waste sources. The model pro-

vided the basis of measuring the impact of planned water resource development on an inland agricultural area, as well as on San Francisco Bay. Of major concern was the impact of pesticides and nutrients resulting from agricultural drainage. Through the use of this model, alternative locations of the drain outfall with consequent economic costs were determined, as were the costs of alternative treatment measures.

As planning for basinwide pollution abatement and regional waste treatment moves ahead in the future, the systems capability developed by FWQA will become increasingly important in the Nation's battle to achieve clean water.

Estuarine and Coastal Studies

For well over three and a half centuries, the estuarine and coastal waters of our Nation were thought of primarily as conveniences—places for the conduct of international commerce, locations for the residential and industrial development that resulted in our great cities, sites for mineral exploitation, and dumps for all kinds of wastes. Although this thinking is still commonplace, times are changing, and more and more people are becoming increasingly aware of the necessity to change our behavior with regard to these waters. We can no longer afford to treat our estuaries and the coastal waters over our Continental Shelf as endless sewers.

Because estuarine and Continental Shelf waters are so closely inter-related, pollution in one zone will affect the other. For example, hard pesticides, which are carried down rivers from the agricultural uplands and tend to accumulate in waters near the mouths of rivers, eventually spread into the surrounding oceanic waters. Conversely, an oil spill caused by the breakup of a tanker at sea will ultimately spread to the coastline, there to foul beaches and kill wildlife and waterfowl. Modification of the shoreline by dredging and filling will have an effect on life far out to sea. Ocean outfalls, while disposing of wastes at a distance from shore, are fre-

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quently responsible for water conditions which make a shoreline area unfit for swimming or shellfishing. Sludge and solid wastes that are barged out to sea for dumping can return to shore on the currents and tides. Continental Shelf mineral development—ever increasing in importance—has the potential for major environmental damage.

The condition of the New York Bight area is a startling illustration of disposal wastes into coastal and ocean waters. The dumping of wastes near the New Jersey coast has recently come to the attention

of a shocked public. Sewage sludge, treated and untreated, and various industrial wastes are a primary concern. A dumping area of approximately 14 square miles has been damaged and its bottom fauna severely impoverished. Even several species normally tolerant to pollution are absent from this area and evidence of pollution has been found on nearby beaches.

Not far away in the New York Harbor area, an outbreak of fish diseases has occurred over a three-year period. Large numbers of fish have neither tails nor fins, and there is some evidence that pollution may be at least partially responsible. Fish kills in the area are numerous, and there is growing concern about the contamination of shellfish—a threat both to the harvesting industry and to public health.

Federal Water Quality Administration (FWQA) over the last several years has strengthened its various programs, giving increasing emphasis to estuarine and coastal pollution. Increased enforcement activity along the

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coast—such as the recent conferences in Biscayne and Mobile Bays—has already been highlighted. Added emphasis is being given to oil clean-up activities. FWQA is now accelerating its work with the Coast Guard to prepare plans for a more speedy reaction to oil pollution incidents. Research and training programs that have a relationship to estuarine and coastal problems have also been increased. More emphasis is being given to studying pollution effects and ecological damages in the estuaries. More research chemists and marine biologists are being trained in FWQA-funded programs.

Because of the long-term cumulative impacts on the estuaries and coastal environment and because of the many interrelated actions affecting these waters—dredging and filling of marshes and construction of navigation facilities—considerable emphasis must be given to the overall planning and management of this valuable environment. Planning to protect our estuaries and coastal waters is a clear-cut example of the pressing need for environmental planning described previously.

As a result of increased public awareness of estuarine and coastal pollution problems, the Congress directed that a survey of estuarine pollution be made. FWQA, in November, 1969, submitted the report of this first comprehensive, definitive study of estuarine pollution to the Congress. With this report, the *National Estuarine Pollution Study*, proposed legislation for a comprehensive national management program for the estuaries and coastal zones, based on the report's recommendations, was submitted to the Congress.

The Study sought to obtain detailed information on the biophysical, socio-economic, and institutional aspects of estuaries from a variety of sources. First, a series of 30 public meetings was held in the various coastal States to obtain information and opinion from the local citizens who are most directly affected by estuarine pollution. Second, information was collected from the coastal States concerning their laws and programs affecting estuarine uses and management. Third, studies were contracted to provide needed background on certain aspects of specific estuaries or on a restricted aspect of the Nation's estuarine areas. These include studies on ecology, economic and social values, sedimentation, and law. Reports on some of these studies are being published as the *Estuarine Pollution Study Series*. The first of these is entitled, *Legal Perspectives of Chesapeake Bay*. Others to be published will include *A Socioeconomic Analysis of Narragansett Bay*, and *The Social and Economic Values of Estuaries*.

A major part of the study was the development of the National Estuarine Inventory, an automated information system. This massive compilation of coastal zone information is the basis for the development of a continuing national Coastal Zone Management Information System to satisfy the information requirements of States, Federal agencies, and other entities for factual data on which to make decisions.

The recommendations which were presented in the Study were predicated upon the concept that the States should have the major responsibility for managing the estuarine and coastal zones and that the Federal role should be to provide coordination of the State programs within the national plan, to provide technical and financial assistance to the States and their subdivisions and to arbitrate conflicts between States.

Legislation to promote these aims is presently being considered by the Congress. The bill, if enacted, will provide for Federal grant support of State management programs. The prime objective will be the management of the estuarine zones in such a way as to permit maximum beneficial use with minimum damage.

Closely related to the National Estuarine Pollution Study (NEPS), the Fish and Wildlife Service has recently completed the *National Estuary Study* (NES). This study involved an intensive look at fish, wildlife, and recreational values of the coastal zone for the purpose of recommending a scheme for protection of extremely valuable areas. FWQA assisted in this latter study by making the data bank of NEPS available to the Fish and Wildlife Service as its base source of information. The NES is a complementary effort to FWQA's broader study of man's activities in the coastal zone and how pollution from these activities causes environmental damage to coastal resources.

FWQA has also sponsored a major study, conducted by the National Academy of Science and the National Academy of Engineering, to determine the state of knowledge on ocean waste disposal. The findings of the study are being used to help formulate approaches to the problem. A report—*Wastes Management Concepts for the Coastal Zone*—will be published later this year.

FWQA will continue to conduct and fund studies to increase our knowledge of the estuaries, their resources, the damages done to them by pollution, and their relationships to the surrounding land. In addition, direct technical and financial assistance will be provided to States for management and improvement of their estuaries.

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Data and Information

Effective implementation and enforcement of water quality standards, development of regional and basin plans, administration of grants, and preparation of reports assessing costs of pollution control and abatement progress require up-to-date, accurate fact-finding and readily available data.

Several types of technical information are required to meet the various needs: specific data covering the status and effectiveness of municipal, industrial and Federal waste treatment and control facilities; current economic data associated with construction activities; and water quality data related to the water quality standards.

Collection, evaluation, and dissemination of data on chemical, physical, and biological water quality and other information relating to water pollution discharges is an essential element of the Federal Water Quality Administration (FWQA) program. Through effective coordination with other Federal and State agencies, such data and information are utilized at the national, regional and basin levels.

Collection and timely evaluation of reliable information on water quality is vital to the effective management of a dynamic national pollution control program. This has always been a requirement, but the need has intensified with the establishment and implementation of water quality standards and the resulting necessity of identifying priorities in waste treatment facility construction. Regardless of the number of treatment facilities constructed or the number of basin management plans completed, in the final analysis, program effectiveness can only be measured in terms of actual water quality improvements. And, this can be achieved only through adequate monitoring of water quality.

Thus, FWQA has been reorienting and expanding its data collection activities to identify compliance and noncompliance with water quality standards; improvements in water quality resulting from pollution

abatement measures, such as waste treatment facility construction; and emerging water quality problems that should be corrected before crises arise.

Key steps required in the development of an adequate nationwide water quality surveillance system involve planning the system in close coordination with State and other Federal water data collection agencies and implementing the system by utilizing existing programs of FWQA, State pollution control agencies and other Federal water data collection agencies, principally the U.S. Geological Survey. During the past year, plans for integrated State-Federal water quality monitoring systems have been developed for six of the nine FWQA Regions and are now being implemented.

If a surveillance system is to be fully effective, thorough attention must be given to its design as well as its operation. In recognition of this, a systems analysis approach to the design of optimum water quality monitoring programs is under development. This approach will per-

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mit the monitoring subsystems, making up the nationwide integrated State-Federal surveillance system, to be designed and updated as necessary on a uniform basis in such a way as to ensure maximum program effectiveness.

To ensure the reliability of data collected by the coordinated program, an analytical quality control program, which is now under development, will become an integral part of the overall system. All cooperating agencies will be expected to participate in such a program. Thus far, a manual entitled, *Federal Water Pollution Control Administration Methods for Chemical Analysis of Water and Wastes*, 1969, has been published and distributed to all participating laboratories. Similar manuals covering standard biological and bacteriological laboratory procedures are under development. Quality control checks and procedures that will be employed on a routine basis in participating laboratories are also being developed.

A portion of the coordinated network is already in operation. It presently utilizes approximately 400 FWQA-funded and operated stations, 260 FWQA-funded and U.S. Geological Survey-operated stations, 200 stations jointly funded by the State and Federal agencies and 500 State-funded and operated stations. Ultimately, the network will encompass State and Federal stations numbering in the thousands. Network data will be supplemented by the findings of the many short-term intensive field studies of specific water quality problems that are conducted by FWQA.

In addition to water quality data, detailed knowledge of waste

sources, treatment and discharges is also necessary to fulfill the needs of FWQA programs. Municipal sewage and industrial wastes are the two largest sources of pollutants. During 1969, the Pollution Surveillance Branch completed the processing and analysis of data on municipal waste facilities collected in a cooperative Federal-State inventory. This effort, the first since 1962, reflects conditions as of January 1, 1968. Because the need for timely and accurate data in this area is so critical, procedures have been developed for bringing the 1968 inventory up to date and for continually updating it to keep it current. In addition, data from the implementation plan portion of the water quality standards have been correlated to and integrated with the inventory to show schedules for providing additional municipal waste disposal facilities.

As for industrial wastes, plans have been made to initiate an inventory of industrial manufacturing and processing plants. Initially, this will be an in-house effort; eventually, it will be expanded to a joint FWQA-State cooperative project. Here, again, data from the implementation plans of the water quality standards will be valuable in planning and conducting the inventory. Once established, this inventory, like that of municipal facilities, will be continuously updated.

With the recent publication by the Secretary of new construction grants regulations, data on waste sources and discharges have become even more important. These regulations require the States to show that a proposed municipal facility is a part of, and in conformity with, a basin, regional or metropolitan pollution control plan before the project is declared eligible for a construction grant. In addition, regulations prescribe as a further condition for eligibility the provision of data on all waste discharges in the immediate proximity of a proposed plant which may affect its design and operation. For these reasons, additional data will be required on wastes characteristics and strengths.

In addition to the municipal and industrial inventories, a new collection effort has been planned and initiated to provide data on thermal discharges from electric power generating plants. By agreement with the Federal Power Commission, data for this inventory will be collected by that agency through a questionnaire on environmental control information.

To achieve the objectives of the coordinated data and information program, it is essential that the data collected be evaluated in an expeditious manner and made readily available to all users. Only in this way can appropriate follow-up actions be taken. FWQA's existing computerized data storage and retrieval system (STORET), coupled with additional computer programs, will meet these requirements.

All data collected by FWQA will be placed in STORET to be available for analysis and use.

Using the most up-to-date computer technology, the data collected are entered in a central computer on a daily and weekly basis by remote terminals in all FWQA Regions. Similarly, questions can be asked of the central computer from the remote terminal and receive timely responses. This application is now being expanded to include several Federal and State agencies.

Evaluation and dissemination of the large amounts of data and information collected is assisted by the STORET system. Currently, this system is being expanded to include water quality standards and uses so that many questions can be asked, such as what facilities have inadequate treatment, what type of treatment is provided or waste contributed at any source, how

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many miles of streams are polluted, how many miles have been improved, what is the number of violations of water quality standards and where, and what uses have been affected and over how many miles. It will be several years before all of these questions can be accurately asked and answered for each individual basin, or region, or for the Nation as a whole. However, those questions must be answered to provide an effective overview of our rate of progress, and FWQA is beginning to build towards that capability now.

A quantitative analysis of changing trends in water quality and of the progress in abating pollution nationwide will be essential in guiding the course of the national water pollution control effort. It will also contribute to the assessment of national environmental conditions and trends required under the National Environmental Policy Act of 1969 by indicating whether we are gaining ground or falling behind in pollution control.

Economic Studies

For the first time, the Nation stands on the threshold of a major effort to reverse the heritage of neglect and to face the problems of a deteriorating environment. Massive investments will be required for environmental improvement and the expenditure of these funds will have major impacts on the economy. Formulation of sound public policy will require an increasing understanding of these costs, their distribution throughout the economy, and their economic impact, both on individual communities and firms and on the economy as a whole.

For three years the Federal Water Quality Administration (FWQA) has been conducting a series of economic studies aimed at gaining a deeper understanding of these factors and at assisting the

Executive Branch and the Congress in formulating national policies and legislation. These studies have included: analysis of the national costs of treating municipal and industrial wastes and the impact of these costs on State and local governments; studies of sewer user charges as a means of financing local expenditures; studies of the need for economic incentives for industrial waste control; and studies to determine the extent of animal feedlot pollution and the costs of abating it. Collectively, these studies represent the most intensive and comprehensive effort ever made to understand the costs of water pollution control.

The findings of FWQA's economic studies are submitted to Congress annually. The first report projected municipal investment requirements for the period 1969 to 1973 and assessed the impact of funding required to meet municipal waste treatment needs on the municipal governments and bond markets. The second report examined the influences that determine investment levels and concluded that the critical factors were to be found in the dynamics of the situation—in the interaction of investment with time-conditioned growth, replacement, and demand for higher plant efficiencies. It was also found that regional cost differences, transmission costs, and the influence waste loadings were extremely important factors in analyzing the economics of water pollution control.

During the past year, these cost studies have concentrated on information needed to reshape the funding of the construction grants program to make it fully adequate to meet the Nation's needs. The Secretary of the Interior's legislative proposal for a Federal, State, and local investment of \$10 billion over the next four years reflects the findings of these studies. The 1970 report, *The Economics of Clean Water*, defines the rate of investment needed to close the gap for municipal waste treatment in the years immediately ahead. This report provides the most thorough estimates ever developed for the Nation's municipal sewage treatment needs and costs. Detailed studies of the pollutorial impact

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of the inorganic chemicals industry and concentrated animal populations were also completed as separate sub-reports.

Various aspects of the socio-economic problems of water pollution are presented in the latest report. These include discussions and conclusions about investment trends and needs, Federal cost sharing, priority systems for grant funds, public treatment of industrial wastes, and regional waste handling systems. In addition, several estimates discussed in earlier reports were reviewed in view of the latest available information. These included investment estimates for col-

lecting sewers, separation of storm sewers, industrial waste treatment and cooling facilities, and sediment control and acid mine drainage reduction.

The Water Quality Improvement Act of 1970 requires that a complete investigation and study of all methods of financing the cost of water pollution control, other than methods authorized by existing law, be made and the results submitted to Congress by December 31, 1970. To meet this requirement, FWQA has structured a study which will deal with pollution sources of all types including, but not limited to, municipal, industrial, agricultural, land and acid mine drainage, oil and accidental spills and debris. Questions of responsibility, ability to pay and equity will be addressed in allocating potential funding requirements among the private sector and the various levels of government. The study will examine the feasibility of a wide range of financing possibilities in the light of the analysis outlined above. Potential methods will include: conventional financing; loan arrangements; user, influent and effluent charges; taxation; insurance-type arrangements and others. In addition, potentials for reducing financing requirements by means of structural policy alternatives will be assessed.

Although considerable insight into and understanding of the economics of water pollution control has been gained through past studies, there are still many unanswered questions concerning the costs of pollution abatement and the impact that efforts to cleanse our environment will have on the national economy. The challenge is clear, however: if the Nation's water resources are to be enjoyed without the burden of increasing water pollution, *now* is the time to institute prudent action to clean up our streams. The people and their government have accepted the challenge. FWQA reflects their determination and will give continuing emphasis to devising policies and programs which will create a cleaner environment in the most expeditious and economical manner.

RESEARCH, DEVELOPMENT, AND DEMONSTRATION PROGRAMS

The search for new answers is an important part of the Federal pollution control mission. Federal Water Quality Administration (FWQA) is conducting a research, development, and demonstration program which is a coordinated, problem-solving program dedicated to exploratory research of new and imaginative pollution control methods; the engineering development of these methods to solve the practical problems associated with bringing an "idea" out of the laboratory and into the real world; and the demonstration of this new technology to go that extra, normally forgotten step of showing the

decision-makers that new answers, new technology have really arrived and are available for use.

The program being conducted is highly mission-oriented. Each project responds to an identified need for an answer. These needs are specified and assigned priority primarily through input from the non-research elements of FWQA. In short, responsiveness to the research needs of the Agency is a prime responsibility of this program.

There are really only two major categories of "answers" being sought. First, how are the water quality goals defined? Second, how are these goals reached with maximum effectiveness and at least cost? With regard to quality goals, research is required on the effects of pollution. What are they? How is the degree of effect related to the amount of pollution? And, how can the level and type of effect be predicted in advance? With this type of information we can improve and extend the water quality standards now being established and implemented for the Nation's waters. Simply knowing what water quality is required is not enough, of course. In those cases where we already have some ability to control pollution, new and improved means for control are needed in order to reduce the cost of pollution abatement to the very minimum possible. Beyond this, the need to develop and demonstrate means for controlling that pollution, which today is literally uncontrollable or untreatable at any cost, is assuming a high priority. Corollary to and, in fact, inseparable from this objective is the simultaneous upgrading of wastewater quality such that used water may be reused again—a concept of major significance in extending our relatively dwindling fresh water supply.

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To assist in managing this program and in setting priorities and resource allocations, a problem-oriented project categorization is utilized. Eight major categories exist: the first five relate to single-source-related pollution problems from municipal, industrial, agricultural, mining, and from other sources. The last three categories relate to problems of a multiple-source nature, where the answers will be applicable broadly to many different sources of pollution. In the single-source category FWQA is working on such pollution problems as combined sewer discharges, pulp and paper wastes, agricultural runoff, acid mine drainage and oil pollution. In the multi-source categories FWQA has programs on eutrophication, thermal pollution, removal of nutrients and refractory organics, and effects of pesticides and other pollutants on fish and aquatic life. The mechanisms utilized in carrying out this program are three-fold:

- (1) In-house research and development at eight laboratory locations and a number of associated field sites.

- (2) Contract projects, primarily with industry.
- (3) Grant projects with universities, industries, States and municipalities.

Contract projects are funded entirely with Federal dollars and are utilized primarily for laboratory investigations and pilot-scale research projects which involve a high degree of uncertainty and which are primarily aimed at determination of feasibility and development of design requirements. These are not the types of projects that municipalities and private corporations will readily sponsor with matching funds because of the large degree of risk involved. The work performed under contracts often requires highly-specialized personnel, equipment and facilities, having a high value over a short period of time, but limited value in the long term.

Grant projects require some level of matching support from the grantee. Grants are employed in meeting objectives where it is desirable to utilize State, municipal, academic or industrial talents and expertise in carrying out research, development and, often, demonstration efforts on a cost-sharing basis to the mutual benefit of both the Federal government and the grantee.

FWQA's in-house activity forms the real foundation of an effective overall program. In-house researchers must establish objectives and plans of attack; they must review and evaluate the many, many project proposals received by this Agency; and they must be the ones to integrate the results of these efforts into a usable and applicable form. To do this most effectively, in-house staff must be involved in the work for which they are responsible.

FWQA's program is predicated on the assignment of specific areas of technical responsibility to each of eight laboratories. In this way, each laboratory functions as a national focal point for research on a given set of problems, and duplication of facilities, staff and effort among the various laboratories is avoided. Research laboratories are located in Cincinnati, Ohio; Athens, Georgia; Ada, Oklahoma; Corvallis, Oregon; College, Alaska; Duluth, Minnesota; Narragansett, Rhode Island; and Edison, New Jersey. These laboratories are also responsible for operating a number of field sites to carrying out pilot plant work and necessary

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field studies. FWQA operates such field sites at Pomona and Firebaugh, California; Ely, Minnesota; Lebanon and Newtown, Ohio; Norton, West Virginia; and Washington, D.C.

In addition to the in-house efforts carried on at agency laboratories, FWQA is also involved in a number of joint efforts with the Bureau of Reclamation, Atomic Energy Commission, Office of Saline Water,

Office of Water Resources Research, Public Health Service, and Tennessee Valley Authority.

Notable in the research, development and demonstration program are the special authorities to support both pilot-scale and full-scale demonstration projects on storm and combined sewer discharges, advanced waste treatment and wastewater renovation, and industrial waste treatment and control. These projects are particularly significant in permitting FWQA to carry on research and development findings into the demonstration phase, thereby literally showing what can be accomplished through the use of new technology and at what cost.

In order to effectively manage this program, communicate the results to users, and respond to special Administration, Congressional and public requests, a computerized management information system was instituted. As a result, up-to-date information is readily available on nearly 2,000 projects, on future needs, on priorities, on work plans, and on necessary planning, programming and budgeting data to effectively direct future efforts.

A supplementary project reports system has been established for the acquisition, filing, indexing and, most importantly, dissemination of research results. The final results in the form of reports and publications are indexed into a technical library, distributed, and made known to a wide range of users both inside and outside FWQA. In Executive Order 11514, President Nixon directed that the results of Federal research programs be made available for widespread use. FWQA will continue to emphasize this important aspect of the research, development and demonstration program.

The problems of water pollution, as previously described in the "Water Pollution and the Environment" chapter of this report, are so complex, so varied and so numerous that they have multiplied faster than solutions. To ensure that our technology is improving and to make existing control methods more effective in the overall effort to make America's waters clean and useable, FWQA has intensified its research programs. The Water Quality Improvement Act of 1970, enacted and signed into law recently, added emphasis to research programs in oil pollution, acid mine drainage, vessel pollution, and pollution in the Great Lakes, and FWQA is moving to meet these responsibilities.

The eight categories of research being conducted in FWQA's program are directed at solving the problems already discussed. These categories, the problems at which they are focused, and some of the recent accomplishments of the research are discussed below.

Municipal Pollution Control Technology

Municipal wastes, as indicated earlier, are a major source of pollution in the United States. Although a technology to treat these wastes has already been developed and is being applied, FWQA is continuing the search for better and more efficient ways of treating municipal wastes in conventional systems. For example, significant improvement and upgrading of treatment in overloaded plants has been demonstrated using synthetic organic polyelectrolytes.

Another major concern is research on methods to control the more complex municipal problems, such as combined sewer and urban sediment control. Combined sewers carry both sanitary sewage and urban runoff. During storms, the volumes in these sewers are often too much for local treatment plants and wastes are discharged untreated. Yet control of these discharges has largely been neglected until recent years because the only method of solving

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the problem was separation of combined sewers, a costly and disruptive process. Through the efforts of FWQA's research program, a new technology for control of sewer discharges is being developed.

One of the alternatives being demonstrated is storage of excessive flows until they can be released to the treatment plants. Full-scale storage facilities under construction in Boston, Massachusetts; Milwaukee, Wisconsin; Dallas, Texas; and Shelbyville, Illinois, have determined the design criteria necessary for such facilities. Cost-effectiveness evaluation will allow other communities to economically design similar combined sewer pollution abatement facilities.

Another major alternative is treatment. Existing municipal and industrial treatment processes cannot be utilized for combined sewer overflow treatment because of the intermittent, widely fluctuating high-flow rates and the dynamic quality changes of combined sewer overflows. Screening and dissolved air flotation are two treatment methods which are amenable to the above constraints.

The demonstration of a novel, rotating collar, vibratory base screening treatment unit for combined sewer overflows was carried out in Portland, Oregon, in 1969. The unit provided primary treatment to normally bypassed sewage at a cost only slightly higher than the equivalent conventional treatment. The space utilization of the screens is one-tenth that of settling tanks.

Through these studies, a combination of control methods is being developed which will be applicable to the different combined and storm-water sewer problems throughout the country. Although determinations of the cost of controlling these discharges by the new methods being demonstrated are very preliminary, the total job may

cost only about one-third of the earlier estimates based on separation.

Erosion and sediment from urban areas cloud rivers and impair their use. These waters generally are not confined to sewers, so the above methods cannot be applied to solve the problem. The National Association of Counties Research Foundation, in conjunction with FWQA, has therefore developed a *Community Action Guide for Erosion and Sediment Control*. This document will aid local officials in developing erosion and sediment control ordinances to control pollution from urban development construction projects. The control programs would be based on the establishment of control ordinances and on the use of present technology, such as vegetation control, mulching, sediment traps and other common erosion control practices. Adoption of effective control programs based on this guide will substantially reduce the silt load to urban waters.

Of great importance is FWQA's research on joint treatment of municipal and industrial wastes. As has been pointed out, the benefits of joint treatment are considerable. Industry, while paying operating costs, is spared the burden of the capital costs; and regionalization of waste treatment and economies of scale help communities achieve more effective pollution control.

The benefits of joint treatment are recognized. Certain industrial wastes, however, have proved difficult to treat effectively in combination with domestic wastes. In this regard, our demonstration of the feasibility of joint treatment of domestic sewage and semi-chemical pulping waste from a paper mill in 1969 at Erie, Pennsylvania, was an encouraging breakthrough.

In addition, a joint municipal-industrial wastewater treatment engineering study of the Onondaga Lake watershed was also completed last year. Approximately 140 industries in the watershed participated in the study by assisting in characterizing their wastes, and it was recommended that a joint treatment system be implemented by Onondaga County during the remaining phases of the project.

The successful demonstration of joint treatment of industrial wastes in municipal treatment systems holds great promise for the future. FWQA is encouraging such joint treatment and numerous communities with significant industry within their jurisdiction are considering such treatment.

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Industrial Pollution Control Technology

Industrial waste discharges, together with municipal wastes, comprise the two largest sources of pollution. Industrial wastes are

complex—a result of the wide variety of products manufactured—and are discharged in enormous volumes. In order to effectively control pollution, industries must often face the heavy financial burden of installing waste treatment facilities. Current waste treatment methods, while sometimes adequate, are expensive and in many instances offer little hope of providing the type and degree of treatment which will be required in the future. Because of the competitive economic aspects, industries are continually searching for new means of reducing their wastes at lower costs.

An effective attack on industrial pollution—wastes from metal, chemical, petroleum, coal, paper and other product manufacture—requires a cooperative industry-government effort to conceive, develop, demonstrate, and install treatment processes, process modifications, and water conservation programs. Already, research funded by FWQA covers some industrial problems from almost all major sources of industrial pollution.

A grant project with the American Oil Company at its Mandan, North Dakota, refinery has demonstrated the feasibility of using a commercially available fluidized-bed incinerator for the disposition of refinery sludges. The project was initiated in May, 1968, and inquiries to date by others in the industry show a keen interest in the utilization of this technique to resolve their sludge disposal problems. Another oil company has indicated its desire to apply the method at its own refinery. The American Oil Company is presently considering the possible use of a much larger fluidized-bed unit at the Whiting, Indiana, refinery in the near future.

The color of pulp and paper mill wastes has long been an aesthetic nuisance, difficult to control. Interstate Paper Corporation at Riceboro, Georgia, has demonstrated the lime coagulation process for the removal of color from kraft pulping effluents. This installation is the first full-scale operation of its type and has obtained color reductions greater than 90 percent throughout the experimental program. The results of this grant have been utilized by both paper companies and State agencies in selection of effluent treatment processes to meet receiving water quality standards.

FWQA and the State of Vermont have jointly entered into a demonstration project which provides an excellent illustration of the side benefits of some industrial pollution control. A project initiated in late 1968 on the conversion of cottage cheese whey into an edible grade material has produced, on a pilot-scale, a high grade food powder for human consumption. A plant for the full-scale demonstration of the developed process has been completed and will be operable in 1970. The plant could ultimately have the capacity to produce 20 million pounds per year of dried edible whey. Cheese

they produced in this country represents pollution equivalent to that produced by a population of 16 million people.

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With the expansion of both the population and the industrial sector and the corresponding needs for water, conservation of water is becoming increasingly important. Much of today's research is directed toward finding easy-to-treat and re-use water effluents. A project with the Johns-Manville Products Corporation in Defiance, Ohio, demonstrates that a wastewater treatment system using diatomite filtration can effectively treat a waste stream, containing glass fibers, caustic and phenols, to a quality suitable for process reuse. The treatment facilities are operating on a 72,000 gallon-per-day basis with effective pollution control a demonstrated success.

Agricultural Pollution Control Technology

The most difficult sources of wastes to control are those that do not come out of pipes. Agricultural pollution is a good example of such "diffuse" wastes. Major forms of pollution associated with agriculture have already been identified as problems in earlier sections of the report. They include: nutrients; pesticides; salts and other materials in irrigation return flows; animal feedlot wastes; and silt and other solids from logging operations. Most of these wastes are not collectible and, therefore, cannot be treated in a conventional fashion. New and imaginative solutions are being sought for these problems.

Projects with Cornell University, South Carolina State, and South Dakota University are aimed at studying the addition of nutrients to streams from cropping practices as related to their respective geogranomic areas. This is a precursor to the development of criteria for new management concepts that include considerations for waste management.

The quality of irrigation return flows is a major problem in the arid sections of the country, primarily because of nutrients, silt, and salts. Treatment of such flows has long been considered impractical. A development program at Firebaugh, California, has developed two techniques for removing nitrates from irrigation return waters. These will be demonstrated on an engineering scale to obtain more definitive operating and cost data that will be applicable to a complete treatment system for the entire San Luis Drain.

Work is also under way with the Bureau of Reclamation to demonstrate a technique of forecasting the effects of irrigation practices on the quality of underground aquifers and surface streams before lands are irrigated. This method will enable us to make better provision for avoiding water quality damage in planning and developing new irrigation projects.

The tremendous load of animal wastes discharged from a rapidly growing number of animal feedlots is an area of particular concern in FWQA's research program. Projects have been initiated to demonstrate available techniques for treating runoff from animal feeding operations and for preventing its discharge to receiving waters. These include activated sludge, oxidation ditch, anaerobic-aerobic lagooning and management changes to control and collect the runoff. Cooperative projects with the Department of Agriculture have also been initiated to determine the quantity and pathways of nitrate addition to surface streams and underground water formations from excreta in beef feeding operations.

Mining Pollution Control Technology

Mine drainage, as noted in the discussions in "Water Pollution and the Environment" is a major pollution problem, particularly in the Appalachian Region. Past attempts to prevent or reduce such drainage have generally failed, and FWQA is emphasizing research to demonstrate the technology necessary to control such wastes.

A new method of preventing the formation of acid mine drainage has been proven through laboratory studies which have shown that an inert gas atmosphere which displaces oxygen will prevent acid mine drainage formation. This method is presently being field tested in an

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abandoned underground mine and is also being studied for use in operating underground mines. When applied to an operating mine this technique might also reduce the fire and explosion hazards to gassy mines.

Two methods of hydraulically sealing underground mines have also been demonstrated in the field. The first method used quick setting cementation materials placed near the mine portal; it was, however, relatively expensive. The second method used lime and limestone to eventually form an impermeable seal, also placed near the mine portal. This method was less expensive than the former.

The passage of the Water Quality Improvement Act of 1970 adds new emphasis to FWQA's program to demonstrate abatement techniques which will contribute substantially to effective and practical methods of acid or other mine water pollution control. As a result of the mandate of the new Act, the Agency will be stepping up its research in this area.

Control of Pollution from Other Sources

In addition to the pollutants already identified, there are a number of very significant waste sources for which improved technology is

needed. These include recreational and commercial vessels, construction projects and impoundments, salt water intrusion, dredging, and oil pollution. Although some work has been done on all these problems, emphasis was given to vessel and oil pollution. The Water Quality Improvement Act of 1970 directs further attention to these sources of waste.

Increasing amounts of wastes are discharged from the ever-growing number of recreational and commercial vessels which use both inland and coastal waters. Suitable on-board equipment for properly treating or holding vessel wastes must be developed. In response to a request for proposals to demonstrate the feasibility of various control and/or treatment concepts for wastes generated on vessels, four projects were undertaken in 1969. One system demonstrated holding tanks on pleasure craft and an underwater storage bag for temporary storage of the pleasure craft waste prior to disposal by trucking to a sewage treatment plant. Other concepts are for holding tanks on large vessels and treatment utilizing an electro-chemical flocculating concept.

Closely related to vessel waste control, oil pollution has become a problem of major proportions and of increasing concern. The effects of drilling and tanker accidents, which release large quantities of crude oil into our coastal waters, have been described in detail elsewhere in the report. But the technology to avoid and to clean up such "spills" is woefully inadequate.

Primary program emphasis last year was placed on development of devices and techniques to restore oil contaminated beaches and to harvest oil from the water surface without the aid of additives. Fabrication of a unique centrifugal oil-water separator having high capacity and efficiency and relatively low power requirements was recently completed. An oil harvesting device for oil clean-up is also being designed and fabricated. The two units will be combined and tested at sea early in 1970.

Demonstration projects in progress under the direction of the Maine Port Authority in Portland, Maine, and the City of Buffalo, New York, developed valuable practical information on the effectiveness of a variety of oil containment and clean-up devices and techniques which were evaluated under actual conditions. In-sewer instrumentation for oil detection and oil traps was developed, demonstrated and evaluated. Modification of the inverted siphon is indicated to be an effective oil trap.

In order to use any of the above methods of treatment, the oil must be contained in the local area of the discharge or spill. A system of booms is generally used for containment, but the present systems have not been effective. Model studies were therefore initiated to

develop criteria for effective design of booms for harbors, rivers and estuaries.

An increasing amount of attention is being given to methods of preventing oil pollution from tankers. For example, the purpose of one project started in 1969 was to determine the

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feasibility of transporting oil in the form of a highly viscous emulsion, created by using ultrasonic techniques and certain additives. The thicker substance of the oil would prevent cargo loss in event of accidents. The same principle is being applied in the development of chemicals to rapidly gel oil within a tanker compartment after leaks are developed.

A joint American Petroleum Institute-FWQA Conference on Prevention and Control of Oil Spills was held in December, 1969. The meeting attracted over 1,200 registrants and 42 equipment exhibitors. Information developed in the course of industry and government programs in this country and the United Kingdom was exchanged, and reports were made on experience with the clean-up of recent large spills. The Conference summary pointed out some advances in oil pollution control technology but strongly emphasized the need for much greater effort in this area.

Water Quality Control Technology

This part of the research program includes all research, development and demonstration directed toward: the prevention and control of accelerated eutrophication and thermal pollution; the control of pollution by means other than waste treatment (e.g. industrial manufacturing process change to eliminate a waste); the socio-economic, legal and institutional aspects of pollution; the assessment and control of pollution in extremely cold climates; and the identification, source and fate of pollutants in surface, ground and coastal waters.

The accelerated aging (eutrophication) of our lakes, brought on by the increased discharge of nutrients (nitrogen and phosphorus) from municipal and industrial wastes and land runoff, has become a problem of major proportions. Technology has rapidly developed to effectively and economically control phosphorous discharges from municipal treatment plants to alleviate a portion of the problem and hopefully retard the aging process. Efforts are being made toward the replacement of the phosphates in laundry detergents with environmentally less harmful materials to eliminate this major source of nutrients. Many and varied approaches are being considered and new ideas sought to combat this extremely complex problem.

Another problem facing us results from the increased demand for

electrical energy and the attendant requirement to dissipate waste heat to the aquatic environment. Significant effort is being expended to determine the actual temperature requirements of our surface waters and

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aquatic life and to discover means of preventing harmful effects of heat.

Development of water quality control technology will become of major and increasing importance as the pollution control payoff from waste treatment becomes increasingly marginal. This involves techniques other than conventional treatment systems, such as industrial process change or management of water resources to minimize the effect of waste discharges. These techniques are applicable in concert with or after high levels of waste treatment are provided.

Cold climate research has also proven to be of significant benefit. Many problems which have been solved elsewhere have required re-evaluation and investigation in Alaska because of the extremes of arctic climate. Efforts are focused on studying pollution problems specifically in regard to the arctic environment, such as determining the impact on Alaskan streams of sewage and other wastes resulting from a rapidly expanding population and industrial growth. An extended aeration system to stabilize wastewater has proven effective in arctic climates, and the use of physical-chemical techniques to provide reusable water for North Slope development camps offers promise.

The Water Quality Improvement Act of 1970 contains a special provision for demonstration of methods to provide central community facilities for safe water and pollution control in Alaskan villages. Today only eight percent of the native homes in Alaska have adequate sanitation facilities. FWQA's research and development staff will be working with the State of Alaska and the Department of Health, Education and Welfare to implement this provision of the new Act and to provide safe water and waste treatment for Alaskan natives, using both conventional and innovative methods.

Waste Treatment and Ultimate Disposal Technology

Waste treatment and ultimate disposal technology focuses on the development and demonstration of new processes and process modifications to control pollution from any source.

There are actually two corollary objectives to be attained through improved waste treatment technology. The obvious one is the alleviation of the Nation's increasing water pollution problems through removal of pollutants from waste effluents; the other is the renovation of wastewaters for deliberate reuse as industrial, agricultural, recrea-

tional, or, in some cases, even municipal supplies. These two objectives cannot really be separated, for as our ability to cleanse wastewaters increases, the resulting product water approaches closer and closer to, and may even exceed, the quality of a water supply. This concept, perhaps startling to the average citizen, will nonetheless play a larger and larger role in water resource management, especially in water-short areas.

The need for and the degree of advanced waste treatment will vary with the individual local needs for control of pollution and/or increased water supplies. To meet the spectrum of needs, almost 100 different processes and process variations for treatment and disposal of waterborne wastes have been considered. Some 85 of these processes are under active study at this time at almost 150 different locations throughout the United States. These studies are aimed at determining the efficacy and the cost of the various unit processes which may make up the advanced waste treatment systems of the future.

The fruits of this program have become apparent with the emergence of several advanced waste treatment systems into the demonstration plant phase. The methods being developed range across the spectrum of physical, chemical and biological techniques. They range from the "ordinary," such as filtration and gravity settling, through the "novel," such as biological denitrification, to the "exotic," such as reverse osmosis or ultrafiltration.

The government's investment in this effort has paid off handsomely. First generation process technology, capable of achieving greatly improved pollution control of municipal wastes, has already been brought to the stage of full-scale demonstration and is now available for use under many conditions.

An excellent example of the application of this technology was announced March 24, 1970, by Secretary Hickel and Mayor Walter E. Washington of Washington, D.C. The new process to be installed at the District of Columbia Blue Plains wastewater treatment plant will substantially reduce the pollution of the Potomac and is applicable to rivers and lakes throughout the Nation.

The new technique is the result of a series of research projects conducted jointly by FWQA and the District at the Blue Plains plant. Pilot plants have been testing the new system for two years. The process couples advanced biological techniques with a new physical-chemical treatment. The precipitation phase of the treatment process employs a greater use of chemicals than current processes, and pure oxygen, instead of air, is used in the biological phase of the treatment. The new process appears capable of re-

moving nearly 100 percent of the biological impurities, 96 percent of the phosphates and 85 percent of the nitrogen in wastewater.

The results of this program have provided the necessary technology to reduce the pollution from municipal sources to essentially zero. The present cost is within economic feasibility, but further efforts are needed to optimize both processes and economics. This breakthrough will mean the development of effective, safe, and economical wastewater systems, which, in effect, will amount to the same thing as creating a new water supply.

Water Quality Requirements Research

This program provides information on the effect of pollution needed to provide an improved scientific basis for determining the water quality necessary for municipal, industrial, agricultural, and recreational uses and for the propagation of fish and other aquatic life. This information is essential to the establishment and refinement of the Nation's water quality standards. Because of the tremendous number of new chemical compounds being synthesized and finding their way into our environment each year, intensive research investigations must be conducted to develop a predictive capability that will allow us to predict the potential pollutional impact of these compounds in advance.

Far too little is known about the effects of pollution. The drastic effects, such as the massive fish kill, can be easily recognized, but quite often the true cause of such events cannot be defined even with extensive investigation. To look ahead and to predict the occurrence of such events is, unfortunately, well beyond our current capability for any but the simplest stream systems under the least complicated set of environmental conditions and pollution loads. There is also the challenge of detecting, understanding and preventing the more subtle, long-term effects of pollution, which could, even now, be robbing us of valuable water resources. Such effects, as yet unknown, may be just as severe as the sudden fish kill, the unpalatable water supply or the condemned bathing beach. Because these problems are difficult to solve and the starting baseline inadequate, a rapidly accelerated program has been initiated.

Extensive, background data has been acquired and new test methods have been developed to better and more rapidly define the requirements for many uses. For example, a comprehensive research effort to develop sound information upon which to base temperature standards is underway. A temporary field site at a power plant has been established. A standard testing section to determine safe concentration of industrial waste in a natural waterway also continues to show promise. Our research on water quality requirements will

continue its accelerated effort to provide the information necessary for the establishment of scientifically sound water quality bases.

Although there are monumental problems still facing the research program, the Agency and the Nation, there is much that is already known; there are problems that have economical solutions. In the future, considerable effort will be focused on putting the results of the research, development and demonstration program in the hands of those charged with implementing water pollution control in our Nation.

THE HUMAN ELEMENT

In the final analysis, success or failure of the national pollution control effort will depend primarily upon the human element.

It will depend upon an informed public, which can express its voice intelligently and effectively in decisions affecting the quality of its environment. The President's March 7 Executive Order, issued in furtherance of the National Environmental Policy Act of 1969, placed great emphasis upon the need of the American people to know. He directed all Federal agencies to develop procedures for keeping the public fully informed on the environmental impact of Federal plans and programs and for enabling them to express their voice through public hearings on these issues.

Our success will also depend upon training and motivating a skilled work force to undertake the complex and technically demanding tasks of pollution control. People of many diverse skills and backgrounds will be needed to man the waste treatment plants, the laboratories, the offices of State and Federal regulatory agencies, industries, universities and local governments.

For the long run, the course of pollution control will be dependent most of all upon the attitudes and activities of the Nation's young people. As a group they have perceived—perhaps better than anyone else—that the quality of their lives in future years will depend on what we do about the environment today.

For all these reasons, FWQA is placing heavy emphasis upon the human element in

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pollution control—through informing the American public, through working with youth and through training and manpower development.

Informing the American Public

FWQA's public information program is founded on the firm conviction that our agency has a major responsibility to meet the American public's need and right to know.

Public information involves much more than mere voicing of official policy. It involves providing the public with full information on efforts to clean up the Nation's waterways, even if such disclosures may sometimes be controversial. This outlook recognizes that public information is often in opposition to public relations, and that its function is to serve the public first. As Commissioner Dominick recently told a group of FWQA information officers, they "are going to have to serve as the innovators, as the creative force, as the non-bureaucratic force, as the force in the Agency which gives us stimulation, new blood, new life, new challenges, new headaches—which gives us all of the things that a Federal bureaucracy could do without."

FWQA has received recognition for its information efforts. Senate Minority Leader Hugh Scott said in the *Congressional Record* of February 9, 1970: "President Nixon, in his State of the Union message, termed environment 'the great question of the 1970's.' It has become a matter of survival. Yet, despite some encouraging signs, too many Americans are still unaware of, or refuse to face up to, the danger. Clearly, there is an informational challenge as well.

'With this in mind, I was particularly gratified to learn that the Washington Chapter of the Public Relations Society of America has, for the second consecutive year, presented its Toth Award for professional excellence to FWQA's Public Information Office. With imagination, inspiration, and ingenuity, they have been alerting America to the multiplying dangers of pollution. Their message is crucial, and they richly deserve this recognition.'

The message is being given to the American public by mail, by telephone, and in many other ways. Telephone requests from the news media, students, parents, service and fraternal organizations, and the general public have come from approximately 250 a week last year to nearly 600 a week at present. Correspondence requiring replies has risen from 4,000 a month last year to an average of 5,000 a month so far. Over the past 30 months, the Public Information Office has distributed over 2 million brochures, leaflets, and folders dealing with such subjects as water quality standards, estuaries, heat pollution, acid mine drainage, a primer on waste water treatment, fish kills, what citizens can do about water pollution, vessel pollution, and manpower and training needs. FWQA exhibits and posters have been used by the United States Post Office, the Water Pollution Control Federation, the Izaak Walton League of America, the Audubon Society, the National Rivers and Harbors Congress, the Boy Scouts of America and numerous State fairs and schools.

FWQA's efforts to inform the public have shown particularly gratifying results in television and radio campaigns. Eight film spots

have been distributed to television networks and stations coast-to-coast. These spots were produced on what Variety Magazine described as a "shoestring" budget and were good enough to "make Madison Avenue shiver and shake." The Variety writeup continued: "The chiller is that the FWPCA (sic) division of the USD of I (United States Department of the Interior) did it on a production budget totaling \$31,000, without an ad agency—and with a producer who had never turned out a blurb before." The International Broadcasting Awards and the American Television Commercial Awards—the advertising world's version of the Academy Awards—cited the "Clean Water" television spots as outstanding in the Public Service Category. Twenty-five radio "Clean Water" spot announcements were produced by FWQA's public information program. Some were interviews with prominent and average citizens, fishermen, conservationists and resort owners who had suffered as a result of water pollution. Another radio series provided a recording of New Orleans jazz by the Chicago Footwarmers, in which variations of popular songs were adapted to the theme of water pollution control.

The television and radio campaign has produced results. Mail addressed to "Clean Water, Washington, D.C.", solicited from viewers and listeners has shown a sharp rise. These letters are answered with literature which gives the correspondent an appreciation of the problem and of means to rectify it through community action.

Of course there is a temptation, in the midst of the ecological furor, to be overzealous. As a prominent columnist observed, "The environment issue lends itself to grandstanding." It is a situation in which the fear words and the bright blue words come too easily. The public must not only be alerted to hazards, but also apprised of progress—progress being made in research, in clean-up agreements reached with industry, and in successful new approaches to the

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task at hand. Of the some 200 FWQA press releases issued since Secretary Hickel took office, many have dealt with new approaches for turning wastes into usable products, for using sludge as a fertilizer for crops, for new methods for controlling pollution from combined storm sewers—as well as with the oil disasters, the dying lakes, and the dangers posed by new contaminants.

The Water Quality Improvement Act of 1970 also points to the importance of adequately recognizing progress in pollution control. The Act authorized a program of official recognition by the Federal government to industrial organizations and local authorities which have demonstrated outstanding technological or innovative achievements in their pollution abatement programs.

Looking to the future, the public information program of FWQA has produced a film entitled, *The Gifts*, which will be distributed to citizens groups and television. The movie on water pollution and its impact on the chain of life is narrated by Lorne Green, with original music by Skitch Henderson, and again sounds the theme that we must act—now.

In the publications field, a new booklet aimed at grade school children is being planned. The booklet may use drawings done by children because of their fresh charm and appeal.

Working with Youth

The quality of the environment is fast becoming the consuming issue on our campuses. At least 500 colleges and 1,500 high schools are expected to conduct environmental teach-ins on April 22, 1970. FWQA has been invited to participate in many of these events. Over 100 staff members are expected to serve as speakers and panel members, and a large volume of literature and other materials is being made available to individual campus sponsoring organizations.

As an agency whose mission is environmental protection and preservation, FWQA since 1969 has been deeply involved with students seeking to participate more effectively in the quest for environmental quality improvement.

SCOPE (Student Council on Pollution and the Environment) was created to serve as a two-way communication link between students and government on the issue of environmental quality. For the students it is an opportunity to obtain and apply governmental expertise and information to the process of formulating solutions to environmental problems and a chance to discuss their proposals for solving environmental problems with top-level government decision-makers. For the government it is a means of getting fresh viewpoints on environmental problems and solutions. Government agencies will be able to request student study and recommendations on specific points or issues.

SCOPE is composed of students at the college and high school levels interested in the issue of environmental quality. A SCOPE group was established in each of FWQA's nine Regions by

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December, 1969. The first meeting of national representatives elected by each Regional organization was held in Washington on February 20-21, 1970. At the national meeting, Secretary Hickel committed a large amount of his time to listening to SCOPE representatives' proposals and answering penetrating questions that reflected their broad concern for all facets of the environment.

SCOPE was initiated by FWQA in response to Secretary Hickel's

belief that improved communications would benefit both the Federal government and concerned students. SCOPE is an innovative experiment. Now that its basic feasibility has been demonstrated, the possibility of broadening its sponsorship both within and outside the Department of the Interior is being explored. Secretary Hickel recently announced the formation of a "Task Force on Environmental Education and Youth Activities" to act as a go-between for the Department and young people concerned about the environment. The Task Force's immediate projects include being the liaison group for SCOPE and making recommendations for the creation of a National Environmental Control Organization (ECO), proposed by the Secretary and modeled after the Peace Corps. The Task Force is also programmed to provide the focal point within the Department of the Interior for its participation in future national student teach-ins. Upon request, the group will provide assistance, information, and speakers to colleges, high schools, and private organizations.

Perhaps the most basic point expressed by SCOPE members is that mankind will have to change many of its attitudes and aspects of its life-styles if we are to live within the earth's supply of natural and recreational resources over the long term. They see the need for general recognition that the earth and its inhabitants form a "closed system" and that actions by any segment of its population generally have an effect on other groups—or perhaps on the action-originating group at a later date. Further, they believe that remedial steps require changed attitudes and public acceptance and support for the expenditure of vast sums to improve the quality of our environment.

Public awareness and attitudes are at the heart of all of these broad concerns. In order to improve our understanding of the nature and magnitude of the public education task that lies ahead and to understand better what role organizations such as SCOPE can play, FWQA is seeking the help of the Institute for Creative Studies.

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The Institute for Creative Studies is a private, nonprofit, educational corporation which attempts to use bright, imaginative, innovative high school and college students to apply modern research techniques and scientific methods to the resolution of policy problems. The institute began as a pilot project in the summer of 1967. The research projects are funded by government contracts and the Eugene and Agnes E. Meyer Foundation.

The only controls on the individual students' research projects are regular quality control review sessions, a formal interim report, and a thorough review of each project by a panel of experts at the end of the project period.

The Institute for Creative Studies will investigate in depth the

role and nature of public attitudes on water pollution control problems. Additional topics may also be considered by the Institute for Creative Studies in connection with their work for FWQA.

FWQA has been involved in other work with young people. For example, a program called "Operation Clean Waters" has been conceived and organized by FWQA to involve youth directly in the clean-up of water. Pilot projects have demonstrated that teams of young men aged 16 to 21 can remove tremendous amounts of debris from waterways, thereby improving their aesthetic appearance and value for recreational use. These pilot projects have been carried out in the District of Columbia, Chicago, and Puerto Rico. This program will be expanded to a number of other cities. The new projects will be supervised entirely by local governments, with FWQA staff serving as advisors.

In another approach to young people, FWQA is developing a project with the Boy Scouts of America that will be known as "Conservation Good Turn." A Boy Scout *Leader's Guide* has been prepared outlining various projects which the Scouts can undertake, such as checking to see whether their community has a waste treatment plant; if the sources of pollution from industry are under control; and where other trouble spots are developing. The *Guide* gives directions for checking the quality of water in a stream or lake. We are anxious to enlist the support of the five million Boy Scouts in this country as another volunteer cadre for protecting the environment.

In addition to the involvement with these special youth programs, FWQA has a number of on-going programs which involve youth participation and offer young people an opportunity to work or study in the field of water pollution control. These programs—to be discussed in the following section on training and manpower—include traineeships and fellowships, grants to technical, professional, and secondary schools, in-house short-term training, and part-time or summer jobs.

Training and Manpower Development

Substantial expenditures for construction grants, research and development, technical assistance, and similar endeavors are outlined in various sections of this report. Effective utilization of these funds and achievement of clean water results will basically depend on adequate staffs of skilled and motivated people, from treatment plant operators to research scientists. We must very substantially increase both the number and proficiency of those employed in the water pollution control effort and, accordingly, manpower development has become a major program thrust within FWQA.

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The objectives of manpower development programs are to assist in attracting and preparing new professionals, technicians and operators and to help prepare existing personnel to do a more effective job. To meet these objectives, FWQA is pursuing a number of approaches. These include support of and work with the universities to assure an adequate flow of engineers, scientists, and other professionals into the field; conduct of short-term training by FWQA staff, designed to upgrade the skills of those already in the field; and a variety of approaches to the training of sewage treatment plant operators.

FWQA is working to increase the flow of highly trained professionals through training grants awarded to academic institutions to establish or extend the scope of advanced training in water pollution control in their engineering, biological, physical and social science departments. Under this program, institutions are encouraged to develop the specialized and multidisciplinary training of scientists, engineers, and administrators in water quality management. These grants support expansion and improvement of facilities and equipment, provide partial support of faculty salaries and offer stipends, dependency allowances and tuition to trainees. In 1969 training grants were awarded to 61 institutions. This type of grant will support 693 trainees in 1970, most of whom are working toward master's degrees.

Research fellowships are also awarded to individuals for specialized graduate and postgraduate research training involving investigations particularly related to FWQA's mission. These awards provide funds for institutional costs of education, stipends for the fellow and allowances for supplies. Fellowships are generally awarded to persons working towards the Ph.D. degree, the objective being to maintain the future supply of research scientists and engineers and university professors. A long training period is required to produce researchers and teachers, generally at least three years of full-time study after the bachelor's degree has been obtained. It is extremely important to maintain a steady flow of persons under training so that there are no major gaps in the supply of trained persons available to begin research and teaching careers. About three-quarters of the Ph.D. recipients who have received FWQA support through a fellowship or training grant embark on research and university teaching careers.

In 1969, approximately 300 students supported by FWQA training grants or fellowships received advanced degrees. They will make a significant contribution towards filling the demand for new professional talent in the field.

Other steps are being taken to increase this flow of talent. FWQA will be participating in intensified Federal efforts to improve the quality of education available at black institutions in accordance

with declared Presidential support for a Black College improvement program. FWQA training grants have already been awarded to two such institutions. Predominantly Negro Delaware State College received support for development of an undergraduate water chemistry course to train baccalaureate candidates for pollution control-oriented jobs in industry. More recently, a grant was awarded to Howard University to support a Master of Science in Sanitary Engineering program. In 1970, we expect to consider a proposal for training pollution control microbiologists and biochemists at Tuskegee Institute. In the coming year, other black institutions will be investigated to determine opportunities for and means of developing professional training programs in water pollution control.

We are also exploring the need to encourage pollution control training at an earlier stage through increased emphasis in junior and senior high school science curricula. As a start in this direction, the Tilton School in New Hampshire was recently awarded a grant to provide for the modification and re-writing of a previously developed teacher's guide. The guide provides objectives, procedures and teacher's plans for scientific analysis of water pollution problems and consideration of social, legislative and historical factors. The revision will be performed in the summer of 1970 by a group of teams composed of a high school science or biology teacher and a student from each of forty different schools. These teams, during the regular school year, have gained experience in field and water laboratory testing techniques and will base their revisions on this experience. The teacher's guide is expected to become basic material for initiating secondary school courses emphasizing water pollution control at schools across the country.

We must not only attract and train new people for careers in pollution control; we must turn our attention to those already in the field. Water pollution control technology and techniques are developing rapidly. To be effective, pollution control personnel must be kept up-to-date on the latest developments. One of the best means of obtaining such updating is through attendance at short-term training courses. This type of training is also needed by the ever-increasing numbers of trained people

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shifting from related fields to water pollution control. They need to be acquainted rapidly with current knowledge and methods.

To meet these needs, specialized and advanced technical training is offered at FWQA laboratories to government employees and others working in pollution control. Special emphasis is given to training courses or programs which assist the State and local agencies in

training their personnel, thus strengthening State and local effectiveness in the water pollution control effort.

Trainees are drawn from the professional, technical and treatment plant operator ranks across the Nation. In fiscal year 1969, more than 50 of these short-term courses were presented to approximately 1,300 persons at FWQA training facilities. The curricula included a variety of technical courses in water quality management of one or two weeks' duration. Also offered are orientation courses and short technical seminars to meet the special needs of particular Federal, State and local agencies or academic institutions. For example, in 1969 FWQA presented a two-week "Water Quality Studies" course in Harrisburg, Pennsylvania, to meet the needs of that State's employees. Also, two courses were offered to assist Federal agencies in meeting their increased responsibility to prevent water pollution: "Design and Management of Sewage Treatment and Disposal for Federal Installation," and "Water Pollution Control for Federal Installations." A special course was conducted for U.S. Geological Survey personnel to enable them to participate fully in the accelerated water quality monitoring program prescribed elsewhere in the report.

Training of sewage treatment plant operators has been an area of special and increasing emphasis in the FWQA training program. The fastest and cheapest way to significantly improve water quality in the short run would be to operate existing treatment plants at reasonably efficient levels. Too often today, multi-million dollar plants produce unsatisfactory effluents which deny desired and obtainable water uses. Usually the reason is that these expensive plants are turned over to poorly trained personnel for operation and maintenance. Poor plant operation can result in undue pollution of the receiving waters with the resulting loss of water uses, such as closed swimming beaches. Poor plant maintenance can be extremely costly in yet another way. Most waste treatment plants are designed and constructed so as to have a useful life of at least twenty years. Improper plant maintenance can actually reduce that useful plant life to one or two years in extreme cases.

The need for competent, well-trained operators in the Nation's treatment plants is obvious. Traditionally, this has been viewed as a responsibility of State and local governments. The Federal government, and FWQA in particular, has taken a more active role in the past few years for very basic reasons. The job was not being adequately done at the State and local level: a large portion of existing treatment plants were, and are, being poorly operated and maintained. State and local governments often have had difficulty marshalling the financial and staff resources needed to conduct adequate training programs on their own. Therefore, FWQA has worked to provide

advice, consultation and financial assistance to State and local governments to carry out operator training.

Recently, improved operation and maintenance of treatment plants has become more than a matter of Federal encouragement and assistance; it will be required in order for States and communities to receive construction grant assistance. It would make little sense for the Federal government to embark upon a major program to assist construction of treatment works without assuring that, once built, they will be adequately operated and maintained. Secretary Hickel's recently published regulations to this effect have been described elsewhere in this report.

FWQA is supporting operator training in several ways. First, and foremost, FWQA has assisted State and local governments in qualifying for funding for operator training under a variety of existing programs administered by other Federal agencies. This involves working with State and local governments to identify training needs, to formulate training programs to meet those needs, including assistance in such areas as curriculum development and instructor training, and to obtain Federal financial assistance. FWQA then works with Federal agencies to gain acceptance for Federal support of this training and to develop procedures to make funds available. Utilizing principally Manpower Development and Training Act (MDTA) funds which are administered by the Departments of Labor and Health, Education and Welfare, FWQA assisted projects that accomplished the training of 981 operators in fifteen States and in Puerto Rico in 1969. The number of operators trained under this mechanism in 1970 will total approximately 2,800 in 30 States.

The present use of MDTA funds illustrates the successful application of a multiple-purpose

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governmental program. FWQA-assisted projects utilizing Manpower Development and Training Act funds not only produce trained operators but also serve to enable persons classified as unemployed or under-employed to obtain better jobs and participate more fully in the economic life of the Nation. FWQA is further developing this approach through the Department of Defense's "Project Transition" which affords an opportunity to attract returning servicemen into the pollution control field. The "Project Transition" program provides enlisted military personnel with training for civilian jobs during their last six months of duty. Training is funded by the Manpower Development and Training Act and is administered by the Departments of Defense, Labor, and Health, Education and Welfare. FWQA is currently developing a pilot program to provide entry-level training

in wastewater treatment plant operations for approximately 300 servicemen at Forts Belvoir, Virginia; Bragg, South Carolina; Hood and Bliss, Texas; and at the El Toro Marine Air Base in California. FWQA will use information gathered through a variety of programs to assist successful trainees in obtaining jobs across the country in waste treatment plants seeking qualified personnel.

We are moving forward in a number of other ways to upgrade operator training. Correspondence courses may prove the most practical method of reaching many operators of one-man plants—of which there are thousands. By late 1970 or early 1971 FWQA expects to have three correspondence courses available to help meet this need. The University of Michigan, under an FWQA grant, has developed a course utilizing programmed learning on chemistry of water and wastes for operators and technicians. Within FWQA's own short-term training teaching staff, a course on membrane filter methods in water microbiology has been developed. It will be aimed at operators. Under another grant, Sacramento State College has developed a course for improving the skills of operators in small and remote plants.

Efforts are also underway to better prepare those who will be responsible for training operators. FWQA developed and first offered a short-term training course for instructor development in April 1969. We co-sponsored with Clemson University the first large-scale national conference on operator training in Atlanta in November, 1969. This first-of-its kind meeting provided a forum for operator-trainers to meet together and listen to and discuss presentations on the latest instructional methods and teaching aids.

The President's February 4 Executive Order on control of Federally-caused pollution has established a vastly increased responsibility for FWQA to assist other Federal agencies in training operators of plants at Federal installations. The order requires Federal operators to meet levels of proficiency consistent with those being required of operators at the community level. To assist the Federal agencies, we will provide increased training opportunities, using FWQA training facilities and staff to present selective offerings of practical courses in waste treatment plant operation, methods and procedure—both for Federal operators and for personnel engaged in training Federal operators. This program will also provide FWQA with an opportunity to develop and test training techniques and materials which will ultimately be passed on to State and local governments for use in training large numbers of operators.

Enactment of the Water Quality Improvement Act of 1970 will further strengthen FWQA's activities and programs in training treatment plant operators. The new legislation authorizes a combination of grant, contract, and scholarship programs to attract and prepare

students for careers in the design, operation and maintenance of waste treatment plants. Planning for implementation of new activities and approaches under this legislation is now underway.

In summary, FWQA is very substantially accelerating its training efforts, in concert with State, local and Federal agencies, with universities, and with others concerned. More effective manpower planning is needed to guide these efforts.

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FWQA's last overall study of manpower needs, *Manpower and Training Needs in Water Pollution Control*, was submitted to the Congress in 1967. A much more specific appraisal of where and when job vacancies will occur and how they may best be met is now required. In 1969, FWQA initiated development of a manpower planning system which, when implemented, will define manpower demands, manpower supplies, and criteria for judging whether manpower resources are being effectively utilized. The system will provide carefully developed estimates of the total manpower needs in the water pollution control field and improve the identification of particularly severe manpower shortages. The system will also include more precise definition of occupations, manpower staffing guides, work force profiles, and industrial planners.

This manpower planning system will enable FWQA to formulate better action plans, through understanding the timing and nature of State, local, industrial and academic training needs. Rapid and effective implementation of this system will be needed to help us meet the training provisions of the Water Quality Improvement Act of 1970.

INTERNATIONAL ACTIVITIES

Public concern for environmental quality has reached international proportions in the last few years, and President Nixon has advanced the participation of the United States in efforts to solve global pollution problems.

The Federal Water Quality Administration (FWQA) is active on several major fronts of international activity in the environmental field. Efforts are moving ahead to meet the increasing pressures for an international leadership role in the environmental quality area.

The United States shares the North American continent with Canada and Mexico. A significant part of the water resources of the continent crosses or forms a part of the political boundaries between the United States and its two neighbors. This is especially true along the Canadian boundary where the Great Lakes system, constituting the largest source of fresh water in the world, is shared equally.

An important part of FWQA's involvement in international activi-

ties is the provision of technical support to the International Joint Commission (IJC). The latter was established pursuant to the Boundary Waters Treaty of 1909 between the United States and Canada. This activity includes membership on a number of international technical advisory boards which have been established by the IJC to investigate and report on specific boundary water problems referred to the Commission by the Governments of the two countries. At the present time, there are seven technical advisory boards working on the pollution problems of Lake Erie, Lake Ontario, the international section of the St. Lawrence River, St. Croix River (Maine), Niagara River, Detroit River, St. Clair River, St. Marys River, and Rainy River of the North.

Because of the serious acceleration of pollution in the highly industrialized areas of the Great Lakes, the work of the IJC and its advisory boards has assumed an increasingly important role in coordinating the remedial programs being carried on in the two countries to abate pollution. This coordination has resulted in significant agreement on the present levels of pollution in Lake Erie and Lake Ontario, the sources and amounts of pollutants reaching the Lakes and recommendations for an abatement program. In recent weeks, a comprehensive report on these agreements has been submitted to the IJC by its technical advisory board.

Other programs being coordinated through the IJC are oil contingency planning for boundary waters, vessel pollution control and review of off-shore drilling practices. In addition, the meeting of water pollution control technicians of the United States and Canada on boundary water problems has resulted in increasing cooperation in several areas which have not been referred to the IJC for consideration, such as Arctic pollution, exchange of scientific information, participation in pollution seminars and consultation on handling of oil spills.

Within the last year, meetings between higher levels of administrative personnel on matters of policy have developed as a result of the complexity of the pollution problems of the Great Lakes. Meetings were held between Secretary Hickel and Assistant Secretary Klein and their counterparts from Canada. As a result, the governments of both countries are moving closer together in a coordinated approach to pollution abatement in the Great Lakes. Additional meetings are being planned for FY 1970-71 involving White House level officials of the United States Government.

Although a Water and Boundary Treaty was established between the United States and Mexico in 1944, it contains no provision for formal institutions for dealing with pollution problems

as is contained in the treaty with Canada. However, informal arrangements are established with the Water and Boundary Commission, and the FWQA does provide consultative services on border pollution problems when requested. Consultative services have been provided on border pollution problems stemming from domestic wastes in the Brownsville-Matamoros, El Paso-Juarez, Nogales, Yuma-Mexicali and Tijuana areas.

As the world's technicians turn to the task of controlling pollution of global waters, the development of a reliable mechanism for the exchange of existing and developing scientific information becomes increasingly necessary. As a result of this need the United States has established or explored bilateral agreements with other countries to exchange technical knowledge on water pollution control and research. Such agreements have been in operation with Germany and Japan for several years. Agreements to develop bilateral exchanges are presently being negotiated with the Soviet Union, France and Czechoslovakia. Requests for such agreements have been received from Sweden, the United Kingdom, Iceland, Poland and Romania. In negotiating these agreements, consideration is being given to including cooperation in specific research projects in problem areas of mutual interest, such as sludge disposal, the effects of pollution on fish and aquatic life, eutrophication of lakes, effluent standards and user charges.

The effect of detergent phosphate on the environment has been a matter of public and scientific discussion for several years and has recently come to the front as a major issue in the problem of accelerating lake eutrophication. As a result of the shared concern over the nutrient enrichment of Lake Erie, a joint United States-Canada team of scientists undertook a mission to Sweden in January, 1970, to investigate and study the use of low phosphate-content detergents in that country. Their findings will contribute to the development of policies for phosphate reduction in both nations.

During the past year, over 100 foreign water pollution technicians and scientists have visited the United States to study control programs and techniques which have been instituted in this country. A number of these visitors have participated in the short technical training courses offered in the FWQA Regional laboratories on various aspects of water pollution control technology. This represents a sharp increase over previous years and indications are that the number can be expected to double in the next 12 to 24 months. This increased number of foreign visitors is also expected to include higher-level government administrative officials than in past years.

With the establishment by President Nixon of the Environmental Quality Council and the concurrent structuring within the Depart-

ment of State of an Office of Environmental Affairs, the Administration is gearing to meet increasing responsibilities in the international area. Most, if not all, of the international, multi-lateral organizations in the free world today are in some way engaged in carrying out programs in environmental protection. These programs consist mainly of establishing procedures and organizational arrangements for the exchange of technical and scientific information and of providing a platform for the discussion between government officials of member countries on environmental problems of general concern.

In recent months, however, increasing attention has been given to the development of international policies for environmental protection. Many international conferences and symposiums are scheduled for the next 12 to 24 months, including the international Water Pollution Control Research Conference in San Francisco in September 1970; the Environmental Safety Conference in 1971 in Prague, Czechoslovakia, sponsored by the Economic Commission for Europe; and the UN's major effort in this field in 1972 in Sweden. The conference will bring together the world's leading scientists and political leaders to discuss the environmental problems that beset the world.

FWQA has provided an increasing number of its technical and top administrative personnel to support these developing activities. This includes the appointment of agency representatives to environmental technical and planning panels which have been established in the North Atlantic Treaty Organization framework, the Economic Commission for Europe, the Organization for Economic and Cultural Development, and others. Co-sponsorship of the biennial International Congress on Water Pollution Research is a major undertaking of FWQA, and the Agency will be active in the planning and conduct of the next conference to be held in San Francisco in September, 1970.

The involvement of FWQA in the international field has been relatively small in the past and restricted to specialized technical fields. But sudden world concern for protection of the environment will thrust upon us an increasing pressure to share our knowledge, progress and technical capability with all Nations. This is especially true if the United States is to continue its present role as a leader in the free world.

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ORGANIZATION, RESOURCES, AND FACILITIES

The capability of any agency to accomplish its mission is dependent upon its resources—budget, staff, and facilities—and upon how effectively those resources are organized and managed. During the past year, substantial efforts have been directed towards the improved organization and management of Federal Water Quality Administration (FWQA).

Major improvements have been made in FWQA's personnel systems and organization structure. Added emphasis is being given to systematic work planning—competing demands on the Agency's resources have made of prime importance the identification and maintenance of priorities, schedules, and objectives to guide our work. An Agency-wide accounting and management information system will be operational by July 1, 1970. This system will generate electronic data programs and develop reports which will aid top management in their decision-making process.

A formal directives system has been established to assure rapid and accurate communication of policy and instructions throughout the Agency. Better systems of delegation of authority and other management improvements are currently underway.

FWQA's mission is an increasingly complex one, and constant attention to modern management methods is an essential part of its overall job.

ORGANIZATION

FWQA is organized along functional lines, as outlined on the attached organization chart.

During the past years, there have been a number of changes in FWQA's organizational structure, at both Headquarters and field levels, designed to marshall the Agency's resources most effectively to meet its changing mission.

With increasing emphasis placed on securing compliance with established water quality standards, the standards function has been transferred from the jurisdiction of the Assistant Commissioner for Operations to the jurisdiction of the Assistant Commissioner for Enforcement. The current emphasis on the environment as a whole is reflected by the proposed creation of the position of Assistant Commissioner for Environmental and Program Planning. The passage of the Water Quality Improvement Act of 1970 prompted the creation and staffing of an Office of Oil and Hazardous Materials.

The bulk of FWQA's activities is in the field. Of a present staff of 2,538 permanent and temporary employees, 592 are located in Headquarters, and 1,946 are assigned to the nine

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Regions. Regional boundaries are outlined on the attached map.

FWQA's Regions are organized along hydrologic lines to facilitate the planning and implementation of the clean-up of entire river basins and to aid our work with related water resource agencies. This method of organization is considered most effective in terms of the Agency's current program operations. It sometimes creates difficulties, however, for States whose boundaries fall within more than one

Region. With the increased emphasis on effective working relationships with the States, major attention is being given to adjustments in responsibilities and lines of communication which will ease these problems.

The Department of the Interior's participation in the President's Federal Activities Review Program, which is designed to assure that services to State and local government are of maximum effectiveness, may lead to further adjustments in our Regional structure.

PERSONNEL

FWQA's most valuable resource is its staff—a staff comprised of dedicated and experienced professionals, with backgrounds representing the many disciplines needed to operate in effective governmental agency. Heavily represented on the staff, because of the nature of the Agency's mission, are scientists and engineers with specialized experience in water pollution control, oceanography, and related fields. Lawyers, economists, public administrators, regional planners, and others provide the needed balance of skills.

A major management improvement during the past year has been initiation of an Agency career development system, designed to provide for planned intake of college graduates in entrance level positions; training and development for each careerist; a career counseling and appraisal system; and a centralized bank of data on all employees in an occupational field. This system will cover all scientific and engineering, technical support and administrative personnel by June 30, 1970. The Career Planning System will enable management to obtain, develop and retain a highly qualified workforce to meet mission goals and objectives in a timely and economical manner.

In addition to this system, a Graduate Fellowship Program was developed to provide a system to hire top quality graduate students who have completed all requirements for their advance degree but the thesis. They are hired on a temporary appointments for one year and work on a special project selected by FWQA which can serve as the basis for their thesis. These employees form a pool of outstanding candidates for future employment with FWQA on a permanent basis.

Further in-house personnel management improvements were made by the implementation of a personnel program evaluation and management advisory service designed to measure the effectiveness of personnel management policies, practices and procedures. Lengthy interviews with managers at all levels, non-supervisory attitude questionnaire sessions, and discussions with Personnel Office staff members have provided the data for evaluation. At the conclusions of each survey, a report is made to management containing action

items or recommendations for improving working conditions, employee morale, and supervisory performance.

Another innovation is the automated personnel system which results in statistical reports prepared by computer which greatly reduces the amount of time spent on this function at all levels of management. It also provides management with instant feedback of data needed for planning and other purposes. By the end of FY 1971, it is anticipated that all employee training records including FWQA-wide training needs will be fully automated. Also, the skills inventory file will be converted to an automated data bank to enable the instantaneous referral of outstanding candidates for vacant positions and to provide data needed for the manpower planning function.

FACILITIES

In addition to its Headquarters and Regional Office locations, FWQA conducts its work at 46 field stations and laboratories located in the field. These facilities range from complex laboratories, designed and operated to conduct sophisticated research, to small field stations, studying special problems. A variety of physical facilities is needed. At the Southeast Water Laboratory on the University of Georgia campus at Athens, controlled environmental chambers, designed to simulate varying conditions in the natural environment, have been constructed. Work with these chambers is shedding new light on basic pollution relationships in streams. In Newtown, Ohio, an entire tributary has been protected and controlled with weirs and other devices to test the long-term effects of low level toxic wastes on biota under natural conditions. This unique facility has already attracted the attention of scientists across the Nation. A small laboratory on a floating barge provides a

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base for a team of investigators studying pollution along the Florida coast. The National Water Quality Laboratory at Duluth, Minnesota, provides special facilities to conduct a wide range of studies designed to determine environmental requirements of fresh water organisms.

During the past year, the Bears Bluff Laboratory on the South Carolina coast was leased to FWQA by a non-profit educational institution. This facility will provide an invaluable opportunity to conduct work on environmental requirements of southern waters marine life—an important need in the establishment of improved water quality criteria.

Currently, FWQA is completing a comprehensive review of the need for additional facilities. A 5-year proposed facilities program has been developed. It is designed to provide necessary facilities and laboratory space for the future.

BUDGETARY RESOURCES

FWQA's budgetary resources for the past, current and coming fiscal years are shown below. These figures show a significant increase for water pollution control, reflecting the high priority this program is receiving from the President and Congress during a period of overall budgetary stringency.

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4.3 NATIONAL OIL AND HAZARDOUS MATERIAL POLLUTION CONTINGENCY PLAN

Council on Environmental Quality, August 20, 1971

COUNCIL ON ENVIRONMENTAL QUALITY

NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CON- TINGENCY PLAN

This National Contingency Plan as revised August 1971, prepared at the direction of the 91st Congress and Public Law 91-224, provides a mechanism for coordinating the response to a spill of oil or hazardous polluting substance. (This Plan supersedes the National Oil and Hazardous Materials Pollution Contingency Plan—June 1970.)

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100 INTRODUCTION

101 AUTHORITY

101.1 This National Oil and Hazardous Substances Pollution Contingency Plan has been developed in compliance with the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1151, et seq.). The President, in section 4(a), Executive Order 11548, July 22, 1970, delegated authority and responsibility to CEQ to carry out subsection (c)(2) of section 11 of the Act, providing for the preparation, publication, revision and amendment of a National Contingency Plan for the removal of oil.

102 PURPOSE AND OBJECTIVES

102.1 This Plan (including the Annexes) provides for a pattern of coordinated and integrated response by Departments and Agencies of the Fed-

eral Government to protect the environment from the damaging effects of pollution spills. It also promotes the coordination and direction of Federal,

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State, and local response systems and encourages the development of local government and private capabilities to handle such pollution spills.

102.2 The objectives of this Plan are to provide for efficient, coordinated and effective action to minimize damage from oil and hazardous substance discharges, including containment, dispersal, and removal. The Plan, including the Annexes and regional plans, provides for: (a) Assignment of duties and responsibilities, (b) establishment and identification of strike forces and emergency task forces, (c) a system of notification, surveillance and reporting, (d) establishment of a National Center to coordinate and direct operations in carrying out this Plan, (e) a schedule of dispersants and other chemicals to treat oil spills, (f) enforcement and investigative procedures to be followed, (g) directions on public information releases and (h) instructions covering on-scene coordination.

103 SCOPE

103.1 This plan is effective for all U.S. navigable waters, their tributaries and adjoining shorelines. This includes inland rivers, Great Lakes, coastal territorial waters, the contiguous zone and high seas where there exists a threat to U.S. waters, shoreface, or shelf-bottom.

103.2 The provisions of this Plan are applicable to all Federal Agencies. Implementation of this Plan is compatible with and complementary to currently effective joint International contingency plans, assistance plans, agreements, security regulations, and responsibilities based upon Federal statutes and Executive orders.

104 ABBREVIATIONS

104.1 Department and Agency Title Abbreviations

CEO—Council on Environmental Quality.
Commerce—Department of Commerce.
Corps—U.S. Army Corps of Engineers.
DHEW—Department of Health, Education and Welfare.
DOD—Department of Defense.
DOI—Department of Interior.
DOT—Department of Transportation.
EPA—Environmental Protection Agency.
Justice—Department of Justice.
MarAd—Maritime Administration.
NOAA—National Oceanic and Atmospheric Administration
OEP—Office of Emergency Preparedness.
State—Department of State.
USCG—U.S. Coast Guard.
USGS—U.S. Geological Survey.
USN—U.S. Navy.

104.2 Operational Title Abbreviations

NRC—National Response Center.
NRT—National Response Team
OSC—On-Scene Coordinator.
RRC—Regional Response Center.
RRT—Regional Response Team.

105 DEFINITIONS (WITHIN THE MEANING OF THIS PLAN)

105.1 "Act" means the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1151, et seq.).

105.2 "Discharge" includes but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping.

105.3 "United States" means the States, the District of Columbia, the Commonwealth of Puerto Rico, the Canal Zone, Guam, American Samoa, the Virgin Islands, and the Trust Territory of the Pacific Islands.

105.4 "Inland Waters" generally are those navigable fresh waters upstream from the coastal waters (see 105.5).

105.5 "Coastal Waters" generally are those U.S. marine waters navigable by deep draft vessels.

105.6 "Contiguous Zone" means the entire zone established or to be established by the United States under Article 24 of the Convention on the Territorial Sea and the contiguous zone. This is assumed to extend 12 miles seaward from the baseline where the territorial sea begins.

105.7 "Public Health or Welfare" includes consideration of all factors affecting the health and welfare of man,

including but not limited to human health, the natural environment, fish, shellfish, wildlife, and public and private property, shorelines, and beaches.

105.8 "Major Disaster" means any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, earthquake, drought, fire, or other catastrophe in any part of the United States which, in the determination of the President, is or threatens to become of sufficient severity and magnitude to warrant disaster assistance by the Federal government to supplement the efforts and available resources of States and local governments and relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby.

105.9 "Oil" means oil of any kind or in any form, including but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil.

105.10 "Hazardous Polluting Substance" is an element or compound, other than oil as defined in 105.9 which, when discharged in any quantity, into or upon navigable waters of the United States or their tributaries, presents an imminent or substantial threat to the public health or welfare.

105.11 "Minor Spill" is a discharge of oil of less than 1,000 gallons in inland waters, or less than 10,000 gallons in coastal waters or a discharge of any material in a quantity that does not pose a threat to the public health or welfare. Discharges that: (1) Occur in or endanger critical water areas; (2) generate critical public concern; (3) become the focus of an enforcement action; or (4) pose a threat to public health or welfare, should be classified as medium or major spills depending on their degree of impact.

105.12 "Medium Spill" is a discharge of oil of 1,000 gallons to 10,000 gallons in the inland waters or 10,000 gallons to 100,000 gallons in coastal waters, or a discharge of any quantity of any material that poses a threat to the public

health or welfare. See 105.11 for a definition of those spills which might be classified as a major spill even though their quantities conform to the definition of a medium spill.

105.13 "Major Spill" is a discharge of oil of more than 10,000 gallons in inland waters or more than 100,000 gallons in coastal waters or a discharge of any quantity of material or substance that substantially threatens the public health or welfare, or generates wide public interest.

105.14 "Potential Spill" is any accident or other circumstance which threatens to result in the discharge of oil or hazardous polluting substance. A potential spill shall be classified as to its severity based on the guidelines above.

105.15 "Primary Agencies" are those Departments or Agencies comprising the NRT and designated to have primary responsibility and resources to promote effective operation of this Plan. These agencies are: DOD, DOI, DOT, and EPA.

105.16 "Advisory Agencies" are those Departments or Agencies which can make major contributions during response activities for certain types of spills. These Agencies are: Commerce, DHEW, Justice, OEP, and State.

105.17 "Remove or Removal" is the removal of oil or hazardous polluting substance from the water and shorelines or the taking of such other actions as may be necessary to minimize or mitigate damage to the public health or welfare.

200 POLICY AND RESPONSIBILITY

201 FEDERAL POLICY

201.1 Federal Policy. The Congress has declared that it is the policy of the United States that there should be no discharge of oil into or upon the navigable waters of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone (sec. 11(b) (1) of the Act). It must also be emphasized that this Nation, in November 1970, announced a goal of no intentional discharges of oil from tankers and other

vessels to the seas by mid-decade.

201.2 The primary thrust of regional plans is to provide a Federal response capability at the regional level. The OSC shall determine if the person responsible for the discharge of oil or hazardous polluting substances has reported the discharge in accordance with section 11(b) (4) or section 12(c) of the Act, or in accordance with regulations promulgated under the Outer Continental Shelf Lands Act, and is taking adequate action to remove the pollutant or adequately mitigate its effects. The OSC should, if practicable, insure that the person responsible for the spill is aware of his responsibility and is encouraged to undertake necessary countermeasures. When such person is taking adequate action, the principal thrust of Federal activities shall be to observe and monitor progress and to provide advice and counsel as may be necessary. In the event that the person responsible for a pollution spill does not act promptly, does not take or propose to take proper and appropriate actions to contain, clean up and dispose of pollutants or the discharger is unknown, further Federal response actions shall be instituted as required in accordance with sections 11(c) (1) or 12(d) of the Act.

201.3 The Federal agencies possessing facilities or other resources which may be useful in a Federal response situation will make such facilities or resources available for use in accordance with this Plan, as supplemented by the regional plans, and as consistent with operational requirements, within the limits of existing statutory authority, and within the spirit of the President's intention to minimize discharges and their effects when they do occur.

201.4 Because Federal agencies other than OEP, or the public or private agency that caused the pollution spill, have primary responsibility and resources for alleviating or eliminating the pollution hazard, there appears to be little additional Federal assistance that could be made available as the result of a major

disaster declaration. It appears, therefore, that a Presidential major disaster declaration will rarely be involved in a pollution spill.

202 FEDERAL RESPONSIBILITY

202.1 Each of the Primary and Advisory Federal Agencies has responsibilities established by statute, Executive order or Presidential directive which may bear on the Federal response to a pollution spill. This Plan intends to promote the expeditious and harmonious discharge of these responsibilities through the recognition of authority for action by those Agencies having the most appropriate capability to act in each specific situation. Responsibilities and authorities of these several Agencies relevant to the control of pollution spills are detailed in Annex VII. In the development of the regional plans, provision shall be made to assure recognition of the statutory responsibilities of all involved Agencies.

202.2 The Council on Environmental Quality is responsible for the preparation, publication, revision or amendment of this National Contingency Plan in accordance with section 4(a) Executive Order 11548. The Council will receive the advice of the NRT on necessary changes to the Plan and shall insure that any disagreements arising among members of the NRT are expeditiously settled.

202.3 The Department of Commerce, through NOAA and MarAd, provides support to the NRT, RRT, and OSC with respect to: Marine environmental data; living marine resources; current and predicted meteorological, hydrologic and oceanographic conditions for the high seas, coastal and inland waters; design, construction, and operation of merchant ships; and maps and charts, including tides and currents for coastal and territorial waters and the Great Lakes.

202.4 The Department of Health, Education, and Welfare is responsible for providing expert advice and assistance relative to those spills or potential spills

that constitute or may constitute a threat to public health and safety.

202.5 The Department of Defense, consistent with its operational requirements, may provide assistance in critical pollution spills and in the maintenance of navigation channels, salvage, and removal of navigation obstructions.

202.6 The Department of Interior, through the USGS, supplies expertise in the fields of oil drilling, producing, handling, and pipeline transportation. Also the USGS has access to and supervision over continuously manned facilities which can be used for command, control and surveillance of spills occurring from operations conducted under the Outer Continental Shelf Lands Act. Additionally, the Department of Interior will provide, through its Regional Coordinators, technical expertise to the OSC and RRT with respect to land, fish, and wildlife, and other resources for which it is responsible DOI is also responsible for American Samoa and the Trust Territory.

202.7 The Department of Transportation provides expertise regarding all modes of movement of oil and hazardous substances. Through the USCG, the Department services as vice chairman of the NRT and supplies support and expertise in the domestic/international fields of port safety and security, marine law enforcement, navigation, and construction, manning operation, and safety of vessels and marine facilities. Additionally, the Coast Guard maintains continuously manned facilities that are capable of command, control, and surveillance for spills occurring on the navigable waters of the United States or the high seas. The USCG is responsible for chairing the RRT and for implementing, developing and revising, as necessary, the regional plans for those areas where it is assigned the responsibility to furnish or provide for OSCs (sec. 306.2). EPA will provide guidance to and coordinate with DOT regarding pollution control and the protection of the environment in the

preparation of such plans.

202.8 Environmental Protection Agency is responsible for chairing the NRT. In this capacity, it will assure that the Plan is effectively and efficiently implemented with optimum coordination among Federal agencies and will recommend changes in the Plan to CEQ, as deemed necessary. EPA is also responsible for chairing the RRT and for development, revision, and implementation, as necessary, of regional plans for those areas in which it has responsibility to furnish or provide for the OSC (sec. 306.2). Through the resources of the Office of Water Programs, EPA will provide technical expertise to NRT and the RRTs relative to environmental pollution control techniques including assessment of damages and environmental restoration.

202.9 The Department of Justice can supply expert legal advice to deal with complicated judicial questions arising from spills and Federal agency responses.

202.10 The Office of Emergency Preparedness will maintain an awareness of pollution incidents as they develop. The normal OEP procedures will be followed to evaluate any request for a major disaster declaration received from a Governor of a State. If the President declares that a pollution spill constitutes a major disaster under Public Law 91-606, the Director, OEP, will provide coordination and direction of the Federal response in accordance with OEP policies and procedures.

202.11 The Department of State can provide leadership in developing joint international contingency plans with Canada and Mexico in concert with the United States. It can also provide assistance in coordination when a pollution spill transects international boundaries or involves foreign flag vessels.

202.12 All Federal agencies are responsible for minimizing the occurrence of spills and for developing the capability to respond promptly in cases of spills from facilities they operate or supervise, and for making resources

available for National spill response operations. Primary Agencies, however, have the following additional responsibilities: For leading all Federal agencies in programs to minimize the number of and environmental damage associated with spills from facilities they operate or supervise; to develop, within their operating agencies, the capability for a rapid, coordinated response to any spill; for providing official representation to NRT and RRT; for making information available as may be necessary; and, for keeping RRT informed, consistent with national security considerations, of changes in the availability of resources that would affect the operation of this Plan.

203 NON-FEDERAL RESPONSIBILITY

203.1 State and local governments, industry groups, the academic community, and others are encouraged to commit resources for response to a spill. Their specific commitments are outlined by the regional plans. Of particular relevance is the organization of a standby scientific response capability.

300 PLANNING AND RESPONSE ELEMENTS

301 SPILL RESPONSE ACTIVITIES AND COORDINATION

301.1 For spill response activities, Federal on-scene coordination is accomplished through a single, predesignated agent, the On-Scene Coordinator (OSC). He reports to and receives advice from an RRT composed of appropriate representatives from the Regional and District offices of the Primary and Advisory Agencies.

301.2 National level coordination is accomplished through the NRT which receives reports from and renders advice to the RRT. Activities are coordinated through the National and various regional response centers.

302 NATIONAL RESPONSE CENTER

302.1 The NRC, located at Headquarters, USCG, is the Washington, D.C., headquarters site for activities relative to pollution spills. NRC quarters are

described in Annex III, and provide communications, information storage, necessary personnel and facilities to promote the smooth and adequate functioning of this activity.

303 NATIONAL RESPONSE TEAM

303.1 The NRT consists of representatives from the Primary and Advisory Agencies. It serves as the National body for planning and preparedness actions prior to a pollution spill and acts as an emergency response team to be activated under conditions specified in 303.3.

303.2 Planning and preparedness responsibilities of the NRT are:

303.2-1 Maintenance of a continuing review of regional spill response operations and equipment readiness to insure adequacy of regional and national planning and coordination for combating spills of oil and hazardous substances.

303.2-2 Review of functioning of the RRT's to insure that regional plans developed are fully coordinated among involved agencies. It shall serve as a body to which the RRT's may refer for settlement of matters which they cannot resolve.

303.2-3 Development of procedures to promote the coordination of Federal, State, and local governments, and private agencies to respond to pollution spills.

303.2-4 Establishment and maintenance of a standing committee on revision of the National Plan. This committee shall provide suggested revisions to the NRT for consideration, approval and publication by CEQ. The Primary Agencies shall provide membership on this standing committee. Advisory Agencies shall participate whenever revision or proposed amendments would affect those Agencies.

303.2-5 Maintenance of the National posture with respect to pollution spills. Based on a continuing evaluation of response actions it shall consider and make recommendations to appropriate agencies relating to training and equipping response team personnel; necessary research, development, demonstration

and evaluation activities to support response capabilities; and equipment, material stockpiling and other operational matters as the need arises. CEQ shall be advised of any Agency's failure to adequately respond to these recommendations. Committees shall be established, as appropriate, to consider various matters. Membership on these committees shall consist of the representatives from the Primary Agencies and such Advisory Agencies that may have direct involvement.

303.2-6 Establishment and maintenance of liaison with the U.S. National Committee for the Prevention of Pollution of the Seas by Oil in order to insure a consistent U.S. posture regarding oil pollution control. The NRT shall also maintain awareness of international coordination efforts in contingency planning.

303.3 During pollution spills, NRT shall act as an emergency response team comprised of representatives from the primary and selected Advisory Agencies to be activated when the spill of oil or hazardous polluting substances (a) exceeds the response capability of the region in which it occurs, (b) involves national security, or (c) presents a major hazard to substantial numbers of persons or nationally significant amounts of property. Any Advisory Agency may, by request to NRT, have a representative present whenever the NRT is activated for response to a spill. When activated the NRT shall:

303.3-1 Monitor and evaluate reports generated by the OSC insuring their completeness. Based on this evaluation, NRT may recommend courses of action in combating the spill through RRT for consideration by the OSC: NRT has no operational control of the OSC.

303.3-2 Consider requesting other Federal, State, local government or private agencies to take action under their existing authorities to provide resources necessary for combating a spill or deployment of personnel to monitor the handling of a spill.

303.3-3 Coordinate the actions of regions or districts other than those affected by spills to supply needed equipment, personnel, or technical advice to the RRT and OSC.

303.3-4 Act as the focal point for national public information releases and for information transfer between the OSC and the Washington, D.C. headquarters of the Agencies concerned, so as to minimize or prevent dissemination of spurious and incomplete information. Public information actions are discussed in Annex VI.

304 REGIONAL RESPONSE CENTER

304.1 The RRC is the regional site for pollution spill response activities. It will be accommodated in quarters described in each regional plan and will provide communications, information storage and other necessary personnel and facilities to promote the proper functioning and administration of regional spill response operations.

305 REGIONAL RESPONSE TEAM

305.1 The RRT consists of regional representatives of the Primary and selected Advisory Agencies, as appropriate. RRT shall act within its region as an emergency response team performing response functions similar to those described for NRT. RRT will also perform review and advisory functions relative to the regional plan similar to those prescribed for NRT at the National level. Additionally, the RRT shall determine the duration and extent of the Federal response, and when a shift of on-scene coordination from the predesignated OSC to another OSC is indicated by the circumstances or progress of a pollution spill. Any of the Advisory Agencies, by request to the RRT, may have a representative present when RRT is activated.

305.2 Boundaries of the standard regions for Federal administration shall be followed for the development of regional contingency plans, where practicable. As a minimum, these areas shall

be defined to correspond to the areas in which the Environmental Protection Agency and Coast Guard are respectively responsible for furnishing or providing for the OSC's.

305.3 The Agency membership on RRT is as established by 305.1 above; however, individuals representing the Primary Agencies may vary depending on the subregional area in which the spill occurs. Details of such representation are specified in each regional contingency plan.

305.4 The States lying within a region are invited to furnish one observer each to meetings of the RRT.

305.5 Activation of the RRT shall be automatic in the event of a major or potential major spill. Any Primary Agency representative on the team may request activation during any other spill. Deactivation of RRT shall be by agreement between EPA and USCG team members.

306 ON-SCENE COORDINATION

306.1 Coordination and direction of Federal pollution control efforts at the scene of a spill or potential spill shall be accomplished through the OSC. The OSC is the single executive agent pre-designated by regional plan to coordinate and direct such pollution control activities in each area of the region.

306.1-1 In the event of a spill of oil or hazardous polluting substance, the first Federal official on the site shall assume coordination of activities under the Plan until the arrival of the pre-designated OSC (or other appropriate person, pending the arrival of the OSC).

306.1-2 The OSC shall determine pertinent facts about a particular spill, such as its potential impact on human health; the nature, amount, and location of material spilled; the probable direction and time of travel of the material; the resources and installations which may be affected and the priorities for protecting them.

306.1-3 The OSC shall initiate and direct as required Phase II, Phase III

and Phase IV operations as hereinafter described.

306.1-4 The OSC shall call upon and direct the deployment of needed resources in accordance with the regional plan to initiate and continue containment, countermeasures, cleanup, restoration, and disposal functions.

306.1-5 The OSC shall provide necessary support activities and documentation for Phase V activities.

306.1-6 In carrying out this Plan, the OSC will fully inform and coordinate closely with RRT to ensure the maximum effectiveness of the Federal effort in protecting the natural resources and the environment from pollution damage.

306.2 EPA and the USCG shall insure that OSC's are pre-designated for each region and subregion, and for each Federally operated or supervised facility within subregions in accordance with the following criteria:

306.2-1 EPA shall furnish or provide for OSC's on inland navigable waters, and their tributaries.

306.2-2 The USCG shall furnish or provide for OSC's for the high seas, coastal and contiguous zone waters, and for Great Lakes coastal waters, ports and harbors.

306.2-3 The major consideration in selection of the OSC for a particular area or facility shall be based upon the Agency's capability and resources to provide on-scene coordination of pollution control response activities. If the responsible Agency does not act promptly or take appropriate action, the EPA or USCG shall, depending on the area in which the spill occurs, assume the OSC functions. Pollution control actions taken must be in accordance with Federal regulations and guidelines, EPA policies and this Plan.

306.3 Section 4(a)(4) Executive Order 11507, February 5, 1970, requires development, by all Federal agencies, of emergency plans and procedures for dealing with accidental pollution. Plans developed pursuant to that authority shall be in accordance with and comple-

mentary to appropriate regional oil and hazardous substances pollution contingency plans.

306.4 In the event of a nuclear pollution spill, the coordination and response procedures of the Interagency Radiological Assistance Plan shall apply.

400 FEDERAL RESPONSE OPERATIONS— RESPONSE PHASES

400.1 The actions taken to respond to a pollution spill can be separated into five relatively distinct classes or phases. For descriptive purposes, these are: Phase I—Discovery and Notification; Phase II—Containment and Countermeasures; Phase III—Cleanup and Disposal; Phase IV—Restoration; and Phase V—Recovery of Damages and Enforcement. It must be recognized that elements of any one phase may take place concurrently with one or more other phases.

401 PHASE I—DISCOVERY AND NOTIFICATION

401.1 Discovery of a spill may be by a report received from the discharger in accordance with statutory requirements, through deliberate discovery procedures such as vessel patrols, aircraft searches, or similar procedures, or through random discovery by incidental observations of Government agencies or the general public. In the event of receipt of a report by the discharger, written verification of such notification shall be provided by the receiving Federal agency within 7 working days. In the event of deliberate discovery, the spill would be reported directly to the RRC. Reports from random discovery may be initially through fishing or pleasure boats, police departments, telephone operators, port authorities, news media, etc. Reports generated by random discovery should be reported to the nearest CG or EPA office. Regional plans should provide for such reports to be channeled to the RRC as promptly as possible to facilitate effective response action.

401.2 The severity of the spill will

determine the reporting procedure and the participating Federal agencies to be notified promptly of the spill. The severity of the spill is determined by the nature and quantity of materials spilled, the location of the spill and the resources adjacent to the spill area which may be affected by it. *Regional plans should specify critical water use areas and detail alerting procedures and communication links.* All spills should be reported to the OSC and the RRC. A major or potential major spill shall immediately be reported to the RRC and NRC via telephone and teletype. Members of the RRT and NRT shall be notified by the appropriate response center depending on the severity of the spill. Medium spills shall be reported to the RRC and the NRC as soon as practicable, utilizing teletype whenever possible.

402 PHASE II—CONTAINMENT AND COUNTERMEASURES

402.1 These are defensive actions to be initiated as soon as possible after discovery and notification of a spill. After the OSC determines that further Federal response actions are needed and depending on the circumstances of each particular case, various actions may be taken. These may include, public health protection activities, source control procedures, salvage operations, placement of physical barriers to halt or slow the spread of a pollutant, emplacement or activation of booms or barriers to protect specific installations or areas, control of the water discharge from upstream impoundments, and the employment of chemicals and other materials to restrain the pollutant and its effects on water related resources. Surveillance activities will be conducted as needed to support Phase II and Phase III actions.

403 PHASE III—CLEANUP AND DISPOSAL

403.1 This includes those actions taken to remove the pollutant from the water and related onshore areas such as the collection of oil through the use of sorbers, skimmers, or other collection

devices, the removal of beach sand, and safe, nonpolluting disposal of the pollutants which are recovered in the cleanup process.

404 PHASE IV—RESTORATION

404.1 This includes those actions taken to restore the environment to its prespill condition, including assessment of damages incurred, and actions such as reseeded shellfish beds.

405 PHASE V—RECOVERY OF DAMAGES AND ENFORCEMENT

405.1 This includes a variety of activities, depending on the location of and circumstances surrounding a particular spill. Recovery of Federal cleanup costs and recovery for damage done to Federal, State or local government property is included; however, third party damages are not dealt with in this Plan. Enforcement activities under appropriate authority such as sections 11 and 12 of the Act, the Refuse Act of 1899, and State and local statutes or ordinances are also included. The collection of scientific and technical information of value to the scientific community as a basis for research and development activities and for the enhancement of our understanding of the environment may also be considered in this phase. It must be recognized that the collection of samples and necessary data must be performed at the proper times during the case for enforcement and other purposes. Enforcement procedures, including investigative requirements, are detailed in Annex VIII.

406 PROCEDURES TO BE FOLLOWED FOR THE PURPOSE OF WATER POLLUTION CONTROL

406.1 The agency furnishing the OSC for a particular area is assigned responsibility to undertake and implement Phase I activities in that area. Other agencies should incorporate Phase I activities into their ongoing programs whenever practicable. Upon receipt of information, either from deliberate or random discovery activities, that a spill

has occurred, the OSC for the affected area will be notified. Subsequent action and dissemination of information will be in accordance with the applicable regional plan.

406.2 The OSC is assigned responsibility for the initiation of Phase II actions and should take immediate steps to effect containment or other appropriate countermeasures.

406.3 The OSC is assigned responsibility for conduct of Phase III activities.

406.4 The OSC is assigned responsibility for the conduct of Phase IV activities utilizing techniques concurred in by the RRT.

406.5 Phase V activities shall be carried out by the individual agencies in accordance with existing statutes, with such assistance as is needed from other agencies and from the OSC.

406.6 Environmental pollution control techniques shall be in accordance with the applicable regional plan. In any circumstance not covered by the regional plan, the use of chemicals must be in accordance with Annex X and must have the concurrence of the EPA representative on RRT; in his absence, the concurrence of the appropriate EPA Regional Administrator will be required.

500 COORDINATING INSTRUCTIONS

501 DELEGATION OF AUTHORITY

501.1 Delegation of authority or concurrence in proposed or continuing water pollution control activities may be either verbal or written by the EPA representative on RRT.

502 MULTIREGIONAL ACTIONS

502.1 In the event that a spill or a potential spill moves from the area covered by one contingency plan into another area, the authority to initiate pollution control actions shall shift as appropriate. In the event that a polluting spill or potential spill affects areas covered by two or more regional plans, the response mechanism called for by both plans shall be activated; however, pollution control actions shall be fully

coordinated as detailed in the regional plans.

502.2 There shall be only one On-Scene Coordinator at any time during the course of a spill response. Should a spill affect two or more areas, the RRT will designate the OSC, giving prime consideration to the area vulnerable to the greatest damage. NRT shall designate the OSC if members of one RRT or of two adjacent RRTs, if appropriate, are unable to agree on the designation.

503 NOTIFICATION

503.1 Sections 11 and 12 of the Act require that all harmful discharges of oil and all discharges of hazardous substances into or upon the navigable waters of the United States must be reported to appropriate Federal authority. Designation of the Federal agents to receive such reports are contained in Title 33, Part 153, Subpart B, Code of Federal Regulations published by the U.S. Coast Guard and are available through that Agency's District Headquarters. In general, such reports are to be made to the nearest USCG or EPA office.

504 GENERAL PATTERN OF RESPONSE ACTIONS

504.1 When the On-Scene Coordinator receives a report of a spill, or potential spill, the report should be evaluated. In most situations, the sequence of actions shown below should be followed.

504.1-1 Investigate the report to determine pertinent information such as the threat posed to public health or welfare, the type and quantity of material spilled, and the source of the spill.

504.1-2 Effect notification in accordance with the applicable regional plan.

504.1-3 Designate the severity of the situation and determine the future course of action to be followed.

504.2 The result of the report probably can be categorized by one of five classes. Appropriate action to be taken in each specific type case is outlined below:

504.2-1 If the investigation shows that the initial information overstated

the magnitude or danger of the spill and there is no environmental pollution involved, it should be considered a false alarm and the case should be closed.

504.2-2 If the investigation shows a minor spill with the discharger taking appropriate cleanup action, contact is made with the discharger, the situation is monitored and information is gathered for possible enforcement action.

504.2-3 If the investigation shows a minor spill with improper action being taken, the following measures should be taken:

a. Attempt should be made to prevent further discharges from the source.

b. The discharger should be advised of the proper action to be taken.

c. If, after providing advice to the discharger and this advice is not followed, the discharger should be warned of legal responsibility for cleanup and violations of law.

d. Information should be collected for possible enforcement action.

e. The OSC should notify appropriate State and local officials. He should keep the Regional Response Center advised and initiate Phase II and III activities as conditions warrant.

504.2-4 When a report or investigation indicates that a medium spill has occurred or that a potential medium spill situation exists, the OSC should follow the same general procedures as for a minor spill. Additionally, the OSC should make a recommendation on convening the RRT.

504.2-5 When a report indicates that a major spill has occurred, that a potential major spill situation exists, or that a spill or potential spill which could arouse wide public concern has occurred, the OSC should follow the same procedures as for minor and medium spills. RRC and NRT should, however, be notified immediately of the situation even if the initial report has not been confirmed.

505 STRIKE FORCE

505.1 A nucleus National level strike

force, consisting of personnel trained, prepared and available to provide the necessary services to carry out this Plan has been established by the USCG. This force, presently located on the east coast, is being augmented and will be on site at various locations throughout the country. The National level strike force will be made available if requested to assist in response during pollution spills. The National level strike force may be requested through the appropriate USCG District Commander, Area Commander, or the Commandant, USCG. The strike force will direct the operation of any government-owned specialized pollution cleanup equipment and will function under the OSC.

505.2 Regional plans shall provide the designation of local strike force teams consisting of personnel from operating units within the region. They shall be trained, prepared, and available to provide necessary services to implement the Plan. Regional plans shall specify the location of the local strike force teams. The services of the local strike force teams will be obtained through the appropriate Coast Guard District Commander. These teams are to be capable of merging with other strike forces within the region, or of being sent outside their own region. They are to be capable of supplementing the National level strike force. The local strike force teams should be capable of full independent response to all minor spill situations and joint coordinative response to medium or major spill situations.

600 PROCEDURES FOR CHANGING THE PLAN AND ANNEXES

601 AMENDMENT OF THE PLAN AND ANNEXES

601.1 Recommended changes to this Plan and Annexes shall be developed by NRT and submitted to CEQ for approval and publication. Should disagreements between agencies arise, recommendations of a majority of the NRT members

and the minority opinion shall be submitted to CEQ for decision.

602 AMENDMENT OF THE REGIONAL PLANS

602.1 Regional plans may be amended by EPA or the USCG in their respective areas with the concurrence of the Agencies affected by such changes.

Any disagreements will be referred to NRT for resolution.

ROBERT CAHN,
Acting Chairman.

ANNEX X

2000 SCHEDULE OF DISPERSANTS AND OTHER CHEMICALS TO TREAT OIL SPILLS

2001 General. 2001.1 This schedule shall apply to the navigable waters of the United States and adjoining shorelines, and the waters of the contiguous zone as defined in Article 24 of the Convention on the Territorial Sea and the Contiguous Zone.

2001.2 This schedule applies to the regulation of any chemical as hereinafter defined that is applied to an oil spill.

2001.3 This schedule advocates development and utilization of mechanical and other control methods that will result in removal of oil from the environment with subsequent proper disposal.

2001.4 Relationship of the Environmental Protection Agency with other Federal agencies and State agencies in implementing this schedule: In those States with more stringent laws, regulations or written policies for regulation of chemical use, such State laws, regulations, or written policies shall govern. This schedule will apply in those States that have not adopted such laws, regulations, or written policies.

2002 Definitions. Substances applied to an oil spill are defined as follows:

2002.1 Collecting agents—include chemicals or other agents that can gel, sorb, congeal, herd, entrap, fix, or make the oil mass more rigid or viscous in order to facilitate surface removal of oil.

2002.2 Sinking agents—are those chemical or other agents that can physically sink oil below the water surface.

2002.3 Dispersing agents—are those chemical agents or compounds which emulsify, disperse, or solubilize oil into the water column or act to further the surface spreading of oil slicks in order to facilitate dispersal of the oil into the water column.

2003 Collecting agents. Collecting agents are considered to be generally acceptable providing that these materials do not in themselves or in combination with the oil increase the pollution hazard.

2004 Sinking agents. Sinking agents may be used only in marine waters exceeding 100 meters in depth where currents are not predominately onshore, and only if other control methods are judged by EPA to be inadequate or not feasible.

2005 Authorities controlling use of dispersants. 2005.1 Regional response team activated: Dispersants may be used in any place, at any time, and in quantities designated by the On-Scene Coordinator, when their use will:

2005.1-1 in the judgment of the OSC, prevent or substantially reduce hazard to human life or limb or substantial hazard of fire to property;

2005.1-2 in the judgment of EPA, in consultation with appropriate State agencies, prevent or reduce substantial hazard to a major segment of the population(s) of vulnerable species of waterfowl; and,

2005.1-3 in the judgment of EPA, in consultation with appropriate State agencies, result in the least overall environmental damage, or interference with designated uses.

2005.2 Regional response team not activated: Provisions of section 2005.1-1 shall apply. The use of dispersants in any other situation shall be subject to this schedule except in States where State laws, regulations, or written policies that govern the prohibition, use, quantity, or type of dispersant are in effect. In such States, the State laws, regulations or written policies shall be followed during the cleanup operation.

2006 Interim restrictions on use of dispersants for pollution control purposes. Except as noted in 2005.1, dispersants shall not be used:

2006.1 On any distillate fuel oil;

2006.2 On any spill of oil less than 200 barrels in quantity;

2006.3 On any shoreline;

2006.4 In any waters less than 100 feet deep;

2006.5 In any waters containing major populations, or breeding or passage areas for species of fish or marine life which may be damaged or rendered commercially less marketable by exposure to dispersant or dispersed oil;

2006.6 In any waters where winds and/or currents are of such velocity and direction that dispersed oil mixtures would likely, in the judgment of EPA, be carried to shore areas within 24 hours; or

2006.7 In any waters where such use may affect surface water supplies.

2007 Dispersant use. Dispersants may be used in accordance with this schedule if other control methods are judged to be inadequate or infeasible, and if:

2007.1 Information has been provided to EPA, in sufficient time prior to its use for review by EPA, on its toxicity, effectiveness

and oxygen demand determined by the standard procedures published by EPA (prior to publication by EPA of standard procedures, no dispersant shall be applied, except as noted in section 2005.1-1 in quantities exceeding 5 p.p.m. in the upper 3 feet of the water column during any 24-hour period. This amount is equivalent to 5 gallons per acre per 24 hours); and

2007.2 Applied during any 24-hour period in quantities not exceeding the 96 hour TL_{50} of the most sensitive species tested as calculated in the top foot of the water column. The maximum volume of chemical permitted, in gallons per acre per 24 hours, shall be calculated by multiplying the 96-hour TL_{50} value of the most sensitive species tested, in parts per million, by 0.33; except that in no case, except as noted in section 2005.1-1, will the daily application rate of chemical exceed 540 gallons per acre or one-fifth of the total volume spilled, whichever quantity is smaller.

2007.3 Dispersant containers are labeled with the following information:

2007.3-1 Name, brand, or trademark, if any, under which the chemical is sold;

2007.3-2 Name and address of the manufacturer, importer, or vendor;

2007.3-3 Flash point;

2007.3-4 Freezing or pour point;

2007.3-5 Viscosity;

2007.3-6 Recommend application procedure(s), concentration(s), and conditions for use as regards water salinity, water temperature, and types and ages of oils; and

2007.3-7 Date of production and shelf life.

2007.4 Information to be supplied to EPA on the:

2007.4-1 Chemical name and percentage of each component;

2007.4-2 Concentrations of potentially hazardous trace materials, including, but not necessarily being limited to lead, chromium, zinc, arsenic, mercury, nickel, copper, or chlorinated hydrocarbons;

2007.4-3 Description of analytical methods used in determining chemical characteristics outlined in 2007.4-1, -2 above;

2007.4-4 Methods for analyzing the chemical in fresh and salt water are provided to EPA or reasons why such analytical methods cannot be provided; and

2007.4-5 For purposes of research and development, EPA may authorize use of dispersants in specified amounts and locations under controlled conditions irrespective of the provisions of this schedule.

NOTE: In addition to those agents defined and described in section 2002 above, the following materials which are not a part of this schedule, with cautions on their use, should be considered:

1. Biological agents—those bacteria and enzymes isolated, grown and produced for the specific purpose of encouraging or speed-

ing biodegradation to mitigate the effects of a spill. Biological agents shall be used to treat spills only when such use is approved by the appropriate State and local public health and water pollution control officials.

2. Burning agents—are those materials which, through physical or chemical means, improve the combustibility of the materials to which they are applied. Burning agents may be used and are acceptable so long as they do not in themselves, or in combination with the material to which they are applied, increase the pollution hazard and their use is approved by appropriate Federal, State, and local fire prevention officials.

ANNEX XX

3000 REGIONAL CONTINGENCY PLANS

3001 General. 3001.1 Regional Contingency Plans have been developed for all U.S. coastal and inland navigable waters.

3001.2 These plans are available for review at the local District or Regional offices or the USCG and EPA respectively.

3002 Cross references. 3002.1 State Stand-ard Administrative Regions, USCG District and EPA Regions are as follows:

States	Coast Guard district (coastal)	EPA region (inland)
Region I:		
Maine	First	Region I.
New Hampshire	First	Do.
Vermont	Do.	Do.
Massachusetts	First	Do.
Connecticut	Third	Do.
Rhode Island	First	Do.
Region II:		
New York:		
Coastal Area	Third	Region II.
Great Lakes Area	Ninth	Do.
New Jersey	Third	Do.
Region III:		
Pennsylvania:		
East Coast	Third	Region III.
Lakeside	Ninth	Do.
Maryland	Fifth	Do.
Delaware	Third	Do.
West Virginia	Do.	Do.
Virginia	Fifth	Do.
Puerto Rico	Seventh	Do.
Virgin Islands	Seventh	Do.

Region IV:

Kentucky	Region IV.
Tennessee	Do.
North Carolina	Fifth
South Carolina	Seventh
Georgia	Seventh
Florida:	
Atlantic and Gulf Coasts.	Seventh
Panhandle	Eighth
Alabama	Eighth
Mississippi	Eighth
Canal Zone	Seventh

Region V:

Minnesota	Ninth
Wisconsin	Ninth
Michigan	Ninth
Illinois	Ninth
Indiana	Ninth
Ohio	Ninth

Region VI:

New Mexico	Region VI.
Texas	Eighth
Oklahoma	Do.
Arkansas	Do.
Louisiana	Eighth

Region VII:

Nebraska	Region VII.
Iowa	Do.
Kansas	Do.
Missouri	Do.

Region VIII:

Montana	Region VIII.
Wyoming	Do.
Utah	Do.
Colorado	Do.
North Dakota	Do.
South Dakota	Do.

Region IX:

California:	
Northern	Twelfth
Southern	Eleventh
Nevada	Do.
Arizona	Do.
Hawaiian Islands	Do.

Region X:

Washington	Thirteenth
Oregon	Thirteenth
Idaho	Do.
Alaska	Seventeenth

3002 2 Please refer to Annex IV for addresses and telephone numbers as appropriate EPA and USCG offices.

4.4 GUIDELINES FOR LITIGATION UNDER THE REFUSE ACT PERMIT PROGRAM

Department of Justice, April 7, 1972

TO: All United States Attorneys

SUBJECT: Guidelines for Litigation Under the Refuse Act Permit Program (33 C.F.R. Part 209 *et seq.*)

In view of (a) the signing by the President of the attached Executive Order 11574 which establishes a permit program under the Refuse Act to regulate the discharges of pollutants and other refuse matter into the navigable waters of the United States or their tributaries, (b) the signing of a Memorandum of Understanding between the Corps of Engineers and the Environmental Protection Agency with respect to the enforcement of the Refuse Act, and (c) the consolidation within the Land and Natural Resources Division pursuant to Departmental Memo No. 725 of criminal as well as civil responsibility for the administration of the Refuse Act, the Guidelines for Litigation Under the Refuse Act transmitted to the United States Attorneys on June 13, 1970, are hereby withdrawn and the following procedures are to be adhered to by all United States Attorneys:

1. United States Attorneys are authorized to initiate any action, either civil or criminal, referred to

[p. 1]

them for litigation by the District Engineer of the Corps of Engineers or the Regional Representative of the Environmental Protection Agency, pursuant to their Memorandum of Understanding.

2. All allegations of violations of the Refuse Act submitted to the United States Attorneys from sources other than the District Engineer of the Corps of Engineers or the Regional Representative of the Environmental Protection Agency shall be referred to the District Engineer of the Corps of Engineers and the Regional Representative of the Environmental Protection Agency for investigation and recommendations, in accordance with the procedures set forth in the Memorandum of Understanding between the Corps of Engineers and the Environmental Protection Agency, as to whether or not legal action should be initiated.

3. The provisions of these guidelines shall not apply to actions under the Refuse Act against vessels, which actions shall continue to be handled in the manner set forth in Departmental Memorandum 376, dated June 3, 1964, and Supp. 1 thereto, dated May 24, 1966, and shall continue to be under the jurisdiction of the Civil Division.

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4. All requests for instructions and guidance relating to the enforcement of the Refuse Act, whether of a civil or criminal nature, excepting vessels, shall be referred to the Pollution Control Section of the Land and Natural Resources Division, United States Department of Justice, Washington, D.C. 20530 (202-739-2707).

5. No criminal or civil action under the Refuse Act shall be dismissed or settled without the prior authorization of the Assistant Attorney General for the Land and Natural Resources Division.

6. Prior to the filing of civil complaints or criminal informations, or the return of indictments in Refuse Act cases, the United States Attorney shall advise the Land and Natural Resources Division, Pollution Control Section (202-739-2707).

7. The United States Attorneys shall supply the Pollution Control Section, Land and Natural Resources Division, copies of all pleadings, motions, memorandums, etc., filed in Refuse Act cases.

8. United States Attorneys shall, no later than the fifth day of each month, submit to the Pollution Control

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Section a report of Refuse Act activities for the previous month on the attached form.

Dated: April 7, 1971.

SHIRO KASHIWA,
*Assistant Attorney General,
Land and Natural Resources Division.*

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4.5 WATER QUALITY STANDARDS SUMMARIES

The water quality standards program is directed by the Environmental Protection Agency, an independent regulatory agency which has responsibility for approving State-adopted standards, evaluating adherence to the standards, and overseeing enforcement of standards compliance.

Standards, the first nationwide strategy for water quality management, contain four major elements: the use (recreation, drinking water, fish and wildlife propagation, industrial, or agricultural) to be made of the interstate water; criteria to protect those uses; implementation plans (for needed industrial-municipal waste treatment improvements) and enforcement plans; and an antidegradation statement to protect existing high quality waters.

Minimum water quality criteria, or numerical specifications of physical, chemical, temperature, and biological levels, are stated in the National Technical Advisory Committee report to the Secretary of the Interior, *Water Quality Criteria*, dated April 1, 1968, and pub-

lished by the Government Printing Office, Washington, D.C. Unavailability of the NTAC report before June 30, 1967—the date set by the Water Quality Act of 1965 for formal adoption of State standards—resulted in significant variations between the State-adopted and the NTAC minimum criteria. Some standards were adopted and approved before the NTAC report became available.

The *Water Quality Criteria* report is presently being updated in light of new scientific and technical information, with schedule publication in June 1972. These criteria compilations are issued to provide information to the public on water quality standards. As further information becomes available, they will be updated.

Water quality standards are subject to change when justified by newly available technical and scientific information. For the latest information refer to the existing approved water quality standards which can be obtained from the individual State water pollution control agency or EPA regional office.

4.5a “STANDARDS FOR TEMPERATURE”

Environmental Protection Agency, Division of Water Quality Standards, March 1971

Temperature standards are set to control thermal pollution, or the amount of heated wastes discharged into the water. Thermal pollution creates adverse conditions for aquatic life; accelerates biological processes in the streams, reducing the dissolved oxygen content of the water; increases the growth of aquatic plants, contributing to taste and odor problems; or otherwise makes the water less suitable for fish and wildlife, domestic, industrial, and recreational uses.

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Water Quality Criteria, used by EPA in evaluating State standards, recommends a maximum water temperature of 90°F with a maximum permissible rise above the naturally existing temperatures of 5°F in streams and 3°F in lakes. It recommends that trout and salmon waters not be warmed in order to protect these resources. Because of the lesser temperature fluctuations in the marine and estuarine environment, the NTAC report recommends that monthly maximum daily temperatures recorded at any site, before the addition of artificial heat, not be raised by more than 4°F from September through May and by more than 1.5°F from June through August.

Individual State-adopted standards follow.

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MARCH 30, 1971

WATER QUALITY STANDARDS SUMMARY

TEMPERATURE CRITERIA

Key	<p>PWS—Public Water Supply Rec.—Recreation F & WL—Fish and wildlife propagation Agric.—Agricultural water supply Ind.—Industrial (also may include power and cooling) water supply Nav.—Navigation Shell.—Shellfishing *—not approved by Secretary</p>
Alabama	<p>PWS—"With respect to cooling water discharges only, the ambient temperature of receiving waters shall not be increased more than 10°F. by the discharge of such cooling waters, after reasonable mixing; nor shall the discharge of such cooling waters, after reasonable mixing, cause the temperature of the receiving waters to exceed 93°F." Rec.—same as PWS Agric. and Ind.—same as PWS Shell.—same as PWS* F & WL—same as PWS*</p>
Alaska	<p>PWS—below 60°F.; waste flows above 60°F. adjusted to ambient receiving water temperature. Rec.—numerical value not applicable F & WL—may not exceed temperature of natural conditions by more than 5% for salt water or 10% for fresh water. No change permitted for temperatures over 60°F. Maximum rate of change —0.5°F./hr. Shell.—less than 68°F. Stock and Irrigation—between 60°F. and 70°F. for optimum growth to prevent physiological shock to plants. Ind.—less than 70°F.</p>
Arizona	<p>93°F. max; not more than 5°F. change. Cold water fish.—Nov.—March—55°F. max. } not more than April—Oct.—70°F. max. } 2°F. change</p>
Arkansas	<p>20°C.—max. in trout streams 30°C.—max. in smallmouth bass streams 35°C.—max. in other streams</p>
California	<p>Smith River—the following maxima: 60°F., Sept.—Oct.; 55°F., Nov.—May; 60°F., June; 70°F., July—Aug.* Klamath River—the following maxima: 60°F., Oct.; 55°F., Nov.—May; 65°F., June; 70°F., July—Aug.; 65°F., Sept.* Lake Tahoe—no criteria*, but prohibition of all waste discharges East & West Walker Rivers and Lake Topaz—22°C.* East & West Forks Carson River and Truckee River—20°C.* Goose Lake—the mean daily temperature shall not exceed 70°F., or the mean daily ambient air temperature, whichever is greater.*</p>

[p. 1]

Alamo & New Rivers—temperature change less than 2°F.*

All other waters—various narrative statements which state that temperatures shall not adversely affect aquatic life or other water uses.*

Colorado

Class B₁ (cold water fish)—70°F. max. No controllable temperature change will be permitted which will interfere with the spawning and other aspects of fish life. Abrupt changes in temperature must be avoided and the normal pattern of diurnal and seasonal fluctuations must be preserved. The maximum allowable rise in temperature resulting from waste discharges in streams and the epilimnion of lakes shall be 2°F. No discharge permitted to the hypolimnion of lakes.

[p. 2]

Class B₂ (warm water fish)—90°F. max. No controllable temperature change will be permitted which will interfere with spawning and other aspects of fish life. Abrupt changes in temperature must be avoided and the normal pattern of diurnal and seasonal fluctuations must be preserved. The maximum allowable temperature increase due to waste discharge in streams will be 5°F., and the maximum increase allowable from waste discharges to the epilimnion of lakes is 3°F.

Class B₁ and B₂—In temperature measurement, allowance shall be made for a mixing zone. Provisions shall be made for adequate mixing and no thermal barrier to migration and free movement of aquatic biota shall be permitted in any waters of the State.

Class C—Temperature—The temperature shall not exceed 93°F.

Class D—Temperature—No temperature criteria assigned.

Connecticut

Class A (PWS)—no increase other than natural origin

Class B (Rec.)

Class C (F & WL)

Class D (Nav. & Ind.)

Class SA (Shell.)

Class SB (Restricted Shell.)

Class SC (Shell. Habitat)

Class SD (Nav.)

No increase to exceed recommended limits on most sensitive water use, and in no case to exceed 4°F. over natural with a max. of 85°F.

Delaware

Ocean waters—shall not exceed 5°F. above normal for the area or a max. of 75°F.

Most rivers—shall not exceed 5°F. above normal for the section. (For some rivers—a max. of 85°F. or 87°F.)

District of Columbia

Not to exceed 90°F., 5°F. change limit; no sudden or localized temperature changes which may adversely affect aquatic life.

Florida

All waters—temperature shall not be increased so as to cause any damage or harm to the aquatic life or vegetation of the receiving waters or interfere with any beneficial use assigned to such waters.

(Secretary has requested changes in criteria)

[p. 3]

Georgia	PWS	} Not to exceed 93.2°F. at any time and not to be in- creased more than 10°F. above intake temperature. In streams designated by the State Fish and Game as trout waters, there shall be no elevation or de- pression of natural stream temperature.
	Rec.	
	F & WL	
	Shell.	
	Ind. not to exceed 93.2°F. at any time and not to be increased more than 10°F. above intake temperature.	
Guam	PWS—85°F. max., 5°F. change limit, 1.5°F. hourly change limit. Rec.—85°F. F & WL—1.5°F. change limit from natural conditions.	
Hawaii	Classes AA, A, B (all uses of coastal and tidal waters)—tem- perature of receiving waters shall not change more than 1.5°F. from natural conditions.	
Idaho	No measurable temperature increase when stream temperature is 68°F. or above, or more than 2°F. increase when river tem- perature is 66°F. or less. (Except 70°F. and 68°F., respectively, for Snake River—RM 407 to 247.)	
Illinois	PWS—90°F. max. F & WL—not to exceed 90°F., April through Nov.; not to exceed 60°F., Dec. to April* Ind.—90°F. max., except in SWB-8 where maximum is 93°F. Lake Michigan—85°F. max.	
Indiana	Industrial Classification—Temperature shall not exceed 95°F. at any time. Aquatic Life 1. Warm water species a. There shall be abnormal temperature changes that affect aquatic life unless caused by natural conditions. b. The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes shall be maintained. <div>[p. 4]</div> c. The maximum temperature rise at any time or place above natural temperature shall not exceed 5°F. In addition, the water temperature shall not exceed the maximum limits indicated in the following table:	

	Ohio River main stem	St. Joseph River tributary to Lake Michigan	Other Indiana streams
January	50	50	50
February	50	50	50
March	60	55	60
April	70	65	70
May	80	75	80
June	87	85	90
July	89	85	90
August	89	85	90
September	87	85	90
October	78	70	78
November	70	60	70
December	57	50	57

2. Cold Water Species

- a. In trout and salmon streams where natural reproduction is to be protected, no heat shall be added.
- b. In put-and-take streams, temperature shall not exceed 65°F. or a 5°F. rise above natural, whichever is less.

Iowa Warm water fish.—93°F., May–Nov.; 73°F., Dec.–April*
Cold Water fish.—70°F. max.*
(Criteria only approved for Mississippi and Missouri Rivers)
[p. 5]

Kansas Maximum temperature 90°F.
Allowable rise for streams and rivers is 5°F.
Allowable rise for the epilimnion of lakes and reservoirs is 3°F.
Temperature measurement is at the outfall and with the maximum temperature allowed at the outfall reflecting a reasonable mixing zone in the receiving waters so that the 5°F. or 3°F. rise specified is not violated in the contiguous receiving waters. Any barrier to migration and the free movement of the aquatic biota is prohibited.

Kentucky F & WL—not to exceed 93°F., May–Nov.; not to exceed 73°F., Dec.–April.
Ind.—95°F. max.
Min. daily allowable temperature change of 10°F., and an hourly rate not to exceed 2°F./hr. Temperature not to exceed 73°F. in Dec., Jan., and Feb.—all waters.

Louisiana Not to be raised more than 3°C. above normal ambient water temperature, nor to exceed a max. of 36°C.
A few rivers—2°C. rise, 35°C. max.

Maine Freshwater (rivers, streams, and lakes)—84°F. max. for warm water fish and 68°F. max. for trout and salmon waters. Rise of 5°F. from heated effluent of artificial origin allowed to rivers and streams, and a 3°F. rise due to heated effluent for the epilimnion of lakes.
Narrative Statement: No heated effluent allowed to be discharged in the vicinity of, or so as to affect, waters designated as fish spawning beds by the State.
Tidal Waters: No discharge of heated effluent that will raise the monthly mean of the maximum daily temperature
[p. 6]

outside mixing zones of more than 4°F. or, where the necessity therefor in any specific location is shown to exist, more than 1.5°F. during the months of July, August, and September.

Maryland F & WL—
Nontidal waters:
Trout waters—not to exceed 72°F. at any time. All other waters—not to exceed 93°F., elevation of temperature not to exceed 20°F. or 10°F. depending whether the natural water temperature is below or above 50°F., respectively, with a maximum of 60°F. and 93°F., respectively.

Tidal Waters: 90°F. max.; same temperature change limit as above with absolute max. temperatures of 60°F. and 90°F.

For all waters not classified for F & WL, no adverse temperature change and max. of 100°F.

Massachusetts Class A (excellent)—no increase other than natural origin.
 Class B (Rec., F & WL) } No increase except where temper-
 Class C (F & WL) } ature will not exceed the recom-
 mended limit on the most sensitive
 receiving water use and in no case
 exceed 83°F. in warm water fish,
 and 68°F. in cold water fish, or in
 any case raise the normal temper-
 ature more than 4°F.

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Class D (Ind.)—no increase to exceed limits on most sensitive use and in no case exceed 90°F.

All coastal and marine waters—no increase to exceed limits on most sensitive water use.

Michigan PWS—10°F. allowable rise above natural temperatures.
 Ind.—same as PWS
 Rec.—90°F. max.
 F & WL—Cold water fish—70°F. max., 10°F. change limit*
 Intolerant—85°F. max., 10°F., or 15°F. change limit*
 Tolerant—87°F. max., 10°F., or 15°F. change limit*
 Nav.—same as PWS

Minnesota F & WL & Rec.—2A—no material increase
 2B—86°F. max.
 2C—90°F. max.
 Ind.—3A—75°F. max.
 3B—86°F. max.
 3C—90°F. max.

Mississippi Shall not be increased more than 10°F. above the natural pre-
 vailing background temperatures, not to exceed a max. of 93°F.
 after reasonable mixing.
 (Temperature change not approved for F & WL)

[p. 8]

Missouri Effluent shall not elevate or depress the average cross-sectional
 temperature of the stream more than 5°F. The stream tem-
 perature shall not exceed 90°F. due to effluents (for most
 streams).
 Trout waters—Effluents shall not elevate or depress the average
 cross-sectional temperature of the stream more than 2°F.
 Lakes and reservoirs—no temperature increase due to any dis-
 charge which may be a source of heat.

Montana PWS—no allowable change to naturally occurring water tem-
 perature.
 Salmonid fish—(Classes D1 and D2)
 increases—32°F. to 67°F.—2°F. max.; above 67°F.—0.5°F.
 max.

	<p>decreases—over 55°F.—2°F. max./hr.; 55°F. to 32°F.—2°F. max., provided that water temperature must be below 40°F. in the winter season and above 44°F. in the summer season.</p> <p>Non-salmonid fish—(Class D-3)</p> <p>increase—32°F. to 85°F.—4°F. max.; above 85°F.—0.5°F. max. decreases—same as Salmonid fish.</p> <p>Ind.—no allowable temperature change in sufficient quantities to adversely affect the use indicated.</p>
Nebraska	<p>PWS—5°F. change limit, May–Oct.; 10°F. change limit, Nov.–April; limit of 2°F./hr.</p> <p>Rec.—same as PWS</p> <p>Trout Streams—65°F. max., 5°F. change limit</p> <p>Warm water streams—90°F. max., change limits same as PWS</p> <p>Missouri River (Gavins Point Dam to Sioux City, Iowa)—85°F. max.; 4°F. change limit</p>
	[p. 9]
Nevada	<p>Max. summer values—30°C. to 20°C. (varies with stream)</p> <p>Max. winter values—14°C.</p>
New Hampshire	Temperature criteria applicable to New Hampshire waters are those set forth in Section 3, pages 28 through 110, of the National Technical Advisory Committee Report "Water Quality Criteria," and in the official standards of the New England Interstate Water Pollution Control Commission.
New Jersey	<p>FW-1—preserve natural conditions</p> <p>FW-2—(PWS)—5°F. change limit up to max. of 87°F. (unless due to natural stream temperature)</p> <p>FW-3—(F & WL)—same as FW-2</p> <p>(change limits not approved for FW-2 & FW-3)</p> <p>Coastal and Tidal waters—no increase that will adversely affect biota*</p> <p>Delaware Bay and Estuary—5°F. change limit above temperature gradient (daily avg.) for 1961–1966, or a max. of 86°F., whichever is less.</p>
New Mexico	<p>Warm water fish.—93°F. max., 5°F. change limit.</p> <p>Cold water fish.—70°F. max., 2°F. change limit.</p> <p>Allowable rise of 9°F. for the lower reach of the Pecos River.</p>
New York	<p>Trout waters—no thermal discharge which will cause adverse affects on trout.</p> <p>Non-trout waters—90°F. max. within mixing zone; 86°F. max., and 5°F. change limit outside mixing zone, plus a 2°F. max. change limit/hr., and/or 9°F. max. change limit for a 24 hr. period. (fresh waters)</p> <p>86°F. max. and 5°F. change limit outside mixing zone, plus a 1°F. max. change limit/hr. and/or 7°F. max. change limit for a 24 hr. period (tidal waters).</p>
	[p. 10]
North Carolina	Class A-II (PWS); Class B; Class C. 5° change limit, maximum of 84°F. for the mountains and upper piedmont, maximum of 90°F. for lower piedmont and coastal plain.

Natural trout waters shall not exceed 68° and shall not be significantly increased as a result of the discharge of heated liquids. Put-and-take trout waters shall not exceed 70°F. and may be increased 3°.

Class D. Not to exceed 5°F. above natural, maximum of 84° in mountains and upper piedmont, and maximum of 90°F. in lower piedmont and coastal plain.

Class SA (Shell.) Allowable rise of 1.5°F. during June, July, and August, 4.0°F. remaining months.

Not to exceed 90°F. due to the discharge of heated effluents.

North Dakota	90°F. maximum all waters. Maximum allowable rise is 5°F. above natural.
Ohio	Aquatic Life A—not to exceed 93°F., May–Nov.; not to exceed 73°F., Dec.–April* Aquatic Life B—not to exceed 95°F. Ind.—not to exceed 95°F.
Oklahoma	5°F. change limit, provided the max. man-made temperature does not exceed 70°F. in trout streams, 75°F. in smallmouth bass streams, or 93°F. in warm water streams.
Oregon	General statement that no measurable increase in temperature allowed when the receiving water temperature is 64°F. or above, or more than 2°F. increase when the receiving water temperature is 62°F. or less. The exceptions follow:

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Multnomah Channel and main stem Willamette River, from mouth to Newberg (RM 50): 70°F. and 68°F., respectively.

Main stem Willamette River from Newberg to confluence of Coast and Middle Forks (R. M. 187): 64°F. and 62°F. respectively.

Main stem Columbia River, main stem Grande Ronde River, Walla Walla River: 68°F. and 66°F., respectively.

Goose Lake. 70°F. or the daily mean ambient air temperature, whichever is greater.

Klamath River: 72°F. and 70°F., respectively.

Marine waters: no significant increase above natural background temperature or water temperatures to be altered to a degree which creates or can reasonably be expected to create an adverse effect on fish or other aquatic life.

Pennsylvania	Trout waters 58°F. max., 5°F. change limit. Warm water fish.—5°F. change limit above natural or 87°F. max., whichever is less; 2°F. change limit per hour. Delaware River Estuary—same as warm water fish, but with 86°F. max. Mahoning River 93°F. max.; 2°F. change limit per hour.
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Puerto Rico	SA—no change SB (Shell.) SC (Rec.) SD (F & WL) SE (Ind.)	} 93°F. max., 4°F. change limit
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Rhode Island	Class A (Excellent)—no increase from other than natural origin.	
	Class B (Rec.)	} 68°F. and 83°F. max. for cold and warm water fish, respectively; 4°F. change limit.
	Class C (F & WL)	
		[p. 12]
	Class D (Nav. & Ind.)—90°F. max., no increase to exceed limits on most sensitive use.	
	Class SA (Shell.)	} No increase over the recommended limits for the most sensitive use.
	Class SB (Bathing)	
	Class SC (Shell. habitat)	
	Class SD (Nav.)	
South Carolina	Class AA (PWS)	} 93.2°F. max. in mixing zone; 10°F. change limit. Must be unheated zone for fish passage.*
	Class A (Red.)	
	Class B (treated PWS)	
	Class C (F & WL)	
	Class C _a (fish survival)	
	Class SA (Shell.)	} Fall, winter, spring, no more than 40°F. above natural; summer, no more than 1.5°F. above natural.
	Class SB (Bathing)	
	Class SC (Crabbing)	
South Dakota	Cold water permanent fish.—68°F. max., 4°F. change limit.	
	Warm water permanent fish.—85°F. max., 4°F. change limit.	
	Warm water semi-permanent.—90°F. max., 8°F. change limit.	
Tennessee	PWS	} 93°F. max., 3°F. change limit per hour; in no case shall the temperature rise more than 10°F. above natural—as measured at an upstream point.
	Rec.	
	Ind.	
	F & WL—same as above but with 68°F. max. for trout*	
	Stock watering & Nav.—no increase other than from natural origin.	
Texas	Canadian River Basin—93°F. max., 5°F. change limit.	
	Tidal waters—fall, winter, and spring, not to exceed a 4°F. rise; summer—not to exceed a 1.5°F. rise	
	All other waters—96°F. max., 5°F. change limit (until adequate stream study is made)	
		[p. 13]
Utah	Cold water fish.—68°F. max., 2°F. change limit.	
	Warm water fish.—80°F. max., 4°F. change limit.	
Vermont	Class A (PWS)—No increase other than natural	
	Class B (Rec.)	} 68°F. and 83°F. max. for cold and warm water fish, respectively; no increase over 4°F. (cold water criteria not approved)
	Class C (F & WL)	
	Class D (Ind.)—90°F. max. or not harmful to assigned uses.	

Virginia

Rules with General State-Wide Application:

The areas in lakes and impoundments of significance to aquatic organisms shall not be raised more than 3°F. above that which existed before the addition of heat of artificial origin. The increase will be based on the monthly average of the maximum daily temperature. Unless a special study proves that a discharge of heated effluent into the hypolimnion (or pumping water from the hypolimnion for discharging back into the same water body) will not produce adverse effects, such practices shall not be approved.

Maximum temperature standards for these waters will be consistent with those of areas upstream and downstream.

2.01 Primary Classification of Waters Within the State

Major class	Geographical area or other description of waters	Temperature of	
		Rise above natural	Maximum
I	Open Ocean (Seaside of the Land Mass).	4.0 (Sept.-May) 1.5 (June-Aug.)	— —
II	Estuarine (Tidal Water—Coastal Zone to Fall Line).	4.0 (Sept.-May) 1.5 (June-Aug.)	— —
III	Free Flowing Streams (Coastal Zone and Piedmont Zone to the Crest of the Mountains).	5	90
IV	Mountainous Zone	5	[p. 14] 87
V	Put and Take Trout Waters	—	70
VI	Natural Trout Waters	—	70

Special Standards:

Temperature standard to be established for lakes and impoundments receiving thermal discharges:

In lakes and reservoirs, the temperature of the epilimnion, in those areas where important organisms are most likely to be adversely affected, shall not be raised more than 3°F. above that which existed before the addition of heat of artificial origin. The increase is to be based on the monthly average of the maximum daily temperature. Unless a special study shows that a discharge of a heated effluent into the hypolimnion (or pumping water from the hypolimnion for discharging back into the same water body) will be desirable, such practice shall not be approved.

Portions of interstate streams shared with the State of West Virginia not classified for trout would match the State's temperature requirements of a maximum of 81°F. and an allowable rise of no more than 5°F.

Virgin Islands

Class A (preservation of natural phenomena)—no change.
Class B (Rec. & F & WL)—90°F. max.; fall, winter, spring—4°F. allowable rise; spring 1.5°F. allowable rise.

Washington

Class AA (extraordinary waters)—No measurable increases in temperature permitted within the waters designated which

result in water temperatures exceeding 60°F. (Fresh water) or 53°F. (Marine water) nor shall the cumulative total of all such increases arising from nonnatural causes be permitted in excess of $t = 75 / (T - 22)$ (Fresh water) or $t = 24 / (T - 39)$ (Marine water); for purposes hereof "t" represents the permissive increase and "T" represents the resulting water temperature.

Class A (excellent waters)—65°F. and 61°F. max. for fresh and marine waters, respectively. $t = 90 / (T - 19)$ and $t = 40 / (T - 35)$ for fresh and marine waters, respectively.

[p. 15]

Class B (good waters)—70°F. and 66°F. max. for fresh and marine waters, respectively. $t = 110 / (T - 15)$ and $t = 52 / (T - 32)$ for fresh and marine waters, respectively.

Class C (fair waters)—75°F. and 72°F. max. for fresh and marine waters, respectively. $t = 125 / (T - 12)$ and $t = 64 / (T - 29)$ for fresh and marine waters, respectively.

Wisconsin F & WL—in waters where this use is of primary importance —84°F. max., 5°F. change limit, 2°F. change limit per hour. Where fishing is an additional use—89°F. max., 5°F. change limit. In addition, authorization is required for proposed installations where thermal discharges may increase natural temperature by 3°F.

Trout streams—no temperature change that will adversely affect trout.

Ind.—89°F. max.

West Virginia Class B2 (Ind.)—safe fish passage required
Class C (F & WL)—not to exceed 93°F. May–Nov.; not to exceed 73°F. Dec.–April; 5°F. rise limit; 2°F./hr change rate.

Class D (cooling)—same as Class C

Class E (waste transport)—fish passage required

Wyoming Streams where natural temperatures exceed 70°F., 4°F. change limit over natural.

Streams where natural temperatures are less than 70°F., 2°F. change limit over natural.

(Until study is made, Max. temperature limit is daily average plus allowable rise.)

[p. 16]

4.5b "STANDARDS FOR DISINFECTION"

Environmental Protection Agency, Division of Water Quality Standards, May 1971

Disinfection is employed to protect public water supplies, primary- and secondary-body-contact recreational waters, shellfisheries (because oysters, clams, and mussels can accumulate microorganisms, including bacteria and viruses, and transmit them to consumers), and agricultural waters for domestic animals. Disinfection reduces the water-borne coliforms—organisms existing in feces, and other sources, used as indicators of pathogen content of the disease-producing

potential of water. Inadequately disinfected sewage can contaminate receiving waters with *Salmonella*, *Shigella*, *Escherichia coli*, *Leptospira*, and *Mycobacterium*. Enteric viruses such as polio and hepatitis can also be present.

Individual State-adopted standards follow.

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WATER QUALITY STANDARDS SUMMARY

DISINFECTION

Alabama	"All sewage discharged to waters of the State used as sources of public water supply, used for the harvesting of oysters or customarily used by the public for swimming and other whole body water-contact activities shall receive a minimum of secondary treatment and, if necessary, disinfection."
Alaska	Disinfection required where necessary.
Arizona	Chlorination is required when wastes contain pathogenic organisms.
Arkansas	No specific requirement found in standards.*

* The State Water Pollution Control Commission has the authority to require whatever treatment is necessary including disinfection of effluents.

California	North Coastal streams only—Treated wastes which may indirectly enter a North Coastal stream must be disinfected so as to contain not more than a median MPN of 50/100 ml total coliform.
Colorado	"All wastes capable of treatment or control prior to discharge into any waters of the State, shall receive secondary treatment with disinfection or its industrial waste equivalent, as determined by the State Water Pollution Control Commission."
Connecticut	All sewage treatment plant effluents must be disinfected before discharged to any of the State's inland or coastal waters.
Delaware	"All wastes (exclusive of storm water bypass) containing human excreta or disease producing organisms shall be chlorinated."
Florida	(No requirement found in standards.)
Georgia	Secondary treatment or the equivalent with disinfection is a basic requirement for all wastes discharged to Georgia waters.
Hawaii	(No requirements found in standards.)

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Idaho	Communities and industries...having primary treatment no current waste treatment needs will be required to provide secondary treatment or its equivalent...Secondary treatment with disinfection or the equivalent will be required for all new domestic waste discharges.
Illinois	Disinfection with up to 1 mg/l of chlorine residual in the effluent to reduce coliform 5000 or less, where necessary (is re-

quired) . . . (least stringent criteria—most regulations have stricter requirements). (Tertiary or other advance treatment or modifications of conventional treatments will be specified for all intermittent streams and small or low flow streams and shall include effluent disinfection at least through the statements in "Technical Release 20-22," April 1, 1967.)

Indiana	Continuous disinfection is to be provided throughout the year for all municipal wastewater treatment plant effluent in the Lake Michigan Basin. "The Indiana implementation plan shows disinfection specified for most sewage effluents."
Iowa	"Where a significant coliform or other bacterial increase in a designed Recreation Use Area can be identified with a controllable waste discharge, chlorination or other control procedures to reduce the bacterial concentration below the guide limits may be required."
Kansas	"All treated wastes discharged to ephemeral streams which flow through populated areas or are discharged in the vicinity of body contact recreational areas must be chlorinated . . ."
Kentucky	Specific treatment requirements are not included in Kentucky Standards.*

* The State Water Pollution Control Commission has the authority to require whatever treatment is necessary including disinfection of effluents.

Louisiana	(No requirements found in standards.)
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Maine	"Effluent disinfection will be required on a year-round basis for all effluent from sewage treatment plants as well as any other waste treatment plant effluent containing fecal material or other substances which without adequate disinfection would be inimical to the public health. Such disinfection will be required for all classes of water."
Maryland	(No requirement found in standards.)
Massachusetts	<p>Freshwater—"All wastes shall receive appropriate waste treatment which is defined as secondary treatment with disinfection or its industrial waste treatment equivalent except when a higher degree of treatment is required to meet the objectives of the water quality standards, all as determined by the Division of Water Pollution Control. Disinfection from October 1 to May 1 may be discontinued at the discretion of the Division of Water Pollution Control."</p> <p>Coastal or Marine Waters—"Appropriate treatment is defined as the degree of treatment with disinfection required for the receiving waters to meet their assigned State or interstate classification and to meet the objectives of the water quality standards. Disinfection from October 1 to May 1 may be discontinued at the discretion of the Division of Water Pollution Control."</p> <p>Freshwater and Coastal or Marine Waters—"The amount of disinfection required shall be equivalent to a free and com-</p>

bined chlorine residual of at least 1.0 mg/l after 15 minutes contact time during peak hourly flow or maximum rate of pumpage."

Michigan "Year around disinfection of all final effluents from sewage treatment plants is required."

Minnesota "No treated sewage, or industrial waste or other wastes containing viable pathogenic organisms, shall be discharged into interstate waters of the State without effective disinfection. Effective disinfection of any discharges, including combined flows of sewage and storm water, may be required where necessary to protect the specified uses of the interstate waters."

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Mississippi (No requirement found in standards.)

Missouri (No requirement found in standards.)

Montana The minimum treatment requirement for domestic sewage discharged to the Missouri and Mississippi Rivers drainages is . . . "Primary treatment and disinfection."

Nebraska (No requirement found in standards.)

Nevada (No requirement found in standards.)

New Hampshire Section 311:3:1 of Chapter 311 Laws of 1967 states: "Insofar as practicable, the initial objective of the control program will be to obtain the installation of primary treatment (with adequate disinfection where sewage discharges are involved) for all discharges of sewage and industrial wastes."

New Jersey "Year-round effective disinfection is an accepted method of treatment required in New Jersey for most domestic wastes and other wastewaters. Effective disinfection is hereby defined as:
(a) One (1) mg/l combined chlorine residual after a thirty (30) minute contact period based on design flow or a twenty (20) minute contact period during peak hourly flow or maximum rate of pumping.
(b) Coliform organisms not to exceed an MPN of 240 per 100 milliliters.

New Mexico (No requirement found in standards.)

New York Continuous year-round disinfection of sewage treatment plant effluents.

North Carolina (No requirement found in standards.)

North Dakota Effective disinfection of any treated discharges, whether sewage, industrial wastes, or other wastes, or overflow discharges from combined storm water and sanitary discharge, if such discharges constitute a *potential or actual interference* with the intended usage of the waters of the Red River of the North, the Boise de Sioux, and parts of the Sheyenne and Pembina Rivers may be required by the State Health Department. Disinfection was not mentioned in standards for other interstate waters.

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Ohio	<p>Secondary treatment and disinfection is required for effluents discharged to the Ohio River. Disinfection that will maintain coliform concentrations below 5,000 organisms per 100 ml at public water supply intakes, and not to exceed 1,000 organisms per 100 ml where and when the receiving waters in proximity to the discharge point are used for recreational purposes are required for the interstate waters of Lake Erie. All effluents discharged to the Great Miami, Whitewater, and Wabash River Basins will be satisfactorily disinfected to meet the criteria for downstream water uses.</p> <p>All sewage effluents discharged to the Mahoning River, Pymatuning and Yankee Creeks, and Little Beaver Creek will be satisfactorily disinfected to meet the stream-water quality criteria. All municipal sewage effluents discharged to the Maumee, Tiffin, St. Joseph, and St. Marys River Basins will be disinfected in a manner that will maintain coliform concentrations not to exceed 5,000 organisms per 100 ml at public water supply intakes, and not to exceed 1,000 per 100 ml where and when the receiving waters in proximity to the discharge point are used for recreational purposes involving bodily contact. Municipal sewage treatment plant effluents discharged to the Ashtabula River, Conneaut Creek, and Turkey Creek including interstate waters of Ohio and Pennsylvania will be disinfected in a manner that will maintain coliform concentrations not to exceed 5,000 organisms per 100 ml at public water supply intakes, and not to exceed 1,000 organisms per 100 ml where and when the receiving waters in proximity to the discharge point are used for recreational purposes involving bodily contact.</p>
Oklahoma	<p>All interstate rivers and tributaries of same have the following requirement: "... Waste discharges into waters used or capable of being used for domestic water supplies or body contact aquatic sports including skiing and swimming, shall receive disinfection or equivalent treatment as necessary..."</p>
	[p. 5]
Oregon	<p>All sewage shall receive a minimum of secondary treatment or equivalent (equal to at least 85% removal of 5-day biochemical oxygen demand and suspended solids) and shall be effectively disinfected before being discharged into any public waters of the State.</p>
Pennsylvania	<p>"Effective disinfection to control disease producing organisms shall be the production of an effluent which will contain..." included as part of definition of secondary treatment.</p>
Rhode Island	<p>"All effluents from domestic wastes treatment plants and industrial waste treatment plants accepting domestic wastes, are and will be chlorinated at all times before their discharge to a water course."</p>
South Carolina	<p>(No requirement found in standards.)</p>
South Dakota	<p>Effective disinfection of any wastewater discharges, including</p>

sewage, industrial wastes, other wastes and overflows from combined storm and sanitary sewer systems, if these discharges constitute an actual or potential interference with the intended beneficial uses of these waters, may be required by the (South Dakota) Committee (on Water Pollution).

Tennessee

(No requirement found in standards.)

Texas

It is the policy of the State of Texas, acting through the Texas Water Quality Board, to require primary and secondary treatment and disinfection (except for oxidation pond effluents) at all facilities serving the general public and which treat domestic sanitary wastes.

Utah

While the standards described apply generally to receiving stream flow, they can and must become effluent standards as required by lack of dilution water. Furthermore, because of the public health ramifications of the standard for coliform bacteria, it is presently an effluent standard by reason of the requirements stated in Section I-9 b, Exhibit 5, which limits coliforms to 5,000/100 ml. in any discharges not isolated from the public. This requirement is given additional force by Section III-82 b, Exhibit 5, which recognizes the limited ability of chemical disinfectants, especially chlorine, to kill bacteria which are protected by layers of organic substance, through a requirement for certain biological oxidation treatment prior to final disinfection."

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Part III-82 of the Utah State Department of Health Code of Waste Disposal Regulations explain their chlorination requirements which are:

- (a) Treatment works effluents shall be chlorinated for reduction of bacteria and viruses as required by final conditions of disposal and as stipulated by the Boards.
- (b) In general, chlorination will be considered fully effective for the purposes of these regulations when applied to oxidized effluents retaining not more than 25 percent of the raw wastewater BOD and containing not more than 50 mg/l of BOD and not more than 50 mg/l of suspended solids.
- (e) ... "For disinfection, the capacity should be adequate to produce a residual of 1.0 mg/l in the final effluent..."

Vermont

"Appropriate treatment shall be defined as secondary treatment with disinfection or its industrial waste equivalent as determined by the signatory State regulatory agency. Lesser degrees of treatment or control will be permitted only where it can be demonstrated that attainment of the specified water use class criteria of quality can be effectuated."

Virginia

Minute 59 states: "Chlorination facilities are to be operated continuously during the entire year and a chlorine residual of at least 2.0 ppm shall be maintained at all times... at sewage treatment facilities that discharge effluent to Williams and Upper Machodoc Creeks, King George County."

The Board requires that all treated discharges to the Nansemond River (Suffolk area and Shingle Creek) "...containing bacteria shall be chlorinated sufficiently and continuously (100% of the time) to maintain a residual which will insure substantially complete removal of coliform organisms. This action is to be instituted immediately by all concerned owners." Although disinfection is not specifically required for all State interstate waters, the Board has the necessary authority to require it in specific instances as they deem necessary.

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Washington	Existing and new domestic waste dischargers shall provide adequate secondary sewage treatment, disinfection and outfall facilities. Where existing and new commercial, industrial or domestic wastes discharge to salt water, secondary treatment shall be required unless, after a review of existing data or an engineering study, it can be demonstrated that a lesser degree of treatment will provide for protection of present and future water uses and the preservation or enhancement of existing water quality. In no case, however, will less than primary treatment with disinfection and adequate outfall be accepted.
West Virginia	"Chlorination will be required for all installations and will be employed for twelve months of the year."
Wisconsin	Disinfection of sewage effluents is necessary for a fuller use of our surface waters and in the protection of public health. Disinfection is to be used during the May 1, through October 31 period annually where recreational use is involved. The department will require year around disinfection where public water supplies are involved.
Wyoming	Required at sites determined by studies.
District of Columbia	Although disinfection is not specifically mentioned as a requirement in the adopted water quality standards as submitted and approved by the Secretary of the Interior, later enforcement conferences have required it as a policy.
Virgin Islands	Although disinfection is not specifically noted as a requirement in the water quality standards, the power of the Commissioner of Health to make it one is clearly indicated under the section titled "Implementation and Enforcement Plan."
Guam	No specific requirement found in standards.
Puerto Rico	"Chlorination of treatment plant effluent will be required in those cases in which it is necessary to maintain the receiving body of water within the specified quality for its use."

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4.5c "STANDARDS FOR MERCURY AND HEAVY METALS"

Environmental Protection Agency, Division of Water Quality Standards, May 1971

Mercury, silver, arsenic, cadmium, chromium, copper, lead, nickel, and zinc are heavy metal compounds present in our waters and toxic to man in varying degrees. They are serious pollutants because these stable compounds have persistent and toxic effects for many years following deposit. The heavy metal compounds chromium, cadmium, mercury, and lead have no known biological function in animal life and can act synergistically with other substances to increase toxicity. Marine organisms, especially shellfish, readily take up and concentrate these heavy metals, which are thereafter ingested by man. Once in the human system their toxic effects are cumulative and are harmful to the degree that the dosages and resultant concentrations approach a lethal threshold. The fishery industry has sustained economic losses in recent years when unacceptable levels of mercury or other heavy metals were discovered in fish from contaminated waters, provoking government condemnation of the effected catches. Fishing waters have been closed to fishermen, cutting them off from their livelihood.

EPA generally recommends criteria in the NTAC report, *Water Quality Criteria*, which cites the U.S. Public Health Service Water Standards. These standards list "desirable criteria" as the minimum detectable concentrations of the heavy metal compounds. In effect, this sets the limit to near zero.

Individual State-adopted standards follow.

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FEDERAL-STATE WATER QUALITY STANDARDS AND USPHS DRINKING WATER STANDARDS
FOR MERCURY AND HEAVY METALS¹

All States have been required to adopt statements as a part of general standards applicable to all waters which require that those waters be free of substances attributable to discharges or wastes which are toxic or which produce undesirable physiological responses in human, fish, and other animal life and plants.

State	Metal	Criteria values in mg/l	Use classification to which applied
Alabama	All Toxic materials, Including metals.	Not to exceed 0.1 of the 48 hr. median tolerance limit for fish, aquatic life or shellfish, including shrimp and crabs Narrative Statement.	Shellfish Harvesting Fish and Wildlife. All Classes.
Alaska	USPHS Standards CCE (carbon chloroform extracts) 0.1 USPHS Standards All Toxic materials, Including metals.	Narrative Statement	Class A Water Supply. Class B Water Supply. Recreation. Growth and Propagation of Fish and other aquatic life. Agriculture. Industry. Shellfish.
	All Toxic materials, Including metals. Pesticide (heavy metal constituents).	Narrative Statement 0.001 of the LC50 for the most sensitive organism on 96 hr. exposure.	
Arizona	No Specific Criteria		
Arkansas	All Toxic materials, Including metals.	0.1 48-hr TLM ^a	Fish and Wildlife.
California-Sacramento-San Joaquin Delta.	Cadmium Chromium (hexavalent) Copper Iron Lead Manganese Silver Zinc	0.01 0.05 0.01 0.3 0.05 0.05 0.01 0.1	Water Supply. Water Supply. Water Supply. Water Supply. Water Supply. Water Supply. Water Supply. Water Supply.
Colorado	Cadmium Chromium (hexavalent) Lead Silver Zinc	0.01 0.05 0.05 0.05 0.05	Water Supply. Water Supply. Water Supply. Water Supply. Water Supply.
Connecticut	USPHS Standards		Water Supply.
Delaware	No Specific Criteria		
Florida	Copper Zinc Chromium (hexavalent) Chromium (total)	0.5 1.0 0.50 1.0 in effluent 0.05 after mixing	All Waters. All Waters. All Waters. All Waters. All Waters.

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FEDERAL-STATE WATER QUALITY STANDARDS AND USPHS DRINKING WATER STANDARDS
FOR MERCURY AND HEAVY METALS ¹—Continued

State	Metal	Criteria values in mg/l	Use classification to which applied
	Lead	0.05	All Waters.
	Iron	0.30	All Waters.
Georgia	No Specific Criteria		
Hawaii	No Specific Criteria		
Idaho	(Water Quality Criteria, published by the State of California referenced as a guide)		
Illinois	Cadmium	0.01	Water Supply.
	Chromium (hexavalent)	0.05	Water Supply.
	Chromium (trivalent)	1.00	Water Supply.
	Copper	1.0	Water Supply.
	Iron (total)	0.3	Water Supply.
	Lead	0.05	Water Supply.
	Silver	0.05	Water Supply.
	Zinc	5.0	Water Supply.
	Cadmium	0.05	Aquatic Life.
	Chromium (hexavalent)	0.05	Aquatic Life.
	Chromium (trivalent)	1.00	Aquatic Life.
	Copper	0.04	Aquatic Life.
	Iron	1.00	Aquatic Life.
	Lead	0.1	Aquatic Life.
	Silver	0.05	Aquatic Life.
	Zinc	1.00	Aquatic Life.
Illinois River Basin:	Cadmium	0.05	Water Supply.
	Chromium (hexavalent)	1.0	Water Supply.
1. Wabash Basin	Lead	0.05	Water Supply.
	Silver	0.05	Water Supply.
	All Toxic materials, including metals.	0.1 of 48-hr. median tolerance limit.	Aquatic Life.
2. Ohio and Saline Basins	Cadmium	0.01	Water Supply.
	Chromium (hexavalent)	0.05	Water Supply.
	Lead	0.05	Water Supply.
	Silver	0.05	Water Supply.
	All Toxic materials, including metals.	0.1 of 48-hr. median tolerance limit.	
3. Mississippi River between Illinois and Iowa.	Cadmium	0.01	Water Supply.
	Chromium (hexavalent)	0.05	Water Supply.
	Lead	0.05	Water Supply.
	Cadmium	0.05	Aquatic Life.
	Chromium (hexavalent)	0.05	Aquatic Life.
	Chromium (trivalent)	1.00	Aquatic Life.

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FEDERAL-STATE WATER QUALITY STANDARDS AND USPHS DRINKING WATER STANDARDS
FOR MERCURY AND HEAVY METALS —Continued

State	Metal	Criteria values in mg/l	Use classification to which applied
	Copper	0.02	Aquatic Life.
	Lead	0.10	Aquatic Life.
	Zinc	1.0	Aquatic Life.
	All Toxic materials, including metals.	max. 5.0	Aquatic Life.
4. Mississippi River between Illinois and Missouri.	No Specific Criteria		
5. Wabash River and Tributaries.	Cadmium	0.01	Water Supply.
	Lead	0.05	Water Supply.
	Silver	0.05	Water Supply.
	Chromium	0.05	Water Supply.
	(hexavalent)		
	All Toxic materials, including metals.	0.1 of 48-hr. median tolerance limit.	Aquatic Life.
6. Illinois River and Lower Section of Des Plaines River.	Cadmium	0.01	Water Supply.
	Chromium	0.05	Water Supply.
	(hexavalent)		
	Chromium	1.00	Water Supply.
	(trivalent)		
	Copper	1.0	Water Supply.
	Iron (total)	0.3	Water Supply.
	Lead	0.05	Water Supply.
	Silver	0.05	Water Supply.
	Zinc	5.0	Water Supply.
	All Toxic materials, including metals.	0.1 of 48-hr. median tolerance limit.	Aquatic Life.
	Cadmium	0.05	Aquatic Life.
	Chromium	0.05	Aquatic Life.
	(hexavalent)		
	Chromium	1.00	Aquatic Life.
	(trivalent)		
	Copper	0.04	Aquatic Life.
	Iron	1.00	Aquatic Life.
	Lead	0.1	Aquatic Life.
	Silver	0.05	Aquatic Life.
	Zinc	1.00	Aquatic Life.
7. Lake Michigan, Little Calumet, Grand Calumet, Rivers, and Wolf Lake:			
(a) Lake	Iron (Fe)	Annual Av.	All Classifications.
Michigan		not more than	
Open		0.15	
Waters.	USPHS Standards		Water Supply.
(b) Lake			
Michigan			
Shore			
Waters.	USPHS Standards		Water Supply.

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FEDERAL-STATE WATER QUALITY STANDARDS AND USPHS DRINKING WATER STANDARDS
FOR MERCURY AND HEAVY METALS ¹—Continued

State	Metal	Criteria values in mg/l	Use classification to which applied
(c) Little Calumet River.	No Narrative Statement or Specific Criteria Assigned.		All Classifications.
(d) Wolf Lake.	No Narrative Statement or Specific Criteria Assigned.		All Classifications.
(e) Grand Calumet River.	No Narrative Statement or Specific Criteria Assigned.		All Classifications.
8. Chicago River and Calumet River System, and Calumet Harbor Basin:			
(a) Chicago River from Lake Michigan to Con- fluence with the North Br. and the S. Branch, the North Shore Channel.	Cadmium .....0.05 Chromium .....0.05 (hexavalent) Chromium .....1.00 (trivalent) Copper .....0.04 Iron .....1.00 Lead .....0.1 Silver .....0.05 Zinc .....1.00 All Toxic materials, including metals.	0.05 0.05 1.00 0.04 1.00 0.1 0.05 1.00 0.1 of 48-hr. median tolerance limit.	Aquatic Life and Recreation. Aquatic Life and Recreation. Aquatic Life and Recreation. Aquatic Life and Recreation. Aquatic Life and Recreation. Aquatic Life and Recreation. Aquatic Life and Recreation. Aquatic Life and Recreation. Aquatic Life and Recreation.
(b) Calumet Harbor Basin.	USPHS Standards		Water Supply.
9. Effluent Criteria Appli- cable to all Illinois Discharges.			
	Cadmium .....0.05 Chromium .....0.05 (hexavalent) Chromium .....1.0 (trivalent) Copper .....0.04 Iron .....10.0 Lead .....0.1 Silver .....0.05 Zinc .....1.0	0.05 0.05 1.0 0.04 10.0 0.1 0.05 1.0	Effluents. Effluents. Effluents. Effluents. Effluents. Effluents. Effluents. Effluents. Effluents.
Indiana	Cadmium .....0.01 Chromium .....0.05 (hexavalent) Lead .....0.05 Silver .....0.05 All Toxic materials, including metals.	0.01 0.05 0.05 0.05 0.1 96-hr. TLm	Water Supply. Water Supply. Water Supply. Water Supply. Aquatic Life.
Iowa	Cadmium0.01 Chromium0.05 (hexavalent) Lead0.05 Lead0.10 Chromium1.00 (trivalent)	0.01 0.05 0.05 0.10 1.00	Water Supply and Fish and Wildlife. Water Supply and Fish and Wildlife. Water Supply and Fish and Wildlife. Fish and Wildlife. Fish and Wildlife.

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FEDERAL-STATE WATER QUALITY STANDARDS AND USPHS DRINKING WATER STANDARDS
FOR MERCURY AND HEAVY METALS ¹—Continued

State	Metal	Criteria values in mg/l	Use classification to which applied
	Copper	0.02	Fish and Wildlife.
	Zinc	1.0	Fish and Wildlife.
Kansas	USPHS Standards		Water Supply.
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Kentucky	Cadmium	0.01	Water Supply.
	Chromium	0.05	Water Supply.
	(hexavalent)		
	Lead	0.05	Water Supply.
	Silver	0.05	Water Supply.
	All Toxic materials, including metals.	0.1 48-hr. TLm	Fish and Wildlife.
Louisiana	All Toxic materials, including metals.	0.1 48-hr. TLm	All Classifications.
Maine	No Specific Criteria		
Maryland	No Specific Criteria		
Massachusetts	No Specific Criteria		
Michigan	Chromium	0.05	Water Supply.
	(hexavalent)		
Minnesota	Copper	1.0	Water Supply.
	Iron	0.3	Water Supply.
	Manganese	0.05	Water Supply.
	Zinc	5	Water Supply.
	Cadmium	0.01	Water Supply.
	Chromium	0.05	Water Supply.
	(hexavalent)		
	Lead	0.05	Water Supply.
	Silver	0.05	Water Supply.
	Chromium	trace	Class A Fisheries and Recreation.
	Copper	trace	Class A Fisheries and Recreation.
	Chromium	1.0	Class B Fisheries and Recreation.
	Copper	0.2	Class B Fisheries and Recreation.
Mississippi	Cadmium	0.01	Water Supply.
	Chromium	0.05	Water Supply.
	(hexavalent)		
	Lead	0.05	Water Supply.
	Silver	0.05	Water Supply.
	All Toxic materials, including metals.	0.1 48-hr. TLm	Fish and Wildlife.
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Missouri	No Specific Criteria		
Montana	All Toxic materials, including metals.	0.00 Above Background Levels.	Water Supply Class A Closed.
	USPHS Standards		
	All Toxic materials.	Induced variation limited to a 10% Increase of concentration.	Water Supply Class A Open.

FEDERAL-STATE WATER QUALITY STANDARDS AND USPHS DRINKING WATER STANDARDS
FOR MERCURY AND HEAVY METALS ¹—Continued

State	Metal	Criteria values in mg/l	Use classification to which applied
	USPHS Standards		Water Supply Class B.
	All Toxic materials, including metals.	Not to Exceed 0.1 96-hr. TLM for residual materials nor 0.01 of the 96-hr. TLM for pesticides and organic materials with a residual life exceeding 30 days.	Fish and Wildlife Classes D-1, D-2, D-3.
	All Toxic materials, including metals.	Narrative Statement	Agricultural Water Supply Class E.
	All Toxic materials, including metals.	Narrative	Industrial Water Supply (other than food).
Nebraska	USPHS Standards		All Uses.
Nevada	No Specific Criteria		
New Hampshire	No Specific Criteria		
New Jersey	No Specific Criteria		
New Mexico	All Toxic materials, including metals.	Not to exceed 10% of the 48-hr. TLM.	All Classes.
New York	No Specific Criteria		
North Carolina	All Toxic materials, including metals.	0.0	Water Supply.
<p><i>The maximum limits for toxic and other deleterious substances in receiving waters shall not exceed the values recommended in the most recent edition of the "Report of the National Technical Advisory Committee on Water Quality" where stated and in cases where such values are not included in the report bioassays will be conducted according to the standards techniques recommended therein to determine safe levels for such substances on the basis of the discharge and characteristics of the waters under consideration.</i></p>			
North Dakota	Cadmium	0.01	All uses of the Red River of the North, the Boisé De Sioux, and parts of the Sheyenne and Pembino Rivers.
	Chromium (total)	1.0	
	Chromium (trivalent or hexavalent)	0.05	
	Copper	0.1	
	Lead	0.05	
	USPHS Standards		Water Supply.
Ohio	Cadmium	0.01	Water Supply.
	Chromium (hexavalent)	0.05	Water Supply.
	Lead	0.05	Water Supply.
	Silver	0.05	Water Supply.
	Iron (certain Rivers on Ohio/Pa. border only).	1.5	Water Supply.
	All Toxic materials, including metals.	0.1 48-hr. TLM	Aquatic Life and Recreation.
Oklahoma	All Toxic materials, including metals.	0.1 48-hr. TLM	Water Supply.

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FEDERAL-STATE WATER QUALITY STANDARDS AND USPHS DRINKING WATER STANDARDS
FOR MERCURY AND HEAVY METALS ¹—Continued

State	Metal	Criteria values in mg/l	Use classification to which applied
Oregon: These criteria apply only to the Multnomah channel and the Main Stem Willamette River, the Main Stem of the Columbia River from the eastern Oregon-Washington border westward to the Pacific Ocean, the Main Stem of the Grande Ronde River, the Main Stem of the Walla Walla River, and the Main Stem of the Snake River. The remaining Interstate streams and estuaries are protected by a narrative statement.			
	Cadmium	0.01	All Uses.
	Chromium	0.05	All Uses.
	Copper	0.005	All Uses.
	Iron	0.1	All Uses.
	Lead	0.05	All Uses.
	Manganese	0.05	All Uses.
	Zinc	0.1	All Uses.
	Heavy Metals	0.5	All Uses.
	(Totals Including copper, lead, zinc, and others of non- specific designation).		
Pennsylvania: These specific criteria are applicable only to specific reaches of interstate waters as designated in Section 6 of the Pennsylvania Water Quality Standards.			
	Manganese	1.0	All Uses.
	Iron (total)	1.5	All Uses.
	Iron dissolved	0.3	All Uses.
Rhode Island	No Specific Criteria		
South Carolina	All Toxic materials, Including metals.	0.0	Water Supply.
South Dakota	USPHS Standards		Water Supply.
	Iron	0.2	Fish and Wildlife.
Tennessee	No Specific Criteria		
Texas	No Specific Criteria		
Utah	USPHS Standards		All Uses.
Vermont	No Specific Criteria		
Virginia	No Specific Criteria		
Washington	No Specific Criteria		
West Virginia	Cadmium	0.01	
	Chromium	0.05	
	(hexavalent)		
	Lead	0.05	
	Silver	0.05	All Classifications.
Wisconsin	No Specific Criteria		
Wyoming	No Specific Criteria		
District of Columbia	No Specific Criteria		
Guam	No Specific Criteria		
Puerto Rico	No Specific Criteria		

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FEDERAL-STATE WATER QUALITY STANDARDS AND USPHS DRINKING WATER STANDARDS
FOR MERCURY AND HEAVY METALS ¹—Continued

State	Metal	Criteria values in mg/l	Use classification to which applied
Virgin Islands	No Specific Criteria	

¹ Heavy metals considered: Cadmium, Chromium, Copper, Iron, Lead, Manganese, Silver, Zinc.

² The TLM is the concentration of a toxic material which produced death to one-half of the test organisms in a bioassay test within a specified length of time (e.g. 48 hours or 96 hours).

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4.5d "STANDARDS FOR RADIOACTIVE MATERIALS"

Environmental Protection Agency, Division of Water Quality Standards, May 1971

Since radioactive materials such as radium, strontium 90, and tritium, are toxic to man as well as being cumulative in his system, these pollutants are subject to control, monitoring, and measurement whatever the contact medium. The total radiation in an individual's environment—his job and medical treatments; the food and water he consumes, and air he breathes—must be considered. Radiation enters our environment from various sources: mining and processing of radioactive ores; nuclear weapons testing fallout; power reactor emissions; and medical, research, and industrial uses, as well as natural emissions from stellar bodies and geological deposits.

The EPA recommended criteria limits on these materials in water are:

	pc/l
Gross Beta	500
Radium	1.0
Strontium-90	10.0
Tritium	3000.0

These criteria essentially duplicate or parallel the recommended limits in the U. S. Public Health Service Water Standards, cited by the NTAC report, *Water Quality Criteria*.

Individual State-adopted standards follow.

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WATER QUALITY STANDARDS SUMMARY

RADIOLOGICAL CRITERIA

Of the 50 States and 4 other jurisdictions which established inter-state water quality standards under the Federal Water Pollution Control Act, *all* but the following established specific radiological standards: New Hampshire, North Dakota, Pennsylvania, Tennessee, the District of Columbia, Puerto Rico and the Virgin Islands. These

latter seven standards contain general narrative criteria restricting the addition of toxic materials to interstate waters to concentrations that will not impair the designated uses, and the term "toxic materials" is interpreted to include radioactive materials.

The water quality standards submitted by the States contain several types of radiological criteria, which are briefly discussed in the following items. These items are also referenced in the table headings.

Item A. Narrative statements.

Item B. Criteria which duplicate or reference the radiological criteria of the U.S. Public Health Service Drinking Standards (1962). These standards provide limits for two radionuclides, strontium-90 ($10 \mu\mu\text{c/liter}$) and radium-226 ($3 \mu\mu\text{c/liter}$, with a screening limit of $1000 \mu\mu\text{c/liter}$ for gross beta concentrations).

Item C. Criteria which limit the concentration of specific radionuclides to $1/30$ of the maximum permissible concentrations (MPC_w) for a 168-hour week reported in the National Bureau of Standards (NBS) Handbook 69.

Item D. Criteria equivalent to Item C except that a limit of $1/10$ rather than $1/30$ of MPC_w is specified.

Item E. Other types of criteria.

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State	1/30 NBS Hbk. 69 (Item C)	PHS Stnds. (Item B)	Narrative (Item A)	1/10 NBS Hbk. 69 (Item D)	Other (Item E)	Additional Provisions
Alabama		X				PHS Shellfish Stnds.
Alaska		X				PHS Shellfish Stnds.
Arizona	X	X				Narr.—protect aquatic life; prevent concentrations of radioactive material in aquatic life.
Arkansas		X		X		
California		X		X		
				Note: limit not approved by Pacific South-west Region		
Colorado	X	X				Narr.—minimize discharge.
Connecticut					Gross alpha and beta limits only	Narr.—protect aquatic life.
Delaware					Gross alpha and beta limits only	
Florida	X					
Georgia	X	X				
Hawaii	X	X				Narr.—protect aquatic life.

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Continued

State	1/30 NBS Hbk. 69 (Item C)	PHS Stnds. (Item B)	Narrative (Item A)	1/10 NBS Hbk. 69 (Item D)	Other (Item E)	Additional Provisions
Idaho	X	X				Narr.—minimize discharges; protect aquatic life.
Illinois		X				
Indiana					Gross beta limit only	
Iowa	X	X	X		Gross beta limit only	
Kansas					Kansas Radiation Protection Regulation	
[p. 3]						
Kentucky		X				
Louisiana				X		
Maine		X				Narr.—protect aquatic life; prevent concentrations of radioactive material in aquatic life.
Maryland			X			
Massachusetts			X			Narr.—protect aquatic life; prevent concentrations of radioactive materials in aquatic life.
Michigan		X	X			
Minnesota		X	X			
Mississippi		X				PHS Shellfish Stnds.
Missouri		X				
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Montana		X				Narr.—protect aquatic life; A—Closed waters —no allowable radioactivity above naturally occurring levels.
Nebraska					Radiological Health Regulations, State of Nebraska	
Nevada		X			Has agreed to adopt 1/30 Hbk. 69	
New Hampshire					General protection vs. toxic materials	
New Jersey					Gross alpha and beta limits only	
New Mexico ..	X	X				Narr.—minimize discharges; protect aquatic life.
[p. 5]						
New York		X				
North Carolina		X				PHS Shellfish Stnds.
North Dakota					Gen. protection vs. toxic materials	
Ohio		X				
Oklahoma		X		X		

Continued

State	1/30 NBS Hbk. 69 (Item C)	PHS Stnds. (Item B)	Narrative (Item A)	1/10 NBS Hbk. 69 (Item D)	Other (Item E)	Additional Provisions
Oregon			X			Narr.—protect fishes, shellfishes, wildlife, irrigated crops, livestock, and dairy products.
Pennsylvania					Gen. protection vs. toxic materials	
Rhode Island		X				Narr.—protect aquatic life.
South Carolina		X	X			
South Dakota			X			
Tennessee					Gen. protection vs. toxic materials	
Texas		X		X		
Utah	X					Narr.—prevent concentration of radioactive materials in aquatic life.
Vermont		X	X			
Virginia			X			Narr.—protect shellfish.
Washington			X			
West Virginia		X				
Wisconsin		X			AEC Title 10	
Wyoming	X	X				Narr.—minimize discharges.
District of Columbia					Gen. protection vs. toxic materials	
Guam	X	X				Narr.—protect aquatic life; prevent concentration of radioactive materials in aquatic life.
Puerto Rico					Gen. protection vs. toxic materials	
Virgin Islands					Gen. protection vs. toxic materials	

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4.5e "STANDARDS FOR PHOSPHATES"

Environmental Protection Agency, Division of Water Quality Standards, June 1971

PHOSPHATE CRITERIA

Alabama	There are no specific criteria or narrative statement limiting phosphate or any other nutrient in the aquatic environment.
Alaska	There is no specific criteria or narrative statement directed at the limitation of such nutrients as phosphate. Unless the toxic

material standards or the taste and odor standards could be applied to phosphate problems there is only one other possibility. That is the following Policy Statement of the State of Alaska: *Alaska Statutes Title 46, Chapter 05, Section 46,05,010*: "It is the public policy of the state to maintain reasonable standards of purity of the waters of the state consistent with public health and public enjoyment, the propagation and protection of fish and wild life, including birds, mammals, and other terrestrial and aquatic life, and the industrial development of the state, and to require the use of all known available and reasonable methods to prevent and control the pollution of the waters of the state."

Arizona

Policy statement: ... "Other methods and degrees of treatment will be required, as appropriate, to remove nutrients, oily constituents, and other polluting materials from waters before discharge. All waters of the State shall be free from materials attributable to domestic or industrial waste or other controllable sources in amounts sufficient to produce taste or odor in the water or detectable off-flavor in the flesh of fish, or in amounts sufficient to change the existing color, turbidity, or other conditions in the receiving stream to such degree as to create a public nuisance, or in amounts sufficient to interfere with any beneficial use of the water."

Arkansas

No phosphate statement or criteria.

California

They define "*Water Quality Control*" as the control of any factor which adversely and unreasonably impairs the quality of the waters of the State for beneficial use. (California Water Control Act, Section 13005.) Pollution control is an important part of water quality control."

Goose Lake narrative statement regarding plankton indicates that if nutrients including phosphates accumulated to the degree that they cause plankton blooms they would

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be subject to control. "The Total Plankton Population Shall Be Maintained Below Bloom Level: This objective is designed to protect fishlife and recreational use of the lake by limiting the concentration of plankton below the bloom level which is defined as that plankton concentration which causes significant nuisance conditions, or significantly affects desirable fish population."

Sacramento-San Juan Delta no phosphate criteria or statement. "*Materials Stimulating Algal Growth*." "Materials stimulating algal growth shall not be present in concentration sufficient to cause objectionable algal densities." "Plankton Blooms are encouraged by the presence, in sufficient concentrations of several nutrient materials. Among these are nitrogen, phosphorus, silica, vitamins, iron and other metals and dissolved salts.

Tidal Waters Inland From The Golden Gate Within The San Francisco Bay Region. ... "In no case shall nutrients be present in concentrations sufficient to cause deleterious or abnormal

biotic growths except when factors which are not controllable cause greater concentrations. (Note A)."

West Fork Carson River: "Phosphates: A mean annual concentration less than 0.05 mg/l and a maximum concentration not to exceed 0.1 mg/l at any time."

Truckee River: "Phosphates: A mean annual concentration less than 0.1 mg/l, and a maximum concentration not to exceed 0.3 mg/l at any time."

East Fork Carson River: "Phosphates: A mean annual concentration less than 0.1 mg/l, and a maximum concentration not to exceed 0.2 mg/l at any time."

West Walker River and Lake Topaz: "Phosphates: A mean annual concentration less than 0.2 mg/l, and a maximum concentration not to exceed 0.3 mg/l at any time."

East Walker River: "A mean annual concentration less than 0.5 mg/l, and a maximum concentration not to exceed 1.0 mg/l at any time."

New River: No narrative statement or specific criteria concerning phosphates.

Colorado River in California: The only statement that might be applicable to phosphate problems is the following

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narrative statement: "The waters shall be free from materials attributable to domestic or industrial waste or other controllable sources, which may produce taste or odor in the water or detectable off-flavor in the flesh of fish, that may alter the water's existing color or turbidity, or that may adversely affect other conditions in the river."

Lake Tahoe: Soluble Phosphorus: A mean annual concentration not greater than 7 micrograms per liter at any point in the lake." A plankton count criteria related to nutrients including phosphates and nitrates is included: "*Plankton Count*: A mean seasonal concentration not greater than 100 per milliliter and a maximum concentration not greater than 500 per milliliter at any point in the lake."

Another plankton standard related to nutrients is: "Plankton Growth Potential: A mean annual growth potential at any point in the lake not greater than twice the mean annual growth potential at the limnetic reference station."

They have stringent narrative statements on foreign materials and taste and odor which would include phosphates and other nutrients.

1. *Foreign Material*: None which impairs the natural beauty, clarity, or purity of the lake."

2. *Taste and Odor Causing Substances*: None which imparts foreign taste or odor to the lake waters."

Coastal Waters, Point Pedras Blancas to Pescadero Point: Phosphates and other nutrients are not covered by these standards.

Coastal Waters, Rincon Point to Point Arguello: Phosphates and other nutrients are not covered by these standards.

Coastal Waters, Point Auguello to Point Piedras Blancas: Phosphates and other nutrients are not covered by these standards.

Pacific Ocean Pescadero Point to Mouth of Tomales Bay, Bolinas Lagoon, Drakes Estero, Limantour, Estero, Portions of Tomales Bay and tidal Porti Ons of coastal streams: Nutrients which include phosphates, nitrates and others are covered by the following narrative statement: "None in concentrations sufficient to cause deleterious or abnormal biotic growths except when factors which are not controllable cause greater concentrations."

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Humboldt-Del Norte Coastal Waters: The following narrative statement on Toxic or other Deleterious substances applies to phosphates, nitrates, and other nutrients: "*Toxic or Other Deleterious Substances:* There shall be no organic or inorganic substances in concentrations . . . which cause deleterious growths of algae or other plant life."

Pacific Ocean Coastal Waters, Rincon Point to San Gabriel River: The only standard that might be applicable is the following narrative statement. "*Other Materials:* Other materials shall not be present in concentrations that would be deleterious to fish, plant or aquatic wildlife."

Mendocino Coast: The following narrative statement applies to phosphates, nitrates, and other nutrients: "*Toxic or Other Deleterious Substances:* There shall be no organic or inorganic substances in concentrations which are toxic or detrimental to human, animal, plant, or aquatic life, which impart undesirable tastes or odors to species of commercial or sport importance, or which cause deleterious growths of algae or other plant life."

Pacific Ocean San Gabriel River to Drainage Divide Between Muddy Canyon and Moro Canyon: Under objective rationale they state: "*Nutrients* . . . The research to date had not been able to develop satisfactory criteria for nutrient levels in open sea water that will not over-stimulate plankton production. Thus, a standard for nutrients is omitted until a basis for such can be found."

Humbolt Bay: The following narrative statement covers all the nutrients including phosphate: "There shall be no organic or inorganic substances in concentrations . . . which cause deleterious growths of algae or other plant life."

Sonoma-Marin Coast: The following narrative statement covers all the nutrients including phosphate. "There shall be no organic or inorganic substances in concentrations . . . which cause deleterious growths of algae or other plant life."

San Diego Bay: The following narrative statement does not specifically name phosphates but applies to all nutrients of which phosphates are one of the important ones: "Nutrient

levels shall be limited to these levels necessary to minimize phytoplankton blooms, thus preventing unsightliness, turbidity, color and oxygen depression."

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Harbors, Marinas and Tidal Prisms in Los Angeles and Ventura Counties: The following narrative statement does not specifically mention phosphates but applies to all nutrients of which phosphates are one of the important ones. *Nutrients:* Nutrients of other than natural origin shall not be present in concentrations capable of causing proliferation of plankton or other undesirable biotic growths.

Klamath River in California: The following narrative statement does not specifically mention phosphate but applies to all nutrients of which phosphates are one of the important ones: "Concentrations of dissolved nutrients shall be maintained at levels below those which may cause undesirable algae blooms, slime or bacterial growth, or other undesirable biological growths."

Tijuana River Basin in California: "Concentrations of nitrates and phosphates of waste origin, by themselves or in combination with naturally occurring nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth."

Smith River: The following narrative statement does not specifically mention phosphate but includes all nutrients of which phosphate is one of the important ones. "There shall be no organic or inorganic substances in concentrations... which cause undesirable algae blooms, lime or bacterial growth, or other undesirable biological growths."

Mission Bay Including Tidal Prism of San Diego River and Agua Hedionda Lagoon: "Nutrients: Concentrations of nitrates and phosphates of waste origin, by themselves or in combination with naturally occurring nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth."

San Gabriel River Tidal Prism: *Nutrients:* of other than natural origin, shall not be present in concentrations capable of causing proliferation of undesirable biotic growths."

Coastal Bays, Marinas and Sloughs Between the San Gabriel River and the Drainage Divide Between Muddy Canyon and Moro Canyon: "Nutrients: Nutrients (nitrogen, silicate, and phosphate) shall not be present, except from natural conditions, in amounts

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that will cause deleterious or abnormal growths to occur on the substrate or to foster biotic growths that are harmful to beneficial uses."

Colorado

There are no specific criteria for any of the nutrients. The narrative statement concerning toxic materials might restrict phosphate at levels where damage to aquatic life occurred.

This statement is as follows: "*Toxic material*: Free from biocides, toxic or other deleterious substances attributable to municipal, domestic, or industrial wastes, or other controllable sources in levels, concentrations or combinations sufficient to be harmful to aquatic life."

Connecticut

The narrative statements concerning taste and odor and chemical constituents are the only standards that could apply to phosphates. "*Taste and Odor*:" For water supply: "None other than of natural origin." Class B and C waters: "None in such concentrations that would impair any usages specifically assigned to this Class nor cause taste and odor in edible fish." Class D: "None in such concentrations that would impair any usages specifically assigned to this class." For coastal and Marine waters: *Class A*: "None allowable."

Class SB, SC, SD: "None in such concentration that would impair any usages specifically assigned to this Class and none that would cause taste and odor in edible fish or shellfish."

Chemical constituents (freshwater): *Class A, B, C, and D*. "Waters shall be free from chemical constituents in concentrations or combinations which would be harmful to human, animal, or aquatic life for the appropriate, most sensitive and governing considerations and approved limits have not been established, bioassay shall be performed as required by the appropriate agencies. For public drinking water supplies the raw water sources must be of such a quality that United States Public Health Service limits, or State limits if more stringent, for finished water can be met after conventional water treatment."

Chemical constituents (coastal and marine): *Class SA*: "None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the waters for any other use."

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"*Class SB, SC, and SD*: None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, or impair the water for any other usage assigned to this Class."

Delaware

The following declaration of policy in 6301, Chapter 63, Title 7, Part VII, Delaware Code is:

"(a) It is declared to be the public policy of the State to maintain within its jurisdiction a reasonable quality of water consistent with public health and public enjoyment thereof, the propagation and protection of fish and wildlife, including birds, mammals, and other terrestrial and aquatic life, and the industrial development of the State.

(b) It is the purpose of this chapter to safeguard the quality of state waters against pollution by (1) preventing new pollution in such waters and (2) controlling any existing pollution."

ment to protect existing high quality waters from excessive amounts of nutrients such as phosphate.

Illinois

The water quality standards for the Interstate Waters, Wabash River and Tributary Streams Crossing into Indiana, Interstate Waters Mississippi River Between Illinois and Missouri, Interstate Waters Ohio River and Saline River, and the Interstate Waters Mississippi River Common Boundary Between Illinois and Iowa do not include specific criteria or a narrative statement directly concerned with limits for phosphates and other nutrients. Specific criteria for phosphate concentrations was included in the water quality standards for the following interstate waters:

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1. *Interstate Waters Illinois River and Lower Section of Des Plaines River:*
 - a. Public Water Supply and Food Processing: "Not to exceed . . . 4.0 mg/l Phosphate . . . 45 mg/l."
 - b. There are no specific criteria or narrative statement concerning limits for phosphates and other nutrients assigned sectors of these waters classified for Aquatic Life, Recreation, and Industrial Water Supply.
2. *Interstate Waters Chicago River and Calumet River System and Calumet Harbor Basin:* "Total Phosphorus, Annual Average not more than 0.05. Single Daily Value or Average, not more than 0.10.
3. *Interstate Waters Lake Michigan and Little Calumet River, Grand Calumet River and Wolf Lake:*
 - a. Lake Michigan Open Water:

Total Phosphates (PO₄):

Annual Average—not more than 0.03

Single Daily Value or Average—not more than 0.04.
 - b. Lake Michigan Shore Water:

Total Phosphates:

Annual Average—not more than 0.03 mg/l

Single Daily Value or Average—not more than 0.04 mg/l.
 - c. Little Calumet River:

None
 - d. Wolf Lake:

Total Phosphates:

Annual Average—not more than 0.03 mg/l

Single Daily Value or Average—not more than 0.04 mg/l.

The following effluent criteria for phosphate and other nutrients has been adopted by the State as part of their standards. "Phosphate—Discharge rate and concentration not to elevate the stream, after reasonable admixture, above 4.0 mg/l." The State has an approved antidegradation statement that could be used

to protect existing high quality waters from excessive phosphate concentrations causing problems.

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Indiana

There are no specific criteria or narrative statement limiting phosphate or other nutrient substances in the Indiana water quality standards for any of the interstate basins other than the Lake Michigan drainages, unless the antidegradation statement could be applied for existing high quality waters.

Indiana recently revised Official Regulation SPCIR-1 and issued SPCIR-2 which limits the amount of phosphate discharge into the Lake Michigan and Lake Erie basins.

The limitation is as follows:

"Phosphorus Removal In Great Lakes Tributary Basins:

The following municipalities will be required to provide at least 80 percent reduction of total phosphorus on or before the end of 1972:

- a. Lake Michigan Basin—Angola, Elkhart, Kendallville, Mishawaka Valparaiso, Chesterton, Gary LAGRANGE Nappanee, Crown Point, Goshen, Ligonier, Portage, East Chicago, Hobart, Michigan City, South Bend.
- b. Lake Erie Basin—Auburn, Butler, Diversified Utilities, Garrett, Berne, Decatur, Fort Wayne, New Haven."

Phosphorus and other nutrient substances criteria for the Lake Michigan Basins:

Lake Michigan Open Water:

Total Phosphates (PO_4) mg/l:

Annual Average— not more than 0.03.

Single Daily Value or Average—not more than 0.04.

Lake Michigan Shore Waters:

Total Phosphates (PO_4) mg/l:

Annual Average—not more than 0.03.

Single Daily Average or Value—not more than 0.04.

Lake Michigan Inner Harbor Basin:

Total Phosphates (PO_4) mg/l

Annual Average—not more than 0.05.

Single Daily Value or Average—not more than 0.10.

Indiana Harbor Canal:

Total Phosphates (PO_4) mg/l

Annual Average—not more than 0.05.

Single Daily Value or Average—not more than 0.10.

Grand Calumet River:

No phosphate criteria or narrative statement.

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Little Calumet River:

No phosphates criteria or narrative statement.

Wolf Lake:

Total Phosphates (PO₄) mg/l

Annual Average—not more than 0.03.

Single Daily Value or Average—not more than 0.04.

Iowa	<p>The following narrative statement could, in my opinion, be used to limit the amount of phosphate and other nutrients in the aquatic environment:</p> <ol style="list-style-type: none"> 1. <i>Public Water Supply.</i> All substances detrimental to treatment processes shall be limited to non-detrimental concentrations in the surface water. 2. <i>Aquatic Life.</i> All substances detrimental to aquatic life shall be limited to non-detrimental concentrations in the surface waters.
Kansas	<p>The only standards regarding the limiting of phosphates in the aquatic environment are as follows:</p> <ol style="list-style-type: none"> 1. Antidegradation statement—Existing high quality waters could be protected from damages resulting from the discharge of effluent containing high phosphate concentrations to the aquatic environment. 2. The general criteria assigned to all of Kansas Interstate Basins—"Pollutional substances will be maintained below maximum permissible concentrations which would be detrimental for public water supplies recreation requirements detrimental for public water supplies, recreation requirements, . . . and other established beneficial uses."
Louisiana	<p>All interstate waters of Louisiana are assigned a general criteria which could be used to protect such waters from excessive concentrations of phosphates or other nutrients. This statement with slight variations of use classifications is:</p> <p>Wastes after discharge . . . shall not create conditions which will adversely affect public health or use of the water for the following purposes: domestic or industrial water supply, propagation of aquatic life, agricultural water, recreation, and other legitimate uses.</p>
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Maine	There are no specific criteria or narrative statement that limit the amount of phosphate in the interstate waters of Maine.
Maryland	There are no specific criteria or narrative statement that limits the amount of phosphate in the interstate waters of Maryland. Freshwater Interstate.
Massachusetts	<p><i>Class A</i> (Public Water Supply) have no criteria or narrative statement concerning phosphate or other nutrients.</p> <p><i>Class B</i> (Public Water Supply and Recreation) "Total phosphate not to exceed an average of 0.05 mg/l as P during any monthly sampling period."</p> <p><i>Class C</i> (Fish and Wildlife) Total phosphate not to exceed an average of 0.05 mg/l as P during any monthly sampling period.</p>

Class D (Power, Industry, Navigation) No specific criteria, or narrative statement limiting concentration of phosphate in Interstate water.

Coastal Waters:

Class SA (Recreation Shellfish) Total phosphate not to exceed an average of 0.07 as P during any monthly sampling period.

Class SB (Recreation, Industry, Shellfish) Total phosphate not to exceed an average of 0.07 mg/l as P during any monthly sampling period.

Class SC (Boating, fish and aquatic life, industry) Total phosphate not to exceed an average of 0.07 mg/l as P during monthly sampling period.

Mississippi The water quality standards have no specific criteria or narrative statement directly limiting the concentration of phosphate or other nutrients in interstate waters.

One of there Freedom Statements would cover nutrients, "Free from substances attributable to municipal, industrial, agricultural or other discharge producing color, odor, or other conditions in such degree as to create a nuisance."

Mississippi has no specific criteria for phosphates.

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Montana *Class D1*—Growth and propagation of Salmonid Fishes and associated aquatic life, waterfowl and beavers.

Class D2—Growth and propagation of Salmonid Fishes and associated aquatic life, waterfowl and beavers.

Class D3—Growth and propagation of Salmonid Fishes and associated aquatic life, waterfowl and beavers.

Under the heading *Esthetic* considerations not covered under other water quality criteria they state: "... No excess nutrients which cause nuisance aquatic growths. ..."

Nebraska The following narrative statement protects waters from excessive nutrients including phosphates:

"...These waters shall be free of substances attributable to discharge or wastes having . . . substances and conditions or combinations thereof in concentrations which produce undesirable aquatic life."

No specific criteria. Has approved antidegradation statement.

Nevada *West Fork Carson River:*

by Interstate *Total Phosphates (PO₄ mg/l)*

Waters Annual Average—not more than .05

Single Daily Value or Average—not more than .10

Leviathan Creek:

No criteria or statement.

East Fork Carson River:

Total Phosphates:

Annual Average—not more than .1

Single Daily Value or Average—not more than .2

*Carson River (At Muller Lane):**Total Phosphates:*

Annual Average—not more than .10

Single Daily Value or Average—not more than .15

*Carson River (Highway 395, So. of Carson):**Total Phosphates:*

Annual Average—not more than 0.5

Single Daily Value or Average—not more than 1.0

*Carson River (Near New Empire):**Total Phosphates:*

Annual Average—not more than 1.0

Single Daily Value or Average—not more than 2.0

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*Carson River (At Weeks):**Total Phosphates:*

Annual Average—not more than 0.30

Single Daily Value or Average—not more than 0.50

*Lake Lahontan:**Total Phosphates:*

Annual Average—not more than 0.40

Single Daily Value or Average—not more than 0.60

*West Walker River (Above diversion to Topaz Lake):**Total Phosphates:*

Annual Average—not more than .2

Single Daily Value or Average—not more than .3

*Topaz Lake:**Total Phosphates:*

Annual Average—not more than 0.2

Single Daily Value or Average—not more than 0.3

*West Walker River (Near Wellington):**Total Phosphates:*

Annual Average—not more than .2

Single Daily Value or Average—not more than .4

*West Walker River (Above confluent with East Walker River):**Total Phosphates:*

Annual Average—not more than 0.2

Single Daily Value or Average—not more than 0.4

Sweetwater Creek:

No specific criteria. Has approved antidegradation statement.

*East Walker River (At State Line):**Total Phosphates:*

Annual Average—not more than .5

Single Daily Value or Average—not more than 1.0

*East Walker River (South of Yerington and above confluent with W. Walker River):**Total Phosphates:*

Annual Average—not more than 0.50

Single Daily Value or Average—not more than 1.00

*Walker River (At J. J. Ranch):**Total Phosphates:*

Annual Average—not more than 0.70

Single Daily Value or Average—not more than 0.90

Desert Creek:

No specific criteria. Antidegradation statement approved.

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*Chiatovich Creek:**Total Phosphates:*

Annual Average—not more than 0.15

Single Daily Value or Average—not more than 0.20

*Indian Creek:**Total Phosphates:*

No specific criteria. Antidegradation statement.

*Leidy Creek (Above Hydroelectric Plant):**Total Phosphates:*

Annual Average—not more than 0.04

Single Daily Value or Average—not more than 0.08

*Virgin River:**Total Phosphates:*

Annual Average—not more than 0.04

Single Daily Value or Average—not more than 0.08

*Beaver Dam Wish (Above Schroeder Reservoir):**Total Phosphates:*

Annual Average—not more than 0.03

Single Daily Value or Average—not more than 0.04

*Snake Creek (Above Fish Hatchery):**Total Phosphates:*

Annual Average—not more than 0.03

Single Daily Value or Average—not more than 0.04

*Big Goose Creek (At Ranch):**Total Phosphates:*

Annual Average—not more than 0.15

Single Daily Value or Average—not more than 0.20

*Salmon Falls Creek (Highway 93, South of Jackpot):**Total Phosphates:*

Annual Average—not more than 0.05

Single Daily Value or Average—not more than 0.10

Shoshone Creek:

No specific criteria. Approved antidegradation statement.

East Fork, Jarbidge River:

No specific criteria. Approved antidegradation statement.

*Jarbidge River (Upstream from Jarbidge):**Total Phosphates:*

Annual Average—not more than 0.03

Single Daily Value or Average—not more than 0.04

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*Jarbidge River (Downstream of Jarbidge):**Total Phosphates:*

- Annual Average—not more than 0.03
Single Daily Value or Average—not more than 0.04
- West Fort Bruneau (Diamond “E” Riad):*
Total Phosphates:
Annual Average—not more than 0.06
Single Daily Value or Average—not more than 0.10
- East Fork Owyhee River (Above Mill Creek):*
No specific criteria. Approved antidegradation statement.
- East Fork Owyhee River (South of Owyhee):*
Total Phosphates:
Annual Average—not more than 0.2
Single Daily Value or Average—not more than 0.3
- East Fork Owyhee River (State Line):*
Total Phosphates:
Annual Average—not more than 0.06
Single Daily Value or Average—not more than 0.10
- South Fork Owyhee River:*
Total Phosphates:
Annual Average—not more than 0.15
Single Daily Value or Average—not more than 0.20
- Smoke Creek (Approx. 30 mi. East of Susanville, California):*
Total Phosphates:
Annual Average—not more than 0.05
Single Daily Value or Average—not more than 0.07
- Bronco Creek (At Hirschdale Road):*
No specific criteria. Approved antidegradation statement.
- Gray Creek (At Hirschdale Creek):*
No specific criteria. Approved antidegradation statement.
- Truckee River (At Farad, California):*
Total Phosphates:
Annual Average—not more than 0.1
Single Daily Value or Average—not more than 0.3
- Truckee River (At Idlewild):*
Total Phosphates:
Annual Average—not more than 0.1
Single Daily Value or Average—not more than 0.3
- [p. 16]
- Truckee River (At Boynton Lane):*
Total Phosphates:
Annual Average—not more than 0.25
Single Daily Value or Average—not more than 0.40
- Truckee River (Lagomansine Bridge):*
Total Phosphates:
Annual Average—not more than 0.5
Single Daily Value or Average—not more than 0.6
- Truckee River (At Cenrsola Ranch):*
Total Phosphates:
Annual Average—not more than 0.75
Single Daily Value or Average—not more than 1.00

*Lake Tahoe (All points):**Soluble Phosphorus:*

Annual Average—not more than 7.0

Colorado River:

No specific criteria.

New Hampshire	No specific criteria. No applicable narrative statement. Have approved antidegradation statement.
New Jersey	No specific criteria. Have approved antidegradation statement.
New Mexico	No specific criteria. No narrative statement. Approved antidegradation statement.
New York	No specific criteria. No narrative statement. Approved antidegradation statement.
North Carolina	The following narrative statement seems to cover almost any waste including phosphates: “Only such amounts, whether alone or in combination with other substances or wastes will not render the waters unsafe or unsuitable as a source for drinking, culinary or food processing purposes, injurious to fish and wildlife or adversely affects the palatability of same, or impair the waters for any other but usage for this class.”
North Dakota	No specific criteria. Section II, C promises such criteria as follows: “C. The maximum practical reduction of nutrients, including nitrogen, phosphorus and sugars, in sewage, industrial, and other wastes shall be accomplished as soon as a practical method is developed.”
	[p. 17]
	A narrative statement could be used on nutrient problems including phosphates. It is: “None in concentrations or combinations that interfere with, or prove hazardous to, the intended water usage.” This applies to all interstate waters.
Ohio	No specific criteria. The following narrative statement could be applied to problems due to phosphates: “(3) Free from materials attributable to municipal, industrial, or other discharges, or agricultural practices producing color, odor, or other conditions in such degree as to create a nuisance; . . .” Have approved antidegradation statement.
Oklahoma	No specific criteria. Narrative statement for all interstate river's tributary streams is as follows: “The quality of tributary streams shall be controlled . . . to prohibit the development of public health hazards or nuisance conditions in such tributaries.” It appears that this statement would apply to nutrient problems including phosphate. Have approved antidegradation statement.
Oregon	No specific criteria. The following narrative statement would apply to phosphate related problems:

"(5) The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish and shellfish."

Have approved antidegradation statement.

Pennsylvania Standard criteria that can be assigned to interstate waters or sections of such waters at the discretion of the Sanitary Water Board is as follows:

"P—Phosphorus (total soluble)—Not to exceed 0.10 mg/l or natural levels, whichever is greater."

A brief inspection of criteria assigned to all or portions of interstate waters indicate that phosphate criteria were assigned to very few.

No narrative statement. Do not have antidegradation statement.

Rhode Island No specific criteria. Narrative statement for all freshwater classifications:

"Waters shall be free from chemical constituents in concentrations or combinations which would be harmful to . . . aquatic life."

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Narrative statement for coastal waters:

"None in concentrations or combinations which would be harmful to human, animal, or aquatic life, or which would resolve the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the waters for any other uses."

Approved antidegradation statement.

South Carolina No specific criteria. No narrative statement. No approved antidegradation statement.

Tennessee No specific criteria. The following narrative guide statements by use classifications could be used to restrict phosphates in problem areas:

"Domestic Raw Water Supply

K. Other Pollutants—other pollutants shall not be added to the water in quantities that may be detrimental to public health or impairs the usefulness of the water as a source of domestic water supply."

"Industrial Supply

Other Pollutants—other pollutants shall not be added to the waters in quantities that may adversely affect the water for industrial processing."

"Fish and Aquatic Life

H. Other Pollutants—other pollutants shall not be added to the waters that will be detrimental to fish or aquatic life."

"Recreation

I. Other Pollutants—other pollutants shall not be added to the water in quantities which may have a detrimental effect on recreation."

No approved antidegradation statement.

Texas	<p>No specific criteria. A narrative statement that could be used to protect waters from excessive phosphate concentrations is:</p> <p>"Taste and odor producing substances shall be limited to concentrations in the waters of the state that will not interfere with the production of potable water by reasonable water treatment methods, or impair unpotable flavor to food fish, including shellfish, or result in offensive odors rising from the waters or otherwise interfere with the reasonable use of the waters."</p> <p>Approved antidegradation statement.</p>
	[p. 19]
Utah	<p>No specific criteria. Narrative statements:</p> <p><i>Class A.</i> "It shall be unlawful to discharge or place any wastes or other substances in such a way as to interfere with the stated Class "A" Water uses, . . ."</p> <p><i>Class B.</i> "It shall be unlawful to discharge or place any wastes or other substances in such a way as to interfere with the stated Class "B" water uses, . . ."</p> <p><i>Class C.</i> "It shall be unlawful to discharge or place any wastes or other substances in such a way as to interfere with the stated Class "C" water uses, . . ."</p> <p>Have approved antidegradation statement.</p>
Vermont	No specific criteria. No narrative statement.
Virginia	<p>No specific criteria. The following narrative statement would apply in limiting problem causing phosphate concentrations:</p> <p>"All waters within this State shall at all times be free from all substances attributable to sewage, industrial wastes, or other wastes in concentration or combinations which contravene established standards or interfere directly or indirectly with beneficial uses of such waters; . . ."</p>
Washington	<p>No specific criteria. Water use classifications AA, A, B, and C leave a narrative statement that could be used to limit problem causing concentrations of phosphates. It states:</p> <p>"<i>Aesthetic Values</i> shall not be impaired by the presence of materials or their effects, including those of natural origin, which offend the senses of sight, smell, touch or taste."</p> <p>Have approved antidegradation statement.</p>
West Virginia	No specific criteria. No narrative statement. No approved antidegradation statement.
Wyoming	No specific criteria. No narrative statement. Approved antidegradation statement.
District of Columbia	[p. 20]
	<p>No specific criteria. The following narrative statement could be used to limit problems causing phosphates going into natural waters:</p> <p>"Materials attributable to sewage, industrial waste, or other waste which produce taste, odor, or appreciably change the existing color or other physical and chemical conditions in</p>

the receiving streams to such degree as to create a nuisance, or that interfere directly or indirectly with water uses;..."

Have an approved antidegradation statement.

Guam

Specific criteria are:

1. Public or Domestic Water Supply
"Total phosphorus in surface waters shall be less than 0.025 mg/l.
2. None for other use classification.

Narrative statements:

1. "Free from substances and conditions or combinations thereof attributable to sewage, industrial wastes, or other wastes that will induce undesirable aquatic life."
2. "There shall be no discharge of treated or untreated sewage, industrial wastes, or other wastes into waters designated for public or domestic water supply."

Puerto Rico

No specific criteria. The following narrative statement would provide powers to limit the concentrations of problem causing phosphates:

1. "Class SA
Existing natural conditions shall not be altered."
2. "Class SB
e. Toxic wastes or deleterious substances alone or in combination with other substances or wastes in sufficient amounts... which in any way obviously affect the flavor, color, odor or sanitary conditions of the waters..."

Have an approved antidegradation statement.

Virgin Islands

No specific criteria. No narrative statement. Have an approved antidegradation statement.

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4.5f "STANDARDS FOR MIXING ZONES"

Environmental Protection Agency, Division of Water Quality Standards,
September 1971

Mixing zones are areas which are unavoidably and harmfully polluted and which are allowed for mixing of the discharged waters with the receiving waters. They have defined and identifiable limits, and the waters outside of the zones must meet the standards for that particular body of water. The *Water Quality Criteria* report recommends when several mixing zones are located close together that they lie on the same side of the stream to allow a continuous passageway for aquatic organisms on the opposite side. The NTAC report specifies that mixing zones be as small as possible and provided only for mixing in order to preserve the "welfare of the aquatic life resource." This is because mixing zones constitute barriers which can harmfully block the spawning migration of anadromous and catad-

romous species and damage the plankton organisms and aquatic invertebrates in the water flow. Adequate zones of passage (at least 75% of the cross-sectional stream area, according to NTAC) must be maintained at all times for the fish, and adequate provision must be made for the survival of the drift organisms. Mixing zones cannot be considered a substitute for, or an extension of a waste treatment facility. The EPA supports the NTAC recommendations.

Individual state-adopted standards follow.

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SUMMARY OF MIXING ZONE STANDARDS

Alabama	The ambient temperature of receiving water in degrees Fahrenheit, after reasonable mixing shall not be increased by more than 10 percent by the addition of domestic, industrial or other wastes nor shall this waste cause the temperature of the receiving waters to exceed 90°F for not more than eight hours during any twenty-four hour period.
Alaska	No reference to mixing zones.
Arizona	No reference to mixing zones.
Arkansas	No reference to mixing zones.
California	No reference to mixing zones.
Colorado	No reference to mixing zones.
Connecticut	Connecticut's General Policy statement concerning <i>Water Quality Criteria</i> has the following to say about mixing zones: "2. In the discharge of waste treatment plant effluent and cooling waters to the receiving waters, cognizance shall be given both in time and distance to allow for mixing of effluent and streams. Such distances required for complete mixing shall not affect the water usage Class adopted but shall be defined and controlled by the Commission."
Delaware	Delaware makes the following references to mixing zones in item 3(b), General Water Quality Standards For Interstate Streams: "The standards proposed are based upon the ability of the Commission to measure and to determine compliance. All measurements will be made at selected after determining "representativeness" of the sample obtained and the nature of the mixing at the station."
District of Columbia	"Criteria shall apply to an entire stretch of the stream. However, reasonable allowance shall be made for the mixing and dispersion of approved discharges. Sampling frequency shall provide a sound basis for computations. Within the limits of field condition, sampling point locations will be selected to permit the collection of representative samples..." "There shall be No increase in natural water temperature caused by artificial heat inputs shall exceed 5 degrees F. after reasonable allowance for mixing."

Guam	No reference to mixing zones.	[p. 1]
Florida	No reference to mixing zones.	
Hawaii	This class of waters is to be used as zones of mixing for the assimilation of municipal, agricultural and industrial discharges which have received the best practicable treatment or control or such lesser degree of treatment or control as will provide for a water quality commensurate with the classified use of the waters outside the zone of mixing. In addition to periodic reports on monitoring by dischargers, samples of receiving waters will be taken both within the designated zone of mixing and at the outer edges of the zone.	
Idaho	No reference to mixing zones.	
Illinois	The discharge of heated liquids into interstate waters should be prescribed so as to prevent barriers to fish passage and minimize temperature increases inside and outside a reasonable mixing zone.	
Indiana	No reference to mixing zones.	
Iowa	Sampling to determine conformance to these criteria shall be done at sufficient distances down stream from waste discharge points to permit adequate mixing . . .	
Georgia	No reference to mixing zones.	
Kansas	The measurement system to be used in each case should provide for temperature measurement at the outfall and with the maximum temperature allowed at the outfall reflecting a reasonable mixing zone in the receiving waters so that the 5°F or 3°F rise specified is not violated in the contiguous waters. Any barrier to migration and the free movement of aquatic biota is prohibited.	
Kentucky	" . . Further, the discharges into any of the main stems of the rivers under consideration is not based on a dilution as being the substitution for treatment. This Commission has utilized the concept that the zone of influence of a discharge must be maintained in satisfactory condition. In fact, waste treatment by industry and municipality have been required alike so that no adverse affect shall accrue in the zone of influence shall occur in any constituent in the rivers as a whole. . . "	
Louisiana	No reference to mixing zones.	[p. 2]
Maine	After adoption of any classification by the Legislature for surface waters or tidal flats or sections thereof, it shall be unlawful for any person, corporation, municipality, or other legal entity to dispose of any sewage, industrial or other waste, either alone or in conjunction with another or others, in such manner as will, after due consideration for seasonal,	

climatic, tidal and natural variations and after reasonable opportunity for dilution, diffusion, mixture or heat transfer to the atmosphere, within mixing zones reasonably established by the commission in the manner provided by this section, lower the quality of said waters, outside such zones, below the minimum requirements of such classification and notwithstanding any licenses which may have been granted or issued under section 413 to 415.

The commission may establish a mixing zone with respect to any discharge at the time application for license for such discharge is made pursuant to section 414, and when so established shall be a condition of and form a part of the license issued. The commission may, after 30 days' notice to and a hearing with the affected party, establish by order a mixing zone with respect to any discharge for which a license has heretofore been issued pursuant to section 414, or for which no license is required by virtue of the last sentence of section 413. Prior to the issuance of any order, or commencement of any enforcement action to abate a classification violation, the commission shall establish, in the manner above provided, a mixing zone with respect to the discharge sought to be thereby affected.

In determining the extent of any mixing zone to be by it established under this section, the commission shall solicit and receive testimony concerning the nature and rate of the discharge; the nature and rate of existing discharges to the waterway and their effect upon the ability of the waterway to achieve its classification standards; the size of the waterway and the rate of flow therein; any seasonal, climatic, tidal and natural variation in such size, flow, nature and rate and the effect of such variation upon the ability of the waterway to achieve its classification standards; the uses of the waterways in the vicinity of the discharge, and such other and further evidence as in the commission's judgment will enable it to establish a reasonable mixing zone for such discharge. An order establishing a mixing zone may provide that the extent thereof shall vary in order to take into account seasonal, climatic, tidal and natural variations in the size and flow of, and the nature and rate of discharges to, the waterways.

Where no mixing zones have been established by the commission, it shall be unlawful for any person, corporation, municipality or other legal entity to dispose of any sewage, industrial or

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other waste, either alone or in conjunction with another or others, into any classified surface waters, tidal flats or sections thereof, in such manner as will, after reasonable opportunity for dilution, diffusion, mixture or heat transfer to the atmosphere, lower the quality of any significant segment of said waters, tidal flats or sections thereof,

affected by such discharge, below the minimum requirements of such classification, and notwithstanding any licenses which may have been granted or issued under section 413 to 415.

Maryland	<p>"For all water use categories other than IV, there must be no temperature change that adversely affects fish, other aquatic life, or spawning success. There must be no thermal barriers to the passage of fish or other aquatic life. Maximum temperature must not exceed 100 degrees F. beyond 50 ft. from any point of discharge."</p> <p>For <i>NONTIDAL WATERS</i>: "For the propagation of fish and other aquatic life (Water Use Category IV) in all other non-tidal waters, temperature must not exceed 93 degrees F. beyond such distance from any point of discharge as specified by the Department as necessary for the protection of the water use."</p> <p>For <i>TIDAL WATERS</i>: used for the propagation of fish and other aquatic life (Water Use Category IV), temperature must not exceed 90 degrees F. beyond such distance from any point of discharge as specified by the Department as necessary for the protection of the water use."</p>
Massachusetts	"When an effluent is permitted to be discharged to the receiving waters, cognizance shall be given both in time and distance to allow for mixing of effluent and stream. Such distances required for complete mixing shall not affect the water usage class adopted."
Michigan	No reference to mixing zones.
Minnesota	The only thing relating to mixing zones is the following statement: ". . . Reasonable allowance will be made for dilution of the effluents in relation to the uses of the interstate waters into which they are discharged or other interstate waters which may be affected. . . ."
Mississippi	Temperature shall not be increased more than ten degrees F (10°F) above the natural prevailing background temperatures, nor exceed a maximum of 93°F after reasonable mixing.
Missouri	No reference to mixing zones.
Montana	No reference to mixing zones.
Nebraska	No reference to mixing zones.
Nevada	
New Hampshire	New Hampshire has adopted the criteria of the New England Interstate Water Pollution Control Commission with regard to temperature which states, ". . . A heated discharge to a lake shall not raise the temperature more than 3 degrees F at the surface immediately outside a designated mixing zone." New Hampshire had also adopted verbatim the entire criteria pertaining to temperature and zones of passage con-

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tained in Section 3 of the National Technical Advisory Committee Report on Water Quality Criteria dated April 1, 1968. This report makes recommendation regarding mixing zones and zones of passage on page 31.

New Jersey

Localized areas of surface waters, as may be designated by the Department, into which wastewater effluents, including heat, may be discharged for the purpose of mixing, dispersing or dissipating such wastewater without creating nuisances or hazardous conditions.

Trout Maintenance Streams: No heat may be added which would cause temperatures to exceed 2°F over the natural temperatures at any time or which would cause temperatures in excess of 68°F. Reductions in temperatures may be permitted where it can be shown that trout will benefit without detriment to other designated water uses. The rate of temperature change in designated mixing zones shall not cause mortality of the biota.

Non-Trout Waters: No thermal alterations, except in designated mixing zones, which would cause temperatures to deviate more than 5°F at any time from natural stream temperatures or more than 3°F in the epilimnion of lakes and other standing waters. No heat may be added, except in designated mixing zones, which would cause temperatures to exceed 82°F for smallmouth bass or yellow perch waters or 86°F for other non-trout waters. The rate of temperature change in designated mixing zones shall not cause mortality of the biota.

New Mexico

The following policy guideline statement concerns mixing zones: "... as samples taken for the regulation and enforcement of these standards are to be collected at the mid-point of the stream flow at locations a sufficient distance downstream

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from the point of introduction of wastewater inflow to provide for reasonable mixing of the stream and the inflowing water. Sampling in reservoirs, and lakes for the purposes of the general standards may be at any point in the body of the water, but not closer than 250 feet from the point of introduction of a water contaminant. A reservoir or lake is considered to include all of the area flooded when the water in the basin is at the spillway level.

New York

Trout Maintenance Streams: No heat may be added which would cause temperature to exceed 2°F over the natural temperatures at any time or which would cause temperatures in excess of 68°F. Reductions in temperatures may be permitted where it can be shown that trout will benefit without detriment to other designated water uses. The rate of temperature change in designated mixing zones shall not cause mortality of the biota.

Non-Trout Waters: (1) *Mixing Zones:* The mixing zone will be separately determined for each discharge so as to minimize detrimental effects. Fish and other aquatic life shall be protected from thermal blocks by providing for a minimum fifty percent stream or estuarine cross-section and/or volumetric passageway, or establishing artificial fishways where considered necessary. Generally, the surface water temperature shall not exceed 90°F within the mixing zone. Consideration will be given to effects of each discharge based on hydrodynamics and other factors of receiving waters. (2) *Outside Mixing Zone:* Stream temperature in excess of 86°F will not be permitted after mixing. Further, no permanent change in excess of 5°F will be permitted from naturally occurring background temperatures. In multiple discharge situations stream capacity to meet such criteria will be apportioned among the discharges. (3) *Outside Mixing Zone: Fresh Surface Water Classes:* Temperature change rate shall be limited to 2°F per hour, not to exceed 9°F in any 24-hour period, further limited in that for any seven day period the average change will meet the 5°F change of background criteria stated in item 2 above. (4) *Outside Mixing Zone: Tidal Salt Water Classes:* Discharges shall not raise monthly means of maximum daily temperatures more than 4°F from September through May, nor more than 1.5°F during June, July, and August. Temperature change shall not be more than 1°F per hour, not to exceed 7°F in any 24-hour period at maximum, except when natural phenomena cause these limits to be exceeded.

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North Carolina

In making tests or analytical determinations of classified waters to determine conformity or nonconformity with the established standards, samples shall be collected beyond the boundaries of prescribed mixing zones in such manner and at such times and locations as to be representative of the receiving waters after reasonable opportunity for dilution and mixture with the wastes discharged thereto. The boundaries of such mixing zones will be determined for each waste discharge after consideration of the magnitude and character of the discharge, the size and character of the receiving stream or waters in question, and shall be restricted to as small an area and length as possible. In streams or other waters which support fish, a free passageway of at least 75% of the cross-sectional area and/or volume of flow shall be free of any barriers to and shall be maintained for the migration and free movement of fish, drift organisms, and other resident species of aquatic life. In free-flowing waters, the passageway shall extend for a considerable distance along the same bank. In marine waters, lakes, ponds, and reservoirs, a passageway shall be provided between the shore and the zone influenced by the discharged wastewater.

North Dakota	“The distance of river flow to allow for a reasonable opportunity to mix and dilute wastes shall be at the discretion of the State Department of Health and will be based upon stream flow conditions at the time of sampling, except where such discharges may adversely affect a beneficial water use immediately downstream or in close proximity to the waste point. In such instances, a change in the method of waste discharge or other control measures may be required.”
Ohio	No reference to mixing zones.
Oklahoma	No reference to mixing zones.
Oregon	No reference to mixing zones.
Pennsylvania	No reference to mixing zones.
Puerto Rico	No reference to mixing zones.
Rhode Island	The following statement on mixing zones is made under the heading of “General Policy.” In the discharge of waste treatment plant effluents to the receiving waters, cognizance shall be given both in time and distance to allow for mixing of effluent and stream. Such distances required for complete mixing shall not affect the water usage Class adopted but shall be defined and controlled by the regulatory authority.”
	[p. 7]
South Carolina	Not to exceed 93.2 degrees F at any time, after adequate mixing of heated and normal water, as the result of the discharge of heated liquids, nor shall the water temperature in a zone of adequate mixing be more than 10 degrees F greater than that of water unaffected by the heated discharge. <i>PROVIDED</i> : That hydraulic conditions at the point of discharge are arranged so that there is an unheated zone for fish passage between the point of discharge and the zone of adequate mixing.”
South Dakota	The following statement on mixing zones is concerned with sampling procedures under Section III— <i>Enforcement Provisions</i> : “4. In making tests or analytical determinations of surface waters to determine conformity or non-conformity with the established criteria, samples shall be collected in such manner and at such locations, times and frequencies as approved by the Committee. Every effort should be made to make the samples representative of the receiving waters after reasonable opportunity for dilution and mixture with the polluting material discharged thereto.”
Tennessee	Mixing zone refers to that section of flowing stream or impounded waters necessary for effluents to become dispersed. The Mixing zone necessary in each particular case shall be defined by the Tennessee Stream Pollution Control Board.
Texas	“3. Sampling will be in accordance with fully recognized procedures. Samples must be representative of the receiving waters allowing time and distance for mixing.”

Utah	No reference to mixing zones.	
Vermont	"In assigning classifications to the waters of the State the department may designate certain lengths or areas of such waters as mixing zones provided that any such mixing zones shall be only for the dispersal and dilution of wastes which have been treated in a manner approved by the department, shall be of no greater length or area than is required for such purposes and may only be allowed if such wastes conform substantially with the technical and other requirements established for the receiving waters. Such a mixing zone shall not constitute a barrier to the passage or migration of fish or produce adverse effects on any fishery or other forms of wild or aquatic life."	
Virgin Islands	No reference to mixing zones.	
Virginia	No reference to mixing zones.	
Washington	No reference to mixing zones.	
West Virginia	No reference to mixing zones.	
		[p. 8]
Wisconsin	No reference to mixing zones.	
Wyoming	No reference to mixing zones.	
		[p. 9]

4.5g "STANDARDS FOR DISSOLVED OXYGEN"

Environmental Protection Agency, Division of Water Quality Standards,
November 1971

It is necessary for waters classified for the protection and propagation of fish and wildlife to contain sufficient Dissolved Oxygen to support local biota, taking into consideration the requirements of the desirable aquatic populations at all life-development stages. DO criteria recommendations are made to assure that the oxygen does not fall below certain minimum levels, which vary depending upon natural conditions. In effect, DO standards limit amounts of biodegradable matter which can be artificially induced in the water to tolerable, aquatic life-supportive levels.

Reduction in DO can have such detrimental effects as excess plant growth (algal blooms and, in extreme cases, eutrophy); taste and odor problems; and can otherwise make the water less suitable for fish and wildlife, domestic, and recreational uses.

Water Quality Criteria, used by EPA in evaluating the State stand-

ards, recommends a minimum DO concentration for freshwater biota of 5 mg/l (milligrams per liter) for warmwater species (declining to a lower limit of 4 mg/l "for short periods of time, provided that the water quality is favorable in all other respects"); and for coldwater biota recommends no less than 5–6 mg/l (7 mg/l at spawning times). Stringent limitations (6 mg/l) are recommended for small inland lakes or large lakes which have insufficient or no mixing of constituent layers. For saltwater organisms DO minimum levels of 5 mg/l are recommended in the open coastal waters, and 4 mg/l in the estuarine and tidal tributaries, excepting waters with naturally depressed DO.

Individual State-adopted standards follow.

[p. i]

DISSOLVED OXYGEN CRITERIA (Minimum)			
State	Cold water fishery	Warm water fishery	Miscellaneous
Alabama	4 mg/l*		Shellfish—4 mg/l
Alaska	<i>Class A Drinking Water Supply</i> "Greater than 75% saturation" <i>Class B Drinking Water Supply and Food Processing</i> "Greater than 60% saturation" <i>Class C Bathing, Swimming, Recreation</i> "Greater than 5 mg/l" <i>Class D Growth and Propagation of Fish and Other Aquatic Life, Including Waterfowl Furbearers, and Other Aquatic and Semi-Aquatic Life.</i> "Greater than 6 mg/l in Salt Water Minimum of 7 mg/l in fresh water." <i>Class E Shellfish Growth and Propagation (Natural and Commercial Growing Areas)</i> Greater than six (6) mg/l saturation in the larval stage. Greater than five (5) mg/l in the adult stage. <i>Class F. Agricultural Water Supply, including Irrigation, Stock Watering and Truck Farming</i> "Greater than 3 mg/l." <i>Class G Industrial Water Supply (other than Food Processing)</i> "Greater than 5 mg/l for surface water. Not limiting except as it affects other parameters."		
Arizona	6 mg/l	6 mg/l	
Arkansas	5 mg/l	4 mg/l or 50% saturation	
California	Appropriate criteria were set for each individual body of water. The following is a summary of these criteria and does not reflect all of the variations found therein. Freshwater streams and lakes—a min. of 6 and 7 mg/l with an additional limit of 80 to 85% sat. for some streams. A min. of 90% sat. for Lake Tahoe.		

* Not approved by Secretary.

[p. 1]

DISSOLVED OXYGEN CRITERIA (Minimum), continued

State	Cold water fishery	Warm water fishery	Miscellaneous
Estuarine waters—a min. of 5 mg/l for most waters; min. of 6 and 7 mg/l for other waters. Coastal waters—a min. of 5 mg/l with additional limits on the annual mean ave. which ranges from 6 to 7 mg/l.			
Colorado	6 mg/l	5 mg/l	PWS—4 mg/l Industrial—3 mg/l
Connecticut	5 mg/l*	5 mg/l—16 hrs. per day* 3 mg/l—any time*	SD—2 mg/l* SC—5 mg/l—16 hrs. per day; 3 mg/l any time* SCc—5 mg/l*
Delaware		50% saturation* or 4 mg/l except Delaware River— daily ave. 3.5 mg/l except April 1 to June 15 and Sept. 16 to Dec. 31— 6.5 mg/l	Atlantic Ocean—natural Delaware Bay—daily ave. of 6 mg/l Other coastal waters— 50% saturation* or 4 mg/l Chesapeake and Delaware Canal—
District of Columbia		4.0 mg/l min. 5.0 mg/l daily ave.	D.O. selectively assigned 3.0 mg/l min., 4.0 mg/l daily ave. to Anacostia River and one specific zone of the Potomac River.
Florida		4 mg/l	Shellfishing—4 mg/l
Georgia	5 mg/l	4 mg/l	Industrial and Navigation—2.5 mg/l
* Not approved by Secretary.			
[p. 2]			
Guam		6 mg/l	PWS—6 mg/l Saline waters—6 mg/l
Hawaii			Coastal Waters— Class AA—6 mg/l Class A—5 mg/l Class B—4.5 mg/l limited to docking areas Fresh waters used for fish propagation—5 mg
Idaho		75% saturation at seasonal low; 100 % of saturation in spawning areas during spawning, hatching and fry stages of salmonid fishes.	

DISSOLVED OXYGEN CRITERIA (Minimum), continued

State	Cold water fishery	Warm water fishery	Miscellaneous
Illinois		Lake Michigan not less than 80–90% saturation. Other waters 5 mg/l—16 hrs. per day, 4 mg/l any time.*	Industrial—3 mg/l—16 hrs. per day 2 mg/l—always.
Indiana	6 mg/l daily average 4 mg/l any time	5 mg/l—16 hrs. per day 3 mg/l—8 hr./day*	
Iowa	7 mg/l—16 hrs. 5 mg/l—any time	5 mg/l—16 hrs. 4 mg/l—any time	
Kansas		5 mg/l	Missouri R—4 mg/l* Most waters—5 mg/l Some 4 mg/l
[p. 3]			
Kentucky		5 mg/l—16 hr./day* 3 mg/l—8 hr./day*	
Louisiana		50% saturation* or 60–75% saturation in some waters	
Maine	5 mg/l for 16 hrs.* 4 mg/l any time*	4 mg/l for 16 hrs.* 3 mg/l any time*	Class A—75% sat.* B-1—75% (16 hrs)* 5 mg/l (any time)* B-2—60% (16 hrs)* 5 mg/l (any time)* Industrial—2 mg/l* (16 hrs.) (D.O. present* always) SA, SB-1, SB-2—6 mg SC—5 mg/l SD—3 mg/l
Maryland	5 mg/l minimum 6 mg/l monthly Average	4 mg/l minimum 5 mg/l monthly Average	Industrial—4 mg/l
Massachusetts .....	.5 mg/l	5 mg/l—16 hrs. per day 3 mg/l—any time	Coastal—not less than 6.5 mg/l Industrial—2 mg/l
Michigan .....	.6 mg/l	5 mg/l—intolerant species 4 mg/l—tolerant species	Navigation 1) Interstate waters—sufficient to prevent nuisance 2) Intrastate waters—average 2.5 mg/l, no less than 2.
[p. 4]			
Minnesota	7 mg/l, Oct. 1 through May 31 5 mg/l, other times	Intolerant (Class B) Tolerant (Class C)	6 mg/l April 1 through May 31 5 mg/l, other times 5 mg/l, April 1 through May 31 3 mg/l, other times

DISSOLVED OXYGEN CRITERIA (Minimum), continued

State	Cold water fishery	Warm water fishery	Miscellaneous
Mississippi	4 mg/l*		PWS, Shellfishing and Recreation—4 mg/l* Agricultural and Industrial water supply—3 mg/l Navigation and utility use—3 mg/l
Missouri	6 mg/l	5 mg/l except 6 mg/l—lakes and reservoirs	Missouri R.—4 mg/l*
Montana	7 mg/l (D-1) 6 mg/l (D-2)	5 mg/l (D-3)	
Nebraska	6 mg/l	5 mg/l	
Nevada	5.0–8.0 mg/l, varies with stream and season		
New Hampshire	Class B—75% sat. Class C—5 mg/l	Class B—75% sat. Class C—5 mg/l	
New Jersey	<i>Trout Production Waters</i> Not less than 7.0 mg/l at any time <i>Trout Maintenance Water</i> Daily average not less than 6.0 mg/l. Not less than 5.0 mg/l at any time.	Daily average of 5.0 mg/l. Not less than 4.0 mg/l at any time.	
* Not approved by Secretary.			
	<i>Trout Maintenance Lakes</i> Daily average not less than 6.0 mg/l. Not less than 5.0 mg/l at any time. In eutrophic lakes when stratification is present, not less than 4.0 mg/l in or above the thermocline where water temperatures are below 72 degrees F. At depths where the water is 72 degrees F. or above, daily average not less than 6.0 mg/l and not less than 5.0 mg/l.		
New Mexico	50% sat.; 6 mg/l min.	50% sat.; 5 mg/l min.	

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DISSOLVED OXYGEN CRITERIA (Minimum), continued

State	Cold water fishery	Warm water fishery	Miscellaneous
New York	5 mg/l	4 mg/l	Agriculture—3 mg/l N.Y. Harbor—2.5 mg/l
North Carolina	5 mg/l*	4 mg/l*	Estuarine water 4.0 mg/l, swamp waters 3.0 mg/l, open ocean water 4.0 mg/l.*
North Dakota	Criteria based on "fish species native to the area"—5 mg/l, or 5 mg/l—16 hrs. per day and 3 mg/l any time, by stream		
Ohio	6 mg/l	Aquatic Life A— 5 mg/l—16 hrs. per day, 3 mg/l any time* Aquatic Life B— 3 mg/l—ave., 2 mg/l min. (applied only where no higher levels can be attained with treatment)	
* Not approved by Secretary.			
			[p. 6]
Oklahoma	4 mg/l*		Smallmouth bass— 5 mg/l all waters—4 mg/l
Oregon	75% saturation at seasonal low or 5–7 mg/l, by stream; 95% saturation in spawning areas during spawning, hatching and fry development.		Marine—not less than saturation Estuarine—6 mg/l
Pennsylvania	Min. daily ave.— 6 mg/l, no value less than 5 mg/l	Min. daily ave.— 5 mg/l, no value less than 4 mg/l	Delaware Estuary— varies with location and season.
Puerto Rico		5 mg/l	Navigation—2 mg/l
Rhode Island	5 mg/l*	5 mg/l—16 hrs. per day* 3 mg/l—any time*	Sea Water—6 mg/l
South Carolina	4 mg/l	4 mg/l*	Swamp waters 2.5 mg/l*, fish survival (Class Ca) 3 mg/l, Salt water Class Sa (shell) 5.0 mg/l, Saltwater SB (bathing) 5.0 mg/l, Saltwater Class SC (fish) 4.0 mg/l.
South Dakota	6 mg/l or 5 mg/l by stream	5 mg/l	Big Stone and Traurysse Lakes Min. 6 mg/l April and May
* Not approved by Secretary.			

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DISSOLVED OXYGEN CRITERIA (Minimum), continued

State	Cold water fishery	Warm water fishery	Miscellaneous
Tennessee	6 mg/l	5 mg/l except in limited sections of stream receiving treated effluent—3 mg/l	
Texas		4 to 6 mg/l, by stream	Houston Ship Channel 2 mg/l Tidal 3 to 7 mg/l, by stream
Utah	6 mg/l	5.5 mg/l	PWS—B.O.D.—not more than 5 mg/l 20% of the time— not more than 10 mg/l 10% of the time.
Vermont	<p>Type I Waters "Streams and rivers sustaining natural populations of brook trout, salmon, rainbow trout, and brown trout. Dissolved oxygen content of these waters at and near spawning areas shall not be less than 7 mg/l, and not less than 6 mg/l in nonspawning areas, and normal seasonal, daily and diurnal variations above these limits will be maintained."</p> <p>Type II Waters "Streams and rivers containing mixed populations of such fish as rainbow trout, brown trout, and smallmouth bass. Dissolved oxygen shall not be less than 6 mg/l and normal seasonal, daily and diurnal variations above these limits will be maintained."</p> <p>Type III Waters "Streams and rivers having mixed populations of such warm water species of fish as smallmouth bass, perch, and bluegills, etc. Dissolved oxygen shall not be less than 5 mg/l and normal seasonal, daily and diurnal variations above these limits will be maintained."</p> <p style="text-align: right;">[p. 8]</p> <p>Type IV Waters "Oligotrophic lakes, ponds and reservoirs, natural or artificial, supporting natural populations of brook trout, salmon, lake trout and other associate species. Dissolved oxygen levels for this class shall not fall below 6 mg/l due to the addition of oxygen-demanding wastes and other materials. Normal seasonal, daily and diurnal variations above 6 mg/l will be maintained."</p> <p>Type V Waters "Lakes, ponds and reservoirs, natural or artificial, or portions thereof, not designated as Type IV. Dissolved oxygen levels for this class shall not fall below 4 mg/l due to the addition of oxygen-demanding wastes and other materials."</p>		
Virginia	5 mg/l*	4 mg/l*	PWS—4 mg/l Recreation—4 mg/l Industrial—2 mg/l Agricultural—2 mg/l
Virgin Islands			Marine Life—5.5 mg/l Harbors—5 mg/l
Washington	Class AA—9.5 mg/l Class A—8.0 mg/l Class B—6.5 mg/l or 70% saturation, whichever is greater Class B—6.5 mg/l or 50% saturation, whichever is greater		Marine Water— Class AA—7.0 mg/l Class A—6.0 mg/l Class B—5.0 mg/l or 70% saturation, whichever is greater Class C—4.0 mg/l or 50% saturation, whichever is greater

DISSOLVED OXYGEN CRITERIA (Minimum), continued

State	Cold water fishery	Warm water fishery	Miscellaneous
West Virginia	<p>"Water Uses and Water Quality Criteria</p> <p>"A." Water Contact Recreation. Not less than 4 mg/l as a daily average."</p> <p>"B." "Water Supply Public No specific criteria</p> <p>"B2." "Water supply, Industrial. Not less than 2.0 mg/l at all times as a daily average nor less than 1 mg/l at any time."</p> <p>"B3." "Water Supply, Agricultural"</p> <p>"C." Propagation of Fish and Other Aquatic Life Not less than 5 mg/l for trout (cold water) waters</p>		
<p>* Not approved by Secretary.</p>			
	<p>[p. 9]</p> <p>and not less than 4 mg/l for warm water fish."</p> <p>"D." "Water Transport, Cooling and Power" No specific criteria.</p> <p>"E." "Treated Wastes Transport and Assimilation." No specific criteria.</p> <p>"GENERAL CONDITIONS NOT ALLOWABLE IN STATE WATERS . . . minimum conditions allowable: Dissolved oxygen concentration to be less than 3.0 parts per million at the point of maximum oxygen deletion;"</p> <p>"Oxygen criteria by Basin and Subasin:</p> <p>All Interstate basins and tributaries except two must contain a minimum of 5 mg/l of oxygen. The requirements for the two exceptions are:</p> <ol style="list-style-type: none">1. Tributaries to the Bluestone River rising in West Virginia and flowing into Virginia shall not have less than 3.0 mg/l of oxygen at any time.2. Bluestone River and all its tributaries from the Virginia-West Virginia State line to the head of backwater of the Bluestone Reservoir shall not have less than 4 mg/l of oxygen at any time. <p>Trout Streams Trout streams must contain not less than 6 mg/l of dissolved oxygen at any time.</p>		
Wisconsin	5 mg/l—16 hrs. per day		Fish Life—80% saturation or 5 mg/l
Wyoming	6 mg/l	4 mg/l any time 6 mg/l	

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4.5h "STANDARDS FOR NITRATES"

Environmental Protection Agency, Division of Water Quality Standards,
November 1971

This is a compilation of all nitrate criteria limitations within State-adopted water quality standards.

Nitrate standards are set to control the amount of nitrates discharges into the water. Nitrates and phosphates in wastes contribute to excess amounts of nutrients in our water. Artificially nutrient-enriched waters are over fertilized, altering aquatic systems. Quite often algae blooms occur in lakes and slow-moving streams. Certain

algae can make public water supplies and fish flesh unpalatable. Aquatic growths stimulated by nutrients can trap silt and organic matter, providing ideal breeding spots for bacteria, and can choke up streams. Such growths can reduce the oxygen concentrations in the water, killing fish and greatly reducing the stream's ability to purify itself. Organic enrichment is a primary factor in overaging or eutrophication, the process causing the "death" of Lake Erie.

The National Technical Advisory Committee in *Water Quality Criteria* did not make specific fixed recommendations limiting nutrients. However, nitrates were limited as follows: "The naturally occurring ratios and amounts of nitrogen (particularly NO_3 and NH_4) to total phosphorus should not be radically changed "by artificial means. They recommended that phosphate levels in flowing streams should not exceed "100 ug/l or more than 50 ug/l where streams enter lakes or reservoirs."

Individual State-adopted standards follow.

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Alabama	There are no specific criteria or narrative statements limiting nitrate or any other nutrient in the aquatic environment.
Alaska	There is no specific criteria and no narrative statement directed at the limitation of such nutrients as nitrate. Unless the toxic material standards or the taste and odor standards could be applied to nitrate problems there is only one possibility. That is the following Policy Statement of the State of Alaska: <i>Alaska Statutes Title 46, Chapter 05, Section 46, 05, 010</i> : "It is the public policy of the state to maintain reasonable standards of purity of the waters of the state consistent with public health and public enjoyment, the propagation and protection of fish and wildlife, including birds, mammals and other terrestrial and aquatic life, and the industrial development of the state, and to require the use of all known available and reasonable methods to prevent and control the pollution of the waters of the state."
Arizona	Policy statement: "Other methods and degrees of treatment will be required, as appropriate, to remove nutrients, oily constituents and other polluting materials from wastes before discharge." "All waters of the State shall be free from materials attributable to domestic or industrial waste or other controllable sources in amounts sufficient to produce taste or odor in the water or detectable off-flavor in the flesh of fish, or in amounts sufficient to change the existing color, turbidity or other conditions in the receiving stream to such degree as to create a public nuisance, or in amounts sufficient to interfere with any beneficial use of the water."
Arkansas	No nitrate statement or criteria.
California	They define " <i>Water Quality Control</i> as the control of any factor which adversely and unreasonably impairs the quality of the

waters of the State for beneficial use. (California Water Control Act, Section 13005.) Pollution control is an important part of water quality control."

Goose Lake narrative statement regarding plankton indicates that if nutrients including nitrates accumulated to the degree that they cause plankton blooms they would be subject to control. "The Total Plankton Population Shall be Maintained Below Bloom Level. This objective is designed to

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protect fishlife and recreational use of the lake by limiting the concentration of plankton below the bloom level which is defined as that plankton concentration which causes significant nuisance conditions, or significantly affects desirable fish populations."

Sacramento-San Juan Delta Nitrogen Criteria: "Total Nitrogen Content of Delta Waters shall not exceed:

"A. 1.0 mg/l in the Central Delta."

"B. 2.0 mg/l in the Western Delta."

"C. 3.0 mg/l in the Eastern Delta."

Nitrogen content, as used in this objective is considered to be the sum of Nitrogen present in the water in all forms including Nitrate (NO^3), Nitrate (NO^2), Ammonia (NH_3 or NH_4), organically combined nitrogen.

"Materials Stimulating Algal Growth." "Materials stimulating algal growth shall not be present in concentrations sufficient to cause objectionable algal densities." "Plankton Blooms are encouraged by the presence, in sufficient concentrations of several nutrient materials. Among these are nitrogen, phosphorus, silica, vitamins, iron and other metals and dissolved salts."

Tidal Waters Inland From the Golden Gate Within The San Francisco Bay Region: "Total nitrogen concentration shall not exceed 2.0 mg/l as nitrogen at any point within the Region easterly of Carquinez Strait; in no case shall nutrients be present in concentrations sufficient to cause deleterious or abnormal biotic growths except when factors which are not controllable cause greated concentrations (Note A)."

West Fork Carson River: "Nitrates: A mean annual concentration less than 2.0 mg/l, and a maximum concentration not to exceed 3.0 mg/l at any time."

Truckee River: "Nitrates: A mean annual concentration less than 1.0 mg/l, and a maximum concentration not to exceed 2.5 mg/l at any time."

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East Fork Carson River: "Nitrates: A mean annual concentration less than 1.5 mg/l, and a maximum concentration not to exceed 2.0 mg/l at any time."

West Walker River and Lake Topaz: "Nitrates: A mean annual

concentration less than 1.5 mg/l, and a maximum concentration not to exceed 2.0 mg/l at any time."

East Walker River: "Nitrates: A mean annual concentration less than 3.0 mg/l, and a maximum concentration not to exceed 4.5 mg/l at any time."

New River: No narrative statement or specific criteria concerning nitrates.

Colorado River in California: The only statement that might be applicable to nitrate problems is: "The waters shall be free from materials attributable to domestic or industrial waste or other controllable sources, which may produce taste or odor in the water or detectable off-flavor in the flesh of fish, that may alter the water's existing color or turbidity, or that may adversely affect other conditions in the river." "Allowable limits of annual average of analyses under the surveillance schedule for Nitrate is 5.0 mg/l and for Ammonia (NH₃) 1.0 mg/l."

Lake Tahoe: "Total Soluble Nitrogen: A mean annual concentration of the sum of soluble nitrate-N, nitrate-N, and ammonia-N not greater than 24 micrograms N per liter at any point in the lake."

A plankton count criteria related to nutrients including nitrates is included: "Plankton Count: A mean seasonal concentration not greater than 100 per milliliter and a maximum concentration not greater than 500 per milliliter at any point in the lake."

Another plankton standard related to nutrients is: "Plankton Growth Potential: A mean annual growth potential at any point in the lake not greater than twice the mean annual growth potential at the limnetic reference station." They have stringent narrative statements on foreign materials and taste and odor which would include nitrates and other nutrients.

"1. Foreign Material: None which impairs the natural beauty, clarity, or purity of the lake."

"2. Taste and Odor Causing Substances: None which imparts foreign taste or odor to the lake waters."

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Coastal Waters, Point Pedras Blancas to Pescadero Point: Nitrates and other nutrients are not covered by these standards.

Coastal Waters, Rincon Point to Point Arguello: Nitrates and other nutrients are not covered by these standards.

Coastal Waters, Point Arguello to Point Piedras Blancas: Nitrates and other nutrients are not covered by these standards.

Pacific Ocean Pescadero Point to Mouth of Tomales Bay, Bolinas Lagoon, Drakes Estero, Limatour, Estero, Portions of Tomales Bay and tidal portions of coastal streams: Nutrients which include nitrates and others are covered by the following narrative statement: "None in concentrations sufficient to cause deleterious or abnormal biotic growths except when factors which are not controllable cause greater concentrations."

Humboldt-Del Norte Coastal Waters: The following narrative statement on Toxic or other Deleterious substances applies to nitrates, and other nutrients: "*Toxic or Other Deleterious Substances:* There shall be no organic or inorganic substances in concentrations . . . which cause deleterious growths of algae or other plant life."

Pacific Ocean Coastal Waters, Rincon Point to San Gabriel River: The only standard that might be applicable is the following narrative statement: "*Other Materials:* Other materials shall not be present in concentrations that would be deleterious to fish, plant or aquatic wildlife."

Mendocino Coast: The following narrative statement applies to nitrates, and other nutrients: "*Toxic or Other Deleterious Substances:* There shall be no organic or inorganic substances in concentrations which are toxic or detrimental to human, animal, plant, or aquatic life, which impart undesirable tastes or odors to species of commercial or sport importances, or which cause deleterious growths of algae or other plant life."

Pacific Ocean San Gabriel River to Drainage Divide Between Muddy Canyon and Moro Canyon: Under objective rationale they state: "*Nutrients:* . . . The research to date has not been able to develop satisfactory criteria for nutrient levels in open sea water that will not over-stimulate

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plankton production. Thus, a standard for nutrients is omitted until a basis for such can be found."

Humboldt Bay: The following narrative statement covers all the nutrients including nitrates: "There shall be no organic or inorganic substances in concentrations . . . which cause deleterious growths or algae or other plant life."

Sonoma—Marin Coast: The following narrative statement covers all the nutrients including nitrates. "There shall be no organic or inorganic substances in concentrations . . . which cause deleterious growths of algae or other plant life."

San Diego Bay: The following narrative statement applies to all nutrients including nitrates. "Nutrient levels shall be limited to those levels necessary to minimize phytoplankton blooms, thus preventing unsightliness, turbidity, color, and oxygen depression."

Harbors, Marinas and Tidal Prisms in Los Angeles and Ventura Counties: The following narrative statement applies to all nutrients including nitrates: "*Nutrients:* Nutrients of other than natural origin shall not be present in concentrations capable of causing proliferation of plankton or other undesirable biotic growths."

Klamath River in California: The following narrative statement applies to all nutrients including nitrates: "Concentrations of dissolved nutrients shall be maintained at levels below those which may cause undesirable algae blooms, slime or bacterial growth, or other undesirable biological growths."

Tijuana River Basin in California: "Concentrations of nitrates and phosphates of waste origin, by themselves or in combination with naturally occurring nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth."

Smith River: The following narrative statement covers all nutrients including nitrates: "There shall be no organic or inorganic substances in concentrations... which cause undesirable algae blooms, slime or bacterial growth, or other undesirable biological growths."

Mission Bay Including Tidal Prism of San Diego River and Agua Hedionda Lagoon: "Nutrients: Concentrations of nitrates and phosphates of waste origin, by themselves

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or in combination with naturally occurring nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth."

San Gabriel River Tidal Prism: "Nutrients, of other than natural origin, shall not be present in concentrations capable of causing proliferation of undesirable biotic growths."

Coastal Bays, Marinas and Sloughs Between the San Gabriel River and the Drainable Divide Between Muddy Canyon and Moro Canyon: "Nutrients: Nutrients (nitrogen, silicate, and phosphate shall not be present except from natural conditions, in amounts that will cause deleterious or abnormal growths to occur on the substrate or to foster biotic growths that are harmful to beneficial uses."

Colorado There are no specific criteria for any of the nutrients. The narrative statement concerning toxic materials might restrict nitrates at levels below where damage to aquatic life occurred. This statement is as follows: "Toxic material: Free from biocides, toxic or other deleterious substances attributable to municipal, domestic, or industrial wastes, or other controllable sources in levels, concentrations or combinations sufficient to be harmful to aquatic life."

Connecticut The narrative statements concerning taste and odor and chemical constituents are the only standards that could apply to nitrates. "Taste and Odor:" For water supply: "None in such concentrations that would impair any usages specifically assigned to this Class nor cause taste and odor in edible fish." *Class D:* "None in such concentrations that would impair any usages specifically assigned to this class." For coastal and marine waters: *Class A:* "None allowable." *Class SB, SC, SD:* "None in such concentrations that would impair any usages specifically assigned to this Class and none that would cause taste and odor in edible fish or shellfish."

Chemical Constituents (freshwater): Class A, B, C, and D. "Waters shall be free from chemical constituents in concentrations or combinations which would be harmful to human, animal, or aquatic life for the appropriate, most sensitive and governing considerations and approved limits have not been

established, bioassay shall be performed as required by the appropriate agencies. For public drinking water supplies the raw water sources must be of such a

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quality that United States Public Health Service limits, or State limits if more stringent, for finished water can be met after conventional water treatment."

Chemical Constituents (coastal and marine): Class SA: "None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the waters for any other use." *"Class SB, SC, and SD:* None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, or impair the water for any other usage assigned to this Class."

Delaware

The following declaration of policy in 6301, Chapter 63, Water Pollution, Title 7, Part VII, Delaware Code is "(a) It is declared to be the public policy of the State to maintain within its jurisdiction a reasonable quality of water consistent with public health and public enjoyment thereof, the propagation and protection of fish and wildlife, including birds, mammals, and other terrestrial and aquatic life, and the industrial development of the State. (b) It is the purpose of this chapter to safeguard the quality of state waters against pollution by (1) preventing new pollution in such waters and (2) controlling any existing pollution."

The adopted standards approved by the Secretary with certain exceptions and recommendations that could apply to nitrates are those concerned with toxic substances and taste, odor, and color causing substances: *"Toxic Substances:* None in concentrations harmful (synergistically or otherwise) to humans, fish, shellfish, wildlife, and aquatic life.

Florida

There are no specific criteria for nutrients such as nitrates and no narrative statement directly applicable to nutrients such as nitrates. The only item in the water standards of Florida, as approved, that might be used to protect that States waters from excessive amounts of phosphates and there accompanying problems would be the antidegradation statement.

Georgia

There are no specific criteria for nutrients such as nitrates nor is there a narrative statement directly concerned with nitrates or other nutrients.

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Hawaii

<i>"Nutrient Materials All Waters:</i>	Applicable to
Total nitrogen, not greater than 0.10 mg/l	Class AA
Total nitrogen, not greater than 0.15 mg/l	Class A
Total nitrogen, not greater than 0.20 mg/l	Class B

The following revision of water quality standards regarding nutrients was submitted in a letter dated December 26, 1967, prior to approval by the Secretary from Walter B. Quisenberry, M.D. to Mr. William B. Schroeder: "Insert the following section immediately preceding the section titled "Wastes from Vessels and Marinas:"

"Control of Nutrients:

Nutrient discharges were pointed out in testimony as being a potential problem in several water areas such as Kaneohe Bay and Pearl Harbor. The Agency is cognizant of this potential problem and nutrient limits have been included in the water quality criteria. At present the Agency knows of no practicable methods for the control of nutrients. The Agency will devise and implement control measures when the means to do so become available."

Hawaii has never adopted and submitted for approval an anti-degradation statement that also could be used for the protection of its high quality waters from problems due to excessive nutrients such as nitrates.

Idaho

Under the section titled "GENERAL WATER QUALITY STANDARDS FOR INTERSTATE STREAMS" is the narrative statement: "Interstate waters shall not contain. . . . Excess nutrients of other than natural origin that cause visible slime growths or other nuisance aquatic growths."

There is no specific criteria for nutrients such as nitrates and Idaho does have an approved antidegradation statement to protect existing high quality waters from excessive amounts of nutrients such as nitrates.

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Illinois

The water quality standards for the Interstate Waters, Wabash River and Tributary Streams Crossing into Indiana, Interstate Waters Mississippi River Between Illinois and Missouri, Interstate Waters Ohio River and Saline River, and the Interstate Waters Mississippi River Common Boundary Between Illinois and Iowa do not include specific criteria or a narrative statement directly concerned with limits for nitrates and other nutrients. Specific criteria for nitrate concentrations was included in the water quality standards for the following interstate waters:

1. Interstate Waters Illinois River and Lower Section of Des Plaines River.
 - a. Public Water Supply and Food Processing: "Not to exceed 45 mg/l Nitrate (as NO₃) . . . 2.5 mg/l Ammonia Nitrogen N.
 - b. There are no specific criteria or narrative statement concerning limits for nitrates and other nutrients assigned sectors of these waters classified for Aquatic Life, Recreation, and Industrial Water Supply.

Interstate Waters Chicago River and Calumet River System and Calumet Harbor Basin:

- a. Sectors 1-3: Not to exceed . . . 2.5 mg/l Ammonium Nitrogen (N).
- b. Sectors 4-10: *Ammonium Nitrogen*-mg/l.
Annual Average not more than 0.05.
Single daily value or average not more than 0.12.

Interstate Waters Lake Michigan and Little Calumet River, Grand Calumet River and Wolf Lake:

- a. *Lake Michigan Open Water:*
Total Nitrogen (N)
Not more than 0.4 mg/l.
Ammonium Nitrogen (N)
Annual average 0.02 mg/l.
Single daily value or average 0.05 mg/l.
- b. *Lake Michigan Shore Water:*
Ammonia Nitrogen (N):
Annual average not more than 0.05 mg/l.
Single daily value or average not more than 0.12 mg/l.
- c. *Little Calumet River:*
Ammonium Nitrogen—Single daily value or average not more than 1.5 mg/l.
- d. *Wolf Lake:*
Ammonia Nitrogen (N):
Annual average not more than 0.03 mg/l.

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Single daily value or average not more than 0.12 mg/l.

The following Nitrate Standards by State effluent criteria for nitrates and other nutrients has been adopted by the State as part of their standards.

Nitrate (NO₃): Not to exceed 45.0 mg/l.

Ammonia Nitrogen (N): Not to exceed 2.5 mg/l.

The State has an approved antidegradation statement that could be used to protect existing high quality waters from excessive nitrate concentrations causing problems.

Indiana

There are no specific criteria or narrative statement limiting nitrates or other nutrient substances in the Indiana water quality standards for any of the interstate basins other than Lake Michigan drainages unless the antidegradation statement could be applied for existing high quality waters.

Nitrate criteria applicable to Lake Michigan Basins.

Lake Michigan Open Waters:

Total Nitrogen (N)—mg/l 0.4

Lake Michigan Shore Waters:

Ammonia Nitrogen (N)—mg/l

Annual average not more than 0.05.

Single daily value or average not more than 0.12.

Indian Harbor Canal:

Ammonia Nitrogen (N)—mg/l

Annual average not more than 1.0.

Single daily value or average not more than 1.5.

*Grand Calumet River:**Ammonia Nitrogen (N)*—mg/l

Single value not more than 5.0.

Little Calumet River:

Single daily value or average not more than 1.5.

*Wolf Lake:**Ammonia Nitrogen (N)*—mg/l

Annual average not more than 0.05.

Single daily value or average not more than 0.12.

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Iowa

The following narrative statement could in my opinion be used to limit the amount of nitrates and other nutrients in the aquatic environment.

1. *Public Water Supply*

All substances detrimental to treatment processes shall be limited to non-detrimental concentrations in the surface waters.

2. *Aquatic Life*

All substances detrimental to aquatic life shall be limited to non-detrimental concentrations in the surface waters.

Specific criteria for interstate waters classified for Aquatic Life:

1. Ammonia Nitrogen (N) mg/l not more than 2.0.

They have approved antidegradation statement that could be used to protect existing high quality waters.

Kansas

The only standards regarding the limiting of nitrates in the aquatic environment are as follows:

1. Antidegradation statement—Existing high quality waters could be protected from damages resulting from discharge of effluents containing high nitrate concentrations to the aquatic environment.

2. The general criteria assigned to all Kansas Interstate Basins —“Pollution substances will be maintained below maximum permissible concentrations which would be detrimental for public water supplies, recreation requirements, and other established beneficial uses.”

Kentucky

Interstate waters classified for livestock use:

Nitrates shall not exceed 45.0 mg/l.

Two of four freedoms narrative statements in Kentucky water quality standards could be used to limit nitrates in interstate waters. They are:

“Free from materials attributable to municipal, industrial or other conditions in such degree as to create a nuisance.”

“Free from substances attributable to municipal, industrial or other discharges in concentrations or combinations which are toxic or harmful to human, animal, plant or aquatic life.”

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Louisiana

All interstate waters of Louisiana are assigned a general criteria which could be used to protect such waters from excessive

concentrations of nitrates or other nutrients. This statement with slight variations of use classification is:

"Wastes after discharge . . . shall not create conditions which adversely affect public health or use of the water for the following purposes: domestic or industrial water supply, propagation of aquatic life, agricultural water, recreation, and other legitimate uses."

Maine

The following narrative statements could be used to limit nitrate discharges to the interstate waters of Maine:

Class A Waters: "There shall be no discharge of sewage of other wastes into water of this classification and no deposits of such material on the banks of such waters in such a manner that transfer into the water is likely . . ."

Class B-1 Waters: "There shall be no disposal of sewage, industrial wastes or other wastes in such waters, except those which have received treatment for the adequate removal of waste constituents including, but not limited to, solids, color, turbidity, taste, odor or toxic material, such, that these treated wastes will not lower the standards or alter the usages of this classification, nor shall such disposal of sewage or waste be injurious to aquatic life or render such dangerous for human consumption."

Class B-2 Waters: Same as Class B-1.

Class C Waters: Same as Class B-1.

Class SA Waters: "There shall be no toxic wastes, deleterious substances, colored or other waste or heated liquids discharged to waters of this classification either singly or in combinations with other substances or wastes in such amounts or at such temperatures as to be injurious to edible or shellfish or to the culture or propagation thereof, or which in any manner shall adversely affect the flavor, color, odor or sanitary condition thereof; and otherwise none in sufficient amounts to make the waters unsafe or unsuitable for bathing or impair the waters for any other best usage as determined for the specific waters assigned to this class . . ."

Class SB-1: Same as Class SA.

Class SB-2: Same as Class SA.

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Maryland

Class SC: Essentially the same as Class SA.

The following narrative statement could be used to limit excessive nitrates affecting the uses of the interstate waters:

"Materials attributable to sewage, industrial waste, or other waste which produce taste, odor, or change the existing color or other physical and chemical conditions in the receiving to such degree as to create a nuisance, or that interfere directly or indirectly with water uses . . ."

The following narrative statement could be used to limit excessive nitrates affecting the uses of the interstate waters: "Materials attributable to sewage, industrial waste, or other waste which produce taste, odor, or change the existing color or other

physical and chemical conditions in the receiving to such degree as to create a nuisance, or that interfere directly or indirectly with water uses; . . ."

Massachusetts "Water quality parameters not specifically denoted shall not exceed the recommended limits on the most sensitive and governing water class use."

Class A Waters: Chemical constituents: "None in concentrations or combinations which would be harmful or offensive to humans, or harmful to animal, or aquatic life."

Class B Waters: "Ammonia as (N) not to exceed an average of 0.5 mg/l . . . during any monthly sampling period."

Class C Waters: "Ammonia as (N) not to exceed 1.0 mg/l . . . during any monthly sampling period."

Class D Waters: "Chemical constituents: "None in concentrations or combinations which would be harmful to human, animal, or aquatic life for the designated water use."

Class SA Waters (Coastal and Marine): "Ammonia as (N) not to exceed an average of 0.2 mg/l . . . during any monthly sampling period."

Class SB Waters: "Ammonia as (N) not to exceed an average of 0.2 mg/l . . . during any monthly sampling period."

Class SC Waters: "None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the water for any other usage."

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Michigan *Water Supply Domestic:* "Nitrate (NO₃) should not exceed 45 mg/l at the intake."

Nutrients (Phosphorus, ammonia, nitrates and sugars)

"Nutrients originating from industrial, municipal or domestic animal sources shall be limited to the extent necessary to prevent adverse effects on water treatment processes or the stimulation of growths of algae, weeds and slimes which are or may become injurious to the designated uses."

Industrial Water Supply: Nutrients (Phosphorus, ammonia, nitrates and sugars): "Nutrients originating from industrial, municipal or domestic animal sources shall be limited to the extent necessary to prevent the stimulation of growths of algae, weeds and slimes which are or may become injurious to the designated use."

Recreation: Nutrients (Phosphorus, ammonia, nitrates and sugars): "Nutrients originating from industrial, municipal, or domestic animal sources shall be limited to the extent necessary to prevent the stimulation of growths of algae, weeds and slimes which are or may become injurious to the designated use."

Fish, Wildlife and Other Aquatic Life: Same as for Recreation.

Agriculture: "Nutrients (Phosphorus, ammonia, nitrates and sugars): "Nutrients originating from industrial, municipal, or

domestic animal sources shall be limited to the extent necessary to prevent the stimulation of growths of algae, weeds and slimes which are or may become injurious to the designated use. NO₃ concentrations shall conform to USPHS Drinking Water Standards."

Commercial Water Use: Same as Industrial Water Supply.

Minnesota

Has approved antidegradation statement to protect existing high quality wastes.

The following narrative statement would limit damaging amounts of nitrates: "It is the intention of the Agency to require removal of nutrients from all sources to the fullest practicable extent whenever sources of nutrients are considered to be actually or potentially inimical to preservation of enhancement of the designated water uses."

Specific criteria limiting nitrates for certain class waters is as follows:

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Domestic Consumption:

Class A (Public Water Supply): Nitrates (NO₃) 45 mg/l
None for Class B, C, & D.

Fisheries & Recreation:

Class A: Ammonia (N) Not to exceed a trace

Class B: Ammonia (N) Not more than 1 mg/l

Class C: Ammonia Not more than 2 mg/l

Industrial, Agriculture & Wildlife, and Navigation & Waste Disposal Classifications: None

Mississippi

The only direct reference to nutrients in the State's water quality standards is: "It is the plan of the Commission to work with Soil and Wastes Conservation Districts to effect control of nutrients . . . pollution contributed by agricultural run off increase where this is a problem.

Does not have an approved antidegradation statement.

One of the "Freedom" statements would limit nutrients: "Free from substances attributable to municipal, industrial, agricultural or other discharge producing color, odor, or other conditions in such degree as to create a nuisance."

Missouri

This State's water quality standards include no specific criteria limiting nitrates.

One of the "Freedom" statements could be used to limit nitrates in problem areas. It is applicable to all Missouri interstate waters and states: "Substances attributable to municipal, industrial, agricultural, mining or other effluents shall not have a harmful effect on human or animal life."

These are narrative statements included in early interstate river basin standards that could be applicable in limiting nitrates. They are by River:

White River Basin—Interstate Stream Table Rock Reservoir, Bull Sholes Reservoir, Norfolk Reservoir, Clearwater Reservoir.

Lake Tanecamo, North Fork River and Spring River, Eleven Point River, Current River, & Black River (From the Headquarters to Clearwater Reservoir), Black River (Clearwater Reservoir to Mo.-Ark. State Line)

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"Substances toxic to humans, fish and wildlife detrimental to agricultural, mining, industrial, recreational or other legitimate uses shall be limited to nontoxic or nondetrimental concentrations in the Stream."

Grand and Chariton River Basin—Interstate Streams

Grand and Chariton Rivers

"d. Substances Potentially Toxic or detrimental Substances toxic to humans, fish and wildlife or detrimental to agricultural, mining, industrial, recreational or other legitimate uses shall be limited to non-toxic or non-detrimental concentrations in the stream."

East Fork Grand, Thompson, Little and Weldon Rivers

"d. Substances Potentially Toxic or detrimental Substances toxic to humans, fish and wildlife or detrimental to agricultural, mining, industrial, recreational or other legitimate uses shall be limited to non-toxic or non-detrimental concentrations in the stream."

Mississippi—Des Moines River Basin Interstate Streams

"d. Substances Potentially Toxic or Detrimental Substances toxic to humans, fish and wildlife or detrimental to agricultural, mining, industrial, recreational or other legitimate uses shall be limited to non-toxic or non-detrimental concentrations in the stream."

Osage River Basin—Interstate Streams

Osage—Marais des Cygnes River and Marmaton River

"Substances toxic to humans, fish and wildlife or detrimental to agricultural, mining, industrial, recreational or other legitimate uses shall be limited to non-toxic or nondetrimental concentrations in the lake."

Lower Missouri River Basin—Interstate Streams

Nishnabotna River

"d. Substances Potentially Toxic or Detrimental Substances toxic to fish or detrimental to industrial or other legitimate uses shall be limited to non-toxic or non-detrimental concentrations in the stream."

Tarkio River, West Tarkio River, Nodaway River, Platte River and One Hundred and Two River

"d. Substances toxic to humans, fish and wildlife or detrimental to agricultural, mining, industrial, recreational or other legitimate uses shall be limited to non-

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toxic or non-detrimental concentrations in the stream."

Lower Mississippi River Basin—Interstate Streams

St. Francis River (Excluding Wappapello Reservoir), Wappapello Reservoir, Little River, Buffalo Ditch (St. Francis River Basin)

“d. Substances Potentially Toxic or Detrimental Substances toxic to humans, fish and wildlife or detrimental to agricultural, mining, industrial, recreational or other legitimate uses shall be limited to non-toxic or non-detrimental concentrations in the stream.”

Mississippi River

Mississippi River (Zone 1—Des Moines River to Alton Lock and Dam, and Mississippi River (Zone 2—Alton Lock and Dam to the Missouri-Arkansas State Line)

“Substances Potentially Toxic or Detrimental

d. Substances toxic to humans, fish and wildlife or detrimental or agricultural, mining, industrial, recreational, navigational, or other legitimate uses shall be limited to non-toxic or non-detrimental concentrations in the stream.”

Missouri River

“Substances Toxic or Detrimental

d. Substances toxic to humans, fish and wildlife or detrimental to agricultural, mining, industrial, recreational, navigational, or other legitimate uses shall be limited to non-toxic or non-detrimental concentrations in the stream.”

Grand (Neosho) River Basin

Spring River, Shoal Creek, Turkey Creek, Buffalo Creek, Lost Creek

“Substances Toxic or Detrimental

d. Substances toxic to humans, fish and wildlife or detrimental to agricultural, mining, industrial, recreational, navigational, or other legitimate uses shall be limited to non-toxic or non-detrimental concentrations in the stream.”

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Missouri has an approved antidegradation statement which could be used to protect existing high quality waters from damaging amounts of nitrates.

The requirements for Class B, C, D, D1, D2, and D3 are:

“.....No excess nutrients which cause nuisance aquatic growths.....”

Montana

Class A (closed) “None allowed in addition to concentrations naturally present.”

Class A (open) “Concentrations of chemical constituents shall conform with the 1962 U.S. Public Health Service Drinking Water Standards. Induced variations within these standards shall be limited to an increase of not more than 10% of the concentration present in the receiving water.”

Class B “Concentrations of chemical constituents shall conform with the 1962 U.S. Public Health Service Drinking Water Stand-

ards after treatment. No floating suspended dissolved or settable matter, creating nuisance conditions, not attributable to natural cause. No excess nutrients which cause nuisance aquatic growths. . . ."

Class C "Concentrations of chemical constituents shall be maintained below levels known to be (or demonstrated to be) of Public Health Significance." "...No excess nutrients which cause nuisance aquatic growth. . . ."

Class D1 "Maximum allowable concentrations shall be less than acute or chronic problem levels as revealed by bio-assay or other appropriate methods. No excess nutrients which cause nuisance aquatic growths. . . ."

Class D2 Same as D1

Class D3 Same as D1

Class E "Concentrations shall be less than those demonstrated to be deleterious to livestock or plants or their subsequent-consumption by humans."

Nebraska

The following narrative statement protects waters from excessive nutrients including nitrates:

"...These waters shall be free of substances attributable to [p. 18]

discharge or wastes having...substances and conditions or combinations thereof in concentrations which produce undesirable aquatic life."

There is specific criteria for Class C waters. It is:

"Same as Water Supply -4- Plus ammonia nitrogen concentrations shall not exceed 1.4 mg/l in trout streams nor exceed 3.5 mg/l in warm water streams where the pH in these streams does not exceed a pH value of 8.3. If the pH of the streams exceeds 8.3, the undissociated ammonium hydroxide as nitrogen shall not exceed one-tenth mg/l in trout streams nor exceed 0.25 mg/l in warm water streams. . . ."

Nevada (By Interstate Waters)

West Fork Carson River, Total Nitrates (NO₃)—mg/l, Single value-not more than 3.0.

Leviathan Creek, No criteria or statement.

East Fork Carson River, Total Nitrates (NO₃)—mg/l, Single value-not more than 2.0.

Carson River (At Muller Lane), Total Nitrates (NO₃), Single value-not more than 2.0.

Carson River (Highway 395, So. of Carson), Total Nitrates (NO₃)—mg/l (Tentative), Single value-not more than 2.0.

Carson River (Near New Empire), Total Nitrates (NO₃)—mg/l (Tentative), Single value-not more than 2.0.

Carson River (At Weeks)

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Total Nitrates (NO₃)—mg/l, Single value-not more than 0.50.

Lake Lahontan, Total Nitrates (NO₃)—mg/l, Single value-not more than 4.0.

West Walker River (Above diversion to Topaz Lake), Total Nitrates (NO₃)—mg/l, Single value—not more than 2.0.

Topaz Lake, Total Nitrates (NO₃)—mg/l, Single value—not more than 2.0.

West Walker River (Near Wellington), Total Nitrates (NO₃)—mg/l, Single value—not more than 2.0.

West Walker River (Above confluent with East Walker River), Total Nitrates (NO₃)—mg/l, Single value—not more than 1.0.

*Sweetwater Creek, Has approved antidegradation statement. Not to exceed PHS, Drinking Water Standards 1962.**

East Walker River (At State Line), Total Nitrates (NO₃) mg/l, Single value—not more than 4.5.

East Walker River (South of Yerington and above confluent with W. Walker River.)

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Total Nitrates (NO₃)—mg/l, Single value—not more than 3.0.

*Walker River (At J.J. Ranch), Total Nitrates (NO₃)—mg/l, Not to exceed PHS Drinking Water Standards 1962.**

*Desert Creek, Antidegradation statement approved. Not to exceed PHS, Drinking Water Standards 1962.**

Chiatovich Creek, Total Nitrates (NO₃)—mg/l, Single value—not more than 1.0.

*Indian Creek, Total Nitrates (NO₃)—mg/l, Antidegradation statement. Not to exceed 1962 PHS, Drinking Water Standards.**

Leidy Creek (Above Hydroelectric Plant), Total Nitrates (NO₃)—mg/l, Single value—not more than 1.0.

Virgin River, Total Nitrates (NO₃)—mg/l, Single value—not more than 1.0.

Beaver Dam Wish (Above Schroeder Reservoir), Total Nitrates (NO₃)—mg/l, Single value—not more than 1.0.

Snake Creek (Above Fish Hatchery), Total Nitrates (NO₃)—mg/l, Single value—not more than 1.0.

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Big Goose Creek (At Ranch), Total Nitrates (NO₃)—mg/l, Single value—not more than 1.0.

Salmon Falls Creek (Highway 93, South of Jackpot, Total Nitrates (NO₃)—mg/l, Single value—not more than 1.0.

*Shosphone Creek, Approved antidegradation statement. Not to exceed PHS, Drinking Water Standards 1962.**

East Fork, Jarbridge River, Approved antidegradation statement. Not to exceed 1962, PHS Drinking Water Standards.

Jarbridge River (Upstream from Jarbridge), Total Nitrates (NO₃)—mg/l, Single value—not more than 1.0.

Jarbridge River (Downstream of Jarbridge), Total Nitrates (NO₃)—mg/l, Single value—not more than 1.0.

West Fort Bruneau (Diamond "E" Road), Total Nitrates (NO₃)—mg/l, Single value—not more than 1.0.

East Fork Owyhee River (Above Mill Creek), Approved anti-degradation statement. Not to exceed the 1962 PHS Drinking Water Standards.*

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East Fork Owyhee River (South of Owyhee), Total Nitrates (NO_3)—mg/l, Single value—not more than 1.0.

East Fork Owyhee River (State Line), Total Nitrates (NO_3)—mg/l, Single value—not more than 1.0.

South Fork Owyhee River, Total Nitrates (NO_3)—mg/l, Single value—not more than 3.0.

Smoke Creek (Approx. 30 mi. East of Susanville, California), Total Nitrates (NO_3)—mg/l, Single value—not more than 5.0.

Bronco Creek (At Hirschdale Road), Approved antidegradation statement. Not to exceed 1962, PHS Drinking Water Standards.*

Gray Creek (At Hirschdale Creek), Approved antidegradation statement. Not to exceed 1962, PHS Drinking Water Standards.*

Truckee River (At Farad, California), Total Nitrates (NO_3)—mg/l, Single value—not more than 2.5. Annual average not more than 1.0.

Truckee River (At Idlewild), Total Nitrates (NO_3)—mg/l, Single value—not more than 2.0.

Truckee River (At Boynton Lane)

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Total Nitrates (NO_3)—mg/l, Single value—not more than 2.0.

Truckee River (Lagomansine Bridge), Total Nitrates (NO_3)—mg/l, Single value—not more than 5.0.

Truckee River (At Censola Ranch), Total Nitrates (NO_3)—mg/l, Single value—not more than 5.0.

Lake Tahoe (All points), Total soluble inorganic Nitrogen ug/l, Annual average—not more than 25.0.

Colorado River, No specific criteria.

* "... 10 mg nitrate nitrogen (or 45 mg nitrate) per liter of water is a limit which should not be exceeded."

New Hampshire No specific criteria. No applicable narrative statement. Have approved antidegradation statement.

New Jersey The narrative statement limiting toxic or Deleterious Substances states the following:

"Toxic or Deleterious Substances Including But Not Limited To Mineral Acids, Caustic Alkali, Cyanides, Heavy Metals, Carbon Dioxide, Ammonia or Ammonium Compounds, Chlorine, Phenols, Pesticides, Etc.: None, either alone or in combination with other substances, in such concentrations as to affect humans or be detrimental to the natural aquatic biota or which would render the waters unsuitable for the designated uses. None which would cause the Potable Water Standards of the De-

partment for drinking water to be exceeded after appropriate treatment."

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New Mexico

The following narrative statement under the heading of "General Standards" seems to offer a vehicle to use in limiting nitrates and other nutrients:

"Toxic Substances"

Toxic substances such as, but not limited to, pesticides, herbicides, heavy metals, and organics, shall not be present in receiving waters in concentrations which will change in the ecology of receiving waters to an extent detrimental to existing forms of life or which are toxic to human, plant, fish and animal life. Toxicities of substances in receiving waters will be determined by appropriate bioassay techniques, or other acceptable means, for the particular form of aquatic life which is to be preserved with the concentrations of the toxic materials not to exceed 10 percent of the 48-hour median tolerance limit."

New York

New York does not have specific criteria limiting the amount of nitrates in interstate waters. It does have a toxic substance statement for each class of waters which is the same or similar to the following example: Class AA (Public Water Supply): "None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to fish life, make the waters unsafe or unsuitable as a source of water supply for drinking, culinary or food processing purposes or impair the waters for any other best usage as determined for the specific waters which are assigned to this class."

North Carolina

North Carolina does not have specific numerical criteria to protect its interstate waters from nitrates. It does have an approved antidegradation statement that could be used to limit nitrates in existing high quality waters.

Section II (Rules Applicable To Classes and Standards) contains several narrative statements that could be used to limit nitrates where damage is occurring as a result of their discharge to interstate waters. These are:

1. "The quality of any waters receiving sewage, industrial waste or other waste discharges shall be such that no impairment of the best usage of waters in any other class shall occur by reason of such sewage, industrial waste or other waste discharges."

2. "The maximum limits for toxic and other deleterious substances in receiving waters shall not exceed the values

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recommended in the most recent edition of the "Report of the National Technical Advisory Committee on Water Quality Criteria" where stated and in cases where such values are not included in the report, bio-assays will be conducted according to the standard techniques recommended therein to determine safe levels for such substances on the basis of the discharge and characteristics of the waters under consideration."

There are narrative statements for each class of water use that could possibly be used to limit harmful amounts of nitrates. These are:

Class A-I: In determining the safety or suitability of waters in this class for use as a source of water supply for drinking, culinary or food-processing purposes after approved disinfection, the Board will be guided by the physical, chemical and bacteriological standards specified in the 1962 edition of the "Public Health Service Drinking Water Standards" and the requirements of the State Board of Health as set forth in Section 5, "Protection of Unfiltered Public Water Supplies", of the Rules and Regulations Providing for the Protection of Public Water Supplies, as adopted October 6, 1960, and amended May 9, 1962, August 26, 1965, and October 12, 1967." The 1962 "Public Health Service Drinking Water Standards" recommend that nitrates shall not exceed 45 mg/l.

Class A-II: "Only such amounts, whether alone or in combination with other substances or wastes as will not render the waters unsafe or unsuitable as a source of water supply for drinking, culinary or food processing purposes, injurious to fish and wildlife or adversely affect the palatability of same, or impair the waters for any other best usage established for this class."

Class B: "Only such amounts, whether alone or in combination with other substances or wastes as will not render the waters unsafe or unsuitable for bathing, injurious to fish and wildlife or adversely affect the palatability of same or impair the waters for any other best usage established for this class."

Class C: "Only such amounts, whether alone or in combination with other substances or wastes as will not render the waters injurious to fish and wildlife or adversely affect the palatability or same, or impair the waters for any other best usage established for this class."

Class D: "Only such amounts attributable to sewage, industrial wastes or other wastes as will not render the waters unsuitable for agriculture, industrial cooling purposes, navigation, or fish survival, or cause offensive conditions."

Class SA Waters: Only such amounts, whether alone or in
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combination with other substances or wastes as will not make the waters unsafe or unsuitable for fish and shellfish or their propagation, impair the palatability of same, or impair the waters for any other best usage established for this class."

Class SB: "Only such amounts, whether alone or in combination with other substances or wastes as will not make the waters unsafe or unsuitable for bathing, injurious to fish or shellfish, or adversely affect the palatability of same, or impair the waters for any other best usage established for this class."

Class SC: "Only such amounts, whether alone or in combination with other substances or wastes as will not render the waters

injurious to fish and shellfish, adversely affect the palatability of same, or impair the waters for any other best usage established for this class."

North Dakota No specific criteria. Section II, C promises such criteria as follows:

"C. The maximum practical reduction of nutrients, including nitrogen, phosphorus and sugars, in sewage, industrial, and other wastes shall be accomplished as soon as a practical method is developed."

North Dakota has an approved antidegradation statement that should provide protection to existing high quality interstate waters from harmful amounts of nitrates.

A narrative statement could be used on nutrient problems including nitrates. It is: "None in concentrations or combinations that interfere with, or prove hazardous to, the intended water usage." This applies to all interstate waters.

Ohio Ohio has two narrative statements in their standards that could be applicable in limiting nitrates to less than harmful or nuisance amounts. These are:

"1. Free from substances attributable to municipal, industrial or other discharges in concentrations or combinations which are toxic or harmful to human, animal or aquatic life."

"2. Free from materials attributable to municipal, industrial, or other discharges producing color, odor or other conditions

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in such degree as to create a nuisance"; Ohio has approved antidegradation statement that could be used to protect high quality waters.

Oklahoma No specific criteria limiting nitrogen compounds. Have an approved antidegradation statement which could be used to limit harmful amounts of nitrogen compounds being discharged to interstate waters. The standards for each of the interstate streams in Oklahoma contain four narrative statements that could be used to limit harmful amounts of nitrogen compounds being discharged into interstate waters. These are:

"All tributary streams and all waste effluents shall be in such condition that when discharged to the stream reaches as defined, and Interstate Tributaries, they shall not create conditions which will adversely affect public health, or use of the water for beneficial purposes."

"Taste and Odor Producing Substances—Taste and odor producing substances shall be limited to concentrations that will not interfere with the production of potable water by modern treatment methods or impart off color or unpalatable flavor to flesh or fish, or result in offensive odors in the vicinity of the water, or otherwise interfere with beneficial uses."

"Toxic Substances—Toxic substances shall not be present in such quantities as to cause the waters to be toxic to human, animal, plant, or aquatic life. For aquatic life, using bioassay

techniques, the toxic limit shall not exceed one-tenth of the 48-hour median tolerance limit, except that other limiting concentrations may be used in specific cases when justified on the basis of available evidence and approved by the regulatory authority."

"Other Substances—The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service Drinking Water Standards of 1962, or latest revision thereof, and accumulated scientific data on limits above which injury to use occurs. Pollutational substances will be maintained below maximum permissible concentrations for public water supplies, recreation requirements, agricultural needs and other beneficial uses.(c)*"

Oregon

Oregon has no specific criteria limiting nitrates. They do have an approved antidegradation statement to protect existing high quality interstate waters from damaging amounts of

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nitrates. They have included two narrative statements in their general standards for interstate waters that could be used to limit the amount of nitrates in such waters should problems arise. These are:

"No wastes shall be discharged and no activities shall be conducted which either alone or in combination with other wastes or activities will cause in any waters of the State:

- (4) The development of fungi or other growths having a deleterious effect on stream bottoms, fish or other aquatic life or which are injurious to health, recreation or industry.
- (5) The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish or shellfish."

Pennsylvania

Pennsylvania water quality standards do not contain specific criteria for nitrates. Nor does this State have an approved antidegradation statement to protect existing high quality water from harmful amounts of nitrates. The narrative statement contained under Section 4, General Criteria could be used to limit nitrates in interstate waters where problems from such nutrients occur. The statement is:

"The water shall not contain substances attributable to municipal, industrial or other waste discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life. Specific substances to be controlled include, but are not limited to, floating debris, oil, scum and other floating materials; toxic substances; substances that produce color, tastes, odors or settle to form sludge deposits."

Rhode Island

No specific criteria to limit nitrates. Approved antidegradation statement that could be used to protect existing high quality waters from harmful amounts of nitrates. The water quality

standards assigned the freshwater classification of Class A, B, C, and D each include the following narrative statement that could be used in limiting the amount of nitrates being discharged into interstate waters having nutrient problems: "Waters shall be free from chemical constituents in concentrations or combinations which would be harmful to human, animal, or aquatic life for the appropriate, most sensitive and governing water class use. In areas where fisheries are the governing considerations and approved limits have not been established, bio-assays shall be performed as required by the appropriate agencies. For public drinking water

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supplies the limits prescribed by the United States Public Health Service may be used where not superseded by more stringent signatory State requirements."

The water quality standards assigned to saltwater classifications SA, SB, SC, and SD have the following narrative statement that could be used to limit where problems arise: "None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the waters for any other uses."

South Carolina

No specific criteria limiting the nitrate content of interstate waters. They have an approved antidegradation statement that could be used to protect existing high quality waters from harmful amounts of nitrate. They also have the following narrative statements that could be applicable in limiting nitrates in problem areas:

"Source of water supply for drinking, culinary or food processing purposes shall mean any source, either public or private, the waters from which are used for domestic consumption, or used in connection with the processing of milk, beverages, food or for other purposes which require finished water meeting U.S. Public Health Service Drinking Water Standards."

"The waters of the State shall be free from: Materials attributable to sewage, industrial waste, or other waste which produce taste, odor, or change the existing color or other physical and chemical conditions in the receiving stream to such degree as to create a nuisance, or that interfere directly or indirectly with water uses; and high-temperature, toxic, corrosive or other deleterious substances attributable to sewage, industrial waste, or other waste in concentrations or combinations which interfere directly or indirectly with water uses, or which are harmful to human, animal, plant or aquatic life."

Class SA water quality standards contains the following narrative statement that could be used to limit nitrates where problems exist: "Toxic wastes, deleterious substances, colored or other wastes. None alone or in combination with other substances or wastes in sufficient amounts as to be injurious to

edible fish or shellfish or the culture or propagation thereof, or which in any manner shall adversely affect the flavor, color, odor, or sanitary condition thereof

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or impair the waters for any other best usage as determined for the specific waters which are assigned to this class."

South Dakota

The following narrative statement could be used to limit nitrates for all classes of water other than Domestic Water Supply and Recreation which have specific criteria:

"Toxic Materials. No materials shall be discharged to any surface water or watercourse in the State which produce concentrations of chemicals toxic to humans, animals or the most sensitive stage or form of aquatic life greater than 0.1 times the 96-hour median tolerance limit for short residual compounds or 0.01 times the median tolerance limit for accumulative substances exhibiting a residual life exceeding 30 days in the receiving waters."

"Median tolerance concentrations shall be based on the results of the most recent research results for the material being studied or, in case of disagreement, by bioassay tests simulating actual stream conditions run in accordance with procedures outlined in latest edition of 'Standard Methods for the Examination of Water and Wastewater' published by the American Public Health Association and using test animals or organisms specified by the Committee."

"Concentrations specified for toxic materials shall be based on daily averages, but the concentrations shall not exceed 125% of the value specified at any time or in any section of the receiving water."

Waters classed for Domestic Water Supply and Recreation have the following specific criteria limiting nitrates:

Domestic Water Supply

Nitrates not more than 10 mg/l (as N) or 45 mg/l as (NO₃)

Recreation

Nitrates as (NO₃) not more than 50 mg/l

Have approved antidegradation statement that could be used to limit nitrates causing problems in existing high quality waters.

Tennessee

Does not have an antidegradation statement to protect existing high quality waters from harmful amounts of nitrates. There are no specific criteria limiting the amount of nitrates in interstate waters.

The following narrative statements under use classifications could be used to restrict nitrates in problem areas:

"Domestic Raw Water Supply

K. Other Pollutants—other pollutants shall not be added

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to the water in quantities that may be detrimental to public health or impairs the usefulness of the water as a source of domestic water supply.”

“Industrial Supply

Other Pollutants—Other pollutants shall not be added to the waters in quantities that may adversely affect the water for industrial processing.”

“Fish and Aquatic Life

H. Other Pollutants—other pollutants shall not be added to the waters that will be detrimental to fish or aquatic life.”

“Recreation

I. Other Pollutants—other pollutants shall not be added to the water in quantities which may have a detrimental effect on recreation.”

Texas

No specific criteria. A narrative statement that could be used to protect waters from excessive nitrate concentrations is “Taste and odor producing substances shall be limited to concentrations in the waters of the state that will not interfere with the production of potable water by reasonable water treatment methods, or impair unpotable flavor to food fish, including shellfish, or result in offensive odors rising from the waters or otherwise interfere with the reasonable use of the waters.”

Approved antidegradation statement.

Utah

No specific criteria. Narrative statements:

Class A

“It shall be unlawful to discharge or place any wastes or other substances in such a way as to interfere with the stated Class “A” Water uses, . . .”

Class B

“It shall be unlawful to discharge or place any wastes or other substances in such a way as to interfere with the stated Class “B” water uses, . . .”

Class C

“It shall be unlawful to discharge or place any wastes or other substances in such a way as to interfere with the stated Class “C” water uses, . . .”

Have approved antidegradation statement.

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Vermont

Have an approved antidegradation statement to protect existing high quality water from harmful amounts of nitrates.

Rules 8 and 9 of the Vermont water quality standards concerning discharge requirements for Class A and B waters limit the discharge of nutrients including nitrates as follows:

“RULE 8: Discharges Prohibited—Class A Waters

In accordance with the antidegradation provisions of Rule 2

there shall be no discharge of wastes into Class A waters that does not meet or exceed the technical and other requirements for such waters nor shall there be any new discharges of wastes containing any form of nutrients which would encourage eutrophication or growth of weeds or algae from the date of the adoption of this rule.

RULE 9: Discharges Restricted—Class B Lakes and Ponds

In accordance with the anti-degradation provisions of Rule 2 there shall be no new discharge of wastes into any lake, pond or reservoir, natural or artificial, lying wholly within the state's boundaries, or into the tributaries thereto which does not meet the technical and other requirements for Class B waters nor shall there be any new discharge of wastes containing any form of nutrients which would encourage eutrophication or growth of weeds and algae from the date of adoption of this rule. Any existing waste discharge containing soluble or other nutrients, which would encourage eutrophication or growth of weed and algae, shall be treated so as to remove such nutrients to the extent that such removal is or may become technically and reasonably feasible."

The narrative statement, Rule 12 of the Vermont water quality standards, should be applicable to limit nitrates doing damage to interstate waters, according to the interpretation made in Martin L. Johnson's letter of July 27, 1971, to Mr. Klashman, Acting Regional Director of Region 1. Mr. Johnson is Commissioner of Water Resources for the State of Vermont. The statement and interpretation are as follows:

"RULE 12: Chemical, Radiological Constituents

Wastes shall be free of chemical and radiological constituents which would be harmful to the governing water class use. In areas where fisheries are the governing consideration and

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approved limits have not been established, bio-assays shall be performed as required by the appropriate state agencies.

"The new regulations are very strict with regard to the discharge of chemical or radiological constituents. In interpreting the narrative criteria, we will not permit the concentrations of these constituents due to effluent discharges to exceed those numerical limits set forth in the Public Health Service Drinking Water Standard."

Public Health Drinking Water Standards limit nitrates to less than 45 mg/l.

Virginia

"1.05 In addition to other standards established for the protection of public or municipal water supplies, the following standards will apply at the raw water intake point:

Nitrates plus Nitrites 10 mg/l"

Has an approved antidegradation statement to protect existing high quality waters from harmful amounts of nitrates.

Have special standards applicable to specific waterstate waters and or as assigned that limit the amount of nutrients in effluents, including nitrates.

Have special standards limiting nutrients, including nitrates in specific interstate waters as assigned. They are:

"h. *Objective for Nutrients*—The cumulative total of nitrogen as N from all sources in the effluent shall not be greater than 0.5 mg/l at any time; phosphorus as P from all sources in the effluent shall not be greater than 1.0 mg/l+ at any time.

i. The State Water Control Board has directed and/or ordered the following:

1. That all existing discharges in accordance with h above shall substantially remove the nutrients in their effluents on or before such time as central facilities (The Hampton Roads Sanitation District Commission Chesapeake-Elizabeth System) become available or connect to central facilities, (i.e. The Chesapeake-Elizabeth System).

2. That it will consider approving small discharges to this watershed to facilitate the elimination of potential public health hazards provided central facilities (Chesapeake-

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Elizabeth System) are not available, and

3. That it will not allow additional significant new discharges to this watershed, which do not provide for nutrient removal facilities in accordance with h above.

j. The following, from Minute 73 of the proceedings of the Board at its meeting on July 11-12, 1966, will also apply:

For discharge to the Chickahominy River and its tributaries below Bottoms Bridge, effluent quality obtainable with conventional secondary sewage treatment plants with approved plans is acceptable, except that the following specifications shall be met:

Constituent	Analysis Schedule	Concentration
2 Inorganic Nutrients.	Once/week on a composite sample.	Nitrate (as N) not to exceed .5 ppm. Total phosphate (as PO ₄) not to exceed 1.5 ppm.

In lieu of the above requirements, conventional secondary sewage treatment plants may ordinarily be used anywhere in the Chickahominy River Basin, provided holding ponds, capable of retaining the entire plant effluent during low flow critical conditions, are constructed. "Low flow" is construed to mean less than 15 cubic feet per second in the main stem of the Chickahominy River itself at the (1) point of waste discharge to the main stem, or (2) confluence of a tributary below the point of waste discharge to the tributary. Below Bottoms Bridge, holding ponds with at least 60-day retention capacity

(August 14 to October 13) may be required, if in the opinion of the Board's staff it is deemed necessary.

k. The following from Minute 73 of the proceedings of the Board at its meeting on July 11-12, 1966, will also apply:

Constituent	Analysis Schedule	Concentration
5 Ammonia	Same as biochemical oxygen demand on specially preserved samples	Not to exceed 2.0 ppm as N
Inorganic Nutrients	Once/week on a composite sample	Nitrate (as N) not to exceed .3 ppm, total phosphate (as PO ₄) not to exceed .6 ppm (mean values in the Chickahominy)

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In lieu of the above requirements, conventional secondary sewage treatment plants may ordinarily be used anywhere in the Chickahominy River Basin, provided holding ponds, capable of retaining the entire plant effluent during low flow critical conditions, are constructed. "Low flow" is construed to mean less than 15 cubic feet per second in the main stem of the Chickahominy River itself at the (1) point of waste discharge to the main stem, or (2) confluence of a tributary below the point of waste discharge to the tributary. Above Bottoms Bridge the holding ponds are to retain the entire plant effluent for at least 90 days (July 15 to October 13).

r. The following will also apply to the Occoquan Creek Watershed:

(1) It was willing to permit the discharge of treated sewage effluent from an additional 25,000 persons with the stipulation that:

(a) nutrient removal facilities be constructed in each case.

s. The following, from Minute 20 of the proceedings of the Board at its meeting on January 16, 1969, will also apply to the Powhatan Creek Watershed:

1. All proposals for treated waste discharges to the Powhatan Creek Watershed will in the future be approved only after:

(a) Engineering data has been submitted indicating the capability of the proposed treatment facilities to remove all phosphorus and nitrogen compounds.

(b) Owners with facilities existing at the time of this action will, in a period not to exceed 60 days, submit to the Board, engineering reports and pollution abatement schedules indicating the maximum concentrations of phosphorus and nitrogen

compounds which they can remove from waste waters prior to discharge. No schedule providing a time period exceeding three years will be approved. Modification or replacement of existing treatment facilities may be necessary.

2. It will entertain from owners in the area a proposal for development of:

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(a) A central facility to treat all wastes at a point outside the Watershed, where phosphorus and nitrogen removal will probably not be necessary, or

(b) Treatment facilities inside the Watershed which include complete removal of all phosphorus and nitrogen compounds."

Washington

Have an approved antidegradation statement that could be used to limit nitrates in existing high quality waters.

The Toxic, Radioactive or Deleterious Material Concentrations and the Aesthetic Values statements for each water use classification could possibly be used to limit the amount of nitrates in interstate waters. They are:

"Class AA

Toxic, Radioactive or Deleterious Material Concentrations shall be less than those which may affect public health, the natural aquatic environment, or the desirability of the water for any usage.

Aesthetic Values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch or taste."

"Class A

"Toxic, Radioactive or Deleterious Material Concentrations shall be below those of public health significance, or which may cause acute or chronic toxic conditions to the aquatic biota, or which may adversely affect any water use.

Aesthetic Values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch or taste."

"Class B

"Toxic, Radioactive or Deleterious Material Concentrations shall be below those which adversely affect public health during the exercise of characteristic usages, or which may cause acute or chronic toxic conditions to the aquatic biota, or which may adversely affect characteristic water uses.

Aesthetic Values shall not be reduced by dissolved, suspended, floating or submerged matter, not attributable to natural causes, so as to affect water usage or paint the flesh of edible species."

"Class C

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"Toxic, Radioactive or Deleterious Material Concentrations shall be below those which adversely affect public health during the exercise of characteristic usages, or which may cause acute or chronic toxic conditions to the aquatic biota, or which may adversely affect characteristic water uses.

Aesthetic Values shall not be interfered with by the presence of obnoxious wastes, slimes, or aquatic growths or by materials that will taint the flesh of edible species."

West Virginia All of the interstate waters of West Virginia are assigned criteria which limits nitrates to (NO_3) to less than 45 mg/l. Have approved antidegradation statement that could be used to limit nitrates causing trouble in existing high quality waters.

Wisconsin Have an approved antidegradation statement that could be used to limit nitrates causing problems in existing high quality waters.

These are several narrative statements that could be used to limit problems causing nitrates. These are:

1. "Minimum Standards. Regardless of the water quality standards and water use, untreated or inadequately treated wastes may not impair a designated use nor may standards be interpreted to permit a lower quality within a water sector than that existing or required by outstanding orders..."

2. "Substances in concentrations or combinations which are toxic or harmful to humans shall not be present in amounts found to be of public health significance, nor shall substances be present in amounts, which by bio-assay and other appropriate tests, indicate acute or chronic levels harmful to animal, plant or aquatic life."

The only specific criteria is provided by a statement applying to interstate waters used for public water supplies. That is:

"(d) The intake water supply will be such that by appropriate treatment and adequate safeguards it will meet the Public Health Service Drinking Water Standards, 1962..."

Public Health Service Drinking Water Standards state that nitrate as (NO_3) should not exceed 45 mg/l.

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Wyoming Have no specific criteria limiting nitrates in interstate waters. Have no approved antidegradation statement that could be used to limit nitrates causing problems in existing high quality waters.

No narrative statement that could be used to limit nitrates in interstate waters where such substances are causing problems.

District of Columbia Have no approved antidegradation statement that could be used to limit nitrates causing problems in existing high quality waters.

They have no specific criteria limiting nitrates in interstate waters.

The following narrative statement from the District of Colum-

bia water quality standards could be used to limit nitrates where problems attributable to them exist in the interstate waters:

"Materials attributable to sewage, industrial waste, or other waste which produce taste, odor or appreciably change the existing color or other physical and chemical conditions in the receiving streams to such degree as to create a nuisance, or that interfere directly or indirectly with water uses..."

Guam

Have an approved antidegradation statement that could be used to limit nitrates causing problems in existing high quality waters.

The two following freedom statements could be used to limit nitrates causing problems in interstate waters:

"Free from substances and conditions or combinations thereof attributable to sewage, industrial wastes, or other wastes that will induce undesirable aquatic life.

Free from substances and conditions thereof attributable to sewage, industrial wastes, or other wastes toxic or irritant to humans, animals, plants, and aquatic life."

Waters classed as Domestic Water Supply have both specific criteria and a narrative statement. They are:

"Treated surface waters used for public or domestic water supply shall meet the recommendations of the Public Health Service Drinking Water Standards."

They recommend not more than 45 mg/l as (NO₃).

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"Ammonia nitrogen shall be less than .01 mg/l as N." Waters classed for the Propagation of Fish and Other Aquatic Life limit nutrients such as nitrates as follows:

"The naturally occurring ratio and concentrations of nitrogen and phosphorus will be maintained in near shore waters and fresh waters."

Puerto Rico

The water quality standards of Puerto Rico have no specific criteria limiting nitrates in interstate waters.

Have an approved antidegradation statement that could be used to restrict the amount of nitrates causing problems in existing high quality waters.

Contains a narrative statement that could be used to limit nitrates in interstate waters where problems arising from them exist. It is:

"1. Class SA

Existing natural conditions shall not be altered."

"2. Class SB

e. Toxic wastes or deleterious substances alone or in combination with other substances or wastes in sufficient amounts... which in any way obviously affect the flavor, color, odor, or sanitary conditions of the waters..."

Virgin Islands Have no specific criteria to limit nitrates in interstate water.
Have no narrative statement that could be used to limit nitrates in problem areas.
Have an approved antidegradation statement that could be used to limit nitrates causing problems for existing high quality waters.

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4.5i "STANDARDS FOR ANTIDEGRADATION"

Environmental Protection Agency, Division of Water Quality Standards, April 1972

This is a compilation of all Federally approved antidegradation statements adopted in response to a policy directive issued by the Secretary of the Interior on February 8, 1968. The purpose of antidegradation is to prohibit the deterioration of waters whose existing quality is higher than established water quality standards.

At the time of this report, the following States do not have a Federally approved antidegradation statement: Alabama, Georgia, Mississippi and Tennessee. Action is underway in all the States to adopt an antidegradation provision in their water quality standards.

Individual State-adopted antidegradation statements, contained within State standards, follow.

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ALASKA

(Approved: October 4, 1971)

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at that high quality unless it has been affirmatively demonstrated to the state that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of such waters. Any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required to provide the highest degree of practicable treatment to maintain the high water quality. In implementing this policy, the Administrator of the Environmental Protection Agency will be kept advised in order to discharge his responsibilities under the Federal Water Pollution Control Act as amended.

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ARIZONA

(Approved: September 27, 1968)

Waters whose existing quality is better than the established standards will not be lowered in quality unless and until it has been affirmatively demonstrated to the State Water Quality Control Council that such change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any assigned uses made of, or presently possible in, such waters. Any industrial, public or private project or development which could constitute a new

source of pollution or an increased source of pollution to high quality waters will be required, as part of the initial project design, to provide the highest and best degree of waste treatment practicable under existing technology. In implementing the policy of this paragraph as it relates to interstate streams, the Secretary of Interior will be kept advised and provided with such information as he will need from time to time to protect the interests of the United States and the authority of the Secretary in maintaining high quality of interstate waters.

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ARKANSAS

(Approved: November 19, 1969)

WHEREAS, the Arkansas Pollution Control Commission has heretofore promulgated Regulation No. 2, establishing water quality criteria for interstate streams within the State of Arkansas, pursuant to the provisions of Section 3 of the Arkansas Water and Air Pollution Control Act (Act 472 of the Acts of Arkansas for 1949, as amended; Ark. Stats., §82-1904), and in compliance with the requirements of the Federal Water Quality Act of 1965 (Public Law 89-234, 33 U.S.V.A., §466g); and

WHEREAS, said Regulation provides that "The criteria are designed to enhance the quality, value, and beneficial uses of the water resources of the State of Arkansas and to aid the prevention, control, and abatement of water pollution;" and

WHEREAS, said Regulation further provides that "It is the purpose of these criteria to preserve and enhance the quality of this water so that it shall be reasonably available for all beneficial uses and thus promote the social welfare and economic well-being of the people of the State"; and

WHEREAS, said Regulation further provides for a clear and unequivocal non-degradation policy, to-wit:

"3. The water quality criteria herein contained shall not be construed as permitting any waste amenable to treatment or control to be discharged in any water of the State of Arkansas without reasonable treatment or control. The Arkansas Water and Air Pollution Control Act provides, among other things, that it shall be unlawful for any person to discharge any waste into any waters of the State without having first obtained a written permit from the Commission. A disposal permit may not be issued unless there is submitted to the Commission plans and specifications for a disposal

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system adequate to treat or control the wastes so as not to cause water pollution as defined in the Act. Such treatment or control must be consistent with the state of the art and best practicable industry standards, the minimum requirement being secondary treatment or equivalent, giving due regard to quality and flow of the receiving waters, the present, future and potential uses of such waters, economic feasibility, and other relevant factors"; and

WHEREAS, the Water Quality Standards for Interstate Streams adopted by the Commission, of which Regulation No. 2 is an integral part, were approved without exception by the Secretary of Interior on August 7, 1967; and

WHEREAS, subsequent to such approval the Secretary of Interior and the Federal Water Pollution Control Administration articulated a non-degradation policy, which has been authoritatively construed and explained by responsible officials of the Department of Interior as set forth in a Compendium, dated August, 1968; and

WHEREAS, the non-degradation policy incorporated in Regulation No. 2, mak-

ing clear that waters of existing quality higher than the established standards may not be degraded by untreated waste discharges even though the resulting water quality might comply with the standards and that a waste disposal permit, as required by law, will not be issued by the Commission unless the treatment or control is consistent with the state of the art and best practicable industry standards (the minimum requirement being secondary treatment or equivalent), is at least as strong as that subsequently adopted by the Secretary of Interior and is fully consistent therewith; and

WHEREAS, the Commission wishes to assure the Secretary of Interior and Federal Water Pollution Control Administration of its cooperation in implementing the Arkansas Water Quality Standards in general and the non-degradation policy in particular,

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including the furnishing of relevant information and data;

NOW, THEREFORE, BE IT RESOLVED, That the Arkansas Pollution Control Commission, its agents, servants, and employees, shall cooperate with the Secretary of Interior and the Federal Water Pollution Control Administration in implementing the Arkansas Water Quality Standards and the non-degradation policy incorporated therein. In connection with such implementation, the Secretary of Interior and the Federal Water Pollution Control Administration will be kept advised and will be provided with such information as they will need to discharge their responsibilities under the Federal Water Pollution Control Act, as amended.

BE IT FURTHER RESOLVED, That the Director of the Commission is hereby authorized and directed to take such action as may be necessary or appropriate to effectuate the foregoing.

Resolved the 25th day of October, 1968.

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CALIFORNIA

(Approved: January 9, 1969)

Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

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COLORADO

(Approved: March 4, 1971)

Waters of the state, the quality of which exceeds the limits set in these standards, will be maintained at existing quality unless and until it can be demonstrated to

the State that a change in quality is justified to provide necessary economic or social development. In that case, the best practicable degree of waste treatment to protect the current classification of such waters will be required. The appropriate Federal authority will be provided with information, from time to time, required to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

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CONNECTICUT

(Approved: April 21, 1970)

Interstate waters whose existing quality is better than the established standards as of the date which such standards become effective will be maintained at their existing high quality. These and other interstate waters of the State will not be lowered in quality unless and until it has been affirmatively demonstrated to the Commission and the Department of the Interior that such change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any assigned uses made of, or presently possible in, such waters. This will require that any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required, if provided a permit, as part of the initial project design, to provide the highest and best degree of waste treatment available under existing technology, and, since for interstate waters these are also Federal standards, these waste treatment requirements will be developed cooperatively.

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DELAWARE

(Approved: July 30, 1971)

It is the public policy of the State to maintain within its jurisdiction a reasonable quality of water consistent with public health and public enjoyment thereof, the propagation and protection of fish and wild life, including birds, mammals, and other terrestrial and aquatic life, and the industrial development of the State.

Where conflicts develop between stated water uses, stream criteria or discharge criteria, water uses shall be paramount in determining the required stream criteria, which, in turn, shall be the basis of individual discharge limits.

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at such high quality unless it has been affirmatively demonstrated to the State that a change is justifiable as a result of necessary economic or social development, and will not preclude uses presently possible in such waters. Any industrial, public, or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required to provide the highest and best practicable means of waste treatment to maintain high water quality. In implementing this policy the Administrator of the Environmental Protection Agency will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act as amended.

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DISTRICT OF COLUMBIA

(Approved: January 17, 1969)

There are no waters within the District of Columbia whose existing quality is

better than the quality indicated by the established standards. Accordingly, it is the policy of the District of Columbia to improve the quality of all its waters as reflected in the standards. All industrial, public, and private sources of pollution will be required to provide the degree of waste treatment necessary to meet the water quality standards. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

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FLORIDA

(Approved: January 17, 1969)

The policy inherent in the standards shall be to protect water quality existing at the time these water quality standards were adopted or to upgrade or enhance water quality within the State of Florida. In any event where a new or increased source of pollution poses a possibility of degrading existing high water quality, such project development shall not be issued a Commission permit until the Commission is satisfied that such development will not be detrimental to the best interests of the State and necessary to its social and economic development. In administering the policy, high quality receiving waters will be protected by requiring as a part of the initial project design the highest and best practicable treatment available under existing technology.

The Commission recognizes and will protect the interest of the Federal Government in interstate and coastal waters in accordance with the Federal Water Pollution Control Act, as amended. The Commission further shall consult with the U.S. Department of the Interior on all matters affecting the Federal interest in a cooperative effort.

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GUAM

(Approved: June 12, 1968)

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at their existing high quality. These and other waters of the Territory will not be lowered in quality unless and until it has been affirmatively demonstrated to the Territorial water pollution control agency and the Department of the Interior that such change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any assigned uses made of, or presently possible in, such waters. This will require that any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required, as part of the initial project design, to provide the highest and best degree of waste treatment available under existing technology, and, since these are also Federal standards, these waste treatment requirements will be developed cooperatively.

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HAWAII

(Approved: June 28, 1971)

"It is the public policy of this State to conserve the waters of the State, and to protect, maintain and improve the quality thereof for drinking water supply and food processing, for the growth and propagation of shellfish, fish and other marine

and aquatic life, for oceanographic research, for the conservation of coral reefs and wilderness areas, and for domestic, agricultural, industrial, recreational and other legitimate uses; and to provide that no waste be discharged into any waters of this State without first being given the degree of treatment necessary to protect the legitimate beneficial uses of such waters; and to provide for the prevention, abatement and control of new and existing water pollution; and to cooperate with the federal government in carrying out these objectives.

"Therefore, waters whose qualities are higher than established water quality standards shall not be lowered in quality unless it has been affirmatively demonstrated to the Director that such change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any assigned uses made of, or presently in, such waters. Any industrial, public or private project or development which could constitute a new source of pollution or an increased source of pollution will be required, as part of the initial project design to provide the highest and best degree of waste treatment practicable under existing technology. In implementing the policy of this paragraph as it relates to waters under federal jurisdiction, the Secretary of the Interior will be kept advised and provided with such information as he will need from time to time to protect the interests of the United States and the authority of the Secretary in maintaining high quality of interstate waters."

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IDAHO

(Approved: June 7, 1971)

"Waters whose existing quality is better than the established standards as of the date of which such standards become effective will be maintained at their existing high quality. These and other waters of Idaho will not be lowered in quality unless and until it has been affirmatively demonstrated to the Idaho Department of Health and the Environmental Protection Agency that such change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any assigned uses made of, or presently possible in, such waters. This will require that any industrial, public, or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required, as part of the initial project design, to provide the highest and best degree of waste treatment available under existing technology, and since these are also Federal standards, these waste treatment requirements will be developed cooperatively."

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ILLINOIS

(Approved: January 27, 1968)

Waters whose existing quality is better than the established standards as of the date which such standards become effective will be maintained in their present high quality within the powers granted by the Illinois Water Pollution Control Statutes. Such waters will not be lowered in quality unless and until it has been affirmatively demonstrated to the Federal Water Pollution Control Administration that such change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to, any appropriate beneficial uses made of, or presently possible in such waters.

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INDIANA

(Approved: January 20, 1971)

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained in their present high quality consistent with the powers granted under the Indiana Stream Pollution Control Law. Such waters will not be lowered in quality unless and until it has been affirmatively demonstrated to the Stream Pollution Control Board that such change is justifiable as a result of necessary economic or social development and will not become injurious to, any assigned uses made of, or presently possible in, such waters. In order to preserve, protect, and enhance existing high quality waters, all waste discharges will receive a minimum treatment level of secondary or higher as conditions necessitate. In implementing this policy as it relates to interstate streams, the Secretary of the Interior will be kept advised and provided with such information as is required to discharge his responsibilities under the Federal Water Pollution Control Act.

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IOWA

(Approved: June 30, 1971)

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at high quality unless it has been affirmatively demonstrated to the State that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of such waters. Any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required to provide the necessary degree of waste treatment to maintain high water quality. (In implementing this rule, the appropriate agency of the Federal Government will be kept advised and will be provided with such information as it will need to discharge its responsibilities under the Federal Water Pollution Control Act, as amended.)

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KANSAS

(Approved: April 25, 1969)

All waters of the State, whose existing quality is better than the applicable water quality standards as established by the State of Kansas as of the date the water quality standards become effective will not be lowered in quality until it has been determined by the Kansas State Board of Health that the change is justifiable as a result of necessary social and economic development and that all the beneficial uses of waters affected will not be impaired. In no case shall the quality of waters of the State be reduced below the quality standards as established by the State of Kansas.

Any industrial, public, or private project or development which would constitute a new or increased source of pollution to high quality waters will be required to provide the best practicable degree of treatment available under existing technology.

The Kansas State Board of Health will furnish reports and information to the U.S. Department of the Interior as the Secretary of the Interior may need to carry out his functions under the Water Quality Act of 1965.

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KENTUCKY

(Approved: December 23, 1971)

Waters within the public domain of the Commonwealth that possess a higher quality than that established at the effective date of established standards will be maintained at their present high quality consistent with the powers granted under the Water Pollution Control Law of the Commonwealth of Kentucky. Such high quality waters will not be lowered in quality unless and until it is affirmatively demonstrated to the Kentucky Water Pollution Control Commission that such a change is justifiable as a result of necessary economic or social development and will not adversely effect present uses and future uses to be made of such waters. The most effective degree of treatment for wastes discharged into such high quality waters consisting of a minimum treatment level of secondary or higher as conditions necessitate will be required at the time of such permission. In implementing this policy as it relates to interstate streams the Environmental Protection Agency Administrator will be kept advised and provided with such information as is required to discharge his responsibilities under the Federal Water Pollution Control Act.

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LOUISIANA

(Approved: December 17, 1969)

It is the policy of the Louisiana Stream Control Commission that all interstate waters, portions thereof, and coastal waters whose existing quality exceeds the approved water quality standards will be maintained at their existing high quality unless and/or until it has been affirmatively demonstrated to the Louisiana Stream Control Commission that such changes are justifiable as a result of desirable and economic or social development, and further that such changes will not interfere with or become injurious to the user of the waters as described in the water quality standards. The Louisiana Stream Control Commission will disapprove any waste discharge that will cause water quality degradation of interstate waters, portions thereof, and coastal waters of Louisiana below the standards adopted by the State of Louisiana and approved by the Federal Water Pollution Control Administration without complying with the Federal and State of Louisiana laws applicable to the amendment of water quality standards. Any industrial, public or private project or development that would constitute a new source of pollution or an increased source of pollution to any of the waters in Louisiana will be required, as part of the initial project design, to provide the highest and best degree of waste treatment available under existing technology consistent with the best practice in the area affected under the condition applicable to the project or development. Consistent with the provision of the Federal Water Quality Act the Louisiana Stream Control Commission will keep the Department of Interior informed of its activities and will furnish the Department of Interior informational reports, in such form as the Secretary of the Department of Interior may, from time to time, reasonably require to carry out his function under the Federal Water Quality Act of 1965. The Louisiana Stream Control Commission will consult and cooperate with the Federal Water Pollution Control Administration of the Department of Interior on matters that are a proper consideration of the Federal Agency; the Federal Water Pollution Control Administration will reciprocate in matters that are a proper consideration of the Louisiana Stream Control Commission.

[p. 20]

MARYLAND

(Approved: July 16, 1971)

It is recognized that certain waters of Maryland possess an existing quality which is better than the water quality standards established thereof. The quality of these waters will be maintained unless and until it has been demonstrated to the satisfaction of the Department of Water Resources that a change is justifiable as a result of necessary economic and social development and will not preclude uses made of or presently possible in such waters. To accomplish this objective all proposed new or increased sources of pollution will be required to provide the best practical degree of waste treatment to maintain these waters at this high quality.

In addition, there will be furnished to the Federal Water Quality Office, Environmental Protection Agency, such information as is needed to enable the Administrator of the Environmental Protection Agency to fulfill his responsibilities under the Federal law.

Water which does not meet the standards established therefor, will be improved to meet the standards.

[p. 21]

MASSACHUSETTS

(Approved: November 25, 1970)

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at such high quality unless it has been affirmatively demonstrated to the state that a change is justifiable as a result of necessary economic or social development and will not preclude uses presently possible in such waters. An industrial, public, or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required to provide the highest and best practicable means of waste treatment to maintain high water quality. In implementing this policy, the Secretary of the Interior will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

[p. 22]

MICHIGAN

(Approved: April 17, 1968)

Waters in which the existing quality is better than the established standards on the date when such standards become effective will not be lowered in quality by action of the Water Resources Commission unless and until it has been affirmatively demonstrated to the Michigan Water Resources Commission and the Department of the Interior that the change in quality will not become injurious to the public health, safety, or welfare or become injurious to domestic, commercial, industrial, agricultural, recreational or other uses which are being made of such waters, or become injurious to the value or utility of riparian lands; or become injurious to livestock, wild animals, birds, fish, aquatic life or plants, or the growth or propagation thereof be prevented or injuriously affected; or whereby the value of fish and game may be destroyed or impaired, and that such lowering in quality will not be unreasonable and against public interest in view of the existing conditions in any interstate waters of Michigan.

Water which does not meet the standards will be improved to meet the standards.

[p. 23]

MISSOURI

(Approved: June 26, 1968)

"It is recognized that certain of the waters under consideration possess an existing quality which is better than the standards established herein. The quality of these waters will be maintained unless and until it has been affirmatively demonstrated through public hearings that other uses and different standards are justifiable as a result of necessary economic or social development. It will be required that the highest and best technology be employed to maintain the high quality of the waters. Additional data and increased monitoring in cooperation with the Federal Government and other states, will permit the improvement of these standards. The interest of the Federal Government in interstate waters is recognized and this interest will be protected."

[p. 24]

MINNESOTA

(Approved: November 26, 1969)

Waters which are of quality better than the established standards will be maintained at high quality unless a determination is made by the State that a change is justifiable as a result of necessary economic or social development and will not preclude appropriate beneficial present and future uses of the waters. Any project or development which would constitute a source of pollution to high quality waters will be required to provide the highest and best practicable treatment to maintain high water quality and keep water pollution at a minimum. In implementing this policy, the Secretary of the Interior will be provided with such information as he requires to discharge his responsibilities under the Federal Water Quality Act, as amended.

[p. 25]

MONTANA

(Approved: January 17, 1969)

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at that high quality unless it has been affirmatively demonstrated to the state that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of such waters. Any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required to provide the necessary degree of waste treatment to maintain high water quality. In implementing this policy, the Secretary of the Interior will be kept advised in order to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

[p. 26]

NEBRASKA

(Approved: December 19, 1968)

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at this high quality unless it has been affirmatively demonstrated to the State that a change is justifiable as a result of necessary economic or social development. Any industrial, public or private project or development which would constitute a new source

of pollution or an increased source of pollution to high quality waters will be required to provide the necessary degree of waste treatment to maintain high water quality. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

[p. 27]

NEVADA

(Approved: June 27, 1968)

"...to enhance water quality by upgrading waters that are at present affected by pollution and to perpetually maintain the quality of waters that are at present of high or suitable quality ...

"...It is the public policy of this State to conserve the waters of the State, and to protect, maintain and improve the quality thereof for public water supply, for the propagation of wildlife, fish, and aquatic life, and for domestic, agricultural, industrial, recreational, and other legitimate uses; and to provide that no waste be discharged into any waters of this State without first being given the degree of treatment necessary to protect the legitimate beneficial uses of such waters; and to provide for the prevention, abatement, and control of new and existing water pollution; and to cooperate with other agencies of the State, agencies of other states, and the Federal Government, in carrying out these objectives..."

Note: Nevada set the criteria for the high-quality waters at existing levels. These criteria are the minimum values below which water cannot be degraded, thus allowing no degradation of present levels.

[p. 28]

NEW HAMPSHIRE

(Approved: December 1, 1970)

In accordance with this explicit provision and all other pertinent statutes bearing on the subject of water pollution control, it will be our purpose to cooperate with the Federal Water Pollution Control Administration of the U.S. Department of the Interior in maintaining existing high water quality in all interstate river systems flowing to or from this State. We would further subscribe to the philosophy that there should be no discharges of pollution allowed without the highest and best degree of waste treatment available for such situations. In further connection with the above-referenced legislative policy and in compliance with the anti-degradation requirements of the Department of the Interior, it should be emphasized that all waters with existing high quality will not be lowered in quality unless and until it has been affirmatively demonstrated and established to the complete satisfaction of the Commission and the General Court of the State of New Hampshire, that such lowering in quality is of compelling necessity, in the public interest, and will not interfere with or impair any legitimate uses assigned to or proposed for such waters.

[p. 29]

NEW JERSEY

(Approved: March 13, 1968)

It is the primary objective of the Water Pollution Control Program in New Jersey to protect and enhance the quality of all surface waters of the State including those classified as FW-1 which are to be retained for posterity in their natural state and which shall not be subject to any man-made wastewater discharges.

The objective of protecting and upgrading our waterways will take precedence over allowable minimal quality limits for surface waters established through promulgation of rules and regulations.

In all situations where there may be an impingement of a lesser quality water upon that of a higher quality, it is the objective of the New Jersey program to upgrade the lesser quality water in order to protect or improve adjacent waters having a more critical use. It is anticipated that the surface water classification and the standards of quality for New Jersey waters will be subject to continual review and revision to achieve our basic objectives.

The overriding consideration, however, regardless of the establishment of water quality levels is that of wastewater treatment requirements. The minimum degree of wastewater treatment now being permitted in the State of New Jersey is that commonly identified as secondary treatment. In New Jersey this means treatment necessary to provide as an absolute minimum 80% reduction of biochemical oxygen demand and a maximum permissible biochemical oxygen demand concentration of 50 parts per million. In most areas in New Jersey, this standard is raised to require biochemical oxygen demand reduction of 85% and 90% with appropriate maximum permissible biochemical oxygen demand concentrations. At many inland locations where only small tributaries to streams are available, the policy in New Jersey is either to prohibit the discharge of any effluent to surface waters or to require so-called tertiary treatment which is the reduction of biochemical oxygen demand of 95% as a minimum with a maximum concentration of 15 parts per million. It has been and is presently the policy of the Department that wastewaters prior to discharge into any fresh water streams in the State must receive as a minimum at least 90% treatment.

[p. 30]

NEW MEXICO

(Approved: November 19, 1968)

Degradation of waters whose existing quality is better than the stream standards established by the New Mexico Water Quality Control Commission, unless justifiable as a result of necessary economic or social development, is not reasonable degradation and is subject to abatement under the authority granted the Commission by the Water Quality Act of 1967. To protect the existing quality of water the effluent standards established by the Commission under that act will require the highest and best degree of effluent treatment practicable. In implementing this paragraph, the Commission through the appropriate regional offices of the Federal Water Pollution Control Administration will keep the Secretary of the Interior advised and provided with such information concerning the interstate waters of New Mexico as he will need to discharge his responsibilities under the Federal Water Pollution Control Act (PL 84-660), as amended.

[p. 31]

NEW YORK

(Approved: March 4, 1971)

It is recognized that certain waters of New York State possess an existing quality which is better than the classification standards assigned thereto. The quality of these waters will be maintained unless and until it has been demonstrated to the satisfaction of the Commission of Environmental Conservation that other uses and different standards are justifiable as a result of necessary economic or social development. To accomplish this objective all proposed new or increased

sources of pollution will be required to provide the best practical degree of waste treatment to maintain these waters at this higher quality.

In addition, there will be furnished to the Federal Water Quality Administration, U.S. Department of the Interior, such information as is needed to enable the Secretary of the Interior to fulfill his responsibilities under the Federal law.

Water which does not meet the assigned classification will be improved to meet the standards.

[p. 32]

NORTH CAROLINA

(Approved: January 20, 1971)

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at high quality; provided that the State of North Carolina has the authority to approve any project or development, which would constitute a new or an increased discharge of effluent to high quality water, when it has been affirmatively demonstrated that a change is justifiable to provide necessary economic or social development, and provided further, that the necessary degree of waste treatment to maintain high water quality will be required where physically and economically feasible. Present and anticipated use of such waters will not be precluded under the conditions of the aforesaid. In implementing this policy, the Secretary of the Interior will be kept informed and will be provided with such information as he will need in discharging his responsibilities under the Federal Water Pollution Control Act.

[p. 33]

NORTH DAKOTA

(Approved: May 22, 1970)

It is hereby declared to be the policy of the State of North Dakota to act in the public interest to protect, maintain and improve the quality of the waters in the State for continued use as public and private water supplies propagation of wild-life, fish and aquatic life, and for domestic, agricultural, industrial, recreational and other legitimate beneficial uses, to require necessary and reasonable treatment of sewage, industrial, or other wastes.

The "quality of the waters" shall be the quality of record existing at the time these standards were established. Waters whose existing quality is higher than the established standards shall be maintained at the higher quality unless it can be affirmatively demonstrated that a change in quality is justifiable to provide necessary economic or social development and will not adversely affect the stated beneficial uses of the water. Any industrial, public, or private project or development which would constitute a new or increased source of pollution to high quality waters will be required to provide the highest and best practicable degree of treatment available under existing technology. The Secretary of the Interior will be kept advised and provided with the information needed to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

[p. 34]

OHIO

(Approved: September 13, 1968)

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at their

existing high quality, pursuant to the Ohio water pollution control statutes, so as not to interfere with or become injurious to* any assigned uses made of, or presently possible, in such waters. This will require that any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required, as part of the initial project design, to provide the most effective waste treatment available under existing technology. The Ohio Water Pollution Control Board will cooperate with other agencies of the state, agencies of other states, interstate agencies and the Federal Government in the enforcement of this policy.

* The Solicitor's Office recommends the phrase "and will not interfere with—" as being superior to the adopted and approved phrase "so as not to interfere with—" (lines 5 and 6).

[p. 35]

OKLAHOMA

(Approved: February 17, 1970)

The Water Quality Criteria for the Slat Fork of the Arkansas, Cimarron, North Canadian and South Canadian Rivers, and interstate tributaries, are based on the present and potential uses, and on existing quality data. The proposed criteria shall serve as guidelines to control pollution and to maintain the best quality which will result in an equitable balance of social and economic benefits to the state. It is recognized that certain of the waters under consideration possess an existing quality which is better than the minimum standards established. The quality of those waters will be maintained unless and until it has been affirmatively demonstrated to the state through public hearings that other uses and different standards are justifiable as a result of necessary economic or social development. It will be required that the highest and best technology be employed to maintain the high quality of the waters. The interest of the Federal Government in interstate waters is recognized and this interest will be protected in accordance with the provisions of the Oklahoma Statutes. In implementing these standards, the Federal Government will be kept advised and will be provided with such information as needed to discharge its responsibilities under the Federal Water Pollution Control Act, as Amended. It is realized that the criteria cannot be considered as permanently fixed. Future changes in cultural activities, the development of additional quality data, the enhancement of existing improvements in waste treatment technology may necessitate revisions of the criteria. The proposed criteria are applicable at all times and at all flows, except as otherwise indicated.

[p. 36]

OREGON

(Approved: December 17, 1968)

Notwithstanding the general and special water quality standards contained in this subdivision, the highest and best practicable treatment and/or control of wastes, activities and flows shall in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor and other deleterious factors at the lowest possible levels.*

* Approval contingent on stringent criteria set for high quality waters.

[p. 37]

COMMONWEALTH OF PENNSYLVANIA

(Approved: October 7, 1971)

ANTIDEGRADATION POLICY

Waters having a better quality than the applicable water quality criteria as of the effective date of the establishment of such criteria shall be maintained at such high quality unless it is affirmatively demonstrated to the state that a change is justified as a result of necessary economic or social development and will not preclude uses presently possible in such waters.

Any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters shall be required to provide the highest and best practicable means of waste treatment to maintain high water quality.

In implementing the provisions of this policy, the Department shall keep the Administrator of the Environmental Protection Agency advised and shall provide him with such information to discharge his responsibilities under the Federal Water Pollution Control Act (33 U.S.C. 1151 et seq.).

ADOPTED: Environmental Quality Board, Pennsylvania Department of Environmental Resources, August 11, 1971.

[p. 38]

PUERTO RICO

(Approved: December 30, 1968)

Coastal waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at their existing high quality. These and other coastal waters of Puerto Rico will not be lowered in quality unless and until it has been affirmatively demonstrated to the water pollution control agency for Puerto Rico that such change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any assigned uses made of, or presently possible in, such waters. This will require that any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required, as part of the initial project design, to provide the best practical degree of treatment available under existing technology, and, since these are also Federal standards, these waste treatment requirements will be developed in cooperation with the Federal Water Pollution Control Administration.

[p. 39]

RHODE ISLAND

(Approved: January 20, 1971)

"Waters whose existing quality is better than the established standards as of the date of which such standards become effective will be maintained at such high quality unless it has been affirmatively demonstrated to the State that a change is justifiable as a result of necessary economic or social development and will not result in a significant loss of a use presently possible in such waters. Any industrial, public, or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required to provide the highest and best practicable means of waste treatment to maintain high water quality. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information

as he will need to discharge his responsibilities under the Federal Water Pollution Control Act, as amended."

[p. 40]

SOUTH CAROLINA

(Approved: April 21, 1969)

Waters whose existing quality is better than the established standards will not be lowered in quality unless and until it has been affirmatively demonstrated to the South Carolina Pollution Control Authority that such change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any assigned uses made of such waters. Any industrial, public or private project or development which could constitute a new source of pollution or an increased source of pollution to high quality waters will be required by the South Carolina Pollution Control Authority as part of the initial project design, to provide the highest and best degree of waste treatment practicable under existing technology. In implementing the policy of this paragraph as it relates to interstate streams, the Secretary of the Interior will be advised and provided with such information as he will need from time to time to protect the interests of the United States and the authority of the Secretary in maintaining high quality of interstate waters.

[p. 41]

SOUTH DAKOTA

(Approved: June 28, 1971)

"Waters whose existing quality is better than the established standards as of the date of which such standards become effective will be maintained at this high quality unless it has been affirmatively demonstrated to the State that a change is justifiable as a result of necessary economic or social development. Any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required to provide the necessary degree of waste treatment to maintain high water quality. In implementing this policy, the Administrator of the Environmental Protection Agency will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act, as amended."

[p. 42]

TEXAS

(Approved: May 2, 1969)

In implementing the legislative policy expressed in the Texas Water Quality Act of 1967 and subject to the foregoing, it is the policy of the Texas Water Quality Board that the interstate waters in the State whose existing quality is better than the applicable water quality requirements described herein as of the date when these requirements become effective will as provided hereafter be maintained at their high quality, and no waste discharges may be made which will result in the lowering of the quality of these waters unless and until it has been demonstrated to the Texas Water Quality Board that the change is justifiable as a result of desirable economic or social development. Therefore, the Board will not authorize or approve any waste discharge which will result in the quality of any of the interstate waters in the State being reduced below the water quality standards without complying with the Federal and State laws applicable to the amendment

of water quality standards. Anyone making a waste discharge from any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to any of the interstate waters in the State will be required, as part of the initial project design, to provide the highest and best degree of waste treatment available under existing technology consistent with the best practice in the particular field affected under the conditions applicable to the project or development. In the spirit of the Federal Water Pollution Control Act, the Board will keep the Department of the Interior informed on its activities and will furnish to the Department such reports, in such form, and containing such information as the Secretary of the Interior may from time to time reasonably require to carry out his functions under the Act. Additionally, the Board will consult and cooperate with the Department of the Interior on all matters affecting the Federal interest.

[p. 43]

UTAH

(Approved: December 31, 1968)

Waters whose existing quality is better than the established standards will be maintained at high quality unless it has been affirmatively demonstrated to the State that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of such waters. Any industrial, public or private project or development which would constitute a new source of controllable pollution or an increased source of controllable pollution to high quality waters will be required to provide waste treatment to maintain high water quality to the extent that such treatment is practicable. In implementation of this policy, the Secretary of Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

[p. 44]

VERMONT

(Approved: August 24, 1971)

It is recognized that certain waters of Vermont possess an existing quality which is better than the classification standards assigned thereof.

The quality of these waters will be maintained unless and until it has been affirmatively demonstrated through public hearings that other uses and different standards are justifiable as a result of necessary economic or social development.

To accomplish this objective all proposed new or increased sources of pollution will be required to provide the best practical degree of waste treatment to maintain these waters at this high quality.

In implementing this policy, the Administrator of the United States Environmental Protection Agency will be kept advised and provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

[p. 45]

VIRGIN ISLANDS

(Approved: April 28, 1970)

Waters whose existing quality is better than the established standards as of the date of which such standards become effective will be maintained at their existing high quality. These and other waters of the Virgin Islands will not be lowered in

quality unless and until it has been affirmatively demonstrated to the Territory's water pollution control agency and the Department of the Interior that such change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any assigned uses made of, or presently possible in such waters. Any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required, as part of the initial project design, to provide the highest and best practicable degree of waste treatment available under existing technology, and since these are also Federal standards, these waste treatment requirements will be developed cooperatively.

[p. 46]

VIRGINIA

(Approved: February 22, 1971)

Waters whose existing quality is better than the established standard as of the date on which such standards become effective will be maintained at high quality; provided that the Commonwealth of Virginia has the authority to approve any project or development, which would constitute a new or an increased discharge of effluent to high quality water, when it has been affirmatively demonstrated that a change is justifiable to provide necessary economic or social development, and provided further, that the necessary degree of waste treatment to maintain high water quality will be required where physically and economically feasible. Present and anticipated use of such waters will not be precluded under the conditions of the aforesaid. In implementing this policy, the Secretary of the Interior will be kept informed and will be provided with such information that he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

[p. 47]

WASHINGTON

(Approved: January 22, 1968)

Regardless of the water quality criteria as herein established, wherever existing receiving waters of a classified area are of a higher quality than the criteria assigned for said area, the existing water quality shall constitute water quality criteria. Likewise, existing water quality conditions shall constitute the criteria for interstate and coastal waters not specifically classified herein.

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WEST VIRGINIA

(Approved: July 30, 1971)

"3.02 Waters whose existing quality is better than the established standards will not be lowered in quality unless and until it has been affirmatively demonstrated to the Chief of the Division of Water Resources, Department of Natural Resources, that such change is justifiable as a result of necessary development and will not interfere with or become injurious to any present or future assigned uses of such waters. In special cases where the facts warrant more stringent standards or exceptions thereto may be established. In implementing the policy of this paragraph as it relates to interstate streams, the Secretary of the Interior will be kept advised and provided with such information as he will need from time to time to protect the interests of the United States and the authority of the Secretary in maintaining high quality of interstate waters."

[p. 49]

WISCONSIN

(Approved: January 24, 1968)

Regardless of the water quality standards and water use, untreated or inadequately treated wastes may not impair a designated use nor may standards be interpreted to permit a lower quality within a water sector than that now existing or required by outstanding orders.

[p. 50]

WYOMING

(Approved: November 27, 1968)

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at high quality; provided that the State of Wyoming has the power to authorize any project or development, which would constitute a new source of pollution or an increased source of pollution to high quality water, when it has been affirmatively demonstrated that a change is justifiable to provide necessary economic or social development; provided further that the necessary degree of waste treatment to maintain high water quality will be required where physically and economically feasible. Present and anticipated use of such waters will not be precluded under the conditions aforesaid. In implementing this policy the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

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4.6 MEMORANDUM OF UNDERSTANDING BETWEEN THE ENVIRONMENTAL PROTECTION AGENCY AND THE DEPARTMENT OF TRANSPORTATION

36 Fed. Reg. 24080 (1971)

**DEPARTMENT OF
TRANSPORTATION****Coast Guard****MEMORANDUM OF UNDERSTANDING BETWEEN THE ENVIRONMENTAL PROTECTION AGENCY AND THE DEPARTMENT OF TRANSPORTATION**

This memorandum establishes policies and guidelines relating to the definition of transportation and nontransportation related onshore and offshore facilities and the responsibilities of the Environmental Protection Agency and the U.S. Coast Guard with respect to the prevention of oil discharges from vessels and onshore and offshore facilities.

SECTION I—GENERAL

1. Section 11(j)(1)(C) of the Federal Water Pollution Control Act, as amended authorizes the President to issue regulations consistent with maritime safety and with marine and navigation laws establishing procedures, methods, and requirements for equipment to prevent discharges of oil from vessels and onshore and offshore facilities.

2. This authority was delegated by the President in Executive Order 11548. Section 1 of that Executive order delegates responsibility and authority to the Secretary of the Interior to carry out the provisions of subsection (j)(1)(C) of section 11 of the Act after consultation with the Secretary of Transportation re-

lating to procedures, methods and requirements for equipment to prevent discharges of oil from nontransportation related onshore and offshore facilities. The authority delegated to the Secretary of the Interior was subsequently vested in the Administrator of the Environmental Protection Agency in Reorganization Plan No. 3 of 1970 and section 9 of Executive Order 11548.

3. Section 2 of Executive Order 11548 delegates responsibility and authority to the Secretary of Transportation in consultation with the Secretary of the Interior, to carry out the provisions of subsection (j)(1)(C) of section 11 of the Act relating to procedures, methods and requirements for equipment to prevent discharges of oil from vessels and transportation-related onshore and offshore facilities. The Secretary of Transportation in turn redelegated this authority to the Commandant, U.S. Coast Guard.

4. Although Executive Order 11548 divided responsibility and authority into transportation-related and nontransportation-related facilities, no indication of the extent of transportation relation is given. In the broadest sense every facility is transportation related. Any activity that can possibly discharge oil must transport materials to some extent and have materials transported either to, from, or by the facility.

5. In distinguishing between transportation-related and nontransportation-related facilities, a systems approach was utilized. It is recognized that the life-cycle of oil is characterized by various operations conducted at many different types of facilities. Most facilities necessarily engage in more than one type of operation. These operations include drilling, producing, refining, storing, transferring, transporting, using and disposing. To the extent possible and considering agency resource capabilities and expertise, it is considered most practical to assign one agency the responsibility for regulating a complete operation at any one facility. The Department of Transportation will generally be respon-

sible for regulating the transferring of oil to or from a vessel at any facility including terminal facilities; the transporting of oil via highway, pipeline, railroad, or vessel; and certain storing operations. The Environmental Protection Agency will generally be responsible for regulating drilling, producing, refining, storing, disposing and certain transferring operations at various types of facilities.

6. While the following definitions are intended to be as specific and inclusive as possible, it is recognized that certain problems concerning these definitions will arise from time to time requiring the cooperation and agreement of the Department of Transportation and the Environmental Protection Agency for resolution.

SECTION II—DEFINITIONS

The Environmental Protection Agency and the Department of Transportation agree that for the purposes of Executive Order 11548, the term—

(1) "Non-transportation-related onshore and offshore facilities" means—

(A) Fixed onshore and offshore oil well drilling facilities including all equipment and appurtenances related thereto used in drilling operations for exploratory or development wells, but excluding any terminal facility, unit or process integrally associated with the handling or transferring of oil in bulk to or from a vessel.

(B) Mobile onshore and offshore oil well drilling platforms, barges, trucks, or other mobile facilities including all equipment and appurtenances related thereto when such mobile facilities are fixed in position for the purpose of drilling operations for exploratory or development wells, but excluding any terminal facility, unit or process integrally associated with the handling or transferring of oil in bulk to or from a vessel.

(C) Fixed onshore and offshore oil production structures, platforms, derricks, and rigs including all equipment

and appurtenances related thereto, as well as completed wells and wellhead equipment, piping from wellheads to oil separators, oil separators, and storage facilities used in the production of oil, but excluding any terminal facility, unit or process integrally associated with the handling or transferring of oil in bulk to or from a vessel.

(D) Mobile onshore and offshore oil production facilities including all equipment and appurtenances related thereto as well as completed wells and wellhead equipment, piping from wellheads to oil separators, oil separators, and storage facilities used in the production of oil when such mobile facilities are fixed in position for the purpose of oil production operations, but excluding any terminal facility, unit or process integrally associated with the handling or transferring of oil in bulk to or from a vessel.

(E) Oil refining facilities including all equipment and appurtenances related thereto as well as in-plant processing units, storage units, piping, drainage systems and waste treatment units used in the refining of oil, but excluding any terminal facility, unit or process integrally associated with the handling or transferring of oil in bulk to or from a vessel.

(F) Oil storage facilities including all equipment and appurtenances related thereto as well as fixed bulk plant storage, terminal oil storage facilities, consumer storage, pumps and drainage systems used in the storage of oil, but excluding in-line or breakout storage tanks needed for the continuous operation of a pipeline system and any terminal facility, unit or process integrally associated with the handling or transferring of oil in bulk to or from a vessel.

(G) Industrial, commercial, agricultural or public facilities which use and store oil, but excluding any terminal facility, unit or process integrally associated with the handling or transferring of oil in bulk to or from a vessel.

(H) Waste treatment facilities including in-plant pipelines, effluent

discharge lines, and storage tanks, but excluding waste treatment facilities located on vessels and terminal storage tanks and appurtenances for the reception of oily ballast water or tank washings from vessels and associated systems used for off-loading vessels.

(I) Loading racks, transfer hoses, loading arms and other equipment which are appurtenant to a nontransportation related facility or terminal facility and which are used to transfer oil in bulk to or from highway vehicles or railroad cars.

(J) Highway vehicles and railroad cars which are used for the transport of oil exclusively within the confines of a nontransportation related facility and which are not intended to transport oil in interstate or intrastate commerce.

(K) Pipeline systems which are used for the transport of oil exclusively within the confines of a nontransportation related facility or terminal facility and which are not intended to transport oil in interstate or intrastate commerce, but excluding pipeline systems used to transfer oil in bulk to or from a vessel.

(2) "Transportation-related onshore and offshore facilities" means—

(A) Onshore and offshore terminal facilities including transfer hoses, loading arms and other equipment and appurtenances used for the purpose of handling or transferring oil in bulk to or from a vessel as well as storage tanks and appurtenances for the reception of oily ballast water or tank washings from vessels, but excluding terminal waste treatment facilities and terminal oil storage facilities.

(B) Transfer hoses, loading arms and other equipment appurtenant to a nontransportation related facility which is used to transfer oil in bulk to or from a vessel.

(C) Interstate and intrastate onshore and offshore pipeline systems including pumps and appurtenances related thereto as well as in-line or breakout storage tanks needed for the continuous operation of a pipeline system, and pipe-

lines from onshore and offshore oil production facilities, but excluding onshore and offshore piping from wellheads to oil separators and pipelines which are used for the transport of oil exclusively within the confines of a nontransportation related facility or terminal facility and which are not intended to transport oil in interstate or intrastate commerce or to transfer oil in bulk to or from a vessel.

(D) Highway vehicles and railroad cars which are used for the transport of oil in interstate or intrastate commerce and the equipment and appurtenances related thereto, and equipment used for the fueling of locomotive units, as well as the right-of-way on which they operate. Excluded are highway vehicles and railroad cars and motive power used exclusively within the confines of a nontransportation related facility or terminal facility and which are not intended for use in interstate or intrastate commerce.

SECTION III—COORDINATION AND ENFORCEMENT

The above definitions have been developed to facilitate the development

and enforcement of regulations for prevention of oil discharges and to correspond as much as possible to the existing responsibilities of the Department of Transportation and the Environmental Protection Agency. It is recognized, however, that in some situations the Department of Transportation may have expertise that could be helpful to the Environmental Protection Agency in the development or enforcement of these regulations and vice versa. Such a situation might arise in connection with the regulation of the nontransportation related facilities included within definitions 1 (J) and (K) in section II above.

It is agreed that in such situations the Department of Transportation and the Environmental Protection Agency will provide assistance to and coordinate with each other in the development and enforcement of the regulations to the extent that existing resources permit.

Done this 24th day of November 1971 at the city of Washington.

For the Department of Transportation.

JOHN A. VOLPE.

For the Environmental Protection Agency.

WILLIAM D. RUCKELSHAUS.

[FR Doc. 71-18542 Filed 12-17-71; 8:48 am]

4.7 DISCHARGES OF OIL FOR RESEARCH DEVELOPMENT AND DEMONSTRATION PURPOSES, GUIDELINES, ENVIRONMENTAL PROTECTION AGENCY

36 Fed. Reg. 7326 (1971)

ENVIRONMENTAL PROTECTION AGENCY

DISCHARGES OF OIL FOR RESEARCH, DEVELOPMENT AND DEMONSTRATION PURPOSES

Guidelines

Notice is hereby given of the guidelines to be followed in implementing §610.8 of Title 18 of the Code of Federal Regulations which permits the discharge of oil into or upon the navigable waters

of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone, in connection with research, demonstration projects, or studies relating to the prevention, control or abatement of oil pollution.

1. Conditions to be fulfilled:

a. Discharge of oil for research, development, and demonstration purposes must be approved by the Administrator, Environmental Protection Agency (EPA), or his designee.

b. The need for attendance by a rep-

representative from EPA at research, development, and demonstration operations shall be determined by the Administrator.

c. The requesting person (including an individual, firm, corporation, association and partnership and hereinafter referred to as the applicant) must demonstrate that the proposed discharge will be in the public interest and will result in the acquisition of scientific information not previously available and not obtainable through any other practicable means.

d. The applicant must assume all liability for any personal injury, property losses or environmental damages resulting directly or indirectly from any testing or demonstration program, and for all costs, including costs or damages resulting from cancellation by the Administrator or failure by the Administrator to cancel tests and demonstrations.

e. Results of any testing or demonstration program shall be made available to the Administrator.

2. Procedure for requesting permission to discharge oil for research, development, and demonstration purposes:

a. At least 30 days prior to any proposed test or demonstration, the applicant shall provide the Regional Administrator, EPA, of the EPA Region in which the test or demonstration is proposed, a written work plan including the following elements:

(1) A description of the material, equipment or technique to be tested or demonstrated; and the justification of the quantity and type of oil to be discharged and the method and timing of the discharge.

(2) A description of the site.

(3) An assessment of the environmental damage that may result from the test or demonstration.

(4) A copy of the notification provided to the U.S. Coast Guard which is required whenever the discharge is to be made into coastal and contiguous zone waters or coastal and Great Lakes ports and harbors.

(5) Contingency plans for coping with oil which might escape from the system being tested or demonstrated.

(6) Sufficient background technical information to justify the need for conducting the test or demonstration.

(7) Provision for technical documentation to determine effectiveness and efficiency of equipment and materials tested or demonstrated.

(8) The concurrence of the appropriate State water pollution control agency within whose jurisdiction the proposed site of the test or demonstration is located.

b. A proposal to test or demonstrate any dispersant or other chemical that distributes oil through the water column must recognize and be made in accordance with Annex X, National Oil and Hazardous Materials Pollution Contingency Plan, "Schedule of Dispersants and Other Chemicals to Treat Oil Spills" (35 F.R. 8511).

3. Test administration procedures to be followed:

a. The minimum necessary quantity of oil for test or demonstration purposes shall be discharged, but in no case shall discharges exceeding 1,000 gallons for one or a series of tests or demonstrations at the same site in one 24-hour period be permitted.

b. The applicant shall furnish and pay for all materials, equipment and transportation necessary for execution of any testing or demonstration program and for restoration or mitigation of any continuing environmental damage. The Administrator may at any time order cancellation or postponement of a test or demonstration because of adverse weather or other conditions that would pose safety or pollution problems. Results of any test or demonstration program shall be provided to EPA within 30 days following completion of the test or demonstration.

c. EPA representative(s) may accompany the applicant on any vessels or aircraft used by the applicant in connection with any test or demonstration

program.

4. Review by EPA of technical background data and test or demonstration results will be for purposes of determining the need for such tests or demonstrations and in no way implies Federal Government approval or endorsement of equipment or materials used, test or demonstration procedures used, or results obtained.

5. News releases made by the person conducting the test or demonstration

program shall omit names and photographs of Federal representatives present.

6. Any discharge of oil for research, development or demonstration purposes which does not comply with these guidelines may subject the person responsible for the discharge to the penalties and liabilities provided for in section 11 of the Federal Water Pollution Act, as amended.

4.8 MEMORANDUM OF UNDERSTANDING PROVIDING FOR COOPERATION IN THE INVESTIGATION OF VIOLATIONS OF THE REFUSE ACT BETWEEN ADMINISTRATOR OF THE ENVIRONMENTAL PROTECTION AGENCY AND THE SECRETARY OF THE ARMY

36 Fed. Reg. 3074 (1971)

DEPARTMENT OF DEFENSE

Department of the Army

ADMINISTRATOR OF THE ENVIRONMENTAL PROTECTION AGENCY AND THE SECRETARY OF THE ARMY

Notice of a Memorandum of Understanding Providing for Cooperation in the Investigation of Violations of the Refuse Act

FEBRUARY 10, 1971.

Executive Order 11574 (35 F.R. 19627) announced the establishment of a permit program under the Refuse Act, 33 U.S.C. 407, Proposed Corps of Engineers regulations governing the permit program (35 F.R. 20005) and a proposed memorandum of understanding concerning the implementation of the program (36 F.R. 983) have been previously published in the FEDERAL REGISTER. The following memorandum of understanding which pertains to enforcement of and investigations under the Refuse Act rather than to the permit program itself has been executed by both the

Administrator of the Environmental Protection Agency and the Secretary of the Army:

MEMORANDUM OF UNDERSTANDING BETWEEN THE ADMINISTRATOR OF THE ENVIRONMENTAL PROTECTION AGENCY AND THE SECRETARY OF THE ARMY

The Administrator of the Environmental Protection Agency and the Secretary of the Army, recognizing the interrelationship between section 13 of the Act of March 3, 1899 (33 U.S.C. 407) (the "Refuse Act") administered by the Department of the Army and the statutory responsibilities of the Environmental Protection Agency under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1151 et seq.), and further recognizing their responsibilities under the National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347), and their responsibilities under Executive Order 11574 dated December 23, 1970, which directs the Federal Government to implement a permit program under the Refuse Act to control the discharge of pollutants into navigable waters and their tributaries, have entered into this memorandum of understanding to delineate more fully the respective responsibilities of said Agency and Department for water pollution abatement and control, and to establish policies and procedures for interagency cooperation in the enforcement of the Refuse Act.

I. Responsibilities for water pollution abatement and control. A. At the Federal

level, the Environmental Protection Agency has primary responsibility, pursuant to the Federal Water Pollution Control Act, for the abatement and control of pollution of interstate and navigable waters of the United States.

B. The Department of the Army has primary responsibility for the enforcement of the Refuse Act.

C. Under Executive Order 11574, the Secretary is directed to develop regulations and procedures in consultation with the Administrator governing the issuance of discharge permits under the Refuse Act, and, in connection with the grant, denial, conditioning, revocation and suspension of such permits, to adopt determinations and interpretations of the Administrator respecting water quality standards and compliance therewith.

D. The Department of the Army and the Environmental Protection Agency have in cooperation undertaken to implement the permit authority of the Refuse Act pursuant to a memorandum of understanding dated January, the terms of which are incorporated herein and made a part hereof.

II. *The Refuse Act.* A. The Refuse Act, 33 U.S.C. 407, provides that:

It shall not be lawful to throw, discharge, or deposit, or cause, suffer, or procure to be thrown, discharged or deposited either from or out of any ship, barge, or other floating craft of any kind, or from the shore, wharf, manufacturing establishment, or mill of any kind, any refuse matter of any kind or description whatever other than that flowing from streets and sewers and passing therefrom in a liquid state, into any navigable water of the United States, or into any tributary of the navigable water from which the same shall float or be washed into such navigable water; and it shall not be lawful to deposit, or cause, suffer, or procure to be deposited material of any kind in any place on the bank of any navigable water, or on the bank of any tributary of any navigable water, where the same shall be liable to be washed into such navigable water, either by ordinary or high tides, or by storms or floods, or otherwise, whereby navigation shall or may be impeded or obstructed: *Provided*, That nothing herein contained shall extend to, apply to, or prohibit the operations in connection with the improvement of navigable waters or construction of public works, considered necessary and proper by the U.S. officers supervising such improvement or public work: *And, provided further*, That the Secretary of the Army whenever in the judgment of the Chief of Engineers anchorage and navigation will not be injured thereby, may permit the deposit of any material above mentioned in navigable waters, within limits to be defined and under conditions to be prescribed by him, provided application is made to him prior to depositing such material; and

whenever any permit is so granted the conditions thereof shall be strictly complied with, and any violation thereof shall be unlawful. March 3, 1899, c. 425.

B. Criminal sanctions may be imposed against persons or corporations found guilty of violating provisions of the Refuse Act. As prescribed in 33 U.S.C. 411, the penalty upon conviction is "a fine not exceeding \$2,500 nor less than \$500, or * * * imprisonment (in the case of a natural person) for not less than 30 days nor more than 1 year, or both such fine and imprisonment, in the discretion of the court, one-half of said fine to be paid to the person or persons giving information which shall lead to conviction."

C. Civil proceedings may also be instituted to enjoin conduct which would violate provisions of the Refuse Act. *United States v. Republic Steel Corp.*, 362 U.S. 482 (1960) and *Wyandotte Transportation Co. v. United States*, 389 U.S. 191 (1967).

III. *Policy with respect to enforcement of Refuse Act.* The policy of the Environmental Protection Agency and the Department of the Army is to utilize the Refuse Act and the authorities contained therein to the fullest extent possible and in a manner consistent with the provisions of the Federal Water Pollution Control Act to insure compliance with applicable water quality standards and otherwise to carry out the purposes of the Federal Water Pollution Control Act. Persons wishing to discharge into or place deposits in navigable waters or tributaries thereof will be required to apply for and obtain a permit from the Department of the Army. Persons without an appropriate permit who discharge into navigable waters or tributaries thereof or who discharge into such waters in violation of the terms of a valid permit may be subjected to legal proceedings under the Refuse Act.

IV. *Inter-agency cooperation.* A. In recognition of the expertise of the Department of the Army and the Corps of Engineers in matters pertaining to the navigability of a waterway, it is agreed that the Department of the Army, acting through the Corps of Engineers, has primary Federal responsibility for identifying and investigating violations of the Refuse Act which have an adverse impact on the navigable capacity of a waterway. Whenever a District Engineer has reason to believe that a discharge has or may have occurred having an adverse impact on water quality, he shall so notify the appropriate Regional Representative of the Environmental Protection Agency and shall provide him with all information, including, if the discharger is the holder of a Refuse Act permit, a copy of said permit and all of the conditions attached thereto. The said Regional Representative shall make such investigation as he deems appropriate and shall advise the District Engineer in a timely manner whether

in his opinion a violation of the Refuse Act having an adverse impact on water quality has or may have occurred. If the Regional Representative is of such opinion, he shall make a report to the District Engineer as to the following:

1. The nature and seriousness of the apparent violation (including, if the discharger is the holder of a Refuse Act permit, information as to the conditions of such permit which appear to have been violated).

2. The nature and seriousness of the impact on water quality.

3. The measures, if any, taken or being taken by the discharger to comply with applicable water quality standards or the conditions of a Refuse Act permit, if any.

4. The existence and adequacy of State or local pollution abatement proceedings.

5. The applicability of the Federal Water Pollution Control Act, whether any administrative or judicial proceedings are being taken or contemplated thereunder, and the status of any such proceedings.

6. His recommendations as to the action, if any, which should be taken under the Refuse Act and his reasons therefor. If the discharger is the holder of a Refuse Act permit, such recommended action may include in addition to or in lieu of prosecution under the Refuse Act for one or more of the remedies available thereunder, the suspension or revocation of the permit. A recommendation to suspend shall include a recommendation as to the period and conditions of the suspension.

B. In recognition of the expertise of the Environmental Protection Agency in matters pertaining to water quality, it is agreed that said Agency has primary Federal responsibility for identifying and investigating cases involving discharges into interstate or navigable waters which have an adverse impact on water quality. District Engineers shall assist Regional Representatives of the Environmental Protection Agency by providing them with such information as may become available concerning known or suspected discharges which may adversely affect water quality (including, if the discharger is the holder of a Refuse Act permit, a copy of said permit and all of the conditions attached thereto), and, to the extent of available resources, shall assist in the conduct of investigations concerning such discharges. Regional Representatives shall be responsible for notifying District Engineers of known or suspected violations of the Refuse Act and for providing District Engineers with timely reports of investigations conducted. Whenever in the opinion of the Regional Representative a violation of the Refuse Act having an

adverse impact on water quality has or may have occurred, such report shall include all of the same information and recommendations called for in subparagraphs 1 through 6 of paragraph A with respect to reports submitted under that paragraph.

C. In connection with any remedial action recommended or taken pursuant to this memorandum of understanding, due regard shall be given to the provisions of section 21(b) of the Federal Water Pollution Control Act, and in particular the provisions of sections 21(b)(4), 21(b)(5), and 21(b)(9)(B) relating to the revocation or suspension of permits.

D. In any case in which a Refuse Act permit is suspended, if the District Engineer has reason to believe that the permittee has or may have violated the terms of the suspension, he shall notify the appropriate Regional Representative of the Environmental Protection Agency and provide him with all available information. The Regional Representative shall make such investigation as he deems appropriate and shall make a report to the District Engineer, such report to include, to the extent relevant, the information and recommendations called for in subparagraphs 1 through 6 of paragraph A with respect to reports submitted under that paragraph.

E. If upon review of all reports and information prepared pursuant to this memorandum of understanding and any other available evidence, it is determined by the District Engineer of the Corps or the Regional Representative of EPA to request legal proceedings under the Refuse Act, such District Engineer or Regional Representative shall, in consultation with each other, forward all available evidence and information, including recommendations, if any, of both the Regional Representative and the District Engineer, to the appropriate U.S. attorney. A copy of any covering letter forwarding information and evidence to the appropriate U.S. attorney should be mailed, together with a brief summary of the factual background of the case, to the Assistant Attorney General for Lands and Natural Resources, Department of Justice, Washington, D.C. 20530

WILLIAM D. RUCKELSHAUS,
Administrator,
Environmental Protection Agency.
STANLEY R. RESOR,
Secretary of the Army.

Dated: January 12, 1971.

For the Adjutant General.

R. B. BELNAP,
Special Advisor to TAG.

4.9 REPORT TO CONGRESS ON WATER POLLUTION CONTROL MANPOWER DEVELOPMENT AND TRAINING ACTIVITIES

Environmental Protection Agency, Office of Water Programs, March 1972

SUMMARY OF REPORT

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SUMMARY OF REPORT

INTRODUCTION

The Environmental Protection Agency (EPA) administers a water pollution control program in accordance with the provisions of the Federal Water Pollution Control Act of 1970 (P.L. 91-224).¹ This program includes a broad spectrum of activities related to water pollution control that are conducted in partnership with the States and local governments, private organizations and other Federal Agencies. Generally, the Federal legislation provides that the States and their subdivisions have primary responsibility for conduct of water pollution control activities, with financial and technical assistance from the Federal Government.

This report focuses on the manpower development activities of all organizations, both public and private, that are concerned with water pollution control. Educational institutions are added to indicate the breadth of training resources and requirements.

The report finds that manpower demands are expected for a wide

variety of educational and skill categories from numerous sources and types of organizations. Training activities extend over a broad spectrum of occupational categories through a host of varied programs, both public and private. Given the broad scope of manpower and training activities, several considerations and qualifications should be noted before proceeding with a more detailed summary.

The report presents 5-year projections for increases in jobs in the water pollution control field. These projections represent EPA's best estimates of future job opportunities in water pollution abatement, and have been drawn from a variety of sources as explained in the report. EPA believes that they indicate the order of magnitude of the problem although they are subject to further refinement as additional information becomes available.

The report does not project the numbers of individuals who may become available for these jobs. This is a difficult task owing to the wide variety of professions and skills that will be recruited from an even greater number of institutions, locations, and educational backgrounds. As a consequence, it is not possible to estimate precisely at this time what the training needs will be nor where they will originate. While many programs that provide training may be worthy of expansion there has been insufficient analysis performed on present personnel and how they gained their knowledge to know if these sources will not continue to be sufficient in future years. Furthermore, to the extent that governmental programs are concerned, there is insufficient understanding about what private resources will be allocated to provide or acquire training to supplement public funding.

¹ Hereinafter referred to as the Act.

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It should be noted that even with a rigorous program of construction of new plants, wastes may not be treated at planned levels due in part to shortages of well trained personnel. This problem results partly from the absence of adequate State certification standards governing the minimum acceptable skill levels of operators, and the general level of salaries and wages for waste treatment operators. Often these problems can be traced to the general structure and level of wages and salaries among State and municipal governments.

To improve the ability of State and local governments to meet their many needs and desires, the President has proposed a program of revenue sharing. This program is designed to provide fiscal relief to State and local governments and to strengthen these institutions in dealing with complex problems and difficult situations.

With these considerations in mind, we may turn to the report and the summary of results of this study. The report is in five parts in-

cluding a short introduction. Part II discusses manpower planning; Part III manpower recruitment, retention, and utilization; and Part IV manpower training. In specific response to the requirement of subsection 5(g) (4) of the Act, setting forth the items to be covered in this report, Part II includes a report on actions taken under subsection 5(g) (2) to develop a forecasting system for manpower and training needs and provides interim estimates of future needs. Also responding to the statute, Part IV includes a discussion of EPA actions taken under subsection 5(g) (1) and (3) and comments upon the extent and effectiveness of non-EPA training programs in the field of water pollution control. Finally, Part V of this report sets forth conclusions.

This "Summary of Report" parallels in structure the presentation of the entire report.

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MANPOWER PLANNING

The size and complexity of the water pollution control manpower universe is defined by a number of factors:

The current large number of jobs (1971 estimate 149,400).

The projected rapid growth in jobs (1976 estimate 254,200).

The large number of employers (1971 estimate 25,000 public and private).

The geographic dispersion of jobs throughout the Nation.

The large number of different occupational categories that constitute the universe of jobs (EPA had identified 144 different occupations).

The changing technology that affects the nature of the work performed by many employees.

In light of these factors, EPA is developing a manpower planning program to meet the goals of the overall manpower development system. The program has two primary components:

1. Forecasting
2. Action Planning

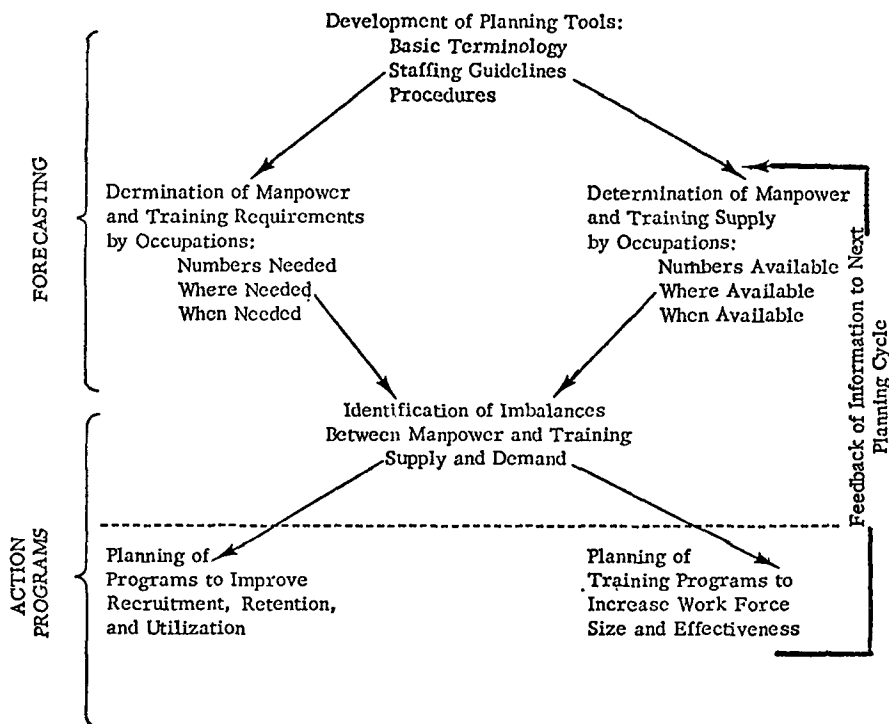
Exhibit I illustrates the relationships between the various elements of the program. The forecasting component is used to estimate the supply and demand for personnel and the need for additional training. The action planning identifies opportunities or programs that may be of benefit when it is determined the supply of personnel or training will be insufficient to meet demand. Manpower forecasts are developed by occupation, labor market area and time frame while training forecasts are developed to project entry, update and upgrade training needs.

The planning program is intergovernmental and interagency in

nature with the States having an important role. EPA, which initiated the program, is developing the planning tools and providing technical assistance and training to the states and their subdivisions. While the program is not yet operational, field installation has begun. State and local personnel are now being provided with training and technical assistance to build up their capabilities for manpower planning.

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EXHIBIT 1
WATER POLLUTION CONTROL MANPOWER DEVELOPMENT PROCESS



[p. 4]

The report includes an interim forecast of water pollution control manpower and training needs through 1976. Despite data limitations which affects the reliability of the projections to some extent, the forecast is indicative of the order of magnitude of the manpower training needs. In summary, this estimate shows the following additional manpower required by 1976:

EXHIBIT 2.—ADDITIONAL MANPOWER REQUIRED BY 1967¹

Personnel category	Sector nongovernmental	Local	State	Federal (non-EPA)	EPA	Total 1976
Professional	10,200	1,300	3,400	1,300	600	16,800
Operator	33,300	8,900	....	1,400	....	43,600
Technician	18,400	1,200	400	200	200	20,400
Other	10,400	11,700	800	400	600	23,900
Total ²	72,300	23,100	4,600	3,300	1,400	104,700

The anticipated requirements represent a very rapid growth in the water pollution control work force, as may be seen in Exhibit 3:

EXHIBIT 3.—LABOR FORCE GROWTH 1971 TO 1976¹

Personnel category	1971 manpower engaged	1976 manpower requirements	Percentage increase
Professional	25,400	42,200	66
Operator	49,300	92,900	88
Technician	26,900	47,300	77
Other	47,800	71,800	50
Total	149,400	258,800	73

¹ The bases for these figures are set forth in Part II-D of this report.

² An undetermined portion of this total will be assigned on a part-time basis to water pollution control activities.

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This growth in the work force, according to EPA estimates, will result in a substantial demand for both entry-level and update training. The average annual training requirements are summarized in Exhibit 4.

The five-year total training need is projected to approach 130,000 entry and 380,000 update training actions during the 1971-1976 period.

The largest increase indicated by the forecast is for more operators. The increase projected in the number of waste treatment plants coupled with the increased sophistication of treatment processes are expected to result in an increase in operator training requirements as well. EPA observations and a report by the General Accounting Office (GAO) indicate that the effectiveness and efficiency of existing treatment plants is already impaired by understaffing and undertraining of operators.

With regard to professionals, there will be a need for more highly trained sanitary engineers, primarily because of the increased technological sophistication of the water pollution control process. Further, specialized water pollution control training is necessary in substantial quantity for professionals of other backgrounds entering the field. Also, from Exhibit 4, it is estimated that there will be a substantial demand for update training for all professionals.

The report also notes that there will be an increased demand for technicians with one or two years of college level training and that

substantial update training for the present work force will be required.

MANPOWER RECRUITMENT, RETENTION, AND UTILIZATION

Gross manpower and training requirements can be partially fulfilled through personnel activities designed to:

Ensure that a sufficient supply of basically qualified persons are available for recruitment;

Improve retention rates in the existing work force; and

Improve utilization of the existing work force.

Successful performance of these activities is crucial to achieving the goals of the overall manpower development system. While primary responsibility for recruitment, retention and utilization of water pollution control manpower rests with individual employers, there are certain activities which EPA can undertake in this area for the benefit of all employers of water pollution control personnel. For example, in recruitment, EPA has produced a very successful movie, "Talent Search," in English and Spanish versions. It has also produced recruitment brochures, and provides employment information to servicemen pending discharge, and to veterans. In retention EPA has supported the adoption of meaningful operator certification programs. In utilization EPA has developed guidance on the application of industrial engineering techniques to wastewater processing.

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EXHIBIT 4.—FORECASTED TRAINING REQUIREMENTS ¹
 [Average Annual Load—1972-1976]

Sector	Nongovernmental		Local		State		Federal non-EPA		EPA		Total	
	Entry	Update	Entry	Update	Entry	Update	Entry	Update	Entry	Update	Entry	Update
Personnel category:												
Professional	2,960	9,140	500	2,480	880	1,920	520	2,640	160	1,260	5,020	17,440
Operator	8,260	16,020	3,480	17,080	.....	.....	.....	2,460	.....	.....	12,260	35,560
Technician	5,160	14,860	480	2,300	100	260	140	960	40	280	5,920	18,660
Other	2,580	3,280	400	1,260	.....	.....	60	280	180	.....	3,220	4,820
Total	18,960	43,300	4,860	23,180	980	2,180	1,240	6,340	380	1,540	26,520	76,480

¹ The bases for these figures are set forth in Part I)-D of this report.

[p. 7]

The subject of operator certification is considered an important part of the recruitment, retention and utilization process. A review of the current situation reveals that 47 States now have certification requirements of some kind, including 31 where certification is mandatory. Further, the standards for certification vary substantially from State to State. Since the quality of operator certification programs has a substantial impact on the efficiency of waste treatment plant operation in the States, EPA believes strongly that States should establish mandatory, uniform certification laws based on national criteria.

To meet this objective, EPA is providing technical and financial support to the Water Pollution Control Federation, the American Waterworks Association, and other interested organizations to establish a national certification board. It is anticipated that this board will serve as an information center for certification activities, recommend standards and guidelines, facilitate reciprocity between State programs and assist authorities establish and update programs. To facilitate States' adoption of certification programs based on national criteria, technical assistance and training should be provided by EPA.

MANPOWER TRAINING

A substantial amount of training for the water pollution control labor force is conducted by EPA and by others—including educational institutions (both four-year colleges and universities and two-year colleges and technical schools), professional and trade associations, private industry, local government agencies, State government agencies, and Federal agencies other than EPA—for three types of water pollution control manpower: ¹ Professionals, Operators and Technicians.

NON-EPA TRAINING ACTIVITIES

Non-EPA organizations conduct a variety of training: Professional training has been largely restricted to graduate-level entry programs; lower-level operator training has concentrated in centralized locations oriented primarily to the need for larger facilities; and training for technicians and higher level operators which has been sporadic and narrowly focused. A comprehensive strategy to focus programs on particular and comprehensive needs has yet to be developed.

Current efforts are fragmented and lack coordination. As a result, there may be some unnecessary overlapping and some inefficiencies in these programs. Thus, mechanisms for achieving economies through interagency coordination and subsequent channeling of resources to

priority needs in water pollution control training would strengthen existing programs.

¹ While the manpower planning program forecasts needs for a fourth category, Others, these other personnel require little or no specialized water pollution control training and, therefore, are not of concern for a discussion on water pollution control training.

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EPA TRAINING ACTIVITIES

The battery of EPA training programs which is outlined in Exhibit 5 is intended to contribute to fulfilling training needs which are unmet by others. As indicated by the Exhibit, EPA's contribution may be:

- Professional Training Grants for Graduate Programs
- Research Fellowships
- Direct Training
- Technology Transfer
- Operator and Technician Training
- Undergraduate Scholarships

PROFESSIONAL TRAINING GRANTS

Pursuant to Subsection 5(g) (3) (A) of the Act, EPA awards professional training grants to institutions for the establishment, expansion, and improvement of graduate-level programs in water pollution control. This program is intended to produce a cadre of trained professionals prepared to contribute to water quality management through subsequent positions in teaching, research, consulting, or direct operation in the public or private sectors. Renewable grants are awarded annually for one year at a time as part of a training project of five years duration. Grant funds may be used for student stipends as well as to expand and improve staff, facilities, and equipment. Recent program activities are summarized in Exhibit 6.

The cost per student trained in the Professional Grants Program has decreased sharply, reflecting a payoff in earlier investment in equipment and staff. It now costs approximately 50 per cent of what it did in the early 1960's to train a water quality professional under this program. Further, less than 3 per cent of the manpower trained under the grants program has left the water quality field.

RESEARCH FELLOWSHIPS

Pursuant to Subsection 5(g) (3) (B) of the Act, EPA awards fellowships to graduate students for selected specialized research training in water pollution control. The purpose of this program is to increase the number and competence of engineers and scientists qualified to conduct independent research and advanced practice in conjunction with teaching at the graduate level. Awards are made on

a competitive basis primarily to Doctoral candidates in engineering, physical sciences, biological sciences, or socioeconomic disciplines. Recent activities under this program are summarized in Exhibit 7.

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EXHIBIT 5.—SUMMARY OF EPA TRAINING PROGRAMS

Program	EPA Authority	EPA Contribution
Professional Training Grants	Subsection 5(g)(3)(A) of the Federal Water Pollution Control Act	Financial support to educational institutions for graduate-level programs in water pollution control.
Research Fellowship	Subsection 5(g)(3)(B) of the Federal Water Pollution Control Act	Awards to graduate students for specialized research training in water pollution control.
Direct Technical Training	Subsection 5(g)(3)(C) of the Federal Water Pollution Control Act	Direct training and training support for others in technical matters relating to the causes, prevention, and control of water pollution.
Technology Transfer	Subsection 5(g)(3)(C) of the Federal Water Pollution Control Act	Direct training to practicing professionals, public decision-makers, conservation groups, and the general public.
MDTA		
Coupled OJT	Agent for the Departments of Labor (DOL) and Health, Education, and Welfare (DHEW) under the Manpower Development and Training Act (MDTA)	Program administration for entry-level operator training.
Institutional Training		
Public Service Careers		
Transition	Agent for DHEW and the Department of Defense.	Program administration for entry-level operator training.
Pilot Program	Subsection 5(g)(1) of the Federal Water Pollution Control Act	Direct training, financial support, and training support for update and upgrade operator training.
Undergraduate Training Grants	Section 16 of the Federal Water Pollution Control Act	Financial support to undergraduate institutions to conduct programs in water pollution control; facilities design and facilities operation and maintenance.
Undergraduate Scholarships	Section 18 of the Federal Water Pollution Control Act	Awards to undergraduate students for study leading to careers in the operation and maintenance of wastewater treatment facilities.

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EXHIBIT 6.—PROFESSIONAL TRAINING GRANTS PROGRAM ACTIVITIES 1970-72

	Academic year	
	1970-71	1971-72
Number of traineeships authorized ¹	788	932
Number of trainees appointed ¹	1,028	² 1,051
Number of professional training grants	88	91
Number of States involved	43	43
Number of institutions involved	72	82
Amounts awarded	\$3,781,756	\$4,562,682

¹ "Number of Traineeships Authorized" refers to the number of traineeships slots authorized. Since more than one trainee may occupy the same slot in a given year due to turnover, the "Number of Trainees Appointed" logically exceeds the number of slots authorized.

² Estimate.

TRAINING DISCIPLINES—1971-72

Under these grants, training was provided in the following disciplines:

Environmental Engineering
 Sanitary Engineering
 Environmental Chemical Engineering
 Environmental Systems Engineering
 Agricultural and Environmental Engineering
 Environmental Mining Engineering
 Nuclear Environmental Engineering
 Soils Environmental Engineering
 Environmental Biology
 Limnology and Aquatic Biology
 Estuarine Biological, Physical and Chemical Oceanology
 Water Chemistry
 Interdisciplinary Environmental Programs
 Environmental Economics

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EXHIBIT 7.—RESEARCH FELLOWSHIP PROGRAM ACTIVITIES 1970-1972

	Academic year	
	1970-1971	1971-1972
New research fellowships authorized ¹	60	46
Total research fellowships awarded ¹	105	108
Number of active fellows ¹	149	161
Number of States involved	29	27
Number of institutions involved	51	58
Funds awarded	\$600,000	\$600,000

¹ "New Research Fellowships Authorized" refers to the number of new fellowships awarded in the year. "Total Research Fellowships Awarded" refers to the sum of new fellowships awarded in the year and preexisting fellowships renewed during the year. "Number of Active Fellows" refers to the total number of active fellows during the year; this figure is derived by adding the "Total Research Fellowships Awarded" for the year to the number of fellows continuing under fellowships awarded in the previous year.

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This program has proven to be the primary source of instructors for university training of professionals and the primary mechanism for building professional research capacity. Over 70 per cent of the research fellows normally go into teaching or research.

DIRECT TRAINING

Under Subsection 5 (g) (3) (C) of the Act, EPA conducts a program of direct technical training in water pollution control matters and provides technical assistance to others similarly engaged. The purpose of this program is:

To provide a continuing, comprehensive program of specialized and advanced technical training generally unavailable elsewhere.

To research and develop instructional technology, and to provide an instructor development program for individuals responsible for and/or conducting environment training or related activities.

To provide, on request, instructors and/or training materials

in support of the training programs of other Federal, State and local agencies.

Students are drawn from the staffs of many water pollution control employers, usually for short courses—two weeks or less—conducted in EPA facilities by specialists from the EPA staff. Normally courses are oriented to professionals, although they are also available to other personnel categories.

The courses given provide either overview summaries of the concepts, science, and techniques for abating and preventing pollution, or detailed reviews of new technological developments, operational methods, and research findings. They also address specific practical features of wastewater treatment design and operation, water quality evaluation in field and laboratory, and technical and administrative aspects of water quality management and water pollution control.

In the FY 1972 program, EPA plans to improve delivery of direct technical training courses by:

- (i) Provision of learner-centered instruction.
- (ii) Formation of mobile training teams to provide courses to small isolated plants.
- (iii) Initiation of correspondence courses.

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The following table summarizes recent program experience:

Year	Courses	Students
1969	45	1,297
1970	57	1,560
1971	59	1,630

These students came from at least 14 different occupational groups.

TECHNOLOGY TRANSFER

The Technology Transfer Program is new and is intended to speed the utilization of new technology in the water pollution control field. To date, the program has concentrated on technology transfer primarily in municipal pollution control. The target groups for the program listed in order of priority are:

- (i) Design engineers.
- (ii) Public decision makers.
- (iii) Conservation groups and the general public.

Training is of both "general awareness" and "detailed knowledge" types. Since the program was first initiated in 1971, specific activities to date have been limited. They include:

Presentation of two-day technical workshop/seminar programs for engineers designing wastewater treatment facilities
Developing design manuals for consulting engineers
Monitoring 60 demonstration grant projects
Developing visual presentations

Preliminary assessments of this program are favorable. The seminars were well received, and a heavy volume of correspondence was generated from public and private engineers involved in the design process.

OPERATOR AND TECHNICIAN TRAINING

EPA has also been active in training for water pollution control jobs below the professional level. This has been done first, as a program manager for the Department of Labor, Health, Education and Welfare, and the Department of Defense under training activities conducted pursuant to the Manpower Development and Training Act (MDTA). Second, it has been done under Subsection 5(g) (1) and Sections 16 of the Act.

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As program manager under MDTA, EPA has operated four types of entry-level and/or upgrade operator training programs:

- (i) Coupled OJT
- (ii) Institutional training
- (iii) Public Service Careers
- (iv) Transition training

Training is conducted through subcontracts from EPA to units of State governments, municipalities, special wastewater treatment districts, vocational schools, community colleges, and universities. Additionally, EPA works with State and local agencies to help them qualify for MDTA support, arranges training for instructors, provides teaching materials and curriculum development assistance, and otherwise assists State and local governments in getting training projects under way.

The programs, which are now continuing, have already enrolled between 3,500 and 4,000 trainees, most of whom qualify as disadvantaged. Graduation rates have been high, as has been the rate of successful employment.

These programs have been highly successful in meeting needs for more skilled operators. In addition, they have proven that trainee operators could be drawn from the disadvantaged—the unemployed, the underemployed, and the minority groups—and be successfully trained for a variety of water pollution control jobs. It has also

shown that the career ladder concept can be highly effective in improving public service in this field. However, serving as program manager has resulted in certain problems for EPA:

(i) It has been necessary to convince potential sponsors, e.g., municipalities, that the program can take disadvantaged persons and train them adequately to perform effectively over an extended period.

(ii) It has been necessary for EPA to locate adequate facilities and train instructors for the programs because of the absence of an instructional framework.

(iii) It has been necessary to convince sponsor agencies, which are only secondarily concerned with fulfillment of the goals of the Federal Water Pollution Control Program, of the continued high priority of these programs. Sponsor agencies are orientated to counterpart State agencies rather than to pollution control agencies and their specific needs and requirements.

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Generally, although not completely, the first two problems have been overcome; the third has not. To obtain funding at expanded levels to meet the requirements projected over the next five years, a new mechanism is needed. One such approach would draw EPA, DOL, and DHEW together to coordinate the use of MDTA-type funds committed to water pollution control training.

To date, subsection 5(g)(1) of the Act, which authorizes a pilot program for supplemental manpower development and training programs for persons entering into operations and maintenance of treatment work and related activities, has been used in small part to provide advanced instructor training for instructors serving in the MDTA program. More importantly, it has been used to develop specialized training courses in advanced wastewater treatment. (The MDTA courses focus on entry- and low-level upgrade training.) The bulk of the FY 1971 pilot program was used to fund grants for 24 grants to States (and one Region). The grants were made in response to applications for innovative plans representing compelling needs from the recipients. Twenty-two grants were awarded for training and two for curricula and materials developed, to 20 different jurisdictions. FY 1971 training under 5(g)(1) is summarized below:

Program	Total number of trainees	Total amount of grant
Advanced Instructor Training	50	\$39,174
Specialized Training in Wastewater Treatment ..	190	183,114
Grants for Special State Projects	2,945	734,416
Total	3,185	956,704

It is too early to evaluate the pilot program. However, enrollment request far exceed capacity under present funding levels. The pilot projects presently supported represent only a small portion of the needs critical by the States.

The pilot program to date has:

Established a mechanism to immediately initiate the training necessitated by an accelerated program

Provided an initial framework upon which the States can build and for which they can eventually assume responsibility.

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The last of the EPA training programs are those funded under Sections 16 and 18 of the Act. These provide grants and scholarships at the undergraduate level for training of higher level operators, technicians, and pre-baccalaureate engineers. Thus far, Section 16 training has been used primarily for training of qualified high school graduates in junior colleges in the operation and maintenance of waste treatment plants and related facilities. This training is intended to fill the gap between lower level operator training and four- or five-year professional training, particularly at the technician and senior operator levels. Under this program, training grants have been awarded to technical schools, junior colleges, and similar institutions to develop and test new approaches to curricula development. Only one grant has been directed toward bachelor degree training in design, as the need for operations and maintenance training resulting in an Associate degree was deemed much more critical.

The entire FY 1971 appropriation of \$331,000 was used to award grants to seven institutions for planning and design of curriculum material, for initiating training programs, and for materials development.

Meaningful assessment of the Section 16 program is precluded by its newness. However, the grantees have made good progress, and the initial training courses were initiated at the beginning of the 1971-1972 academic year.

As the role and strategy of EPA at the national level require strengthening, so do the roles and strategies of the State water pollution control agencies. Much of EPA's training strategy depends on the assumption of greater and, indeed, parallel responsibilities at the State level. The capacities of State agencies to do so are limited and require immediate attention. They must be strengthened to assume greater leadership, and coordinative roles and programs must be tailored to the institutional arrangements peculiar to individual States.

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PART I

INTRODUCTION

The Environmental Protection Agency (EPA) is responsible for the execution of the Federal Water Pollution Control program.

* * * * *

This program is to be accomplished through a Federal partnership with the States and their subdivisions, with the Federal Government assuming its full responsibility while giving the first opportunity to manage and solve the problems to the States and local governments. More specifically, the goals of the program for the 1970's are:

- (i) Acceleration of the program for construction of treatment facilities.
- (ii) Improved standards and enforcement.
- (iii) Improved assistance to the states.
- (iv) Better programs for prevention and abatement of pollution from Federal facilities.
- (v) Development of programs to deal with emerging problems.

Achievement of these goals requires the people of the United States, acting both privately and publicly at all levels of government, to apply adequate resources—men, material, and money—to do the job.

This report focuses on men—the manpower needed to produce clean water. This includes the manpower necessary to authorize the commitment of resources; to set and enforce standards; to plan the details of the programs; to develop, design, construct, operate, and maintain facilities; and to provide administrative support for these operations. The report examines manpower and training needs, both present and projected, and discusses activities that have been taken to meet these needs. Its emphasis is, of course, on the planning and training that has been accomplished under subsection 5 (g) of the Federal Water Pollution Control Act. Further, it attempts to present a comprehensive analysis of the water pollution control manpower situation by discussing all its aspects.

Preliminarily, it should be noted that recently substantial attention has been centered on the quantity and quality of manpower operating

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waste treatment plants. Observations of EPA indicate that undermanned plants and underqualified personnel are too frequently causing plants to operate well under design standards. A 1970 study by the General Accounting Office (GAO) bears out these observations. In its report to Congress on a survey of 69 municipal wastewater treatment facilities, GAO noted that 59 of these plants did not fully meet the minimum provisions for personnel, laboratory controls,

or records recommended by the 1963 Conference of Sanitary Engineers; of 12 that appeared to have serious operation and maintenance problems, seven needed additional qualified plant-operating personnel.¹ The report concluded:

A frequent cause of O&M [Operations and Maintenance] problems at waste treatment plants is the lack of a sufficient number of qualified personnel to operate the facilities. Waste treatment plants must be staffed with an adequate number of qualified personnel to achieve the designed level of treatment and maintain and protect the community's investment in the physical plant. Deficiencies in either the quantity or qualifications of the operating staff can adversely affect a plant's operation.²

The GAO indicated that its conclusion was based on reports from knowledgeable individuals in the Federal Water Quality Administration (EPA's predecessor organization), State water quality offices, municipal wastewater treatment facilities, and consulting engineering firms that a lack of qualified operators was a principal cause of plant operation and maintenance problems.

Further, as reported below, there are substantial manpower and training needs for other classes of manpower as well. These can cause reduced effectiveness and efficiency in water pollution control.

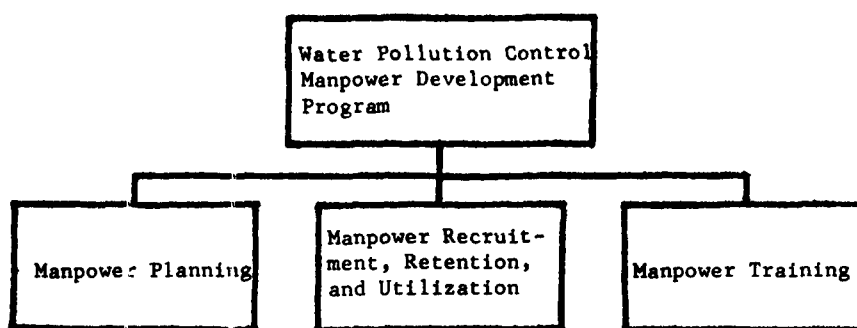
The reasons for such problems are several—including failure to anticipate manpower needs; handicaps to recruitment and retention because of inadequate budgets, low salaries, or lack of advancement opportunities; poor utilization of manpower; and the failure to properly train employees in job skills. These reasons appear without any necessary relation to the classification of the employees, the type of employer, or the labor market area. However, they all do relate to manpower management functions. In this respect, overcoming the problems and developing a qualified and motivated work force requires a comprehensive manpower program.

¹ Comptroller General of the United States, *Report to Congress: Need for Improved Operation and Maintenance of Municipal Waste Treatment Plants—Federal Water Quality Administration*, Department of the Interior B-166506, 1 September 1970, p. 18.

² *Ibid.*, p. 21.

[p. I-2]

In this vein, EPA has conceived of a manpower development program³ to ensure fulfillment of water pollution control manpower needs through three interdependent functional units, as follows:



Each unit is concerned with all manpower classes, types of employers, and labor market locations as they relate to the unit management function.

The manpower development program includes both public and private organizations. The public organizations include Federal, State, and local governments. Within each level, government involvement includes agencies that use water pollution control manpower as well as those that provide training. This is also true on the private side, the program including educational organizations as well as product-oriented organizations. Thus, the program operates within the general manpower development framework of the country.

The manpower development program concept provides the basis for the organization of this report. Thus, Part II reports on the manpower planning program, including the forecasting component authorized by subsection 5(g)(2) of the Federal Water Pollution Control Act, and offers interim estimates of manpower and training needs. Part III is addressed to the recruitment, retention, and manpower utilization activities undertaken by EPA. Part IV discusses manpower training activities, including those authorized under subsection 5(g)(1) and 5(g)(3). A summary is presented in Part V of this report.

³ The program is administered by the Manpower and Training Division of the Office of Water Programs of EPA.

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PART II

THE WATER POLLUTION CONTROL MANPOWER PLANNING PROGRAM

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PART II

THE WATER POLLUTION CONTROL MANPOWER PLANNING PROGRAM

A. INTRODUCTION

If the national goals for water pollution control are to be met, manpower to operate the national water pollution control system must be available in needed amounts, with the requisite skills, at the proper times, and in the proper places. The manpower must also be properly utilized by management, and the employees must be personally satisfied with their situations. The difficulties in meeting this requirement become manifest when the combined effects of the following factors are considered:

The current large number of jobs (1971 estimate—149,400).

The projected rapid growth in jobs (1976 estimate—254,200).

The large number of employers (1971 estimate—25,000, public and private).

The geographic diffusion of jobs throughout the nation.

The large number of different occupational categories that constitute the universe of water pollution control jobs (EPA has identified 144 different occupations).

The changing technology that affects the nature of the work performed by many employees.

These factors indicate the urgency for careful planning if current and future manpower requirements are to be fulfilled. Clearly, an effective water pollution control manpower planning program of substantial nature is required to serve as a rational base for action programs.

The Congress, in subsection 5(g)(2) of the Federal Water Pollution Control Act, authorized EPA to develop and maintain a forecasting program and to publish the results of forecasts produced by

the program. In accordance with this statutory requirement EPA has been working to create a comprehensive program which combines a manpower forecasting activity with the planning of action programs.

Section B of this part of the report sets forth a description of the forecasting program and a status report on its implementation and discusses action planning activities which complement and follow up on [p. II-1]

manpower forecasts. Section C, below, describes the universe of water pollution control manpower as a basis for the interim manpower and training forecasts (Section D) which have been specially developed to serve while implementation of the manpower planning program is completed.

[p. II-2]

B. THE MANPOWER PLANNING SYSTEM

EPA is presently developing forecasting and action planning on a nationwide basis for the major categories of water pollution control manpower. Forecasting must be by occupation since training requirements vary tremendously by occupation and thus cannot be usefully forecast without an occupational relationship. The program will involve the accumulation and reporting of compatible data for each occupation on a local, State, and national basis so that planning will be possible on all of these levels.

A key premise of the program is that it depends upon information from all levels of government and all types of commercial organizations. A second key premise is that planning for water pollution control manpower cannot be conducted independently of planning for other career fields since it draws from the same manpower pool and has objectives overlapping with other manpower planning programs.

In this respect, EPA supports the Cooperative Area Manpower Planning Systems (CAMPS) mechanism. Utilizing broad Federal planning guidelines, under CAMPS, it is intended that the states and their local areas forecast manpower requirements for numerous career fields and draw up action plans to meet many of these needs. CAMPS was initiated in 1967 by the Department of Labor in order to achieve cooperation and coordination in planning for all fields of manpower. At this point in time, the CAMPS mechanism is primarily concerned with training the disadvantaged. Capabilities have not yet been established to deal in depth with the complexities of manpower planning for the water pollution control manpower program. Within the CAMPS mechanism, local coordinating committees meet regularly to determine overall manpower and training needs for

their areas, including any identified in the water pollution field and to outline a series of training courses. These determinations are expressed in an annual comprehensive manpower and training plan for the area. State coordinating committees work out conflicts between local plans and combine local plans to form a blueprint for the state. Federal regional committees review and approve the state plans, and at the national level, a coordinating committee representing six Federal departments and three agencies, including EPA, sets national goals as a framework within which local and State committees prepare their annual plans.

In addition to maintaining a planning relationship with other agencies of the Federal government through its membership in the CAMPS national coordination committee, EPA endeavors to coordinate with and provide assistance to other Federal agencies having planning interests that affect or require water pollution control manpower. Illustrative of this is the technical assistance being provided by EPA to the Bureau of Labor Statistics on a project sponsored by the National Science Foundation to determine the impact of new national programs on employment. Initial efforts of this project focus on the national water pollution control

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program. Through the use of an input-output simulation model, the impact of Federal expenditures for water pollution control will be traced through the involved public and private organizations. As part of this study, BLS and EPA will utilize computer processes to jointly calculate total employment by occupation that is produced by various levels and types of expenditures for water pollution control. This study is expected to be completed late in 1972.

Another example of coordination is the joint EPA/DOL survey of municipal wastewater treatment plants which is described in subsection B-2-b, below. Unfortunately, adequate coordination has not yet been completely established with other Federal agencies—such as the Department of Housing and Urban Development, the Census Bureau, the Civil Service Commission, and the Office of Education (Department of Health, Education, and Welfare)—whose programs include water pollution control manpower planning aspects.

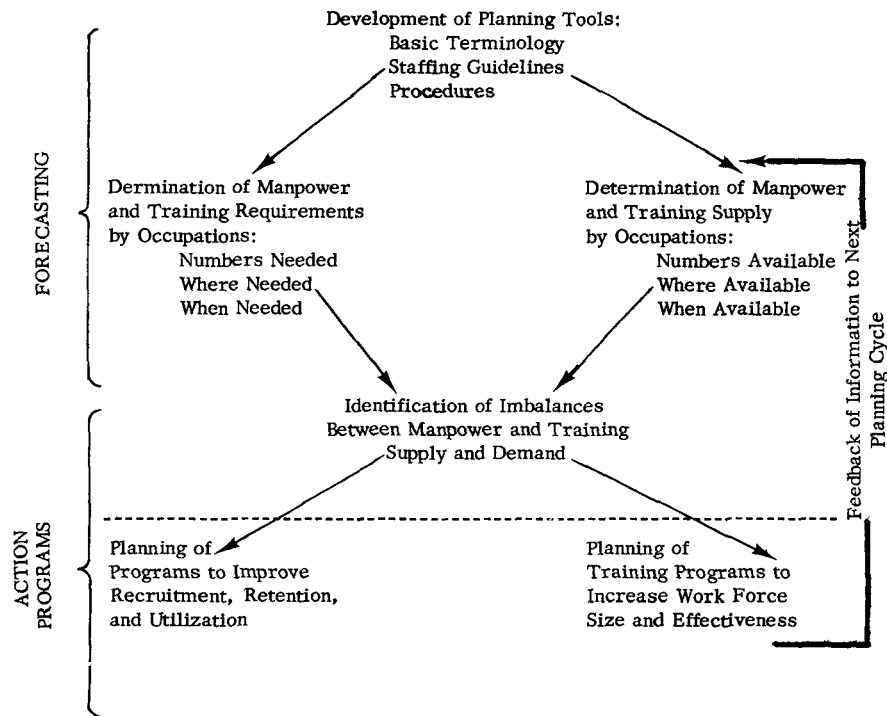
As shown in Exhibit II-1, the EPA manpower development process is a continuing one; manpower forecasts provide the basis for development of action plans, and the information generated by the completion of action planning (and subsequently action plan implementation) is fed back as data for the next planning cycle. The purpose and scope of these two components of the water pollution control manpower planning process are discussed below, together

with the activities conducted to implement both aspects of the program.

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Manpower Planning Program

EXHIBIT II-1 WATER POLLUTION CONTROL MANPOWER DEVELOPMENT PROCESS



[p. II-5]

1. *The Forecasting Component*

The broad purpose of the manpower and training forecasting component of the planning process is to provide time-phased information about anticipated needs for water pollution control manpower and training so that actions can be planned and implemented early enough to ensure that the necessary trained manpower is available at the time and places required.

a. *The Forecasting Process.* Fundamentally, the forecasting proc-

ess is a comparison of probable manpower demand and supply to identify probable imbalances. Perhaps the best way to describe the forecasting component is through examination of its operational process. As may be seen by an examination of Exhibit II-1, the forecasting process consists of four discrete elements:

- Development of planning tools.
- Determination of manpower and training requirements.
- Determination of manpower and training supply.
- Identification of imbalances between supply and demand.

Each of these activities is described below.

(1) *Development of Planning Tools.* Fundamental to the forecasting process are three planning tools:

- Basic Terminology.
- Staffing Guidelines.
- Procedures.

These tools must be available before forecasting can actually commence and, therefore, the first task in the forecasting program is their development, as discussed below.

Basic Terminology. The creation and dissemination of standard terminology based on generally understood and accepted word or phrase meanings substantially reduces the probability of misunderstandings. Accordingly, an early step in the creation of the forecasting component is the development of a tool that may be called a "program language."

Critical terms for definition in the forecasting component are the basic structural categories of the planning system, the various occupations. For example, the label "operator" has historically been applied to a variety of job descriptions. If the forecasts are to be reasonably accurate, the term "operator" must mean literally the same thing to persons who identify, aggregate, and analyze needs; otherwise findings will

[p. II-6]

be distorted and invite an erroneous action. To provide for such common understanding, the occupational definition will convey a body of information, including:

- (i) A statement of the tasks ordinarily performed by personnel in the category.
- (ii) A statement of qualifications for inclusion in the category in terms of the general and vocational education, aptitudes, and physical qualities necessary.

Because it is most economical to have only one effort to develop

the required terminology, it is appropriate that the terms be defined at the Federal level and then distributed to all other levels. Therefore, EPA has the responsibility for developing, disseminating, and subsequently maintaining definitions. Basically, this is done by studying the tasks performed by a sample of water pollution control employees and then constructing the definition around work tasks commonly grouped into similar jobs, as revealed by industry practice. The structure of the definitions follows that of the Department of Labor's Dictionary of Occupational Titles in that occupations are classified by job family and industrial category and are described by tasks performed, requisite training, and aptitudes and physical qualities required to perform the occupation.

Staffing Guidelines. As has been seen, the forecasting component requires need identification by many different people. In determining the needs, judgments are necessary; for example, does it require seven or 17 operators (as defined) to operate a given plant? Although raw judgments in reasonably similar situations may vary substantially from individual to individual, the result of untempered judgment on forecast input data could be outputs with unacceptable margins of error, particularly at the local level where varying judgments would ordinarily have little opportunity to offset each other.

To control this possibility, managers have developed the technique of supplying guidelines to those making needs judgments. Commonly, these guidelines relate staffing needs to ranges of units of production for given facility arrangements. Thus, in the case of water pollution control, for example, staffing needs of treatment plants can be generally related to plant capacity and type in terms of the number of millions of gallons of waste per day that a particular type of plant is designed to treat. A possible staffing for a primary treatment (sludge digestion, sludge beds or lagoon) plant is shown in Exhibit II-2.

Thus another necessary tool for operation of the forecasting component is staffing guidelines. They are appropriately developed at the Federal level since it would be uneconomical to undertake a number of separate efforts to produce them. The responsibility for development is on EPA. The staffing guides are developed on the basis of studies of standard practices in different types of production units throughout the industry.

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EXHIBIT II-2.—SAMPLE STAFFING GUIDE FOR WASTEWATER TREATMENT PLANT

Type: Primary Treatment Sludge Digestion; Sludge Beds or Lagoons

OCCUPATION TITLE	Plant average day capacity, mgd									
	1	3	5	10	20	35	50	65	80	100
Superintendent		0.5	0.5	1	1	1	1	1	1	1
Assistant superintendent						1	1	1	1	1
Clerk typist					1	1	1	1	2	2
Operations supervisor										1
Shift foreman										2
Operator II	1	1	2	2	3	5	5	6	7	7
Operator I	3	3	3	3	4	5	6	6	7	8
Automatic equipment operator								1	1	1
Maintenance supervisor								1	1	1
Mechanical maintenance foreman							1	1	1	3
Mechanic II				1	1	1	1	2	2	2
Mechanic I					1	1	1	1	2	2
Electrician II .....					.5	1	1	1	1	2
Electrician I							1	1	1	1
Maintenance helper					1	1	2	2	3	4
Laborer .....	.5	2	2	2	2	3	5	5	6	7
Painter .....										.5
Storekeeper								1	1	1
Custodian							1	1	1	1
Chemist .....										.5
Laboratory technician				1	1	2	2	2	2	2
Total staff	4.5	6.5	7.5	10	15.5	22	29	34	40	50

Note: Plant components included in this example:

Liquid treatment: Raw wastewater pumping, preliminary treatment, primary sedimentation, chlorination.*Sludge treatment:* Primary sludge pumping, sludge digestion; sludge drying beds (1, 3, 5 mgd plants),* sludge lagoons (10 mgd and larger plants).**Other plant components:* Yardwork, laboratory, administration and general.

*Sludge removed and hauled from plant site by staff personnel.

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Procedures. The third tool required in a forecasting process involving far-flung multiple data inputs and analyses is a set of procedures. Again, the objective is to reduce forecasting error by tempering the individual judgments that otherwise would be made independently and, probably, inconsistently. A second objective is to reduce the man-time required for operation of the forecasting component by the development of one system for all to follow rather than having each contributor take the time to develop his own procedures. The third objective of the development of standard procedures is to ensure that data are collected in a format that will be accepted by EPA's national computerized system for the storage and retrieval of water quality related data (STORET).

Procedures for use throughout the length and breadth of the forecasting process are most economically developed by the entity having the overview of the entire system, the Federal Government. Accordingly, this responsibility is given to EPA. The procedures are

created by fusing the knowledge of planning specialists with that of manpower and training specialists.

(2) *Determination of Manpower and Training Requirements.* In order to identify the demand for water pollution control personnel, it is planned to employ the following process. Manpower and training requirements which constitute demand, form one leg of the forecasting process. All Water pollution control employers,¹ using the planning tools described above, will determine their employee needs in terms of net additions to their respective work forces by occupation (as defined in the tool-making process) for each year in the planning spectrum. This is to be done by comparing the present work force, by occupation (after adjustment for attrition and upgrade potential), with that anticipated in each of the planning years and reporting the difference. To determine the anticipated work force, the employer must first identify the expected work load by function in each planning year. Fortunately, many water pollution control employees can do this with a high level of confidence because generally major changes in work load are associated with major capital improvements whose activation dates can be predicted fairly accurately several years in advance. Having anticipated the work load by function, the employer can use experience and/or standard guidelines to anticipate accurately needed staff additions.

¹ The forecasting program is designed to include the needs of both public and private employers. To the extent that employers do not participate in the program, demand will be understated.

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Next, employers determine their training needs by occupation, by numbers requiring training, and by time frame. Three types of training needs are identified:

(i) *Entry Training*—The specialized vocational training that is required for occupational proficiency upon initial entry into a career field. This training may be received before or immediately after initial employment in the career field.

(ii) *Upgrade Training*—The training that current employees will need in order to become proficient in a new occupation, usually in the same career field. This training is undertaken as a result of or pending promotion.

(iii) *Update Training*—The training that current employees need to maintain proficiency in their current occupations because of technological or other changes in their jobs; in cases where employees are currently performing below the established proficiency level, this includes the training necessary to bring them to proficiency.

Entry training will be largely determined by anticipated new hires, upgrade by anticipated promotions, and update training by management judgment based on performance reviews and anticipated changes in the work environment.

Technical assistance for employers needing it to produce the training needs data required by the program will usually be provided by local or State employees who are specialists in training related to water pollution control.

The manpower and training needs of employers are then reviewed, adjusted as appropriate, and aggregated by occupation and year needed, initially for each labor market area, then for each State, and finally, on a nationwide basis. The initial review, adjustment, and aggregation will ordinarily be accomplished by local planning and training specialists, who are best acquainted with the local peculiarities which must be taken into account. However, in some cases local planners and trainers will not be available, and the initial aggregation will be done by State staff. In other cases local staff may be available but not fully capable. In this situation, the State water pollution control staff will ordinarily provide technical assistance and/or training to the local staff. Assignment of these functions to the states is a primary reason why the states are considered the keystones of the forecasting program. The State/local interface in this respect ordinarily will be closely related to State review of applications for capital grants and to State monitoring of operations in grant-in-aid facilities.

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State review, adjustment and aggregation is to be accomplished by the State staff specialists in water pollution control planning and training, who will be able to bring a state-wide view and a very high level of expertise to the demand determination. This again suggests the key role of the states in the process. It also suggests that the program will flounder without properly qualified personnel in the State manpower planning and training staff. An important aspect of the program then is technical assistance and training to the State personnel to ensure the level of performance required for program success. The Federal Government, through EPA, is assigned the responsibility of providing this technical assistance and training.

The final review, adjustment, and aggregation will provide a national picture of demand. To be developed by EPA, this calculation will offer the opportunity for adjustments based on a national view, such as anticipated changes in national economic or environmental policies or adjustments for interstate overlaps in the labor market.

(3) *Determination of Manpower and Training Supply.* The second

leg of the forecasting program is determination of manpower and training supply. The supply determination process runs concurrently with demand determination. Many of the same individuals and institutions will be as deeply involved in shaping the supply leg as the demand leg, but there are some differences in approach.

To determine the manpower supply is to determine the anticipated numbers of available manpower by occupation, labor market area, and planning year. Included in supply are:

- (i) The anticipated training program graduates ready to begin employment in the occupation.
- (ii) The anticipated unemployed who have had entry training or equivalent experience in the occupation.

The determination of the former requires an estimate of anticipated entry training programs by occupation, number of training slots, labor market area, and planning year. This information will be collected from employers at the same time demand information is collected. It must also be collected from other organizations that deliver entry training. It is planned that this information will be aggregated at the labor market area,² State, and Federal levels, with the respective staff specialists having responsibilities similar to those they hold for demand determination.

Determination of the anticipated unemployment of entry-trained personnel is a matter for the judgment of labor market specialists and labor economists; their judgments are to be aggregated with the entry-training output supply.

² A complication that develops here is that entry training, particularly professional training, occurs to some extent in locations unrelated to the local or State labor market. This will be taken into account in the adjustment that accompanies aggregation.

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(4) *Identification of Imbalances Between Manpower and Training Supply and Demand.* The purpose of the forecasting component is to provide estimates of manpower and training needs. In this step, the supply and demand data are analyzed in their entirety, imbalances are identified, and the estimates of needs are derived.

Analysis is to be conducted on the local, State, and Federal data aggregations. Normally, local planning staffs will compare the demand and supply figures, make adjustments as necessary, and develop forecasts for their respective labor markets. The State water pollution control agency staffs will make comparable analyses and forecasts for the states, and the EPA staff will make the national analysis and forecast. Technical assistance and training will be provided as

needed in analysis, as it is in the demand and supply determination stages.

The manpower forecasts will be in terms of additional numbers of employees needed, by occupations, labor market, and planning year. The training forecast, in similar format, will indicate the additional entry training needed to provide the needed additional employees.

b. *Forecasting Program Implementation.* Authorization by subsection 5(g)(2) of the Federal Water Pollution Control Act, as amended, for the establishment and maintenance of a manpower forecasting system resulted in acceleration of previous efforts in this direction. A small staff has been established at EPA Headquarters. Budget requests for FY 1972 provide for expansion of this staff and establishment of forecasting capabilities in the EPA regional offices. The actions taken to date, in addition to the efforts required for conceptualization of the planning program, are described below.

(1) *Accomplishments in the Development of Planning Tools.*

Conventional Treatment Plants. A contract has been let to provide for the development of occupational definitions and staffing guides for conventional waste treatment plants.

The occupational definitions are following the format of the Department of Labor's Dictionary of Occupational Titles. The occupational definitions will describe for each occupation category the duties performed and the job qualifications in terms of general education, specific vocational training, aptitudes and physical requirements.

The staffing guides will provide, for different types and sizes of waste treatment plants, the number of employees in each occupational category that are normally required for proper operation and maintenance. These guides are not intended to be precise standards; rather, they can be used by design engineers, manpower planners, and others as a frame of reference for planning the staffing of new plants and evaluating the staffing patterns of existing plants.

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Similar definitions and guides have been developed for waste treatment plants used in the inorganic chemical industry. This was done as part of a research and development study on the technology and economic aspects of water pollution control by this industry. A study of this type is now also being conducted for the beverage industry.

New Water Quality Pollution Control Systems. Manpower and training requirements are directly related to the work to be done, which, in turn, is in large part a function of the systems employed by water pollution control activities. Therefore, the development of the required occupational definitions and staffing guidelines can be done in coordination with the design of new systems. At the same time,

systems designers must take into consideration the cost and availability of operational manpower when considering various alternatives.

To ensure that appropriate manpower information is generated and that human factors are considered in the systems designs, a policy directive and guidance manual are being developed. The manual will specify the types of manpower and training information that should be produced during the design of new systems and will also provide guidance concerning the human engineering techniques that can be employed during systems design.

Through this mechanism, occupation definitions, staffing guides, manpower projections, and training materials can be developed simultaneously with the development of advanced waste treatment processes and other technological advances. The availability of this information will enable the timely development of the manpower required to permit full utilization of the new hardware and facilities.

(2) *Accomplishments in the Determination of Manpower and Training Supply and Demand.*

Joint EPA/DOL Survey of Municipal Wastewater Treatment Plants. A survey to determine the numbers and types of workers required to operate and maintain the nation's existing and planned wastewater treatment plants was started in June 1971. The survey is a joint effort of the Department of Labor's Manpower Administration, the Environmental Protection Agency's Office of Water Programs, and the counterpart State and local employment service and water pollution control agencies.

Over 3,000 plants and municipalities have been contacted to obtain data on current employment, job vacancies, future manpower requirements, labor turnover, and wages. The survey data are now being tabulated by many State agencies, and a national tabulation and analysis has been initiated at the Federal level. The resulting State and national reports should be available by mid-1972.

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The survey results can be used by water quality, education, and employment service agencies at all levels of government to plan, budget, and conduct manpower and training programs which will ensure proper staffing of wastewater treatment plants by qualified superintendents, operators, laboratory technicians, maintenance craftsmen, and other workers. The collected data will also provide the basis for the creation of a manpower information system, which is described below. The survey, to date, has been hampered by the limited manpower resources available to some State water quality agencies for this effort. However, the effort has fostered the development of working relationships at the Federal, State, and local levels

among environmental and employment security agency staffs; and it can be considered a fundamental establishment of coordinated manpower planning capabilities in these agencies.

The results of this survey will be used as a basis for a manpower information system that is being designed into EPA's national computerized system for the storage and retrieval of water quality related data (STORET). It is planned to relate pertinent manpower data to each existing and projected waste treatment facility and to make these data and processing services accessible to State and Federal water quality staffs through remote terminals located in their own offices (in the same manner as other water quality data and information services are now available.) The data will be continuously updated and maintained through collection of data generated in EPA and State programs for management of waste treatment plant construction and monitoring of plant operation and maintenance.

(3) *Developments in Training for Manpower Planning.* In cooperation with the Office of Education, Department of Health, Education, and Welfare, a contractor has been engaged to develop a procedures manual and to train representatives of State and local water quality, labor, and education agencies in the concepts and methods of manpower planning. The first workshops were held in December 1971.

The training will encompass information on the structure of the national water pollution control program; the manpower development process; the roles and relationships of Federal, State, and local labor and educational institutions responsible for manpower development; the state of the manpower planning art; and general instructions on the methods and procedures to be applied in manpower planning for municipal waste treatment plants.

2. *The Action Planning Component*

The second component of the water pollution control manpower development process is the development of action plans upon completion of manpower and training forecasts. The forecasts state the manpower and training needs, and action plans are developed to fulfill those needs and to improve the utilization of available manpower and provide for employee satisfaction.

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As indicated in Exhibit II-1, action plans to provide manpower and training can approach the goals from two directions: (i) planning for management programs intended to improve utilization of the existing labor force, for example, by the application of industrial engineering techniques or actions to lower attrition rates by improved working

conditions or more competitive compensation; or (ii) planning to increase the size and effectiveness of the work force by providing additional training.

Action plans are in the first instance the responsibility of the employer. Thus, all public and private managers develop action plans for their own spheres of activity. Naturally spheres of activity vary from one type of organization to another.

The action plans of the managers who are building and/or operating water treatment facilities are concerned solely with personnel engaged directly in water pollution control operations.

On the other hand, recruitment, retention, utilization and training action plans of local nonoperating, State, and Federal agencies frequently take on an additional dimension. Of course, these organizations will develop action plans designed to recruit, retain, and utilize or train their own staffs. However, their missions are in part to support the operating managers. Support involves assistance to operating managers in action planning. Therefore, as a part of their programs, these supporting agencies develop action plans to provide technical assistance and training to operating managers to aid them in development of action plans to improve manpower recruitment, retention, and utilization. Further, since many operating managers are not equipped or financed to provide all the training their staffs may require, these supporting agencies often develop action plans for the direct delivery of training to employees of operating managers in addition to their own employees. Planning for delivery of this technical assistance and training may be done by local management and training specialists who perhaps have the best knowledge of local priorities and specific needs. However, because of lack of local resources, such planning is frequently conducted at the State level.

Under the water pollution control manpower development process as currently conceived, EPA, in addition to planning for its own staff needs, provides impetus and financial assistance for the programs at the State and local levels. EPA also provides technical assistance and training in action programming to other Federal agencies having water pollution control activities. EPA engages in the action development of direct-delivery training and other services only to the extent that such training and services are required to fill identified training gaps that will not be filled by others. Thus, for example, EPA has and will continue in the immediate future to plan operator training courses and short update courses for professionals. EPA also develops action programs for the delivery of technical assistance in training, as in the development of curricula and training materials for the use of others in delivering training.

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C. THE UNIVERSE OF WATER POLLUTION CONTROL MANPOWER

As has been briefly noted, the water pollution control manpower planning program is nationwide in scope and potentially covers all water pollution manpower. An estimated 25,000 employers now engage an estimated 149,000 employees to accomplish a broad variety of activities relating to the achievement of the nation's water quality goals. These activities, which provide a frame of reference for the more detailed examination of the water pollution control manpower universe that follows, include:

- Establishment and enforcement of water quality standards.
- Development and administration of basin plans.
- Responses (on the part of polluters) to governmental imposition of standards and to basin actions.
- Management decisions on the part of polluters on acquisition and design of water quality control facilities.
- Operation and maintenance of facilities.
- Government support activities (such as research and development, technical assistance, and training).
- Educational institution activities.
- Consulting engineering.
- Equipment design and supply.

Water quality personnel with a wide variety of skills are needed to perform these functions. For purposes of this report, they are categorized into four overall groups: professionals, technicians, operators, and others. Each of these groups is described in this section of the report. Projections of manpower and training needs for each group are presented in Section D, below.

1. Professionals

Into the professional category fall those jobs that require creative problem-solving ability; the professional is expected to deal with analysis and correction of unusual management or technical problems. Sanitary engineers are the predominant professionals in the field. In addition to their engineering training, they are schooled in life and physical sciences and are commonly employed as planners, designers, administrators, or facility managers. The professional category also includes civil, electrical, and mechanical engineers and architects who

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design and construct facilities, chemical engineers who design and modify treatment processes, and mechanical and electrical engineers who design and operate the electrical and materials handling systems

in the larger wastewater treatment facilities and the sewage collection systems. As a result of experience and continuing education, these engineers frequently become specialists in water pollution control activities.

In addition to engineers, the professional category includes scientists who are involved in research, monitoring, and technical supervision. Chemists and microbiologists engage in water analysis in facilities and in streams, while aquatic biologists analyze the effects of pollution on water life. These scientists also participate in the design and analysis of waste treatment processes and water quality measurement systems.

Recently, as the interdisciplinary impact of water pollution control has become more apparent, other professionals have become more closely identified with the field. For example, lawyers, economists, and political scientists are frequently involved in enacting and administering water quality legislation, and management specialists and computer specialists have joined with engineers and scientists to provide interdisciplinary teams to solve water quality problems.

Most professionals come to the water pollution field with professional degrees at the bachelor or higher level. Currently the first professional degree for the sanitary engineer is the masters. The other professionals coming into water pollution ordinarily require additional specialized training in water-related subjects in order to become fully effective in their jobs.

2. Technicians

The technician performs complex but routine analytical tasks which require a knowledge of engineering and/or scientific techniques. This category consists largely of wastewater treatment laboratory technicians who perform chemical and biological tests to analyze influents, treatment processes, and effluent characteristics. They are responsible to verify that the influent is processable and does not contain toxic substances that might deactivate the biological treatment processes. In addition, their analyses enable identification of new pollution sources and provide the basis for determination of treatment charges to industrial polluters. Laboratory technicians monitor treatment processes in various parts of the plant to ensure that the system is working correctly, and they assess the effluent to ensure that the plant is operating to the required minimum performance standards. Particularly large or sophisticated water and/or sewage utilities also utilize electronic technicians to work with telemetry and automated control systems. Other technician level personnel include the draftsmen and survey party personnel who work with the con-

sulting engineering firms and large municipal departments.

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Technicians are employed both by treatment facilities and by State agencies charged with surveillance of water pollution.

Some technicians have an associate degree or two years of college, but many technicians actually possess less training, having achieved their positions through long experience and/or OJT. Those formally trained in an academic program frequently require on-the-job training to familiarize them with wastewater treatment problems, and they sometimes attend operator training programs as part of their orientation in order to gain an overall understanding of plant operations.

3. Operators

The operator manpower category includes several levels of personnel who are directly responsible for operation of equipment and systems involved in treating wastewater. While there is considerable confusion in the use of the term "operators," it is possible to identify at least three possible grades of operators, depending on skill, level of responsibility, and experience. The lowest grade of operator is an entry-level job. These operators may have less than a high school education and may have little mechanical experience. They may be responsible for a very small segment of the operation and generally perform both mechanical tasks (such as lubrication, cleaning, and inspection of equipment) and manual labor (such as cleaning out tanks, pumps, and valves). Typically they work under close supervision and normally have little or no particular knowledge of the plant equipment.

The second grade of operators are more experienced and are responsible for operations of part of the plant, or possibly a small plant in its entirety, including the indoctrination of new operators. This level of operator must understand and be able to interpret the indications of the instrumentation in the plant, which reflects the status of various processes; he must be able to diagnose and solve problems on his own initiative and to anticipate the consequences of his actions when problems occur.

The third level of operator includes supervisory personnel such as shift supervisors and plant superintendents who have ultimate operating responsibility for effectively running a plant. Job responsibilities at this level would include the scheduling of operators, the coordination of maintenance and operations tasks, participation in or making final decisions on staffing levels, budgets, and purchases, and so on. In some plants personnel with these duties will be engineers and, if so, would be classified as professionals rather than operators.

To complicate matters further, in small plants—those that process under one million gallons per day (mgd)—operators frequently perform the duties of all three operator levels. Operators in these small plants often work with only a few colleagues—and frequently no one else—on duty

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at the same time. The very smallest plants, in fact, are believed to be staffed generally by one part-time operator, leaving no one in attendance the major part of the time. Ideally, these operators should know everything that is going on in the plant and should be able to set up the plant for more or less automatic operations and to correct faulty conditions with a minimum of help. In such environments, the operator is a general supervisor, laborer, technician, maintenance specialist, and janitor, as circumstances dictate.

Experienced operators at all levels, but particularly at the highest level, are rarely available on the job market, although a few have come out of the military where they have operated treatment plants on military installations. Most operators are initially hired at the lowest level with little previous experience but definite mechanical aptitudes, and they are trained on the job.

4. *Others*

Other job categories include the craftsmen (such as electricians, mechanics, and machinists) who are required for maintenance of wastewater treatment plants; the laborers who support the operators and craftsmen; and clerical and administrative personnel.

Although the nature of plant operations gives maintenance jobs a number of unique characteristics, personnel fulfilling the maintenance function generally require standard craft skills. By definition, craftsmen are already experienced in their trades, and their skills are almost directly applicable to the water pollution control field. In addition to craftsmen, skilled welders and electronics technicians may be employed for maintenance purposes, depending upon the size and specific nature of plant operations. Heavy equipment operators, mechanics, and bricklayers are needed for sewer collection system operation and maintenance. Except for orientation to the job, these personnel rarely receive specialized training. In most cases they are already skilled and are obtained either from the military services or from the local manpower pool.

Large numbers of laborers or related blue-collar workers are employed, predominantly in sewer collection system operation and maintenance activities. They are recruited from the general labor pool and pose a significant manpower development challenge be-

cause of their large numbers and generally low scholastic achievement. These workers generally receive job indoctrination but no formal training.

5. *Associated Occupations*

In addition to those categories discussed above that are directly related to water pollution control activities, other occupations have important supporting inputs into the water pollution control program. Public officials must have an understanding of the wastewater pollution and

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processing cycle. For example, city managers, municipal utilities managers, selectmen, councilmen, and other responsible public officials need to understand broadly what processes are going on inside the plant and the role that trained manpower plays in ensuring plant effectiveness. These people are the sources of local planning and training funds and must appreciate the complexities of and need for funding both activities in addition to the more familiar operating, maintenance, and capital funding programs that are routine.

Personnel in related water quality, water supply, and public health agencies—especially those engaged in surveillance activities—must possess the technical knowledge to recognize good and bad operation of existing equipment. They must also be competent in anticipating potential threats to water quality from accidents, natural phenomena, and the like, and in recommending appropriate correctional measures. Many former operators and technicians now serving in surveillance functions, are capable of such activities, but EPA's estimates of State agency staffing levels indicate that the current supply is insufficient to meet future requirements.

Finally, State and local police, firemen, public utilities workers, housing and industrial park developers, and other related parties must understand the water quality aspects of their jobs. Just as a housing development must be provided the information to control erosion and protect waterways through preventive planning, public workers must be able to administer appropriate corrective measures when unforeseen circumstances threaten to jeopardize a water course—as, for example, in the event that a toxic chemical load spills on a highway near a stream at a point upstream of a municipal water supply intake.

EPA is considering the use of short course orientation techniques to heighten the awareness and competence of the community professionals mentioned above, to enable them to make the correct decisions when faced with the infrequent but potentially catastrophic

situations they might someday have to handle.

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D. PRELIMINARY ESTIMATES OF CURRENT AND FUTURE MANPOWER
REQUIREMENTS AND FUTURE TRAINING NEEDS

Preliminary estimates of manpower and training requirements are presented in this section of the report, with primary focus on:

Current (FY 1971) manpower requirements, by occupational classification.

Anticipated (FY 1976) manpower requirements, by occupational classification.

Future entry and update training requirements, five-year total (FY 1972-1976) and average annual, by occupational classification.

These estimates will be refined as current research efforts are completed but must be viewed as subject to a number of qualifications at this time. Subsection 1 below describes the qualifying factors which affect all of the staffing and training inventories and projections, and subsection 2 discusses the methodology used to develop the estimates. Each of the major sectors requiring water pollution control manpower—nongovernment, local, State, Federal non-EPA, and EPA—is described and discussed in subsections 3 through 7; the overall future manpower and training demand in the field of water pollution control and factors that may modify these estimates of future needs are summarized in subsection 8. Conclusions emerging from this analysis appear at the end of this part of the report.

1. *Qualifications on Preliminary Estimates*

There are several factors that affect the confidence that should be placed on the preliminary estimates that follow, as discussed below. However, despite these qualifications, EPA places high confidence in these estimates as a good reflection of the orders of magnitude of current and future manpower and training needs.

a. *Lack of Uniformity in Occupational Classification.* In the wastewater collection and treatment field, there is currently a lack of precision and uniformity in manpower terminology, occupational definitions, and job requirements and qualifications. Reference has already been made to the various meanings of the term "operator." Another example is the term "laborer." So-called "laborers" in one agency may be called sewer maintenance men, sewer servicemen, public works maintenance men, or maintenance men in other jurisdictions even though the functions of the jobs are substantially similar. The situation is further complicated by nonstandard classification levels;

for example, a Sewer Maintenance Man I in jurisdiction A may perform duties similar or identical to a Sewer Maintenance Man II in jurisdiction B. This lack of uniformity is the result of the multiplicity of independent employers involved in water pollution control.

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b. *Inclusion of Manpower Assigned Part Time.* In some cases part or all of the water pollution control activities of employers may require the part-time rather than full-time application of skills of one or more employees. This may be due to the small scale of the activities or to the organizational structure of the particular employer. Available data does not permit segregation by quantity of part-time from full-time manpower requirements. However, all of these employees—assigned part or full time to water pollution control—must be specially skilled in this field. Therefore, all manpower estimates in this report include manpower assigned on a part-time basis to water pollution control activities. Thus, for example, the manpower estimates include employees working less than full time in the smaller treatment plants where fulltime employment is not considered economically justifiable; industrial plant employees of all classifications whose routine duties include functions in addition to water pollution control; and local government employees whose duties include work in both water supply and waste water collection.

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c. *Lack of Uniformity in Work Organization.* Similar types of employers often organize for water pollution control activities in different ways. For instance, in some states the water pollution functions are largely centered in a water agency, while in others they may be scattered between several agencies such as health, natural resources, and public works. At the local level plants and sewers may be operated as an entity or separately; sometimes management will be plantwide, sometimes citywide, and sometimes regionwide.

d. *Lack of Consistency in Projection of Manpower and Training Needs.* Many employers do not project manpower and/or training needs; those that do do not necessarily use the same timeframes for projection.

e. *New Technology.* All estimates are made on the basis of known technologies. In this respect, it is known that wastewater treatment technology is rapidly becoming more sophisticated. Discussion of how some major technological thrusts may affect the manpower picture follows presentation of the data.

2. Methodology

The water pollution control manpower universe has been divided

into sectors to facilitate the collection and presentation of data. These sectors are:

- Nongovernmental.
- Local government.
- State government.
- Federal Government, non-EPA.
- EPA.

Within each of these sectors estimates are reported for the four general manpower classifications:

- Professional.
- Technicians.
- Operators.
- Others.³

Within each of the sectors, estimates for subgroupings of classifications are shown when they are considered reasonably reliable, such as the breakdown of the professional classification into engineers and scientists. However, no summary analysis below the four general categories can be attempted because of incomplete data.

³ The data available for this classification are incomplete. In instances where data are lacking, no estimates of requirements are made in this preliminary forecast. Therefore, to some extent, manpower and training requirements for "Others" are understated in this forecast.

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The methodology for determining manpower needs varies from sector to sector because of differences in the information available. Accordingly, the data sources and methodology for each sector are described as that sector is discussed.

Throughout the sectors training requirements were calculated in terms of entry and update training needs; to the extent that it was not possible to take account of future upgrade training needs,⁴ the training estimates must be considered conservative. Training required was calculated for the number of personnel engaged, rather than for full-time equivalents, on the assumption that a part-time worker must also be trained.

In the "Others" category, no forecast of entry or update training needs is made for the related blue collar and administrative sub-categories since training for these categories is not related directly to water pollution control but is more related to general blue-collar and administrative functions.

Entry training needs were expressed in terms of expansion positions plus manpower hired to fill positions vacated through an esti-

mated 5 percent turnover rate. No consideration could be given to the proportion of people leaving one waste treatment facility to join another; all of the 5 percent were assumed to be leaving the water pollution control field. However, the 5 percent turnover estimate is a conservative one derived from a consensus of non-EPA Federal agencies that turnover in wastewater personnel is currently 5 to 10 percent.

A simple example serves to illustrate the method of calculation for entry training. If the 1971 staffing for a certain class of manpower is 4,200 and the FY 1976 projection for this same category of manpower is 5,600, the projected five-year expansion is $5,600 - 4,200$, or 1,400. The average population of this category over the 1971-1976 period is thus assumed to be the 1971 population of 4,200 plus one half of the projected five-year expansion of 1,400—for a total of 4,900. To the average population of 4,900, a five percent attrition rate is applied for each of five years; thus, the predicted five-year turnover is $4,900 \times 25\%$, or 1,200. Total five-year entry training needs are the sum of the projected five-year expansion of 1,400 and the estimated five-year turnover of 1,200—a total of 2,600. In every case, the estimated five-year update training need is rounded to the nearest hundred. The average annual training need over the 1971-1976 period is obtained by dividing the total five-year need by the number of years (five) in the projection period ($2,600$ divided by $5 = 520$).

*It is clear that as new facilities are constructed and as existing facilities become more complex, there will be a pressing need to advance present workers.

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Update training needs were calculated using an apparent consensus of non-EPA Federal agencies regarding the frequency with which the various occupational categories of personnel should ideally receive training in the face of a rapidly changing technology. No distinction is made in these figures with regard to the necessary duration of training or the sources of training (which may be from academic institutions, State-run vocational schools, on-the-job training programs, or even equipment suppliers).

The example above may also be used to illustrate the method used for calculating update training estimates. The average staffing level of the category in the example above was 4,900 for the 1971-1976 period. To derive update training needs, this figure must be multiplied by the number of training instances in the forecast period for that category of personnel— $2\frac{1}{2}$ for professionals, operators, and technicians (on the assumption that training is delivered every second year during a five-year period), and $1\frac{2}{3}$ for others (maintenance) (assuming one training experience every third year during a five-

year period). Thus, if the 4,900 represents personnel in the professional, operator, or technician category, $4,900 \times 2\frac{1}{2} = 12,250$, the five-year update training need. In every case, the estimated five-year update training need is rounded to the nearest hundred; applying this principle in the example above, the five-year update need is expressed as 12,300. The average annual update training need is calculated by dividing the five-year training requirement by five, the number of years in the forecast period (12,300 divided by 5 = 2,460, the average annual update training need for this example).

3. *The Nongovernment Sector*

Water pollution control activities outside of the governmental sphere are conducted by several types of institutions and organizations,⁵ including:

Industrial firms, many of which treat their waste material before releasing it into streams or wastewater (sewage) collection systems.

Educational institutions that train the professional and technically specialized operators to design, build, and operate the water pollution control facilities and equipment.

⁵ While it is recognized that other nongovernmental sectors such as power, mining, agriculture, and transportation employ personnel who are involved in water pollution control activities, data are not presently available that will support definitive manpower estimates for these sectors. Therefore, these sectors have not been included in this special preliminary estimates of needs. The omission of these sectors will probably cause an overall underestimate of manpower and training needs. These sectors are discussed in Appendix A.

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Consulting engineers, who design pollution control facilities and assist facility operating personnel to obtain the best performance from their plants.

Because each of these employers has unique manpower and training requirements, they are discussed individually in the subsections which follow. The discussion of nongovernmental manpower and training requirements concludes with a set of composite exhibits which display the employer's current manpower estimates (Exhibit II-3), estimated FY 1976 manpower requirements (Exhibit II-4), and estimated FY 1972-1976 total and average annual training needs (Exhibit II-5).

a. *Industrial Firms That Discharge Wastewater.* Approximately 240,000 industrial concerns are discharging approximately 16 trillion gallons of wastewater each year into our streams, lakes, and estuaries—a volume rivaled only by the domestic household waste discharge. Although not all of this discharge is adding foreign polluting sub-

stances to the waterways, a significant proportion does so and contributes tremendous heat loads to the environment. Eighty-five percent of the annual wastewater discharge is attributable to four major industry groups:

- Primary metal industries.
- Chemical and allied products.
- Paper and allied products.
- Petroleum and coal products.

The discharge of wastewater from manufacturing facilities is highly concentrated. Approximately 60 percent of the industrial discharges are located in five regions: the Delaware and Hudson River basins; the Ohio River; the Eastern Great Lakes; the Western Great Lakes; and the Western Gulf of Mexico. Establishments with an annual withdrawal of 20 million gallons or more of water account for about 97 percent of water withdrawn for manufacturing purposes. However, these organizations represent only 4 percent—approximately 10,000 establishments—of the total number of manufacturing establishments and employ approximately 45 percent of all U.S. manufacturing workers.

Water pollution control activities in industry consist largely of the establishment and operation of internal wastewater treatment plants, either to provide preliminary treatment of toxic wastes before effluent is released into municipal sewage collecting systems or to treat the effluent completely before its ultimate discharge into the waterways. Personnel engaged for water pollution control functions consist predominantly of plant operators and technicians, although professional personnel are used in ever-increasing numbers in treatment process selection, plant design, supervision of operations and maintenance, analysis of industrial effluents to establish treatment requirements, and coordination with municipal utilities to negotiate pretreatment processes and municipal treatment charges for wastewaters discharged into municipal sewer systems.

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Estimated current water quality employment in private industry is based upon the number of plants as shown in the 1968 Census of Water Use in Manufacturing for those industries providing some form of wastewater treatment. This manpower total—over 30,000 persons engaged who devote an average one third of their time, as shown in Exhibit II-3, below—represent the estimated personnel employed by those industries utilizing at least 20 million gallons of water per year for which manpower data were available; it may be considered representative of the order of magnitude of industrial employment in the

field, as these industries withdraw from the waterways approximately 94 percent of the water used for manufacturing and discharged in the United States.

Information regarding future manpower and training needs of private industrial concerns in the field of water pollution control was obtained from discussion with the trade associations of the major water users, such as the American Petroleum Institute, National Council for Clean Air and Streams (pulp and paper), Manufacturing Chemists Association, and the American Iron and Steel Institute. At a later date, these estimates will be refined by two major sources of information: an American Association of Professors in Sanitary Engineering (AAPSE) survey of industry representatives to determine the effect of changes in standards and enforcement on their manpower requirements, and an EPA poll of 10,000 industries to determine their projected professional and technical manpower and training requirements. Although neither of these surveys will be complete before mid-1972, preliminary returns have been used in compiling the best possible estimates which can be made at this time.

As shown in Exhibit II-4, below, manpower needs in all occupational categories are expected to rise considerably. The FY 1972-1976 period will witness a continuation of the current trend of using personnel actively engaged in some other production process of the industry to supervise the personnel conducting industrial wastewater treatment operations. Therefore, the increase in professional personnel will be largely in process functions, and people now devoting a small portion of their time to handling water quality responsibilities will allocate more time to wastewater concerns. While the professionals hired into the industrial wastewater treatment positions will require training specifically focused on water concerns because of their process-oriented responsibilities, little increased burden from this sector is expected on those educational institutions that now educate sanitary engineers. Rather it is reasonable to expect that educational institutions will utilize an increasing portion of their resources to deliver specialized short courses to accommodate the needs of new industrial entrants and others in need of similar training. Finally, with regard to the training of professionals to perform wastewater functions in industry, representatives of the major water-using industries believe that it is easier to train a man familiar with an industry to deal with wastewater problems than to train an environmental

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specialist to familiarize him with the industrial process. In the future, the largest plants may be expected to employ at the cor-

porate level a specialist in process operation and control, as well as a design group to provide internal plans for pollution abatement and control; few environmental specialists will be required even at the corporate level.

The greatest need for operators and technicians will be experienced in industries affected by requirements to increase or improve their water pollution control activities. The need will have to be met partially by upgrading existing personnel and partly by hiring new personnel, who will receive intensive but brief training. As water quality standards are refined and enforcement becomes more stringent, the number of small treatment plants and facilities will increase, and the scale of effort in larger plants will be intensified.

Higher reliability requirements and the more sophisticated processes necessary to achieve higher treatment level may be expected to have a great impact on the manpower and training needs of industries engaged in water quality activities. Increased automation may reduce the total number of operators but will require higher skills in the operators and technicians needed to calibrate and control the more sophisticated facilities. Such changes must be coordinated with both trade unions and management if they are to be implemented smoothly. Manpower planning in these industries must be intensified to anticipate these needs and to program increasingly specialized training.

The most significant influence on the industrial water quality manpower projections set forth in Exhibit II-4 is the possibility that the imposition of Federal water quality standards on all industry—including the 230,000 industries not included among the major water users—will require every industrial concern to employ or have access to at least one individual to assume water pollution control responsibilities. Such an event would significantly increase the manpower needs in total numbers, but it is not possible to determine the extent of that increase or to anticipate the distribution of these requirements among the various occupational categories of personnel.

In light of these considerations, it appears that industrial employers of water quality personnel will experience sizable increases in the need for trained personnel in the FY 1972-1976 period and that the nature of training delivered will increase in technological sophistication at all levels. Estimates of the average annual industrial water quality training load needed to maintain progress in the efforts to control water pollution have been calculated in accordance with the methodology described in subsection 2, above, and are presented in Exhibit II-5, below.

b. Educational Institutions That Train Water Pollution Control Professionals and Technically Specialized Operators. Of the educa-

tional institutions providing sanitary engineering curricula, over 60 percent—

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87 institutions—receive EPA grants in support of their sanitary engineering programs. Manpower employed by these educational institutions consists almost entirely of engineers, scientists, and technicians who perform activities in teaching, research, curriculum planning, and advisory consulting to government agencies and consulting engineering firms. The ratio of technicians to professionals in this subsector is approximately one or two to one, and the total number of technicians employed in these 87 institutions is under 1,000; most technicians hold bachelors' degrees and are responsible to collect data and conduct laboratory experiments in research areas, and few technicians teach. A number of graduate students also serve as teaching fellows and research fellows, but they are not included in the educational water quality manpower inventory because they are still active students. The current inventory is included in Exhibit II-3, below.

It is estimated that educational institutions are now operating at two thirds of their capabilities to produce trained professionals and that they would be able to produce 50 percent more if the job openings existed to create the educational demand. However, realization of this capacity would necessitate a complete diversion of current staff from research to teaching—which is, of course, unrealistic. The true expansion factor for the production of trained professionals using only the existing teaching force is therefore something less than 50 percent. For this reason, educational institution manpower in water quality is expected to experience little change between FY 1971 and FY 1976, as shown in Exhibit II-4, below. Because personnel working in wastewater areas in educational institutions are generally involved in research, Exhibit II-5 assumes (conservatively) that they have no need for further training from sources outside their own organizations.

c. *Manufacturers of Wastewater Analysis and Treatment Equipment and Chemicals.* The wastewater equipment and chemical suppliers represent the most diverse groups that employ professional and technical water pollution control personnel. Services provided by this group range from turn-key type operations, which provide everything required for a completed treatment facility, to the sale of chemicals. The professionals performing the various functions possess all types of academic backgrounds, and it would be essentially impossible to use a general classification scheme for the entire industry. However, the largest employers of professional and technical per-

sonnel are the major equipment manufacturers, most of whom appear to allocate a similar percentage of their effort to their various business functions regardless of the size of their professional staff.

In the absence of a detailed census of the entire industry, estimates of the current and projected manpower inventory for these major manufacturers were derived on the basis of a number of calculations and assumptions. The ratio of professional (engineers and scientists) to sales volume—assuming that the majority of engineers and scientists are employed in product engineering, sales, and research and development activities—and the ratio of technicians to professionals (2 to 1) were

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calculated on the basis of a representative sample of major equipment manufacturers. On the basis of a 1968 survey of the market for wastewater treatment equipment⁶ and the 1971 Water Pollution Control Federation Yearbook, which lists the majority of the large equipment manufacturers, it was determined that the total number of firms handling the majority of equipment sales has changed very little in the past two or three years, even though the total number of manufacturing concerns has increased. Finally, past trends in the proportion of water pollution control expenditures that were allocated for equipment and projected total expenditures through FY 1976 were combined to provide the basis for the estimated expansion in manpower needs.

As shown in Exhibit II-3, below, total FY 1971 water-quality-related manpower employed by major equipment manufacturers totaled just over 4,000, entirely in the professional and technician categories. This is a significant increase over the approximately 1,500 figure experienced in FY 1968. The rate of capital investment is expected to grow between FY 1972 and 1976, increasing manpower requirements in this subsector to over 5,000, as shown in Exhibit II-4. However, it is not anticipated that the demand for environmental specialists will increase significantly in this segment of the industrial market. In addition, the industry will not require a significant amount of training originating outside the individual firms, largely because it employs personnel with previously established qualifications and provides internal training as necessary to perform its product engineering, manufacturing, and marketing functions.

d. Consulting Engineers in Design and Operations. Consulting engineering organizations represent one of the major types of employers of water pollution control specialists. Water quality personnel employed by such firms engage in such activities as water resource planning, preliminary engineering studies, feasibility and

economic studies, process selection and evaluation, preparation of plans and specifications, construction administration, resident engineering supervision, plant start-up and consultation, and monitoring of systems. In the smaller engineering firms, a staff of two or three professionals are involved in all of these activities, while larger firms will be more specialized, with professionals who are involved in only segments of a project and a senior engineer assigned the task of coordinating the various phases.

The current manpower inventory of the water pollution control consulting engineering firms was calculated on the basis of a ratio between staffing levels and receipts developed from data on 11,000 firms representing approximately 70 percent of the total receipts for architectural and engineering services. Assuming that these ratios, calculated

⁶K. L. Kollar and W. G. Youngwirth, "A Growing Market for Water and Wastewater Treatment Equipment," *Water & Sewage Works*, 1970, pp. 319-325.

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on 1967 data, remained constant through FY 1976 in a field which experienced little increase in total manpower, actual and projected total capital expenditures for 1971 and 1976 were used to calculate the current total manpower inventory and projected manpower requirements. These figures are included in Exhibits II-3 and II-4, respectively.

The majority of both large and small firms are engaged in both water supply and water pollution control activities. Based upon the fees received by consulting firms for water-related activities as reported in the 1967 census reports,⁷ it appears that many of the 5,100 water pollution control specialists listed by the Water Pollution Control Federation Yearbook in 1967 were devoting much of their professional efforts toward activities unrelated to water pollution control. This is further supported by the 1971 WPCF Yearbook, which reported a total of only 5,600 professionals, although the expenditures for water pollution control facilities had increased by a factor of 2¼ since 1967.

Information provided by the Consulting Engineers Council also tends to indicate that there has been little change in the number of professionals employed by consultants engaged in water pollution control activities since 1967. Instead, there has been a redirection of effort on the part of water pollution control specialists within these firms. The majority of the consulting firms contacted have indicated that an increase in expenditures by a factor of two or even three would have little impact on their manpower needs. Apparently significant numbers of personnel were hired by the consulting firms

during the middle 1960's in anticipation of a boom in water pollution control expenditures that never materialized. Most of these firms have maintained the personnel hired during that period but have until recently assigned them to other professional activities. Now that the anticipated increase in funds for water pollution control facilities is beginning to materialize, these firms have been able to redirect the efforts of these specialists back to water pollution control activities and apparently have not yet reached full capacity. Therefore, as shown in the appropriate columns of Exhibits II-3 and II-4, only a modest increase is expected in the number of professional and technical personnel employed by water pollution control consulting firms between FY 1971 and FY 1976. Because the FY 1971 inventory of manpower was calculated rather than directly counted, it may not account for personnel who were laid off between 1968 and 1971. For this reason, the current manpower inventory may be slightly high, an error which should not affect the FY 1976 manpower projection.⁸

⁷ 1967 Census of Business—Selected Services—Architectural and Engineering Firms, U.S. Department of Commerce, Bureau of the Census, December 1970.

⁸ In order to develop a more definitive estimate of the need for consulting engineers in water pollution control, the Consulting Engineers Council and the American Association of Professors in Sanitary Engineering are presently conducting a survey of the industry for EPA. The results of this survey should be available in 1972.

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EXHIBIT II-3.—NONGOVERNMENT SECTOR—FY 1971 MANPOWER ENGAGED IN WATER QUALITY ACTIVITIES*

Occupational category	Industrial firms	Educational institutions	Equipment manufacturers	Consulting engineers	Total
Professional	3,700	700	2,000	6,800	13,200
Operator	15,400	.....	.....	.....	15,400
Technician	7,200	1,000	2,300	10,000	20,500
Other:					
Maintenance	4,700	**	**	**	4,700
Related blue collar	**	**	**	**	**
Administrative	**	**	**	**	**
[Subtotal]	[4,700]	**	**	**	[4,700]
Total	31,000	1,700	4,300	16,800	53,800

*Estimate includes manpower assigned on a part-time basis to water pollution control activities. See II D.1, above.

**Data unavailable.

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**EXHIBIT II-4.—NONGOVERNMENT SECTOR—PROJECTED FY 1976 MANPOWER
ENGAGED IN WATER QUALITY ACTIVITIES***

Occupational category	Industrial firms	Educational institutions	Equipment manufacturers	Consulting engineers	Total
Professional	12,100	700	2,400	8,200	23,400
Operator	48,700	.....	.....	.....	48,700
Technician	23,100	1,000	2,800	12,000	38,900
Other:					
Maintenance	15,100	**	**	**	**
Related blue collar	**	**	**	**	**
Administrative	**	**	**	**	**
[Subtotal]	[15,100]	**	**	**	[15,100]
Total	99,000	1,700	5,200	20,200	126,100

*Estimate includes manpower assigned on a part-time basis to water pollution control activities. See II D.1, above.

**Data unavailable.

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The need for training in the consulting field will be concentrated in short courses for update training to keep abreast of technology in both professional and technical job categories and will represent a relatively small effort, as illustrated in Exhibit II-5. Since the current inventory of personnel in the consulting field is estimated to be 16,800 (Exhibit II-3) and since each of these will require update training every other year, the training requirement will be substantial. Further, because of the diverse locations of consultants, the training will be required at locations throughout the country. It is desirable that planning activities include provision for training these employees of consulting firms.

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**EXHIBIT II-5.—NONGOVERNMENT EMPLOYERS—ESTIMATED FY 1972-1976 ENTRY
AND UPDATE WATER QUALITY TRAINING REQUIREMENTS**

[Five-year Total and Average Annual]

Occupational category	Entry personnel		Personnel for update training	
	5-year need	Average annual need	5-year need	Average annual need
Professional:				
Engineer*	14,500	2,900	44,000	8,800
Scientist*	300	100	2,200	400
[Subtotal]	[14,800]	[3,000]	[46,200]	[9,200]
Operator*	41,300	8,300	80,100	16,000
Technician*	25,800	5,200	74,000	14,800
Other:				
Maintenance**	12,900	2,600	16,500	3,300
Related blue collar .....	.....	.....	.....	.....
Administrative .....	.....	.....	.....	.....
[Subtotal]	[12,900]	[2,600]	[16,500]	[3,300]
Total	94,800	19,100	217,000	43,300

*To receive update training every second year.

**To receive update training every third year.

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4. *The Local Sector*

Local agencies—under the authority of either municipal governments or collective groupings of local governments (such as sanitary districts or metropolitan district commissions)—are the operators and maintainers of sewage collection and wastewater treatment facilities. Approximately 13,000 communities in this country have sewer systems, either with or without wastewater treatment plants; there are about 12,500 wastewater treatment plants currently in operation. These facilities range from simple lagoons to advanced tertiary treatment plants.

Water quality manpower at the local level is required to perform several kinds of activities. In municipal agencies, for example, personnel who develop, manage, operate, and maintain sewage and storm water collection and treatment systems engage in many tasks, including overall system management, system planning, design, construction inspections, maintenance, and utility billing. These broad areas involve many detailed subfunctions, such as pumping station design, operation, and maintenance; combined sewer overflow regulator facility design, operation, and maintenance; design, operation, and maintenance of the various types of sewers, drainage channels, and combined sewer overflow treatment or control facilities; catch basin construction and maintenance; review of plans and inspection of construction of sewer connections; enforcement of sewer use and industrial waste disposal ordinances, including the elimination of illicit connections; and infiltration control.

Within the local agency, the organization of these functions varies. Sewage collection system maintenance personnel are often combined with water distribution personnel because of the similar coverage of the respective piping networks; on the other hand, wastewater treatment plant operations and maintenance forces are sometimes separated organizationally because their functions require different skills or because a municipality or district has centralized all maintenance functions.

Estimates of current local agency manpower inventories were calculated on the basis of available data; a complete local manpower census is not yet available. An inventory of all existing wastewater treatment plants was obtained through the EPA STORET computer information system. The inventory was stratified by plant capacity, and the average capacity within each stratum was calculated. Then the preliminary results of a research effort into actual staffing levels in wastewater treatment plants was applied to the total number of plants within each stratum to derive the estimated current manpower inventory at the local level. The current inventory estimate at the local level is shown in Exhibit II-6.

In addition to overall manpower data, analysis of the STORET information revealed an important pattern of operator employment at different sized plants. As indicated by Exhibit II-7, the smaller plants, those of one million gallons per day or less capacity, serve 10 percent

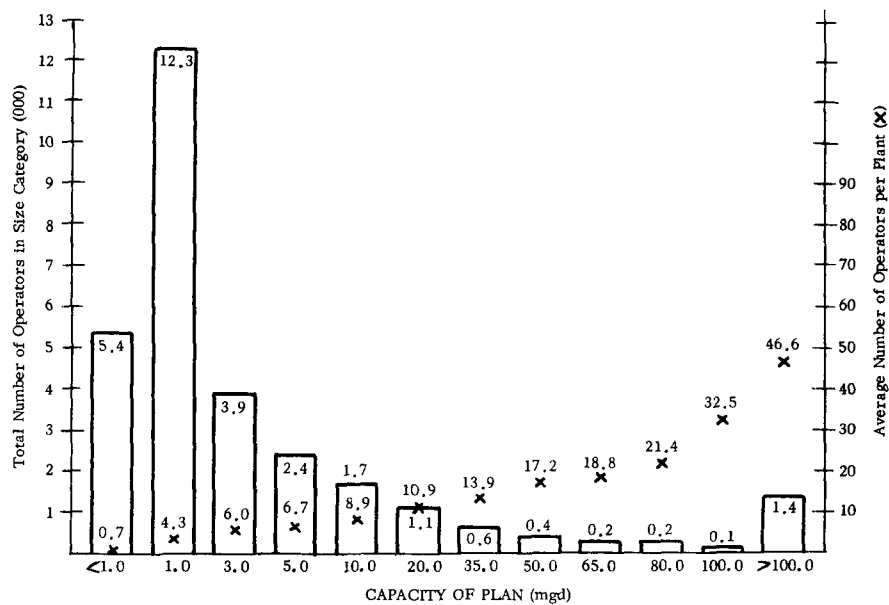
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EXHIBIT II-6.—LOCAL GOVERNMENT EMPLOYERS—FY 1971 WATER QUALITY MANPOWER INVENTORY AND PROJECTED FY 1976 MANPOWER REQUIREMENTS

Occupational category	Wastewater treatment		Sewage collection		Design and administration		Total	
	1971	1976	1971	1976	1971	1976	1971	1976
Professional:								
Engineer	1,400	1,800	1,600	2,000	600	800	3,600	4,600
Scientist	200	300	200	300	300	400	700	1,000
[Subtotal]	[1,600]	[2,100]	[1,800]	[2,300]	[900]	[1,200]	[4,300]	[5,600]
Operator	29,700	38,600					29,700	38,600
Technician	3,200	4,200			800	1,000	4,000	5,200
Other:								
Maintenance	2,100	2,700	1,200	1,600			3,300	4,300
Related blue collar ..	9,200	12,000	25,700	33,400			34,900	45,400
Administrative	400	500			100	200	500	700
[Subtotal]	[11,700]	[15,200]	[26,900]	[35,000]	[100]	[200]	[38,700]	[50,400]
Total	46,200	60,100	28,700	37,300	1,800	2,400	76,700	99,800

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EXHIBIT II-7
OPERATOR DISTRIBUTION BY PLANT CAPACITY



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of the total population tied into sewer systems and employ an estimated 60 percent of all operators. At the other end of the spectrum are large plants, those with a capacity of 100 mgd or more, which employ about 5 percent of the operators and serve 30 percent of the population using sewer systems.

Projections of future local agency manpower needs were derived from initial returns of a questionnaire administered to local water quality agencies by the Department of Labor. The projected FY 1976 manpower requirements should increase by approximately 30 percent between FY 1971 and 1976 in all categories.

Calculated training needs—which include the training load caused by newly created jobs, replacements for turnover, and requirements for new skills—are presented in Exhibit II-8. The estimated entry training needs were calculated on the basis of a 5 percent turnover rate, which is particularly low for the local sector. Field research in municipal wastewater treatment plants indicated that turnover runs particularly high at the local level, and as high as 50 percent or more in new facilities. Although top supervision is usually brought in to the new plant from another location, the plant must be staffed locally. Because the plant must be brought on line quickly and because there is no excess supply of trained wastewater treatment workers, plant supervisors must hire any interested local personnel and train them rapidly. The new plants become operational under the guidance of the designers and engineering consultant to ensure their effectiveness, but usually a short time after the plant is turned over to its own operating force, a number of employees leave their jobs. In many cases this is because inexperienced personnel had to be hired who had no previous exposure to the realities of wastewater treatment; in other cases it is a result of misunderstandings regarding required working hours (rotating shifts, 24 hour “on-call” responsibility, and so on), pay, and other characteristics of the job. Although employee tenure rises markedly after the first year, with turnover in some cases falling almost to zero, the rapid expansion of the total number of treatment facilities suggests that training requirements caused by the need to replace turnover positions are greater than indicated by use of the 5 percent turnover rate.

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EXHIBIT II-8.—LOCAL GOVERNMENT EMPLOYERS—ESTIMATED FY 1972-1976 ENTRY
AND UPDATE WATER QUALITY TRAINING REQUIREMENTS
[Five-year Total and Average Annual]

Occupational category	Entry personnel		Personnel for update training	
	5-year need	Average annual need	5-year need	Average annual need
Professional:				
Engineer	2,000	400	10,300	2,100
Scientist	500	100	2,100	400
[Subtotal]	[2,500]	[500]	[12,400]	[2,500]
Operator	17,400	3,500	85,300	17,100
Technician	2,400	500	11,500	2,300
Other:				
Maintenance	2,000	400	6,300	1,300
Related blue collar				
Administrative				
[Subtotal]	[2,000]	[400]	[6,300]	[1,300]
Total	24,300	4,900	115,500	23,200

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5. The State Sector

Water pollution prevention, abatement, and control activities of the states are the focal points for the effective accomplishment of national goals and priorities in water quality. Because of their critical role and the scope of their responsibilities, the functions of the State agencies cover all activities necessary to ensure the protection of water quality within the State. These activities parallel and expand upon the activities of the Environmental Protection Agency as necessary to conduct a systematic program within the State. Typical State water pollution control activities include:

Planning of State policies and programs.

Standard setting, surveillance, and enforcement.

Regulation of facilities installation and operation (including waste discharge permit issuance, engineering reviews, facility certification, inspection, grants administration, and certification and/or training of operators. This activity normally does not include actual management or operation of waste treatment facilities).

Analysis of wastewater treatment facility needs, and establishment of priorities and schedules.

Research and development as appropriate to the particular problems and needs of each state.

Organization to accomplish these functions within the states ranges from centralized water pollution control agencies to a diffusion of

responsibilities among several State agencies operating with relatively unstructured coordination. Because of the nature of the State role with regard to water pollution control, State water quality agencies tend to require a higher proportion of professional personnel than are needed at the local level.

Current water quality staffing at the State level was determined on the basis of the State Program Grant Applications ⁹ for FY 1971. Where available, appropriate sections of the FY 1972 grant applications were reviewed to determine whether significant changes in staffing levels had occurred or were anticipated. Concurrently, a manpower model ¹⁰ developed by the Office of State and Interstate Programs for issuance as guidance to the states for preparation of plans, was applied to the 1971 inventory

⁹ State Program Grant Applications are submitted to EPA by the states pursuant to Section 7 of the Federal Water Pollution Control Act.

¹⁰ W. R. Hager, *Guidelines for Estimating Personnel Requirements for State Water Quality Control Agencies*, Environmental Protection Agency, December 1970.

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estimate. This model uses the program authority, functions, and activities of each State as reflected in its plan, and, without reference to existing staffing levels, it applies work-load factors to establish gross man-year estimates for each major function. The figures obtained in this way represent the man-loading considered to be essential to the maintenance of an effective program.

The review of the 1971 State staffing plans yielded a current total of 2,936 full-time equivalent positions covered by actual positions. The calculations from the model generated a current need for 8,333 full-time equivalent positions (which cannot be translated into actual positions). Although the need represented by the difference between 8,333 and 2,936 positions is current, practical considerations prevent immediate acquisition of personnel to satisfy needs because the required staffing is approximately 2.5 times the current levels.

The ratio of actual State manpower to manpower requirements as projected by the model is not uniform from state to state, some states having 20 percent or less than the amount of full-time equivalent manpower necessary to perform current functions. The nine states with the greatest combined need appear to have only 30 percent of the manpower needed to perform required functions, while the nine states with the smallest combined needs appear to have manpower equal to 255 percent of the needs. Because FY 1976 manpower projections from the states were not available, the manpower estimate derived from the model was used for the purposes of this report to represent a reasonable goal for 1976 staffing.

The current manpower inventory and 1976 manpower projection

for State agency manpower requirements are shown in Exhibit II-9. It must be emphasized that both of these figures represent man-years actually applied toward and needed for performing required functions, not positions to be filled, and therefore should be viewed as estimates of full-time equivalent staffing. In addition, both of these estimates rest on the assumptions that the current estimate of overall occupational mix, as calculated from the State grant applications, is accurate and that major changes in the required occupational mix will not occur during the five-year manpower projection period.

On the basis of the projected manpower increase that will be required at the State level between FY 1971 and 1976, estimated entry and proficiency water quality training requirements were calculated, as shown in Exhibit II-10. It is particularly important, of course, for the states' personnel to receive the necessary training because of their role in surveillance, enforcement, and—potentially—troubleshooting the operation of substandard treatment plants. Competent personnel at the State level, to be produced largely through short-course training involving surveillance methods and technology updates, will be relied upon to maintain satisfactory national water quality.

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EXHIBIT II-9.—STATE GOVERNMENT EMPLOYERS—FY 1971 WATER QUALITY MANPOWER INVENTORY AND PROJECTED FY 1976 MANPOWER REQUIREMENTS

Occupational category	Fiscal year 1971 staffing	Fiscal year 1976 projection
Professional:		
Engineer	1,500	3,900
Scientist	600	1,600
Subtotal	2,100	5,500
Operator		
Technician	300	700
Other:		
Maintenance		
Related blue collar		100
Administrative	1,200	2,000
Subtotal	1,200	2,100
Total	3,600	8,300

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**EXHIBIT II-10.—STATE GOVERNMENT EMPLOYERS—ESTIMATED FY 1972-1976 ENTRY
AND UPDATE WATER QUALITY TRAINING REQUIREMENTS**

[Five-year Total and Average Annual]

Occupational category	Entry personnel		Personnel for update training	
	5-year need	Average annual need	5-year need	Average annual need
Professional:				
Engineer	2,600	500	6,000	1,200
Scientist	1,300	300	3,000	600
Subtotal	3,900	800	9,000	1,800
Operator				
Technician	500	100	1,300	300
Other:				
Maintenance				
Related blue collar				
Administrative	1,200	200		
Subtotal	1,200	200		
Total	5,600	1,100	10,300	2,100

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6. Federal Sector, non-EPA

A significant number of Federal agencies, bureaus, and departments have primary and secondary missions, tasks, and functions that are directly or indirectly related to the water quality effort of the Environmental Protection Agency. The water pollution control functions in which these agencies engage are indicated in Exhibit II-11. In addition, Executive Order 11507 requires all Federal organizations to be exemplary in the abatement and control of water pollution arising from their respective facilities.

Because of the wide variety of missions among these Federal organizations, Federal water pollution control activities are conducted in or impact upon every State, territory, and possession. Specifically, water quality personnel in such agencies perform a broad spectrum of pollution control functions, including policy formulation, development of quality standards, monitoring and surveillance, research, hygiene, training, design, construction of facilities, and operation and maintenance of water supplies, sewage collection systems, and wastewater treatment plants. These agencies operate and maintain a total of 9,320 wastewater treatment facilities, ranging in capacity from under 1,000 to over one million gallons per day. (A summary of Federal wastewater treatment facilities by size and type is included in Appendix B.) Most Federal treatment facilities are for primary or secondary treatment of sanitary wastes, and nearly 200 plants provide tertiary treatment.

According to the results of a July 1971 EPA (Office of Water Programs) survey of 40 Federal agencies, bureaus, and departments, 24 were identified as currently employing personnel who devote 25 percent or more of their time to water pollution control activities.

On the basis of a 100 percent response, it appears that a total of almost 13,000 personnel are currently employed by Federal agencies outside of EPA to perform water quality functions. As shown in Exhibit II-12, this employment is projected to approach 16,000 by 1976—an increase of over 25 percent. This figure is probably conservative in that it represents projected employment, rather than needs.

Operators make up the largest employment category in the Federal, non-EPA water quality work force, and they are expected to continue to do so in FY 1976. The operator category is projected to experience the greatest rate of growth (approximately 36 percent) during the FY 1972-1976 period, with the increase in engineers following closely (35 percent).

The survey data indicate that employment varies considerably among the non-EPA Federal organizations, with current water pollution control personnel ranging from one to more than 3,700. Projected FY 1976 agency manpower requirements range from one to more than 4,100. Seventeen of the 24 agencies reporting manpower requirements indicated that their needs would increase between FY 1971 and FY 1976, while the others remain relatively constant.

[p. II-45]

[illegible]

[p. II-46]

EXHIBIT II-12.—NON-EPA FEDERAL SECTOR—FY 1971 AND PROJECTED FY 1976
MANPOWER ENGAGED IN WATER QUALITY ACTIVITIES

Occupational category	Fiscal year 1971 staffing	Fiscal year 1976 projections
Professional:		
Engineer	2,300	3,200
Scientist	2,300	2,700
Subtotal	4,600	5,900
Operator	4,200	5,600
Technician	1,800	2,000
Other:		
Maintenance	800	900
Related blue collar		
Administrative	1,100	1,400
Subtotal	1,900	2,300
Total	12,500	15,800

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On the basis of a consensus of the reporting from other Federal agencies, EPA derived estimates of the frequency with which water quality personnel employed by those agencies should ideally receive update training to ensure that they are aware of the most current technological advancements. The projected training needs of these agencies, on the basis of their own manpower projections and frequency-of-training consensus, is presented in Exhibit II-13 in terms of the total five-year need and the average annual need. Because these activities also provided information regarding the number of personnel planned to receive training in FY 1976, the non-EPA agencies' FY 1976 training needs were also calculated by the above method. Comparison of the stated training plans and calculated training needs, as in Exhibit II-14, indicated that even though the agencies had not expressed their training projections by type of training (entry, upgrade, and update), their plans would reach far fewer employees than might legitimately benefit from receiving water pollution control training during FY 1976. The gap between training needs and training plans would be even greater were the total FY 1972-1976 period to be examined in this way. The agencies' training plans to show inclusion of water quality training in the plans of 16 of the 24 non-EPA Federal water quality employers, and it is promising to note that a 50 percent increase in training volume is anticipated.

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EXHIBIT II-13.—NON-EPA FEDERAL SECTOR—ESTIMATED FY 1972-1976 ENTRY AND UPDATE
WATER QUALITY TRAINING REQUIREMENTS
[Five-Year Total and Average Annual]

Occupational category	Entry personnel		Personnel for update training	
	5-Year need	Average annual need	5-Year need	Average annual need
Professional:				
Engineer	1,600	320	6,900	1,380
Scientist	1,000	200	6,300	1,260
Subtotal	2,600	520	13,200	2,640
Operator	2,600	520	12,300	2,460
Technician	700	140	4,800	960
Other:				
Maintenance	300	60	1,400	280
Related blue collar				
Administrative				
Subtotal	300	60	1,400	280
Total	6,200	1,240	31,700	6,340

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EXHIBIT II-14.—NON-EPA FEDERAL SECTOR—COMPARISON OF FY 1976 WATER QUALITY
TRAINING PLANS AND ESTIMATED NEEDS

Occupational category	Total number trained fiscal year 1971	Total number to be trained fiscal year 1976	Calculated annual training needs	
			Entry	Update
Professional:				
Engineer	300	320	400	1,380
Scientist	200	200	100	1,260
Subtotal	500	520	500	2,640
Operator	500	520	500	2,460
Technician	200	140	100	960
Other:				
Maintenance	100	60	100	280
Related blue collar				
Administrative				
Subtotal	100	60	100	280
Total	1,300	1,240	1,200	6,340

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7. Environmental Protection Agency

The Environmental Protection Agency is the lead agency in the Federal Government's program of water pollution research, abatement, and control. The Office of Water Programs of EPA is responsible for ensuring a coordinated and effective Federal effort to protect and enhance the quality of the nation's water resources. Because the role of EPA in water quality requires a variety of financial administration, research, standard-setting, surveillance and enforcement, technical assistance, manpower development, and planning activities, its current water quality manpower inventory is comprised largely of technicians, scientists, engineers, management, and administrative/

clerical personnel. As shown in Exhibit II-15, the current (FY 1971) manpower inventory is projected to increase by over 50 percent, to 4,200, by 1976 as a result of current EPA program plans. Exhibit II-16 projects the estimated FY 1972-1976 update training requirements that will be created by such rapid growth in the EPA water quality program.

[p. II-51]

EXHIBIT II-15.—ENVIRONMENTAL PROTECTION AGENCY—FY 1971 AND PROJECTED FY 1971 AND PROJECTED FY 1976 MANPOWER ENGAGED IN WATER QUALITY ACTIVITIES

Occupational category	Fiscal year 1971 staffing	Fiscal year 1976 projections
Professional:		
Engineer	600	900
Scientist	600	900
Subtotal	1,200	1,800
Operator		
Technician	300	450
Other:		
Maintenance		
Related blue collar		
Administrative	1,300	1,950
Subtotal	1,300	1,950
Total	2,800	4,200

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EXHIBIT II-16.—ENVIRONMENTAL PROTECTION AGENCY—ESTIMATED FY 1972-1976 ENTRY AND UPDATE WATER QUALITY TRAINING REQUIREMENTS

[Five-year total and average annual]

Occupational category	Entry personnel		Personnel for update training	
	5-Year need	Average annual need	5-Year need	Average annual need
Professional:				
Engineer	400	80	1,900	380
Scientist	400	80	1,900	380
Subtotal	800	160	3,800	760
Operator				
Technician	200	40	1,000	200
Other:				
Maintenance				
Related blue collar				
Administrative	900	180		
Subtotal	900	180		
Total	1,900	380	4,800	960

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8. Summary of Future Water Quality Manpower and Training Needs

As illustrated in Exhibits II-17 and II-18, which present composite estimates of current and future manpower needs by occupational

category for all sectors, total water quality manpower requirements are projected to rise by FY 1976 to more than 170 percent of FY 1971 levels. Comparable increases will be experienced in all job categories, with the greatest numbers of people to be needed in the Operator and Other categories, assuming that current technology and management concepts remain the same. Exhibit II-19 portrays graphically the wastewater manpower mix anticipated for the period.

There are, however, several factors which might affect both the occupational mix and the skill requirements that will characterize the expanded wastewater work force. The following subsections of this part of the report discuss the factors likely to modify the manpower and training needs during the five-year projection period, comment upon the manpower and training needs that appear to exist for that period, and identify the apparent focal point for future manpower development efforts in water pollution control.

a. *Factors Likely to Modify Manpower and Training Projections.*—The most significant factors which should be considered in interpreting future manpower and training needs include:

- Rapidly developing technological advances.

- Tendencies to build larger treatment facilities.

- Initiation of regional and basin planning for water pollution control.

- Requirement for increased reliability in treatment plant operations.

Technological developments have affected all sectors and all occupational categories markedly in recent years and will continue to do so through the FY 1976 projection period. In the industrial component of the nongovernment sector, for example, new manufacturing processes and techniques will pose numerous highly specialized wastewater treatment problems to complicate the already difficult problem of analyzing and treating industrial pollutants. It is possible that those responsible for the control and treatment of industrial wastewater will be forced to advance the state of the art in order to respond to governmental water quality standards and to public pressures for a clean environment. The technology of industrial wastewater treatment could therefore change very rapidly and drastically and could present the most dynamic manpower and training challenge.

[p. II-54]

EXHIBIT II-17.—TOTAL FY 1971 MANPOWER ENGAGED IN WATER QUALITY ACTIVITIES

Occupational category	Non-Government	Local	State	Federal (non-EPA)	EPA	Total
Professional	13,200	4,300	2,100	4,600	1,200	25,400
Operator	15,400	29,700		4,200		49,300
Technician	20,500	4,000	300	1,800	300	26,900
Other	4,700	38,700	1,200	1,900	1,300	47,800
Total	53,800	76,700	3,600	12,500	2,800	149,400

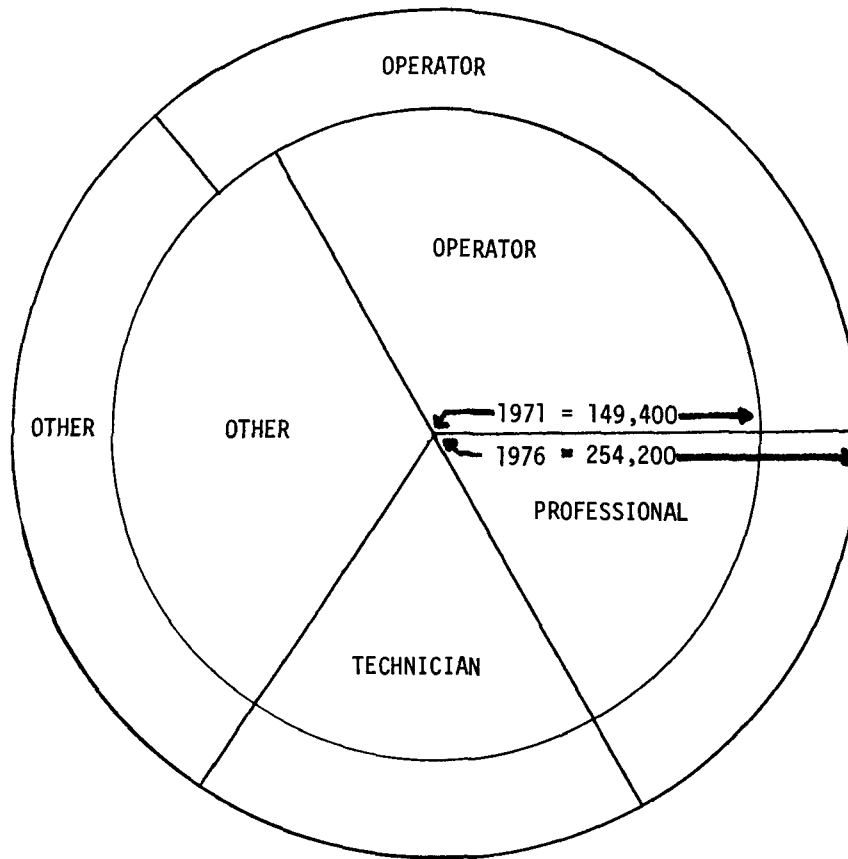
[p. II-55]

EXHIBIT II-18.—TOTAL PROJECTED FY 1976 MANPOWER ENGAGED IN WATER QUALITY ACTIVITIES

Occupational category	Non-Government	Local	State	Federal (non-EPA)	EPA	Total
Professional	23,400	5,600	5,500	5,900	1,800	42,200
Operator	48,700	38,600		5,600		92,900
Technician	38,900	5,200	700	2,000	500	47,300
Other	15,100	50,400	2,100	2,300	1,900	71,800
Total	126,100	99,800	8,300	15,800	4,200	254,200

[p. II-56]

EXHIBIT II-19
THE MANPOWER MIX
FY 1971 and 1976



[p. II-57]

At the local government level, automation of plants and/or more widespread instrumentation of sewer collection systems could significantly change the role of the operator from that of performing certain activities to one of monitoring a number of mechanical, electronic, and information processing activities. The design of technological advances into new facilities may cause a more rapid increase in the numbers of operators and maintenance craftsmen required and a less rapid increase in unskilled labor. A heavier

complement of electronics and computer technicians will be needed, as well as a larger investment in repair equipment and preventive maintenance for increasingly sophisticated instrumentation. In addition, more extensive use of automated chemical analysis equipment will facilitate control of plant operations, requiring more specialized and sophisticated technicians in the areas of chemical analysis and instrumentation. It is also inevitable that the upgrading of plants to secondary and tertiary treatment levels will increase operator specialization and, thus, training requirements. Finally, demands for increased reliability in wastewater treatment may require round-the-clock operations, substantially increasing the demand for trained personnel.

Developments in surveillance technology could affect State-level operation; by introducing automated sampling and chemical analysis, altering the nature of the surveillance/enforcement function. Concurrent upgrading of skill levels of personnel at the State levels would be required to introduce specialists in electronics, statistical sampling procedures, remote reading, instrumentation, and so on. State personnel would need an increasingly sophisticated background against which to assess and monitor the increasingly sophisticated operations of wastewater treatment facilities.

The Environmental Protection Agency itself may become more involved in the management aspects of wastewater treatment plant operations at the local level and the operations of surveillance programs by State agencies because it is a central source of information on activities in all of the municipalities and states. The agency will be in a position to develop increasingly sophisticated management concepts and to disseminate them, both through direct training and through the information channels of the water quality manpower planning system.

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The ultimate effect of technological development on the future manpower requirements in wastewater treatment will be an increase in technical specialization and an upgrading of entry requirements in all sectors and all occupational categories. In turn, this will undoubtedly increase training requirements. It is also possible that new functions or job categories will emerge and that new principles of manpower utilization will affect the manpower mix in as yet undefined ways.

As wastewater treatment plant construction increases, economies in capital investment and operations will be sought through increases in the size of treatment facilities. The immediate impacts of such a tendency will be an increase in the number of personnel employed in large plants, increased specialization of workers (especially operators

and technicians), and vastly more complicated management problems with regard to preventive maintenance, determination of staffing needs, manpower utilization, standards determination, and so on.

Regional and basin planning concepts are just beginning to be implemented, with full EPA support and encouragement. Such new management and planning concepts involve the creation of agencies which may conduct both planning and surveillance on an interstate basis. Although these concepts will not involve large numbers of people, they will probably require a heavier component of professional personnel and may require coordination with land use planners, forestry administrators, agricultural specialists, housing developers, zoning authorities, and so on. Regional and basin planning will rely upon *interdisciplinary cooperation* to further the accomplishment of Federal water quality standards.

It is likely that public demands will require more reliability in the treatment of wastewater. Currently sewage bypasses caused by plant downtime are a major contributor to the fouling of watercourses. One way to improve reliability is to schedule around-the-clock operation of treatment plants. If significant numbers of plants adopt this policy, it will result in a substantial increase in the requirement for manpower and training.

In addition to these four major factors which impact upon any numerical projections of manpower and training requirements, a number of other influences will affect future growth, including:

Future policy decisions regarding enforcement of water quality standards on both industry and public facilities. If more stringent legislative standards are enacted, it would increase industrial water quality manpower requirements and create a more severe training need in both the local and industrial sectors. In addition, increased numbers of trained surveillance and enforcement personnel would be needed in each State or basin area.

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Levels of appropriations made available for construction of municipal wastewater treatment facilities. Needless to say, if the rate of capital investment in wastewater processing were to decrease, water quality manpower requirements would decrease accordingly.

Economic incentives for private industry to control water pollution. Again, if such incentives are provided (over and above the compulsory surveillance and enforcement pressures), industrial water pollution control manpower requirements could be expected to rise, and industry might be expected to contribute significantly to the effort to develop means of treating its waste products.

Levels of appropriations for Federal and State regulatory and technical assistance staffs. Clearly, if the decision is made to enforce water quality standards but no funding is available for regulatory staff personnel or for provision of technical assistance to those municipalities or industries striving to comply, the momentum of facility construction and methods development will lag.

Ability of the construction industry to respond to higher demands for treatment facilities.

Although it is not possible at this time to determine the quantitative impact of these factors, many of which are of uncertain probability, on the preliminary manpower and training projections provided above, they must be considered in identifying probable future manpower and training gaps. Further, it is reasonable to expect that these factors will have substantial effects on the manpower utilization and employment practices and patterns of practically all water pollution control employers. As these factors become manifest to the employers and employers obtain a better view of what is to be done and how it is to be done, they will undoubtedly be acting to:

Change recruiting practices.

Change employment qualifications.

Modify employee mix.

Modify training requirements.

b. *Manpower and Training Problems in Various Occupational Categories.* In light of the previous discussion, on the basis of a projection of current trends regarding training needs—as portrayed in Exhibit II-20 at the end of this subsection—and in consideration of the most probable future developments in wastewater technology, management, funding, and administration, a number of manpower and training problems appear to exist. They are discussed below in terms of the manpower supply and demand and the depth of required training.

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EXHIBIT II-20.—TOTAL ESTIMATED FY 1972-1976 ENTRY AND UPDATE WATER QUALITY TRAINING REQUIREMENTS

A. Entry Training

Occupational category	Average annual load					Total
	Non-Government	Local	State	Federal (non-EPA)	EPA	
Professional	2,960	500	880	520	160	5,020
Operator	8,260	3,480		520		12,260
Technician	5,160	480	100	140	40	5,920
Other	2,580	400		60	180	3,220
Total	18,960	4,860	980	1,240	380	26,420

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EXHIBIT II-20.—(Continued)

B. Update Training

Occupational category	Average annual load					Total
	Non-Government	Local	State	Federal (non-EPA)	EPA	
Professional	9,140	2,480	1,920	2,640	760	16,940
Operator	16,020	17,080	.....	2,460	.....	35,560
Technician	14,860	2,300	260	960	200	18,580
Other	3,280	1,260	280	4,820
Total	43,300	23,120	2,180	6,340	960	75,900

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(i) *Professionals*

The professional category includes personnel with both engineering and scientific backgrounds. In water pollution control, the professionals' professional is the sanitary engineer. EPA believes that many of the new professional positions can best be filled by sanitary engineers, particularly in view of the increasing technological sophistication of water pollution control. Therefore, the supply should be increased.

At the same time, EPA recognizes that many new professional positions will be filled by those trained in disciplines other than sanitary engineering. Likewise, many existing positions will continue to be filled by those trained in other disciplines. This points up the desirability of planning and delivering update and upgrade training for these professionals as well. For those already in the water pollution field, this would be training to broaden and sharpen their skills. For those initially entering the water pollution field, this would be specialized water pollution training which, when added to their basic engineering or scientific skills, would enable them to function effectively and efficiently in water pollution occupations.

Many engineers and scientists in water pollution control function as administrators as well as technical specialists. Currently very few engineers and scientists exist who are knowledgeable and experienced in the field of wastewater equipment maintenance management, community relations, negotiation of industrial wastewater processes and charges, and management of a highly varied and uniquely skilled manpower population, all of which are required at the management level. Specific training will be required to provide these skills and build the managerial confidence and competence necessary to deal creatively with the problems of an ever-changing operational environment.

(ii) *Operators*

As stated in Section A of this part of the report, experienced operators are rarely available on the job market, largely because of

the unique and specialized nature of their responsibilities. Few of the skills have counterparts in other segments of our economic system, yet the job is critical to any effort to attain satisfactory treatment of

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wastewater. The current supply of trained operators is barely adequate for current operations, and the only manpower pool is currently employed in the wastewater field. Therefore, the future supply of operators must be created at a faster rate than the demand is growing in order to simultaneously meet past deficiencies, and satisfy future needs and account for turnover. Large quantities of update as well as entry training are required. Operators represent a serious problem, both in terms of manpower and training requirements.

(iii) *Technicians*

An increasing number of technical positions in the wastewater field will require personnel with associate or bachelor of science degrees, often with specialization in laboratory analysis, computer applications, or electronic systems. The projected high demand for various technicians in the projection period may become more urgent as technological developments increase the sophistication of sewage collection and wastewater processing systems. Further, the growing specialization of wastewater treatment processes is increasing the proportion of technicians of various types of professionals (engineers and scientists) as facilities attempt to reduce their manpower needs by improving manpower utilization. A substantial amount of update training is also required.

(iv) *Other categories*

Among the "Other" categories, the maintenance function probably presents the biggest problem. Although there is a significant supply of skilled craftsmen whose skills might be directly applicable to wastewater maintenance problems, future manpower projections indicate a rapidly growing need for more specialized and higher skilled maintenance personnel as a greater number of larger, more sophisticated wastewater treatment facilities are constructed and begin operations. The critical need for improved maintenance in municipal treatment plants was highlighted in a 1970 Report of the Comptroller General to Congress and will become even more pressing in future years. Although update training requirements for maintenance personnel may not occur as frequently as for other occupational categories, wastewater employers may face some difficulties in recruiting and providing entry training to a sufficient number of such

craftsmen to meet the need that is anticipated between now and FY 1976.

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Because no specialized water quality training is required to perform administrative and clerical functions in a water pollution control agency, there appears to be neither a supply/demand imbalance nor an anticipated training gap in the five-year projection period. Similarly, there are generally no educational or experience requirements for related blue-collar workers and no specialized training is required, so there appears to be neither a supply/demand imbalance nor an anticipated training gap for this group in the five-year projection period.

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c. *Focal Point for Future Manpower Development Efforts in Water Pollution Control.* Clearly, on the basis of Exhibits II-18, II-19, and II-20, and the previous discussion, the greatest manpower need in terms of quantity will be in the operator and technician categories and the greatest training need will affect operators, technicians, and engineers. At the same time, the most rapid manpower growth is projected to occur in the local and nongovernment sectors. These projections indicate that the fastest growing activities will be plant construction/operation/maintenance in municipalities and industrial firms, accompanied by an increase (although less rapid) in State planning/surveillance/monitoring of installation and operations and EPA grant administration and technical assistance related to operations. Undoubtedly, the bulk of the training will be operator-oriented. However, just as critical, if smaller in quantity of workers affected, is the need to produce additional sanitary engineers. Of equally critical nature is the need to update present professionals and to provide specialized water pollution training to professionals entering the field with a basic engineering or scientific background but without adequate preparation in water pollution control.

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E. CONCLUSIONS REGARDING PLANNING FOR MANPOWER AND TRAINING NEEDS

The goals of the water pollution manpower development system are:

- (i) To have manpower available in the needed numbers, with the requisite skills, at the proper times and proper places.
- (ii) To use available manpower effectively and efficiently.

Because of the magnitude and complexities of the industry, a carefully designed manpower planning system is necessary to meet these goals. Such a system has been conceived and partially implemented by EPA. It is an intergovernmental and interagency system and in-

cludes both public and private employers, with the states being pivotal. Basically the system consists of two components:

Forecasting (as authorized by subsection 5(g)(2) of the Water Pollution Control Act).

Action Planning.

When in full operation, the forecasting component will project water pollution control manpower requirements and entry, update, and upgrade training needs by occupation on a national, State, and labor market basis. Presently, as the system conceptualizer and coordinator, EPA is well along in the process of developing the tools and base data for the waste treatment plant portion of the system. EPA has also recently begun preparing for training of the personnel who will implement the system.

The action planning portion of the system produces a variety of action plans at all levels. These are plans to fulfill the manpower and training requirements in accordance with the forecasts and to ensure effective manpower recruitment, retention, utilization, and personal satisfaction. Action plans are of two basic types:

Plans for recruitment, retention, and utilization programs.

Plans for training programs.

EPA provides technical assistance to others in action planning in addition to developing its own action plans to fill in the gaps left after actions planned by others are accounted for.

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The planning program development to date has been accomplished on a very limited budget; many of the efforts to date have been awkward because they had to be "piggybacked" onto other DOL and EPA programs. However, since the program is now conceptualized and the basic tools are in process, the program can soon be installed in the field. Manpower planning is a new function for most State and local governments, and these units presently have a very limited capacity to conduct such planning. Full implementation will require a higher level of expenditure since the states and localities will require substantial technical assistance and training to accomplish their planning responsibilities. This requirement for additional technical assistance is reflected in the EPA FY 1972 budget.

Pending the completion of the implementation of the water pollution control manpower planning system, EPA has developed by means of a variety of techniques an interim estimate of the current manpower inventory and five-year sector-by-sector forecasts of manpower and training needs for the major manpower categories (professional, technical, operator, and others).

These forecasts are based on data that are subject to a number of qualifications. However, EPA places high confidence in these figures

as indicators of the order of magnitude of manpower and training needs.

Forecasts indicate that the needs for additional professionals over the next five years will be about—25,000 entry positions over five years. This indicates a need for the universities to continue to produce these professionals. These professionals fall into two broad categories: sanitary engineers who are trained as water pollution control specialists and other professionals who have basic scientific and engineering skills but require additional specialized water pollution control training to function effectively in the field.

Experts in the field point to a need for increasing the portion of sanitary engineers, thus pointing up the need for increased production of this group. There is also a critical need for the specialized water pollution control training necessary to make fully effective producers of the general group of professionals. In addition, there is an estimated need for technical update training—17,000 trainees being the estimated annual load over the five-year period. Further, there is a need for management training for those many professionals who have assumed administrative duties in addition to their technical responsibilities, but who have never received training in the sophisticated management techniques they must apply.

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The requirement for new technicians is moderate, approximately 30,000 new entry-level positions in five years. However, due to the increasing technological complexity of the field, there is a general requirement to upgrade the formal educational background of the technicians. More and more technicians will be requiring at least one year, and many two years, of college level preparation. Further, particularly for those technicians already on the job but under-educated, there will be a need for update training, 18,500 trainees being the estimated average annual load.

Perhaps the most critical need is for additional operators and operator training. As has been pointed out by EPA, the General Accounting Office and others who have examined the situation, undermanned plants and undertrained manpower are a major jeopardy to the entire control program and the large capital investment that has been made in facilities. In the next five years, it is estimated that 41,000 entry-level positions in private industry and 20,000 in public agencies will need filling. There are almost no trained but unemployed operators so that essentially the entire requirement must be produced from scratch. Likewise, the need for update training of the existing force is estimated at 35,560—average annual need over the next five-year period.

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PART III.—MANPOWER RECRUITMENT, RETENTION, AND UTILIZATION ACTIVITIES

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PART III.—MANPOWER RECRUITMENT, RETENTION, AND
UTILIZATION ACTIVITIES

A. INTRODUCTION

Gross manpower and training requirements can be partially fulfilled through activities designed to improve effectiveness and efficiency of the existing labor force, as well as through activities designed to train additional members of that force. EPA considers that such activities will make a significant contribution to the achievement of water pollution control manpower objectives: the availability of personally satisfied and properly utilized manpower in the needed amounts, with the requisite skills, at the proper times and in the proper places. Accordingly, EPA has undertaken a number of activities in this area. For reporting purposes these activities are broken down into three categories:

Manpower recruitment.

Manpower retention.

Manpower utilization.

A discussion of each of these categories follows. Some of the activities may have ramifications under two or even three of the categories. However, below they are discussed under the category of their primary thrust.

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B. MANPOWER RECRUITMENT ACTIVITIES

The primary responsibility for recruitment rests upon the estimated 25,000 independent water pollution control employers scattered throughout the country. Accordingly, there is no necessary assurance, especially during a labor sellers' market caused by rapid expansion of the industry, that these employers will have an adequate

supply of interested and basically qualified manpower from which to recruit. The existence of such a supply is fundamental to adequately staffed operations and, therefore, at least in part, to efficient and effective water pollution control. Further, without such a supply, recruiting standards tend to be forced below the reasonable minimum, thereby increasing training requirements.

Therefore, EPA has taken actions, largely as a delegate of the Department of Labor, to increase the size of the pool by development and widespread dissemination of information regarding careers in water pollution control, as discussed below.

1. *"Talent Search"—A Movie*

EPA has produced and now distributes a 16 mm color-sound movie depicting the work, training, and importance of wastewater treatment plant operators. The purposes of "Talent Search" are:

To encourage people, particularly young people, to enter the wastewater treatment field.

To dispel erroneous ideas held by many persons about the work of the wastewater treatment plant operators.

To enhance the self-image of the operators, thus helping them to take pride in and appreciate the importance of their jobs.

This movie, which won a top award from the National Visual Communications Association, has been shown to numerous groups of high school students, unemployed workers, placement groups, and environmental organizations. A Spanish language version of the movie is being used to reach Puerto Rican, Cuban, and Mexican American audiences where Spanish is the first language in the home. Recently, prints of "Talent Search" have been released for showings in Latin American countries, and in Mexico, the movie has been shown on nationwide television.

2. *Recruitment Brochures*

EPA has developed and now distributes recruitment brochures in both English and Spanish that summarize the challenges, tasks, opportunities, and rewards that are offered by employment in the wastewater treatment field. EPA also distributes an attractive descriptive recruitment

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brochure published jointly by the Texas Water Utilities Association and the Texas Water Pollution Control Association. This brochure—entitled, "Water . . . the Growth Industry; What's in It for You?"—stresses the importance of water to human habitation, the pay, job security training, and the intangible feeling of rendering needed services, all of which flow from a career in water.

3. *Articles and Reprints*

From time to time, EPA staff members prepare articles for publication in general circulation periodicals related to the need for wastewater treatment manpower. A recent example is an article entitled, "A Critical Need—Training for Wastewater Treatment Plant Operators." As the title implies, the article sets forth the need for operators and then proceeds to discuss present training programs.

EPA also obtains and distributes reprints of articles applicable to waste treatment manpower recruitment. For example, recently reprinted and distributed was an article from the Occupational Outlook Handbook and Quarterly entitled, "Training, Upgrading, Reinforcing Water Pollution Control Workers."

4. *Veterans Recruitment*

Recognizing that recent veterans are a very important recruitment source, EPA has established a mail-order recruitment and referral system for new veterans and servicemen pending discharge. The principal components of this system are various types of outreach information concerning careers in wastewater treatment and—in answer to specific inquiries from veterans or "short-timer" servicemen—the provision of specific information identifying wastewater treatment employers offering job and/or training opportunities throughout the country.

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C. MANPOWER RETENTION ACTIVITIES

Once satisfactory personnel have been recruited, the next concern is the retention of these newcomers so that the recruitment and training investments they represent will not be wasted. A high turnover rate portends inefficient and ineffective operation and a continual demand for more recruits and more training. Conversely, improvements in retention rates will reduce manpower and training demands. As with recruitment, retention is the primary responsibility of the employers. However, since retention affects the attainment of national water pollution control goals, EPA takes an active interest in the subject.

To date, the primary EPA focus on retention rates in water pollution control has been on operators. As was noted in Part II, retention rates for operators have been quite low, particularly in the first year of employment. This has caused general concern among water pollution control managers.

The basic prerequisites for high retention of productive employees are several. Among the primary ones are:

- Good working conditions.
- Good job image.
- Good pay.
- Opportunity for advancement.

The operators' working conditions are not the most pleasant, by the nature of the job, and the operator's job is not held in high esteem or appreciation by his community. In a recent study of operator trainees conducted for EPA¹ only 4 percent expressed complete satisfaction with public appreciation of their work. Fifty-two percent were generally not satisfied, and 19 percent were completely unsatisfied. Confirmation of this problem regarding operator image comes from another finding in this same study. The trainees were asked which job title they preferred for their occupation as operator:

- (i) Sewage Treatment Plant Operator.
- (ii) Wastewater Treatment Plant Operator.

¹ Sewage Treaters or Pollution Controllers—Trainees View Their Jobs, Environmental Protection Agency, Office of Water Program, Division of Manpower and Training, by Longino, Green and Kauffman.

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- (iii) Waste Treatment Plant Operator.
- (iv) Water Pollution Control Specialist

Most often, the trainees chose the last named.

While no hard data are available,² pay rates for operators are generally acknowledged, by those familiar with the industry, to range from very low to very high, but on the average to be at most no more than barely adequate. Further, while there have been opportunities for career advancement of operators, they have not been overwhelming.

One possible way to positively effect all of these retention factors and also improve manpower utilization is through operator certification. It is necessary to understand the background and current status of certification in order to appreciate its full significance and to understand EPA activities in this regard.

Interest in certification of operators has been growing among the states in the hopes that ensuring minimum personnel qualifications will improve the operational effectiveness of wastewater treatment facilities. The President supported this trend in his 10 February 1970 Message to Congress, in which he announced a policy that will require future Federally assisted treatment plants to be operated only by State-certified operators. Further, the President has issued Executive Order 11507 which requires operators of Federal waste treatment plants to be certified in accordance with the requirements of the state in which the plant is located.

Currently 47 of the states require some form of operator certification, and in 31 certification is mandatory. Yet considerable variation exists among the states in educational prerequisites, experience requirements, duration of certification, and applicability of the program. The term "State-certified" on an operator's resume does not have a uniform meaning.

Formal education of some kind is required by 62 percent of the certification programs, but even this requirement varies among the states from eighth grade level to completion of a four-year college program. In addition, 84 percent of the states permit experience to be credited instead of education and a number credit special training, weakening the effectiveness of the educational parameter to determine the quality of the work force. Experience requirements are equally varied, with different states requiring from one to 12 years of experience for the highest class of operators and from three months to four years for the lowest level. Further, many states do not require a written examination as a

² Wage data for treatment plant personnel will be available upon completion of the EPA/DOL survey now under way. This survey is discussed in subsection II-B-1-b-(2), above.

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certification requirement; 15 percent use an oral examination, and four states require only a statement of qualifications—and no examination of any kind.

Variations in the duration of certification also confuse the State certification picture. While a majority of the states require annual renewal, a number have renewal periods as long as five years, and even more issue permanent certification. Unfortunately, these states cannot have meaningful visibility over the skills of their operational personnel.

Applicability of certification varies among the states, both in the categories of wastewater treatment manpower who may be certified and in the extent to which mandatory certification is being achieved in those states where it is required. Some programs certify only wastewater treatment plant personnel, but others will certify employees concerned with collection systems. Only seven of the mandatory certification programs are known to apply solely to treatment facilities. The waiver of examinations and required training and education under "grandfather clauses" for operators employed before certification was instituted tends to defeat the purpose of certification in a number of states. Under such provisions, untrained workers are sometimes allowed to operate plants; in one state with a mandatory certification program, 380 of the 391 certified plant operators were qualified under the grandfather clause.

Classification systems for certified operators include from two to 11 categories, and many states do not specify limitations on the type of facility to which a worker's certification is applicable. In fact, in more than 19 states, approved certification will allow an operator to operate any type of wastewater treatment process. Finally, a Water Pollution Control Federation survey reported in 1970³ indicated that of all the wastewater facilities identified as requiring certified operators in 12 selected states which have mandatory certification programs, only 80 percent were being staffed by certified personnel—regardless of the adequacy of the requirements under which they were certified.

Sound operator certification standards can benefit operators, employers, and the public. The assurance that wastewater treatment plant operators are competent reduces the need for strict surveillance of plants that is otherwise required of the responsible State agency. Further, an effective certification program can be productive to prevent and reduce pollution. Employers benefit through the protection of their capital investment, resulting in maximum plant utilization and reduced repair and maintenance expenses. Finally, employees benefit from salary increases, increased status and responsibility, improved job security, and increased opportunity for career advancement.

³ WPCF Personnel Advancement Committee, "Survey of Wastewater Treatment Plant Operator Certification in the U.S.," *Water Pollution Control Federation Journal*, Vol. 42, No. 4, April 1970, p. 516.

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The Water Pollution Control Federation and the American Water Works Association have recently addressed themselves to the problems of certification and have made significant contributions toward their resolution. EPA views these efforts with favor. Yet, if State certification is to be meaningful, practices must be standardized and training opportunities proliferated, for more stringent certification requirements will greatly inflate the size and complexity of the operator training problem. Such an effort on a nationwide effort will require the resources of the Environmental Protection Agency.

EPA believes strongly that states should establish mandatory uniform certification laws based on national criteria. To meet this objective EPA is providing technical and financial support to the Water Pollution Control Federation, the American Waterworks Association and other interested organizations to establish a national certification board. This board will serve as an information center for certification activities, recommend standards and guidelines, facilitate reciprocity between State programs and assist authorities

to establish and update programs. To facilitate states adoption of national certification programs based on national criteria, technical assistance and training should be provided by EPA.

There will be difficulty in establishing uniform criteria for certification because of the variations in present practices. Further, at present there is not a sufficient understanding of the operational tasks performed in the industry as a whole. Since certification criteria must be directly related to the tasks operators perform, uncertainty about tasks means uncertainty about criteria. The studies under way to develop planning tools [discussed in subsection B-1-b-(1) of Part II] will also yield task information. Additional studies will likely be required. Also, it will be necessary to solicit the views of the states and other interested parties in the process of developing the national certification criteria.

As a prelude to State adoption of a program based on the national certification criteria, it will be necessary for the states, with technical and financial assistance from EPA, to design transition programs which will take into account the additional training and other effects which will flow from the new certification requirements. To design, establish, and subsequently operate these certification programs, the states will be called upon to take new administrative and legislative tacks.

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D. MANPOWER UTILIZATION ACTIVITIES

More productive use of available manpower will also lead to a reduction in gross manpower requirements, and hence, in training requirements. In this respect, perhaps the most attention has been devoted to manpower utilization as one important portion of the proper operation and maintenance of treatment plants. Here, once again, the employer is basically responsible for optimum manpower utilization. However, because of the national interest in the protection of Federal investment in new facilities, EPA has taken direct actions to ensure proper operation and maintenance. This includes the following actions to assure appropriate manpower utilization.

In response to a recommendation of the Comptroller General, EPA has issued a document, "Federal Guidelines, Design, Operation, and Maintenance of Wastewater Treatment Facilities." The guidelines require applicants for facility construction grants to include in their applications a list of the numbers and types of personnel needed to operate and maintain the proposed plant. This list must be updated at the completion of 50 percent of the construction. Thirty days prior to plant start-up, another update must be reported to the cognizant State agency. Further, the guidelines require that the chief operator

must be employed by the time construction is 50 percent complete in order to ensure his full familiarity with the plant. Finally, the guidelines require the designer to consider manpower utilization factors in design and to furnish an operations manual to the owner which sets forth operation and maintenance requirements and procedures.

To provide designers with basic data and concepts for use in development of operation and maintenance manuals, EPA has also let a contract to develop improved concepts and methods by which (i) wastewater treatment plant designers can better reflect operation and maintenance considerations and (ii) managers can more realistically determine staffing requirements and establish effective maintenance management programs. The basic principle in this effort is the application of the techniques developed for analyzing the operation, maintenance, and reliability of complex naval propulsion systems to wastewater treatment plants. Sewage treatment processes are being broken down into subgroups for detailed analysis, and special attention is being devoted to operations, maintenance, staffing, and quality assurance. Upon completion, this project is expected to produce a model for determining the classification and skill levels required of operation and maintenance personnel and recommendations regarding alternative staffing concepts. It is expected that this work will provide a base for future work by the Environmental Protection Agency in the application of advanced industrial engineering and maintenance management techniques in the wastewater treatment field.

Once new plants become operational, evaluation of their performance becomes the responsibility of the cognizant State agency.

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However, EPA is presently considering the establishment of a Federal audit, to include the manpower aspects of plant operation, one year after operations have commenced. Meanwhile, EPA has let a contract for the development of a manual to be used to train State inspectors. The contract also calls for the development of a training plan for inspector training, and it is anticipated that such a course will be developed and offered in the near future.

EPA has approached improvement in manpower utilization through one other channel. As an adjunct to its Public Service Careers (PSC) training program (discussed more fully in Part IV of this report), EPA has been using Department of Labor funds to provide financial and technical assistance to PSC subcontractors for job restructuring. The concept of job restructuring calls for a task analysis of jobs for the purpose of rearranging and recombining tasks in

packages that require skills of similar rather than mixed levels. For example, many jobs are presently made up of tasks requiring a mixture of professional, paraprofessional, and even lower level skills. Since some of these tasks are professional, professional level persons must fill these jobs. To the extent that professional employees are required to perform paraprofessional and lower level tasks, there is a gross underutilization of manpower. In restructuring a job, the objective is to rearrange the tasks so that to the maximum feasible extent, professionals do work requiring professional skills, paraprofessionals do work requiring paraprofessional skills, and so forth. The result of a productive restructuring should be the accomplishment of the tasks at the most economical level of labor and training costs.

Also, since the more homogeneous stratification of tasks means that the proportion of jobs at the lower end of the skill spectrum will increase, more of the jobs can be filled by workers of lesser qualification, broadening the recruitment base. Further, many of the additional potential recruits would be the disadvantaged.

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E. SUMMARY AND CONCLUSIONS

It is possible to reduce water pollution control manpower and training requirements through the application of manpower recruitment, retention, and utilization techniques. While the application of these techniques is in the first instance the responsibility of the employers, their application or lack thereof also bears directly upon the success of the Federal water pollution control program. Therefore, EPA has taken a number of actions to further their adoption.

Most of these actions have been undertaken as an agent of the Department of Labor or as an adjunct to the construction grants program. Taken together, they only scratch the surface of the activities that could be undertaken by EPA to provide management assistance and/or training to employees in the application of such techniques. Further, taken together, they probably only begin to reap the benefits in terms of reductions in manpower and training requirements that could be obtained by the systematic and widespread application of such techniques by all water pollution control employers.

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PART IV.—WATER POLLUTION CONTROL TRAINING ACTIVITIES

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PART IV.—TRAINING ACTIVITIES

A. THE ENVIRONMENTAL EDUCATION PROCESS

The concern of the Federal Government for environmental education was manifested in the congressional enactment of the Environmental Education Act of 1970. This act (P.L. 91-516) authorized the U.S. Commissioner of Education to make grants to establish educational programs intended to encourage public understanding of policies and activities in support of environmental quality. In FY 1971, the Office of Environmental Education of the Office of Education, Department of Health, Education, and Welfare, awarded 74 grants totaling \$1.7 million for projects in 31 states and the District of

Columbia. The grants support several types of education projects, including community education, curriculum development, establishment of environmental education centers, training of public employees other than teachers, and dissemination of information to the public.

Because people at various ages and stages of life need different kinds and degrees of environmental information, an EPA Task Force on Environmental Education is currently considering the specific role EPA should play in general environmental education and how it should interface with other concerned agencies. EPA's current programs include a variety of technical training grants to promote public interest and knowledge. For example, one such grant was made to the Tilton School (Tilton, New Hampshire) to develop a curriculum guide and teaching materials designed to introduce water pollution control illustrations and examples into general science and biology courses in secondary schools. These materials encourage active participation of both teachers and students in solving environmental problems. The project, involving 40 schools throughout the northeast, is a follow-on to a program EPA supported at the University of Massachusetts during the summer of 1969 and a program which the Ford Foundation initiated during the same period at the Tilton School. Negotiations are currently under way to accelerate the distribution, acceptance, and use of the Tilton program on a nationwide basis.

Other representative grants awarded by EPA for general education/awareness purposes include one to the District of Columbia League of Women Voters Education Fund to develop schools for citizens on water use, an award to the Washington (D.C.) Ecology Center to promote environmental education and awareness for youth, and a grant to the Institute of Environmental Education (Cleveland Heights, Ohio) to develop a national program in environmental education.

EPA also sponsors SPARE, which began operations in 1971, is funded by the Department of Labor (as an offshoot of the Neighborhood Youth Corps Program) and is operated by EPA. Since its inception, SPARE has provided a combination of jobs and prevocational environmental training for approximately 9,000 low-income youths, ages 14 to 20, in 50 communities

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across the country. Typical of these projects was one involving 11 high school students in Coos Bay, Oregon. With the necessary supervision and counseling, the students executed a carefully conceived series of dye flow tests to trace the source of sewage badly fouling Coos Bay

to 29 residences not tied into the sanitary sewer system and, more important, to two breaks in the sanitary sewer line. Action has been taken to remedy these defects as a result of the students' finds and the enthusiastic support of city officials and citizens

These are only a few examples of EPA's efforts to cooperate with all interested parties in promoting public awareness and support for environmental programs. The balance of this part of the report relates to that portion of the environmental education process that pertains directly to jobs in the water pollution control field. Most water pollution control jobs begin with a period of intensive "entry" training related immediately to the functions of the particular job. Such training may be formal or informal, or a combination, and may be classroom-oriented, on-the-job training, or a combination. As the career of the water pollution control employee progresses, he will almost inevitably need additional training, usually of a highly specialized nature and of relatively short duration, either to "update" his skills to keep current with technology or to "upgrade" them to permit career advancement.

Section B, below, describes the activities of those non-EPA agencies concerned with water quality by sector—nongovernmental, local government, State government, and non-EPA Federal Government. It also assesses those activities in terms of the agencies' roles in water pollution control training and the adequacy of their activities to satisfy the most compelling current training needs—by occupational category (professional, operator, and technician, as established in Part II) and type of training (entry or update/upgrade). Conclusions are presented regarding the extent to which the needs identified in Part II of this report are being satisfied by the activities of these employers.

Section C describes the efforts of the Environmental Protection Agency to address those needs left unsatisfied by other water quality employers and to fulfill its role as a focal point for water pollution control manpower and development information and activities.¹ The EPA program is discussed in terms of the two most general categories of training recipients—professionals and operators/technicians. Each of the agency's major programs for these categories is described and assessed against the unresolved need, and conclusions are drawn regarding the past adequacy of the programs and the future support needed to meet an ever-expanding training need.

¹ In order to present a complete and comprehensive picture of EPA training activities in response to identified needs, this part of the report describes both those activities for which Congress has requested a report [subsection 5 (g)] and those supplementary activities authorized elsewhere in the Federal Water Pollution Control Act.

B. NON-EPA WATER POLLUTION CONTROL TRAINING ACTIVITIES

1. *A Frame of Reference for Roles in Training the Manpower for Water Pollution Control*

To initiate a manpower training program, two intangibles must exist: a *need* for the training and a *motivational commitment* on the part of the beneficiaries of water pollution control services to satisfy that need. The need for water pollution control training at all occupational skill levels is well recognized (and documented in Part II of this report). A commitment among interested parties in all sectors to establish that training, or to improve and expand that which exists, and to use the training, is long-standing.

Commitment connotes action, however, and action requires three types of tangible resources:

The capacity to train, by means of:

Requisite and accessible facilities.

Available and qualified instructors.

The information with which to train, including:

Tailored curricula.

Effective and responsive materials.

The funds to enable the training to be initiated and conducted:

To build the capacity.

To develop the information.

To bring together the provider and recipient.

To present the program.

The roles of the various non-EPA agents in water pollution control training are defined by the resources which they contribute to the training "action." Those who provide the capacity to train may be said to play a direct role in training because they are the primary points of contact with the trainee. Those who develop course information or provide enabling funds are engaged in a more supportive role. Some organizations play a catalytic role in encouraging the direct or supportive activities of others. Roles are rarely distinctive and are frequently interdependent. However, predominant orientations can be ascribed to the primary participants in the training process.

Educational institutions generally have the capacity and develop or possess the information to provide for the basic educational requirements of their students for entry into occupational fields at various

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levels. Support is normally required to develop the capacity and information needed to respond to the specific vocational requirements of their students, particularly for occupations, such as water pollution control, whose missions or skill shortages require extraordi-

nary action. Stimulation from others is frequently required, especially financial assistance (through grants or fellowships) to supplement normal sources of funds.

Associations, whose memberships frequently include academicians and employer representatives, assume a catalytic role in encouraging, helping organize, and cosponsoring programs. When voids exist, they sometimes provide the capacity or information or the financial support for others to do so.

Employers of manpower hold primary responsibility for orienting each entrant to the peculiarities of his work environment and providing requisite transitional skills to ensure his adequate job performance. They also must ensure that employees maintain their proficiency within the current state of the art and that employees receive opportunities to upgrade their skills to qualify for promotion.

Private industry employers generally provide orientation and informal training on the job. Normally only the larger employers develop and present formal programs for updating and/or upgrading their employees. More typically, they rely on the resources of others to organize and present such programs.

Government agencies at the local, State, and Federal levels act in a similar capacity, but with broader purpose and, consequently, on a larger scale. Indeed, their stimulative function sometimes extends to the imposition of mandatory training requirements with which others must comply.

Local government agencies bear primary responsibility for providing adequate public wastewater treatment facilities and ensuring their effective operations. In fulfilling this responsibility, they mirror the private employer's job of recruiting, training, developing, and retaining the manpower needed. They plan and administer manpower development programs to satisfy local requirements.

State agencies establish standards, criteria, regulations, and other guidelines to promote statewide uniformity and to further objectives which transcend those of local jurisdictions. They also plan and administer manpower training programs to satisfy statewide needs and help build the capacities of their state educational institutions to assist in this effort. Their primary role is supportive, through provision of financial, technical, and planning assistance. They also provide direct services, singly or collaboratively, when others are unable to do so.

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Federal agencies perform a similar role, but from a national program view point and in response to national priorities. Two distinctions are noteworthy, particularly when related to programs of national urgency. With the revenue systems of State and local

governments and their educational institutions already strained in attempting to provide traditional service, the Federal Government provides the principal financial resources to stimulate or facilitate these programs (as is manifestly evident in water pollution control). Secondly, the orientation of the Federal planning financial and technical assistance is to build the capacity of others to more effectively plan, organize, administer, and deliver the requisite services.

The interrelationship of the roles of these various agents is evident—and vital—in order to build and maintain the capacity and to develop and improve the information with which to train the manpower for water pollution control. This section (IV-B) of the report describes the training activities of the non-EPA nongovernmental and governmental organizations in the exercise of their respective training roles.

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2. *Training Activities of Nongovernmental Organizations*

Nongovernmental organizations engaged in water pollution control training include educational institutions, associations, and private industry, as discussed below.

a. *Training Activities of Educational Institutions.* Educational institutions orient their water pollution control training activities to degree programs for students who potentially may pursue careers in the field. These institutions may be distinguished into two groups in terms of the duration of courses of study and the occupational categories for which students are being prepared:

Universities and four-year colleges, which concentrate their program activities on the professional, primarily at the graduate level.

Two-year colleges and technical schools, which focus their programs on the operator and the technician.

Each of these types of educational institutions is discussed below.

(1) *Training Activities of Universities and Four-Year Colleges.* Many universities and four-year colleges offer degree programs in disciplines which relate indirectly to water pollution control. Within the natural sciences, the disciplines of engineering and the physical and biological sciences offer the most direct relevancy to the field of water pollution control; degrees projected ¹ for these disciplines are as follows:

Degrees	1970-1971	1975-1976
Bachelor's and first-professional	102,540	119,060
Master's	34,120	43,890
Doctor's	12,530	20,840
Total	149,190	183,790

Few programs are oriented directly to water pollution control,² suggesting the need for supplementary training for those professionals recruited into the field after obtaining generalized degrees.

EPA estimates that approximately 100 universities and four-year colleges offer degree programs oriented specifically to water pollution control. The major thrust of their involvement is in providing degree

¹ *Projections of Educational Statistics to 1970-80*, National Center for Educational Statistics, 1970 Edition.

² See subsection IV-C-1-a for a discussion of the EPA Professional Training Grants Program.

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programs for students at the graduate level. These institutions have been relatively inactive in independently sponsoring or conducting training other than their formal degree programs. In particular, these institutions have not played a significant role in providing special short courses or supplementary programs to update or upgrade the skills of those professionals previously recruited into the field of water pollution control.

Universities and their staffs, however, have supported the manpower training activities of non-EPA organizations in a variety of ways. Facilities have been provided, faculty members have participated as instructors, and assistance has been given to others in developing curricula and training materials.

These institutions are the primary source for preparing professionals for entry into the field of water pollution control. Through their research and instructional capacities, their potential contribution to the training of manpower already working in the field is substantial. Two noteworthy programs demonstrate the potential impact that can be made by universities, when providing support to and receiving support from other sectors. Illustrative activities of Clemson University are highlighted in this subsection; those of Texas A & M are discussed with those of the State of Texas in subsection IV-B-3-b, below.

Clemson University has conducted annually a three-day operator school since the mid-1930's. Trainees who successfully completed an end-of-course examination were granted certification by the South Carolina Water and Pollution Control Association. Passage of a mandatory certification law effective in 1968 increased course enrollment by 50 percent.

Since 1952 the General Assembly of South Carolina has appropriated \$10,000 annually (increased to \$20,000 in 1967) as a direct and continuing appropriation to Clemson University for the preparation and administration of correspondence courses for the operators of treatment plants in the State. Correspondence courses in the form

of manuals were developed by the University faculty for both water and wastewater treatment plant operators at four levels. The manuals offer opportunity for self-education during the elapsed time between the annual operator training schools, and they are also used as preparation for the certification examination. The additional funds appropriated since 1967 were intended for revision of these manuals and the hiring of a person to visit plants and offer on-the-job advice. The revisions were accomplished with participation from university faculties in several other states to reduce sectional influence and to increase the potential for nationwide replication.

Clemson University also prepared a videotape designed to alert operators to the training opportunities available to them from the local to the national level. The tape has been presented on the South Carolina statewide educational television network as well as at State and national operator training meetings.

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The University sponsored a National Conference on Wastewater Treatment Plant Operator Training in 1969 in cooperation with the Water Pollution Control Federation and the Federal Water Pollution Control Administration. The presentations and discussions of operator training activities and needs mirrored the widespread concerns that led to the passage of the Water Quality Improvement Act of 1970 and its emphasis on operator training. Since then, Clemson University has continued its active interest in this field. Its contributions under EPA support are noted in Section III-C below.

(2) *Training Activities of Two-Year Colleges and Technical Schools.* A 1964 survey of technical education offerings in the nation's schools revealed only one program to educate water and wastewater technicians—a newly begun program at the Fayetteville Technical Institute in North Carolina. Under contract with the Office of Education's Vocational and Technical Education Division, the Institute produced a review draft of a curriculum guide in July 1966. Several institutions initiated programs based on that guide, the final version of which was printed in May 1969 as a joint interdepartmental publication (Office of Education and Federal Water Pollution Control Administration), entitled, *Water and Wastewater Technology, A Suggested 2-Year Post-High-School Curriculum*.¹

In 1969, 17 schools representing 11 states offered programs for training environmental technicians. Currently, there are 55 junior colleges and other institutions in 23 states offering courses in environmental technology. Twenty-one additional institutes have programs in the planning stage. Most of these programs terminate with an Associate of Arts degree in environmental technology, but many offer special-

ization in wastewater treatment technology. Additionally, a number of these institutions have joined with other sectors in providing non-degree programs for operators and technicians.

Two of these institutions—Charles County Community College and the Atlanta Area Technical School—offer good illustrations of this type of training activity. The Charles County Community College in La Plata, Maryland, offers a two-year Associate of Arts degree in Pollution Abatement Technology, a program centered on water pollution control.² It also offers a one-year Solid Waste Management Certificate program and week-long seminars on selected subjects. From 1967 to 1969, it joined with three other community colleges and the Maryland State Departments of Health and

¹ Criteria for the establishment and maintenance of two-year post-high school wastewater technology training programs were developed by Clemson University in 1970, under an EPA grant. Details of this activity and its impact on technician training activity are covered in subsection IV-C-2-c, Technical Training Grants and Scholarships for Undergraduate Study.

² This program has been funded by an EPA grant (see subsection IV-C-2-c, Technical Training Grants and Scholarships for Undergraduate Study).

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Natural Resources in presenting an annual training program for municipal and industrial wastewater treatment plant operators and superintendents. This program consisted of instruction in basic science and unit operations for three hours, one night per week, for 32 weeks. A sanitary engineer from the college faculty visited each student's plant during that period to give on-site technical assistance. Three federally funded¹ (MDTA) operator training programs are presently conducted by the college:

A 44-week on-the-job training program coupled with classroom instruction to upgrade the skills of presently employed operators.

An Institutional Training Program for (new) entry-level operators.

Training for military personnel scheduled for separation from the service under the Transition Training Program.

A science and technology center with classrooms and laboratories was specifically designed at Charles County Community College to support these programs. A wastewater treatment plant designed as a teaching facility was also placed into operation. Teaching aids were developed in the absence of any textbooks published on the technical level in wastewater treatment.

The Atlanta Area Technical School, the second example, was built in late 1967 as a joint endeavor between the Atlanta Public School System and the Georgia Department of Vocational Education. The school offers a two-year program in sanitary engineering technology for high school graduates, with a curriculum based essentially on that

developed by the Fayetteville Technical School. Through guidance from an advisory committee of practitioners, the Atlanta Area Technical School emphasizes practical application. First-year scholarships are offered to high school seniors who participate in the school on a full-time basis, receiving credit toward high school graduation in substitution for elective courses they otherwise would be taking.

The school's in-plant division, which works closely with the industry in developing tailor-made courses to meet its particular needs, offers short courses for wastewater treatment plant operators and laboratory technicians. Under an EPA grant, it conducted a three-week pilot program in wastewater technology, designed exclusively to enhance the technical capabilities of experienced operators and to establish within these students a recognition of the worth of advanced education.

¹ As further reported below in subsection IV-C-2-a, National MDTA-Funded Contracts.

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The Atlanta Area Technical School also administers an MDTA Institutional Training Program, under a subcontract with EPA, to train entry-level operators similar to the program offered by Charles County Community College.¹

Technical courses are also offered for technicians and laboratory workers in the water and pollution control laboratories in the greater metropolitan Atlanta area. A more comprehensive program is conducted jointly with the Georgia Water Quality Control Board, the Manpower division of the State Department of Vocational Education, and the wastewater treatment plants in the area. This program couples three weeks of classroom training with 26 weeks of on-the-job training.

b. *Training Activities of Associations.*—Historically, associations have played an important role in the water pollution control movement. Traditionally established for special and frequently differing purposes, their individual and joint contributions and impact on training of water pollution control personnel have been significant. At the risk of excluding a number of associations whose direct or indirect contribution has been important, the training activities of four leading examples will serve to demonstrate the vital role that they serve.

The Water Pollution Control Federation (WPCF), as indicated by its title, is most pointedly involved in water pollution control activities. For over four decades it has promoted the advancement of knowledge concerning the nature, collection, treatment, and disposal of domestic and industrial wastewaters, and the design, construction, operation, and management of facilities for these purposes. It con-

sists of 58 member associations representing approximately 20,000 individuals from the public and private sectors.

The WPCF has provided unique leadership in disseminating technical knowledge through its publications and its sponsorship and encouragement of training activities. For most of its existence, the WPCF has provided leadership and continuing support of certification and training of treatment plant operators. Its encouragement of the adoption and implementation of mandatory certification laws and regulations and its annual surveys of certification activity are highlighted in Part III of this report. Among the federation's publications is a series of *Manuals of Practice* (on subjects such as sewer design, construction, and maintenance and plant operation and design) and operator training courses with visual aids.

For a number of years the WPCF has conducted surveys of operator training programs of its member associations and states. The 1969 survey

¹ See subsection IV-C-2-a, National MDTA-Funded Contracts.

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(of 1968 activities), conducted by the WPCF's Personnel Advancement Committee, provided the source for the state activities data reported in subsection B-3-b of this part of the report.

In only a few cases was the federation involved in these programs independently of any member association. The WPCF does not provide training programs directly but does conduct annual conferences, seminars, and workshops. More typically, it supports the training activities of its member associations and others in indirect ways. Its operator training course outlines and visual aids have been distributed widely.

To provide pointed focus to its support of manpower and training activities, the WPCF established a manpower program called MANFORCE (an acronym formed from the phrase, *MAN*power *FOR* a Clean *Environment*). Generally, this program is directed at the problems of recruitment, training, certification, and retention of treatment plant operators and collection system personnel. One current MANFORCE project is the development of a central source of information on training and job opportunities. The training survey projected for 1971 will be a collaborative effort among MANFORCE, the federation's Personnel Advancement Committee, the proposed national association of boards of operator certification, and the American Waterworks Association. The survey is expected to produce not only a status report (as was done in 1969) but also a catalog of operator training programs and resources by states. Another MANFORCE project envisions an expanded role in developing and publishing

instructional materials for nationwide use.

The American Waterworks Association (AWWA) is to the water supply field what the WPCF is to the field of water pollution control. Its membership exceeds 20,000, about half of whom are utility executives. AWWA has collaborated with the WPCF in many endeavors: preparation of the model law and regulations for mandatory certification of operators of water and wastewater treatment plants; co-sponsorship of conferences and workshops; co-endorsement of the proposed association of State certification boards; the 1971 WPCF survey of operator training; and joint publications of the laboratory manual, *Standard Methods for the Examination of Water and Wastewater*.

The AWWA has been active for many years in the implementation of water resources training programs, through its national office as well as through its many local sections. Aimed at all levels of operation up through management, AWWA courses relate closely to similar concerns in water pollution control.

Over the past few years, the AWWA has also sponsored a number of seminars and workshops conducted throughout the country. These include management seminars, treatment plant operator workshops, and a seminar on negotiating labor contracts.

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Recently, the AWWA prepared course outlines for training operators of distribution systems and three levels of treatment plant operators. The association also recently published a training manual for the first level of plant operations.

The American Public Works Association (APWA) has a membership of over 12,000 top-ranking public works officials, primarily from public agencies and utilities. The APWA Education Foundation provides a variety of education and training programs. Many are indirectly related to water pollution control due to their generalized nature (such as in-service training courses in public works administration, management seminars for top public works executives, fellowships leading to degrees of Master of Public Works, and sponsorship of public works engineer management trainee programs). Of 10 workshops on specific public works functions presented to administrative and supervisory personnel, one is oriented specifically to water pollution control: a two-day workshop on Sewage and Urban Drainage Systems, presented in cooperation with the WPCF. Eight sessions of this workshop have been or are scheduled to be presented in 1971.

The National Sanitation Foundation (NSF) is a private, nonprofit institution engaged in standard development, environmental research, testing, and education. Some of its activities are directly related to

water pollution control. The foundation is most widely known for its role in developing standards and criteria for products, equipment, and services.

The NSF's programs in environmental education are noteworthy. Their primary focus has been on the environmental technician. Under a five-year grant from the Kellogg and Statler Foundations, NSF established a Program of Training and Education in Environmental Technology (POTEET). The program consists of:

Encouraging the incorporation of environmental subjects in education for industry.

Providing an information clearinghouse concerning curriculum.

Teaching courses on subjects in which the NSF is expert (including in-service training of NSF staff).

The clearinghouse function is performed through the development and widespread dissemination of a current informational packet relating to curricula for the environmental technician. It is distributed to educational institutions, environmental agencies, and individuals seeking assistance in curriculum initiation. The packet consists of technician job descriptions, manpower information on the environmental technician, a categorized bibliography, a current listing of post-secondary institutions with curricula in environmental technology, and sample curricula currently in use.

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The NSF also provides scholarship support for junior college teachers in environmental education. It currently provides support to more than 60 colleges.

Direct NSF training activities for industry and public agencies are in the pilot planning stage and will be funded initially from grant sources. The program is expected to include training input to satisfy industrial needs for the environmental technician, inputs to water and wastewater plant operator training courses, and expansion of the ongoing information clearinghouse for the environmental technician.

c. *Training Activities of Private Industry.* Virtually no data are available on the water pollution control training activities of private industry. Indeed, little detailed information is available even on the training activities of those industries most closely associated with the design, operation, and maintenance of municipal and industrial water pollution control facilities: consulting engineers, suppliers of chemicals and equipment, and industrial manufacturers involved in industrial wastewater treatment.

Industrial manufacturers employ professionals, technicians, and process operators. Professionals are hired with sufficient training to

enable them to handle their job assignments. Orientation to the specific industry and its water pollution control activities generally is accomplished through informal on-the-job training (OJT). Technicians and operators similarly receive OJT, although frequently in a more structured fashion. A number of major firms have developed or sponsor formal OJT programs, sometimes with federal assistance or approval. These and other programs developed by the larger firms are normally for their own internal use. As is true with smaller municipal plants, most of the smaller industrial firms have virtually no formal training programs and rely exclusively on external resources for any formal training for their employees.

Technological advancement and the potential impact of enforcement guidelines and standards promise to create a surge in requirements for continuing education and short courses for updating, upgrading, and reorientation of industrial manpower engaged in water pollution control.

Consulting engineers and suppliers of chemicals and equipment follow basically the same pattern of OJT for their professionals and technicians. Their formal training activities for personnel in other categories are limited, but they do play an important, however informal, role in training other water pollution control personnel. In their frequent contacts with operators and administrators, representatives of these firms disseminate important information on operational problems, new processes, and new techniques. In effect, this represents an informal channel for transfer of technological innovations from research and development into practice.

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Major equipment manufacturers provide training seminars for operators and maintainers of their equipment. Generally, their representatives who conduct these seminars are highly trained and effective teachers who represent a potentially valuable instructional resource for training activities conducted by others in other settings.

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3. *Training Activities of Non-EPA Governmental Organizations*

The public agencies have been very active in water pollution control training as enablers, as collaborators, and as recipients. Training activities at the local, State, and Federal levels vary by agency, as described in turn below.

a. *Training Activities of Local Agencies.*—As described in subsection III-C-3 of this report, local government agencies are basically the operators and maintainers of sewage collection systems and public wastewater treatment facilities. As they vary in structure, size, or-

ganization, and budgetary constraints, so they differ in their approaches to training.

As public employers, local government agencies bear ultimate responsibility for the development of their manpower. Required training for new entrants or to update or upgrade the skills of the current workforce can be provided in a variety of ways:

By the employer (without assistance from others).

By the employer (with assistance from others).

By others (without assistance from the employer).

By others (with assistance from the employer).

Being at the point of operation of water pollution control activities, local agencies are the targets, and, hence, the beneficiaries, of training or training assistance provided or sponsored by other sectors. Little or no training, beyond OJT, is sponsored or provided independently at the local level, with the exception of the larger jurisdictions whose workforce size and concentration and whose budgets would warrant such activity.

Training needs and consequent training activities vary according to the two major manpower functions in local water pollution control: (i) staff activities of administration, planning, enforcement, and design; and (ii) operation of sewer collection systems and wastewater treatment plants.

Most of the personnel in or entering staff or chief operating positions already possess the basic technical or administrative skills required for these positions (either through work experience or as graduates of formal educational programs at universities, colleges, or technical schools). Entrants learn the unique feature of the systems and operations through informal orientation and on-the-job training. Little or no upgrade training in management or technology is sponsored or provided independently by local governments.

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Operators generally receive informal orientation and OJT from their employers in the form of informal "apprenticeship" (working under the guidance of one or more experienced operators), job rotation (short supervised tours in different parts of the plant), or "chalk-talks" (briefings from senior personnel on operations, equipment, procedures, and so forth). Few jurisdictions independently sponsor or provide entry or upgrade training programs. Indeed, no patterns exist for tuition assistance, travel, or subsistence allowances or work-release policies.

A few large municipalities and sanitation districts have independently provided formal training courses for their operators. For example, the Philadelphia Water Department developed an In-Service Training Program and Operator's Guide. The operator's manual is

oriented specifically for treatment plants in Philadelphia, describing plant operation, equipment, and procedures in terms of that environment. Also, the Metropolitan Sanitary District of Greater Chicago developed a four-phased, eight-month in-plant training program conducted by their own technical personnel, with guidance from a local university.

One of the most ambitious programs initiated at the local level is the well-publicized apprentice program conducted by the Orange County Sanitation District in California, which operates the third largest wastewater quality control system on the West Coast. An Apprentice I program was initiated in July 1967 for mechanically inclined entrants, newly graduated from high school. Covering a two-year period, the Apprentice I program provides general training covering all operational and maintenance activities of a wastewater treatment agency, with three-month tours spent in each of its departments. Graduates of the program are expected to become familiar with overall operations but would not have spent sufficient time in any given area to develop a journeyman skill. Consequently, a two-year Apprentice II program for these graduates was initiated in July 1969 to provide advanced and specialized training in one of five occupational areas (engineering, mechanical maintenance, electrical maintenance, laboratory, or operations). Outside schooling, equivalent to 30 college semester units, is required to supplement this OJT, at the employee's own expense and on his own time.

b. Training Activities of State Agencies.—Agencies bearing primary responsibility for the water pollution control activities in their states vary considerably in their organizational orientations and their involvement in training activities. The 54 designated water pollution control agencies receiving state program grants in FY 1971 represent all 50 states, the District of Columbia, Guam, Puerto Rico, and the Virgin Islands. Their organizational orientations are as follows:

Within health organizations	23
Within water (or natural) resources agencies	7
Separate pollution control agencies	24

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Data ¹ extracted from the FY 1971 State Program Plans depict the following levels of involvement in training by the 50 State agencies: ²

A total of more than 104 staff man-years are assigned to training, averaging nearly 2.1 man-years per state and ranging from a high of 10.0 to a low of 0.1 man-years. When compared to total state agency staff activities, the average proportion of staff assigned to training is 4.7 percent, ranging from a high of 27 percent to a low of 0.8 percent.

A total of \$1,393,514 is being expended for training, an average of \$27,870 per state. State expenditures for training range from a high of \$146,000 to a low of \$1,800. This investment in training represents 7.6 percent of the total expenditure budgets for those agencies, with individual states allocating from a high of 33 percent to a low of 0.6 percent of their budgets to water pollution control training activities.

Such figures may be misleading when one considers that much training that takes place in a state typically is sponsored or provided by other state agencies (such as state employment services or vocational education agencies), universities, associations, or Federal agencies. Indeed, the role of the state water pollution control agency is frequently collaborative or catalytic in nature, particularly so in recent years.

Until recently, the main sponsor of training for treatment plant operators (other than on-the-job training) has been the states through provision of short courses, ranging from one or two days up to five weeks. In its last survey³ of operator training programs in the states, the Water Pollution Control Federation found that 44 states had active training programs in 1968, providing at least 100 courses in over 300 actual training sessions that were attended by more than 16,000 persons. These courses were and continue to be made available in collaboration with colleges, vocational schools, associations, and other state agencies.

¹ *Digest of FY 1971 State Program Plans*, prepared by the Water Quality Office of the Environmental Protection Agency, August 1971.

² The District of Columbia, Guam, Puerto Rico, and the Virgin Islands are excluded from the following calculations because their programs are substantially funded by the Federal Government and their inclusion would distort state averages.

³ See subsection B-2-a-(2), above.

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Attempting to further expand the scope and increase the penetration of operator training, a number of state agencies have joined with other sectors in a variety of new ways. One significant breakthrough was the establishment in 1967 of the Cooperative Area Manpower Planning System (CAMPS), which is discussed in Part II of this report. CAMPS is a planning, not a funding, mechanism. However, it does provide a great potential, through persuasion and agreement, for channeling Federal assistance to states and localities for training in water pollution control. Through this mechanism, a number of states have been successful in attracting Federal financial support of state and local water pollution control training projects, primarily through program funding authorized under the Manpower Development and Training Act (MDTA), discussed more extensively in sub-

section C-2-a, below. Projects for institutional training, on-the-job training, and on-the-job training coupled with classroom instruction have been funded directly to the states and localities in the following approximate magnitude:

Contract period	Cost	Number of operators trained
1969-1970	\$1,162,000	980
1970-1971	1,110,000	1,355
1971-1972	2,712,000	2,795
	4,984,000	5,130

Most of this activity has taken place in the Middle Atlantic States and Southeast, South Central, and Northwest regions of the country.

Current state training activities are focused primarily on operator training and mirror this collaborative approach as illustrated in the examples described below for Pennsylvania, Texas, and New England. The Pennsylvania Public Service Institute is the recognized training agency of the State of Pennsylvania for water pollution control operators. The Institute is funded equally by the State and the Federal Governments (under the Vocational Education Act of 1966, described more fully in section 2-b-(3)). The Institute provides the instructor and training materials and presents staggered evening classes (usually three hours per night, one night a week for 10 to 15 weeks) at various locations throughout the State. It also conducts 44-week training programs supported by MDTA funding,¹ in collaboration with the Pennsylvania Department of Health.

Operator trainings in Texas is provided as a joint activity by the Texas State Department of Health, the Texas State Water Quality Board, Texas A & M University (and its Engineering Extension Service, the Texas

¹ This program is conducted under a subcontract with the EPA. (See subsection IV-C-2-a, National MDTA-Funded Contracts.)

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State Technical Institute), in cooperation with two statewide operator associations. An annual short school is held on the campus of Texas A & M, with sponsoring agencies assisting in planning, organizing, and conducting the class sessions. Regional short schools, geographically distributed among towns in which college facilities are available, are conducted by members of the State Division of Sanitary Engineering and faculty from the Engineering Extension Service. To reach operators of small plants, the Engineering Extension Service presents short courses throughout the state by traveling field instructors. Sixty to 80 of these courses are conducted annually (two and one half

hours nightly, four nights a week for two weeks). For wastewater laboratory technicians, an annual 40-day course is held on the Texas A & M campus, and one- and two-year programs are available at Texas State Technical Institute, the latter culminating in an Associate of Science degree in water and wastewater technology. All of these programs are supported by fees, state appropriations (amounting to about 25 percent of the total), and Federal funds.

Finally, the New England region provided a unique and varied approach to operator training in FY 1971. The New England Interstate Water Pollution Control Commission sponsors entry-level training at the New England Regional Wastewater Institute in South Portland, Maine. Its Wastewater Treatment Plant Operators course, an ongoing program of 35 weeks of full-time classroom, shop, and OJT, is offered to all of the New England States (by either open or MDTA referrals). In addition, individual states in the region provide wastewater treatment training at the intermediate and advanced levels.

In one of these states, Connecticut, wastewater treatment training is conducted by four different state agencies. The State Department of Health and the Water Resources Commission conducted entry and upgrade training in basic principles of sewage treatment and upgrade training in secondary treatment theory and practice (40 enrollees each). The Division of Vocational Education offers entry training for waste treatment plant operators (15 enrollees) and part-time entry and upgrade training for sewage plant operators (65 enrollees). Both of these programs are MDTA-sponsored coupled OJT programs. The Department of Labor also conducts a 34-week coupled-OJT program for wastewater treatment plant operators (40 enrollees).

c. *Training Activities of Non-EPA Federal Agencies.*—As previously indicated in subsection II-C-5, other Federal organizations engage in activities that relate directly or indirectly to water pollution control. Of the 40 other Federal organizations surveyed by EPA, seven reported that they conduct internal training programs related to water pollution control. Eight additional Federal organizations which were not included in the survey reported the availability of various funding mechanisms to support the educational activities of others involved in water pollution control. All of these organizations, including those which provide their own internal training programs, participate in courses, workshops, seminars, and correspondence courses provided by other sectors.

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The subsections below discuss the direct training and financial support for training provided by non-EPA Federal agencies in the field of water pollution control.

(1) *Direct Training.* The following summarizes the internal training programs reported by the other Federal organizations.

Department of the Army

- A course for sanitary engineers at the Army Medical Field Service School.
- A course for environmental and sanitary engineers by the Army Environmental Hygiene Agency of the Office of the Army Surgeon General.
- A water supply specialist course for enlisted personnel at Fort Belvoir.
- A water supply course for NCO and supervisory candidates at Fort Belvoir.
- An environmental training course for headquarters personnel at Washington, D.C.
- A course in facilities engineering management at the Army Engineering School, Fort Belvoir.

Department of the Navy

- A program for waste treatment operators and maintenance personnel at the Naval Facilities Engineering Command Technical Training Center.
- Correspondence courses and workshops on basic and intermediate water and sewage treatment for engineers, operators, scientists, and laboratory personnel.

Department of the Air Force

- A course in waste processing for wastewater treatment plant operators at Sheppard Air Force Base.
- Courses for bio-environmental engineers on water hygiene and other health aspects of water and wastewater at the Aerospace Medical School.

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U.S. Geological Survey (Department of the Interior)

- Courses and workshops on ground water, surface water, hydrologics, hydrochemistry, environmental quality, and water quality.

Department of Agriculture

- Courses and workshops in water systems and sewage treatment systems design and treatment plant operation by the Forest Service.
- Educational programs (seminars, publications, media programs) in agriculturally related pollution control and rural community

resource development (for example, sewage disposal and water systems) by the Cooperative Extension Service.

Atomic Energy Commission (AEC)

A program to introduce college and university faculty and others to analytical techniques for monitoring, measuring, and evaluating water quality by the Division of Nuclear Education, in cooperation with the Special Division of Oak Ridge Associated Universities. (Three courses for 67 attendees were conducted in FY 1971 at a cost of \$17,000 out of AEC's educational budget of \$6.8 million.)

U.S. Civil Service Commission (CSC)

A seminar in environmental engineering and ecology by the Dallas Regional Training Center. (Seventy-seven engineers and scientists, mainly from the Federal Government, attended in FY 1971.)

Management training programs for Federal, State, and local government personnel.¹

¹ The CSC is authorized, under the Intergovernmental Cooperation Act of 1968, to assist state and local governments in training professional, administrative, and technical personnel to increase their capability for mission accomplishment. Through a nationwide network of training centers, the CSC offers a broad range of courses in executive development, general and personnel management, communications and office skills, automatic data processing, management sciences and financial management, and labor-management relations. The CSC reports that 7,200 state and local employees attended their programs in FY 1971 (out of a total of 77,000 attendees). No specific breakdown was available to distinguish

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(2) *Financial Support for Training.* Eight Federal organizations reported that they administer various funding mechanisms to support the educational activities of others. These activities relate directly or, in some cases, rather indirectly to water pollution control. These mechanisms are described below by the occupational category (that is, professional and technician/operator) for which the supported programs are primarily intended.

Financial Support of Training Programs for Professionals. Four organizations provide funding assistance oriented primarily to professionals—the National Science Foundation, Office of Water Resources Research, National Institute of Environmental Health Sciences, and U.S. Civil Service Commission—as discussed below.

The National Science Foundation. Under authority of the National Science Foundation Act of 1950 (P.L. 81-507), as amended, the Foundation attempts to strengthen research and education in the sciences. Among its activities that relate potentially to the environment, the National Science Foundation supports a number of training

programs with an environmental orientation. Graduate predoctoral fellowships and traineeships in the mathematical, physical, medical, biological, engineering, and social sciences are the largest single element. In FY 1971, the Foundation invested \$28 million to support 3,500 predoctoral candidates. Its Office of Training estimates that about 30 percent of these awards were environmentally oriented. In its support of teacher upgrading and curriculum and materials development, the Foundation invested approximately \$11 million in FY 1971, of which 20 percent is estimated to have been related to the environmental sciences. Specific breakdowns for those activities related to water quality control were not available. However, the Foundation estimates, in the aggregate, that 13 research and training projects relating to water quality control were supported during FY 1971 at a budget cost of \$1.7 million.

The Office of Water Resources Research (OWRR), Department of the Interior. The OWRR, under authority of the Water Resources Research Act of 1964 (P.L. 88-379), as amended, administers a program of water resources research and training. Through its sponsored research, it helps develop new technology and more efficient methods for resolving local, state, and nationwide water resource problems. It also helps to train water scientists and engineers through their on-the-job participation in research work.

Having no internal research facilities, OWRR supports state university water resources research and training institutes. It also

the functional areas represented (such as water pollution control), their occupational categories, or the specific programs they attended.

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provides grants and contracts for support of urgently needed water resources research. In FY 1971, the OWRR supported 675 projects at a cost of \$11.6 million, with an orientation toward the supply, rather than the quality, of water.

The National Institute of Environmental Health Sciences (NIEHS), Department of Health, Education, and Welfare. The NIEHS conducts, fosters, and supports research and research training relating to the environmental impact on man. It is oriented to the health aspects of environmental pollutants, with particular emphasis on biological effects. The NIEHS supported 158 projects in FY 1971 at a cost of \$13.5 million. The Institute estimates that roughly 5 to 10 percent of these relate to various aspects of water improvement (such as water toxicology).

The U.S. Civil Service Commission (CSC). The CSC develops and administers programs under the Intergovernmental Personnel Act of 1970 (P.L. 91-648). It administers a grant-in-aid program to

help state and general local governments improve their personnel administration and employee training programs. Among other things, the Act provides grants for the training of personnel, for government service fellowships, and for intergovernmental assignment of personnel and cooperation in recruiting and examining. Appropriations for FY 1972 totaled \$10.4 million. Guidelines for grantees were distributed in July 1971, and grant applications are expected to start in FY 1972 at an accelerated pace.

The CSC also provides technical assistance on personnel administration to state and local governments. At the request of state and local governments, the Commission assists these jurisdictions in assessing their training needs and in establishing, operating, and evaluating their own training programs.

Financial Support of Training Programs for Technicians and Operators. Four organizations provide funding assistance oriented primarily to technicians and operators: the Division of Vocational and Technical Education and the Division of Manpower Development and Training of the Office of Education (Department of Health, Education, and Welfare), Manpower Administration (Department of Labor), and Veterans Administration, as discussed below.

Division of Vocational and Technical Education, Office of Education, Department of Health, Education, and Welfare. The Vocational Education Act (P.L. 90-576), as amended, authorizes funds to be used primarily by the states in promoting vocational education for a variety of unemployed or underemployed individuals. It is intended to assist secondary and post-secondary students, dropouts, high school graduates, and those with educational, socioeconomic, and other handicaps.

The vocational educational program is guided by a National Advisory Council, consisting of 21 Presidentially appointed members from

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the fields of labor and management, manpower administration, education, adult education and vocation, the general public, and those trained or knowledgeable in the special areas of the handicapped or the socioeconomically disadvantaged.

Approximately \$427 million in total appropriations were available in FY 1971. The number of enrollees supported by this appropriation approximates 10 million. Most of the Federal funds require matching with state or local funds, and the states traditionally have over-matched such Federal funds four- to fivefold.

The states are allocated basic grants to provide opportunities for persons to become skilled workers, technicians, or paraprofessionals

in recognized occupations. Funds generally can be allocated to support training programs; facilities construction; guidance and counseling; ancillary activities; research, experimental, and demonstration programs; and curriculum development. Funds are generally administered through the State Director of Vocational Education in each state, with the advice of required State Advisory Councils (mirroring the national membership representation from educational, vocational, and technical fields). Federal funds for basic grants in FY 1971 approximated \$322 million. Mandatory set-asides were established for post-secondary programs and programs for the disadvantaged and the handicapped.

Additionally, special vocational education programs may be funded to support additional activities such as:

Exemplary programs and projects which broaden occupational aspirations and create job opportunities for young people through activities such as career opportunity familiarization, work experience, and job placement (\$16 million available in FY 1971).

Cooperative vocational education programs (\$18.5 million available in FY 1971) and work study programs (\$5.5 million available in FY 1971).

Curriculum development activities¹ (\$4 million available in FY 1971).

The Division of Vocational and Technical Education reported that approximately 10 states provided vocational education programs related to water quality treatment or improvement (such as training in

¹ The joint interdepartmental publication, *Water and Wastewater Technology, A Suggested 2-Year Post-High-School Curriculum* (1968), was developed from materials prepared under a grant to the Fayetteville Technical Institute in 1965. [Discussed in subsection 2-a-(1), above.]

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water and wastewater technology) during FY 1971 for approximately 2,500 enrollees at a budgeted cost of approximately \$750,000.

Division of Manpower Development and Training, Office of Education, Department of Health, Education, and Welfare. The Secretary of Health, Education, and Welfare is given responsibility for providing all institutional training required for referrals under the Manpower Development and Training Act (MDTA) of 1962, as amended. The Act generally authorizes the expenditure of Federal funds to reduce the level of unemployment, offset skill shortages, and increase the productivity and earning power of the nation's work force. These objectives are accomplished by offering diverse skill training opportunities to the unemployed and underemployed in occupational areas with immediate manpower needs. The institutional training

component of the MDTA programs includes basic education and employment orientation and supportive services. Distinctively, institutional training is oriented to the classroom, rather than the work site.

Funds for institutional training are either administered through interagency agreement with EPA or channeled directly through appropriate state education agencies to public or private educational agencies or institutions, multi-occupational projects, and manpower skill centers. Federal funds granted directly through the states are matched by state funds on a 90/10 sharing basis.

Approximately \$131 million was available in FY 1971 to provide institutional training for approximately 149,000 enrollees under the MDTA program. No breakdowns were available to distinguish that portion of the institutional training appropriation related directly to water pollution control through direct grants. Those MDTA institutional training programs provided under agreement with EPA are discussed in subsection C-2-a (2) of this part of the report.

The Manpower Administration, Department of Labor (DOL). Two programs administered by the Secretary of Labor pursuant to the Manpower Development and Training Act of 1962, as amended, have direct relevance to and have been significant sources of funding for training in water pollution control: the Coupled On-The-Job Training (OJT) Program and the Public Service Careers (PSC) Program. MDTA funds are also expended in support of the Transition Program of the Department of Defense. Part of each of these programs is administered under interagency agreement with EPA; these arrangements are discussed in subsection C-2-a, below. The MDTA programs are discussed in general terms below.

(i) *The Coupled OJT Program*

The Secretary of Labor is authorized to expend Federal funds for the provision of programs for on-the-job training. Through contracts with the Department of Labor, public and private employers provide supervised work at the

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job site for entry employees hired from the ranks of the disadvantaged or for those employees requiring skills upgrading. Upgrade training is oriented to low-skilled workers trapped in low-paying jobs (the "working poor") and to occupational positions with skills shortages. Projects which include related supplementary classroom instruction are referred to as coupled institutional and on-the-job training or, more commonly, coupled OJT. (When so combined, joint DOL and HEW funding is provided under interagency agreement, although the

separate funding channels are maintained for administrative purposes.)

No statistics regarding funding and enrollment for OJT or coupled OJT programs or for those specifically related to water pollution were available. EPA involvement in the Coupled OJT program is discussed in subsection C-2-a-(1) of this part of the report.

(ii) *The Public Service Careers Program*

The PSC Program was launched in FY 1970 under the authority of the MDTA and the Economic Opportunity Act. The program is designed to provide permanent jobs in government service agencies for disadvantaged workers and also to assist in upgrading employees in dead-end, low-paid positions. Based on a "hire first, train later" concept, the PSC Program helps defray part of the costs of OJT and intensive supportive services for disadvantaged workers hired by public agencies and also helps finance upgrading activities. It is the counterpart program to JOBS (Job Opportunities in the Business Sector).

The program has four major plans, two of which have potential relevance to manpower training in water pollution control:

Plan A provides for the award of contracts directly to State, county, and local government agencies and independent special districts for entry and upgrading of disadvantaged workers. Although the workers' salaries and fringe benefits are paid from the employing agency's regularly budgeted funds, PSC funds are intended to defray the extraordinary costs of training. The upgrading phase, restricted to agencies that have an entry project, is focused on the underutilized, low-income employee.

Plan B provides for entry employment and upgrading in Federal grant-in-aid programs. The Department of Labor negotiates agreements with other Federal agencies to

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build arrangements into their grant-in-aid programs with State, county, and local government agencies and independent special districts. The Federal grant agency negotiates and awards contracts or provides grants to these sponsors. The basic concepts of *Plan B* are identical to those of *Plan A*.

No figures were available on the funds provided under *Plan A* which were related to water pollution control. Activity under *Plan B* is discussed in subsection C-2-a-(3) of this part of the report. (Although no data were available at the time of final preparation of this report, the Emergency Employment Act of 1971 (P.L. 92-54) ¹ may provide additional funding assistance opportunities for employment and training in water pollution control.)

(iii) *The Transition Program of the Department of Defense (DOD)*

The DOD has estimated that about 20 percent of servicemen about to separate from the military lack the educational

¹ The Emergency Employment Act of 1971 authorizes the Secretary of Labor to provide public employment for unemployed workers by entering into arrangements with:

units of Federal, State, and general local government;
public agencies and institutions which are subdivisions of state or general local government, and institutions of the Federal Government; or
Indian tribes on Federal or State reservations.

The purpose of the Act is to provide unemployed and underemployed persons with transitional employment in jobs providing needed public services during times of high unemployment and, wherever feasible, to provide related training and manpower services to enable such persons to move into employment or training not supported under this Act.

The Secretary of Labor is authorized until 30 June 1973 to obligate funds when the unemployment rate equals or exceeds 4.5 percent for three consecutive months. The mechanism is automatic and provisions in the law were activated when signed by the President on 12 July 1971, since the unemployment rate had been above 4.5 percent for the requisite time period. This Act represents a possible source of funds for transitional employment for the unemployed to work in public agencies concerned with water quality. It provides for the payment of 90 percent of wages and salaries in public employment, up to a total Federal share of \$12,000 per year per employee. The Act authorized the appropriation of \$750 million in FY 1972 and \$1 billion in FY 1973.

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or civilian job-related skills required for transition to civilian employment. The Transition Program was established to provide occupational training to provide marketable skills, educational reinforcement to upgrade to secondary or high school equivalency levels, counseling to determine career desires and educational and training choices, and job placement assistance to locate employment opportunities or to secure jobs during the six-month period immediately prior to separation. Both classroom and on-the-job training are provided by cooperating public and private organizations. OJT programs are arranged with public agencies or private employers, while institutional training programs are scheduled on or near military bases. During FY 1970, approximately \$4 million in MDTA funds were used to train about 12,000 servicemen in a variety of occupational areas, including water pollution control.

The Veterans Administration (VA). Under authority of the Veterans Readjustment Benefits Act of 1966, as amended (more commonly considered the "GI Bill"), the VA provides rehabilitation and education benefits for veterans of post-Korean conflict service. Among those benefits are the following which have particular relevance to preparation and training for water pollution control activities:

First priority for veterans for referral to and selection for federally sponsored manpower training programs. (In FY 1970, over 20 percent of new enrollees in MDTA institutional and OJT programs were veterans.)

Remedial educational benefits for veterans without high school diplomas or equivalency, without reducing their entitlements for college or vocational allowances.

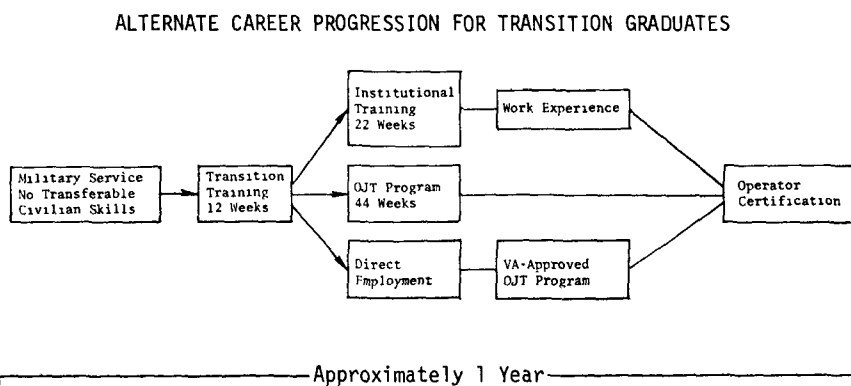
Monthly allowances (\$175 minimum) for attendance at universities or two-year colleges or in approved OJT programs. (Nearly 10 percent of Vietnam era veterans who have received educational training benefits have been enrolled in apprenticeship or other OJT programs.)

Simultaneous payments of training allowances under both the GI Bill and the MDTA.

The President's Committee on the Vietnam Veteran recommended that the VA use provisions of the GI Bill to develop additional OJT courses that serve a public need. An approved OJT program requires an employment commitment and may last from six to 24 months. Water pollution control was one major area specified in the recommendation.

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To fulfill this and other recommendations of the Committee, the Jobs for Veterans campaign was launched in late 1970. Additionally, the President's Veterans Program, announced in mid-1971, provides further emphasis on the coordination and utilization of Federal resources and programs for the returning veteran. Participation of veterans in federally assisted programs is expected to increase substantially. Those federally sponsored programs discussed above which provide training opportunities for veterans (and which can be targeted to water pollution control activities) are illustrated below:



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4. Assessment of the Training Activities of Non-EPA-Organizations

Against the frame of reference established at the beginning of this

section, the roles played by the non-EPA organizations and the orientation and the contribution of their training activities in meeting the current and evolving training needs of water pollution control professionals, technicians, and operators will be assessed in terms of:

 Their capacity to train manpower for water pollution control (facilities and instructors).

 Their development of information with which to provide that training (curricula and materials).

 Their financial support provided to others to enable the training to be initiated and conducted.

Broad measures of training effectiveness, in terms of the comprehensiveness, coordination, responsiveness, and overall economic value of these activities, underlie both the assessment of roles and the assessment of contributions in responding to occupational needs.

a. *Assessment of Roles.* The primary role of *four-year colleges and universities* has been the direct provision of entry training for professionals. Formal degree programs offer the potential capacity to fulfill that role, but in spite of the financial support received from other Federal agencies, these programs have not been oriented pointedly to water pollution control. Although the four-year colleges and universities have great potential for extending their capacity to train professionals already working in this field, they have not been sufficiently active in doing so. Capabilities for transferring technology developed in research have not been fully established, and financial support is required.

Two-year colleges and technical schools, despite their relatively recent attention to water pollution control, represent the primary resource for entrants at the technician or upper-operating levels. The capacity of these institutions needs to be increased substantially. These institutions also have the capacity for providing remedial or transitional education for the unemployed or for those in the work force whose educational deficiencies prevent their upward mobility. This capacity has been tapped to a limited extent under programs funded under the Manpower Development and Training Act. However, two-year college and technical school entry programs require expansion and distinctive orientation to water pollution control, in general, and wastewater treatment technology and operations, in particular. Curricula must be standardized, and basic training materials need to be developed and refined or reoriented.

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Two-year colleges and technical schools have been virtually inactive in providing upgrade training for technicians and operators at the higher levels. Upgrade training programs need to be expanded

considerably, and financial support from non-EPA Federal agencies, which has not been pointed specifically to these needs, should be applied to improve the capabilities of these institutions.

Associations have been extremely active—and successful—in inviting enlightened attention to the deficiencies in manpower training, especially for wastewater treatment plant operators. They have encouraged the improvement of operations through their support of mandatory operator certification, their promotion of increased capacities for training of operators and technicians, and their sponsorship, through local units, of short courses. Their catalytic and enabling roles are limited, to large degree, by their size and financial constraints. Associations require support for their special areas of interest and expertise. Collaborative efforts with government agencies should be increased.

Employers in the private sector (industrial manufacturers, consulting engineers, and suppliers of chemicals and equipment) have generally attended to the training needs of their own employees. Only the larger firms have developed formal programs; only suppliers and, to a limited degree, consulting engineers appear to offer formal training programs for use of others. Programs need to be developed to respond to the anticipated expansion of industrial wastewater treatment activities. Governmental and nongovernmental roles in this endeavor need solidification.

Local governments and agencies have been constrained severely in their training activities by their size and their budgetary limitations, but they have been the beneficiaries of considerable support from the state and Federal sectors. Only the larger jurisdictions have conducted independent training activities beyond the scope of informal orientation and on-the-job training. A number have been the direct or indirect recipients of Federal funds, primarily under one of the MDTA-sponsored programs. Local government agencies should play a greater role in shaping the nature of their training to their own particular environment. Encouragement and financial support are needed to make better use of training and manpower resources available to fill their needs.

State water pollution control agencies traditionally have sponsored short courses for operators, frequently in collaboration with others. These agencies have suffered with inadequate staffing and funding to perform fully their enabling roles. They also have operated fragmentally in pursuit of common goals with their sister agencies (employment, education, health) whose categorically distinctive orientations frequently inhibit, rather than encourage, collaborative action. When collaboration has been evident, striking results have been achieved. Collaboration has been most noteworthy in the states'

involvements with short courses. Indeed, the state's most active role has been collaborative sponsorship of short-course

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upgrade training for operators and participation in MDTA-funded entry and upgrade programs, of longer duration, for lower level operators. Independent support of the direct training activities of others has been limited.

State water pollution control agencies need strengthening by increased staffing and financial support to build their capacity for planning, organizing, administering, and conducting training programs. Closer cooperation and coordination among agencies within a state are required to maximize the potential of the resources they collectively can marshal for water pollution control training. Additionally, their independent efforts require general coordination and guidance to ensure reasonable consistency among the states and to capitalize on opportunities for widespread replication of individual efforts on a regional or national scale.

The roles of *non-EPA Federal agencies* have been varied. A limited role has been played in the provision of direct training for those engaged in water pollution control. Limited internal training activity has been reported by those Federal agencies which operate their own treatment facilities.¹ These programs apparently have been planned and developed independently. The management training provided by the Civil Service Commission is designed for general purposes and is presented to heterogeneous groups at the Federal, state, and local levels.

Substantial Federal financial support is provided to educational institutions. Funds provided by the National Science Foundation support the basic sciences and are generalized in orientation. Similarly, vocational educational support by the Office of Education is generalized (about 0.2 percent of the program funds were reported to have been directed specifically to water and waste treatment technology). Support provided by the Office of Water Resources Research and the National Institute of Environmental Health Sciences is related only tangentially to water pollution control (the former primarily to water supply and the latter to the environment's impact on man).

The MDTA-funded programs administered by the Manpower Administration and the Office of Education have been used actively and productively in some of the states. Expanded use is required to realize their full potential. The Institutional Training Program and the Transition Program offer a source of entrants prepared to assume lower level operator positions. Their maximum effectiveness is

achieved when oriented directly to water pollution control. The Coupled-OJT and Public Service Careers programs offer potential for both entry and upgrade training for lower level operator positions. Plan A of the PSC program offers funding of water pollution control training projects directly to state and local governments;

¹ Executive Order 11507 requires compliance of Federal installations to water quality standards for Federal facilities by the middle of FY 1973. It also requires that all Federal operators meet or exceed the state operator qualification standards for their locale.

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yet little activity has been reported. Finally, pointed use of veterans' benefits under the GI Bill has potential for increasing the reservoir of trained manpower for entry into water pollution control activities.

Like the states, potentials for assistance from non-EPA Federal agencies are great, efforts have been fragmentary, and pointed orientation and coordination of resources toward water pollution control have been inadequate.

As evidenced in the foregoing assessments, the roles played by others have been varied and closely interrelated. Certain limitations and requirements for supplementation have been evident. These are synopsized in Exhibit IV-1.

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EXHIBIT IV-1.—SYNOPSIS OF PRIMARY ROLES AND LIMITATION OF OTHERS IN THEIR TRAINING ACTIVITIES IN WATER POLLUTION CONTROL (WPC)

Sector	Primary role		Limitations
	Direct entry training for professionals.....	Financial support for WPC-oriented program development and student incentives is limited.	
Four-year colleges and universities.		Technology developed in research activities not transferred to existing professionals.	Upgrade activities insufficient.
Two-year colleges and technical schools.	Direct entry training for technicians and upper-level operators.....	Financial support for programs not distinctively oriented to WPC, in general, or wastewater treatment technology and operations, in particular.	Curricula not standardized.
Associations	Catalyst in support of the training activities of others, through information dissemination and collaborative sponsorship of upgrade training.	Training materials inadequate.	Upgrade activities insufficient.
Private industry	On-the-job training for own internal purposes.....	Staff and financial resources insufficient.	
Local agencies	On-the-job training for own internal purposes. Target and beneficiary of training activities of others.	Ability to respond to anticipated expansion of wastewater treatment activities questionable.	
State agencies	Collaborative sponsors of short courses for operators.....	Only the larger firms develop formal programs.	
Non-EPA Federal agencies	Financial assistance in support of educational institutions for entry programs.	Size, concentration and budgets vary.	
	Funding (MDTA) of entry and upgrade training for operators at the lower levels.	Staffing and financial resources insufficient.	
		Interagency collaboration limited.	
		Coordinative focal point absent.	
		Capacity to train inadequate.	
		Direct training very limited.	
		Support of educational institutions very generalized or not oriented to WPC.	
		MDTA funding limited in scope.	
		Interagency collaboration limited.	
		Coordinative focal point absent.	

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b. *Assessment by Occupational Needs.*—The focus of manpower training ultimately must be on the *man*—the target and immediate beneficiary of the training. An assessment of training activities is incomplete without examining the orientation and contributions of those activities in meeting the needs of the major occupational categories of manpower for water pollution control:

Professionals

Operators and Technicians

For each of these categories, activities will be assessed in terms of their orientation (entry or upgrade training) and their contribution (needs satisfied and needs unmet).

(1) *Training for Professionals.* As the complexity of water pollution control increases, so do the number of professional disciplines involved and the extent of training required to cope with its problems. The distinctive entry and upgrade orientations necessary in professional training provide a valuable tool for assessing the adequacy of current activities in the training of professionals for water pollution control.

Entry Training for Professionals. Water pollution control programs require a wide range of professional talents. Technical problems are increasingly complex; management demands offer substantial professional challenge. Clearly, higher levels of formal education, in depth within the technology and in breadth across disciplines, are required. A pointed orientation to water pollution control is necessary, but attention must be given to the *management of technology* as well as to the technology itself.

Direct entry training for professionals has been provided largely by four-year colleges and universities, who have provided the capacity and have developed the information necessary to prepare professional entrants through degree programs, primarily at the graduate level. Programs have been scientifically oriented, with limited emphasis on practical operations and managerial considerations. As suggested by Professor John H. Austin of Clemson University, "Design and operation of plants are two sides of the same coin and graduates of university programs must have an understanding of the necessity for proper operation and ways this might be effected; this is not believed to be the case at present."¹

¹ *Conference Proceedings, Educational Systems for Operators of Water Pollution Control Facilities*, Atlanta, Georgia, 3-5 November 1969, sponsored by Federal Water Pollution Control Administration in cooperation with Clemson University, Clemson, South Carolina, pp. 137-140.

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Financial assistance for university efforts has come primarily from the Federal sector. The impact of funds provided by other Federal

agencies has been positive in increasing the total professional labor pool. Its direct impact on water pollution control has been limited, since most of the support has either been generalized or oriented to subjects only tangentially related.

Update and Upgrade Training for Professionals. Short courses offer the best potential for updating the skills of professionals in the field and for developing transitional skills in those recruited from allied fields. The rapid rate of technological change mandates the need for transfer of technology to practitioners. The complexity of the technology and its management dictates the need for a broad range of subjects, from basic scientific skills to the sophistications of advanced technology of the management sciences.

Little update or upgrade training has been directly provided for professionals by the universities, the private sector, or by state or local government agencies. Programs of other Federal agencies are limited in number, generalized in scope, and relatively inaccessible to water pollution control professionals in the field.

(2) *Training for Operators and Technicians.* Operators comprise a wide range of personnel, from the lower level operator who requires a rudimentary knowledge of wastewater treatment processes and operational techniques, to the chief treatment plant operator who manages a large and complex advanced wastewater treatment facility and who supervises a number of operational personnel. Each level of skill within this range requires a correspondingly specialized level of training.

The educational requirements of a technician are reasonably compatible with those of operators at higher levels of skill or organization. Assessments of training activities and, indeed, the formation of training programs should recognize this commonality of needs as quite distinctive from those of the lower level operator. Therefore, the needs of lower level operators and those of technicians and upper level operators are discussed separately below as parameters for assessing current training activities.

Lower Level Operators

Entry Training for Lower Level Operators. Jobs in the lower portion of the operator structure generally require lower educational qualifications and involve less sophisticated types of job responsibilities than do jobs in the upper levels. The high school graduate or those whose educational skills can be raised to that level are the prime candidates for entry to these jobs. Vocational orientation for the high school graduate can be and generally is provided by on-the-job training programs, either.

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informally or formally structured. Repair of academic deficiencies and concomitant requirements for vocational preparation generally necessitate a more structured and lengthy program.

This type of training requirement suggests a set of conditions compatible with various national social programs designed to assist the disadvantaged, particularly those programs funded under the Manpower Development and Training Act. Pretechnical programs to repair academic deficiencies, such as institutional training, permit the potential entrant to reach a degree of productivity, once in a job, much earlier than if he were to enter the job without such training. Programs which combine institutional training with OJT (such as Coupled OJT, Public Service Careers, and the Transition Program) offer even more potential for acceleration. The most effective form of job-related training is at the field level, where entrants are able to work with and ask questions of practitioners.

MDTA-funded programs have been arranged directly with some agencies to help prepare entrants for lower level operator positions. The scope of states and localities covered and the level of funding have been inadequate. For the most part, programs have been centralized at the larger facilities or in urban locations where large numbers of the disadvantaged are concentrated. Qualified instructors have been difficult to recruit and train; of the alternatives of either teaching the teacher about operations or teaching the operator to teach, the latter has been considered preferable but not enough instructional programs have been available. Curricula and materials for these programs require focus and standardization. The absence of centralized coordination at the national level raises potential and inevitable questions of quality control and economies of resources. Dozens of separate, uncoordinated programs dilute the potential for economic attainment of national objectives.

Unmet needs include:

Expansion of MDTA-funded programs in coverage (to more states and localities), location (accessible to smaller facilities), and funding levels (beyond that currently provided directly to states and localities).

Programs to equip operators with requisite teaching skills to instruct in entry-level programs.

Curricula and training materials tailored to the comprehensive needs of entry-level operators at the lower echelons.

Alternative entry-level programs to reach that portion of the available entrant pool who do not meet the requirements as "disadvantaged" for MDTA program eligibility.

Update and Upgrade Training for Lower Level Operators. Updating the skills of those already employed at lower levels and upgrading those employees to higher level positions has traditionally been accomplished informally, on the job, through contact with those who possess the advanced knowledge or skills. Few formal programs had been developed prior to 1968, when operator training began to receive intensive emphasis by all sectors.

State-supported programs, presented independently or in collaboration with associations, have been of relatively short duration. Those programs that extend over a period of weeks have been limited in quantity. Comprehensive approaches, such as that illustrated in Texas, have been the exception rather than the rule. Some of the MDTA programs funded directly with states and localities (Coupled OJT or Public Service Careers, Plan A) have included components to upgrade existing employees in lower level positions who are disadvantaged ("the working poor") or whose advancement would help to alleviate occupations with skills shortages. The same limitations apply to this component as were described previously for the entry component (limitations in coverage, location, funding, instructors, curricula, materials, and coordination). In particular, upgrade programs for lower level operators must be responsive to the needs of local personnel and offered in locations that will provide, not deny, opportunities for convenient attendance. Problems in reaching smaller communities are compounded by the costs of travel and the necessity to provide relief operators.

Unmet needs are the same as those outlined for entry programs for lower level operators.

Technicians and Upper Level Operators

Entry Training for Technicians and Upper Level Operators. Technicians, by their very title, may require very specialized technical training—ranging from computer technology to the operation of sophisticated analytical equipment. Their close working relationships with professionals and operators suggest expanded educational preparation to include a basic appreciation of those functions as well.

Most technicians currently engaged in water pollution control activities are experienced plant personnel promoted through the ranks. Those in specialized positions may require degrees at the associate level, although the orientation of programs of two-year colleges to water pollution control technology has been too recent to produce a substantial number of graduates already in the field. A number of current technicians hold bachelor's degrees, although many consider them to be underemployed. Technicians require post-secondary training, either in one-year or two-year programs at community col-

leges or technical schools. Associate degree programs particularly oriented to water pollution control technology are required for specialized laboratory work.

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Personnel for the higher echelons of the operator structure have correspondingly higher entry requirements than those at the lower levels. Their jobs characteristically include supervisory responsibilities, necessitating a much more comprehensive understanding of the plant's various processes and their interrelationships. To perform effectively, the upper level operator must obtain a thorough understanding of the complete technology of the entire plant system and the scientific principles that govern the effectiveness of wastewater treatment. Higher level operators require a balanced education to comprehend the principles (the basic sciences), apply them practically (the treatment process), and supervise their activities (the management of technology). The educational preparation required for these positions is no less demanding than that required for the entrant technician. (Indeed, many jurisdictions require a bachelor degree or higher for their superintendents or chief operators; many argue that an associate degree, properly tailored, is sufficient.) Certainly, the movement toward larger and more complex plants suggests the desirability of high educational levels. This educational background should be provided at least at the two-year college or technical school level.

Substantial amounts of Federal, state, and local funds are potentially available for the education of skilled operators and technicians, primarily through the two-year colleges and technical schools. However, financial support from these levels and stimulation from other Federal agencies, for the most part, has been generalized without pointed focus to water pollution control. Graduates of these programs should be prepared for employment in upper level operator positions or as technicians (in research and development, industrial sales and service, design and construction, regulatory agencies, and larger treatment facilities).

The development and implementation of programs in wastewater treatment technology in two-year institutions have not kept pace with the need for adequately prepared entrants. Programs generally have been inadequate, both in quantity and quality. Curricula have been varied and require standardization. Training materials and an instructional cadre have been slow in development.

Unmet needs include:

Development of criteria for the establishment, maintenance,

and improvement of programs at two-year colleges and technical schools.

Refined curricula and tailored training materials.

Expansion of the available instructional cadre.

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Upgrade Training for Technicians and Upper Level Operators. Increasing the skills of technicians in the work force offers a substantial potential to increase the productivity of the professionals with whom they work and some of whose responsibilities they can assume. A wide range of updated and expanded skills is required to realize this potential. Many operators at the higher levels have been promoted through the ranks. Updated and upgraded skills are required, particularly in advanced treatment and the management sciences. Generally, state agencies in collaboration with others have been most active in sponsoring short courses. The type and number have varied substantially. The states have been restricted in these activities by inadequate resources and capacity.

MDTA-funded programs are not designed primarily for this level of employee. Direct training programs of other Federal agencies have not focused on wastewater treatment technology or its management.

Universities have been involved sporadically. Technology transfer opportunities have not been fully exploited.

Two-year colleges and technical schools have not had limited involvement; their major orientation, however recent, has been in long-term resident programs. Once the institutional capacity is in place, they represent a logical source for development and expansion of upgrade training programs.

Unmet needs include:

A comprehensive program of direct training oriented specifically to the updating and upgrading of skills required by technicians and operators at the higher levels (particularly those skills related to expanding technology).

A formal mechanism for technology transfer to these practitioners.

Tailored curricula and training materials and improved instructional capabilities.

Training programs in management and supervision, oriented to the specific environment of the operator and technician.

Increased capacity and resources in the states to initiate, develop, administer, and present innovative and responsive training (for this and other purposes).

The contributions of others is satisfying the training needs of the

major occupational categories of manpower in water pollution control have been substantial, but a number of needs remain. Unmet needs are synopsized in Exhibit IV-2.

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EXHIBIT IV-2.—SYNOPSIS OF UNMET NEEDS IN WATER POLLUTION CONTROL (WPC) TRAINING

Occupational category	Type of training	Capacity	Information	Funds
Professionals ..	Entry	In place, requires expansion	For training of professionals other than sanitary engineers, inclusion of WPC information. For training of all professionals, practical operational and managerial matters.	Financial support to develop and maintain capacity and information for programs with these characteristics.
	Update/Upgrade	A comprehensive program of direct training oriented specifically to the updating and upgrading of skills required by the professional in WPC.	A formal mechanism for technology transfer to the practitioner.	
Lower Level Operators.	Entry and Update/Upgrade.	Expansion of MDTA-funded programs in coverage, location, and funding levels. Improved coordination of efforts. Programs to equip experienced operators with requisite teaching skills to instruct in these programs. Alternative programs to reach that portion of the available pool that do not qualify as "disadvantaged" according to the eligibility requirements of MDTA programs. Development of criteria for establishment, maintenance, and improvement of these programs.	Curricula and training materials tailored to the needs of operators at the lower level.	Financial support to develop and maintain capacity and information for programs with these characteristics.
Technicians/Higher Level Operators.	Entry .....	.....	.....	.....
	Entry and Update/Upgrade.	.....	Tailored curricula and training materials.	.....
		Expansion of the available instructional cadre.	.....	Increased capacity and resources in the states to plan, initiate, develop, administer, and present innovative and responsive training programs.
	Update/Upgrade ...	Training programs in management and supervision, oriented to the specific environment of the operator and technician.	A formal mechanism for technology transfer to the practitioner.	

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5. *Conclusions Regarding the Training Activities of Non-EPA Organizations*

The needs for training water pollution control manpower are generally recognized and the multiplicity of needs has suggested a multiplicity of approaches from all sectors concerned. As a result, the basic institutional framework for developing and delivering the training is generally established.

Efforts of others have been constrained in numerous ways, however. Capacities have been established but are insufficient to meet the expected demand for manpower oriented specifically in water pollution control. The training information which has been developed is not sufficiently tailored to meet the comprehensive and diversified needs of the potential or existing work force. Financial support potentially available to develop both these capacities and the requisite information has not been provided outside EPA in sufficient amounts and has not been effectively channeled to meet the demonstrated needs.

Programs that have been implemented have been parochial in their orientation: professional training has been largely restricted to graduate level entry programs; lower level operator training has been concentrated in centralized locations, oriented primarily to the environments of the larger facilities; and training for technicians and higher level operators has been sporadic and narrowly focused. A comprehensive strategy to focus programs on particularized and comprehensive needs has not been developed by the independent or collaborative efforts of others.

These efforts have been fragmented and have suffered from a conspicuous lack of coordination. As a result, programs have proliferated, overlapping and competing for scarce resources. These scarce resources have not been allocated either efficiently or effectively, thereby reducing the return on their investment. Mechanisms for achieving economies, through interagency coordination and consequent channeling of resources to priority needs in water pollution control training, have not been fully developed.

Responses by others to the evolving training needs of professionals, technicians and operators have been incomplete. The Environmental Protection Agency, through its Office of Water Programs and its predecessor organization, the Federal Water Quality Administration, has attempted to overcome these limitations, supplement these roles, and satisfy these unmet needs, as reported in Section C, below.

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C. EPA WATER POLLUTION CONTROL TRAINING ACTIVITIES

The Environmental Protection Agency has undertaken the develop-

ment of a multifaceted training program to supplement the roles played by others, to help overcome the limitations of their activities, and to attempt to satisfy the unmet training needs of the professionals, technicians, and operators in or entering the field of water pollution control.

The skills and abilities of these personnel represent an essential resource in the nation's effort to restore and protect the environment. As established in Part II of this report, the qualified manpower pool in water pollution control is insufficient to meet the expanding demand in both the private and public sectors. Additionally, many of those employed in the field are undertrained, have skills too narrowly focused, or possess educational backgrounds and experience that are dated in terms of an expanding technology.

Under its charter, EPA has attempted to help respond to these deficiencies through the conduct and support of training activities designed to expand the number and improve the abilities of personnel engaged in water pollution control. In doing so, EPA has shaped its training activities according to a fundamental three-step training strategy:

- Determination of the various training needs and their order of priority.

- Development of carefully tailored training approaches making maximum use of existing resources.

- Implementation of approaches in a cost-effective manner.

EPA activities in determining training needs have been reported in Part II above. Of most significance is EPA's intention to help develop this capacity in other sectors, particularly in the States.

The EPA strategy for developing effective and comprehensive approaches to training again relates to the essential ingredients of any manpower training program: requisite capacity, information, and financial support. Once a need has been identified, capacities must be identified or developed and supported to respond to that need. It is EPA's policy to work within the existing institutional framework and to develop and encourage the use of new mechanisms for the delivery of training at the point closest to the source of the need. EPA's strategy is to help build this capacity and to supplement, rather than supplant, the activities of others

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only when they are unable to respond in a timely fashion. EPA is attempting to ensure that a sufficiently wide range of facilities and accessible, qualified instructors are available to respond to the full variety of training needs.

Once capacities are identified or developed, the information with

which to train must be available to respond to the identified need. Given EPA's knowledge of the latest technology in water pollution control and its focus on matters of national concern, the Agency is in a position to encourage the development of information most responsive to the needs of water pollution control manpower. Accordingly, EPA's strategy is to encourage and support or to help build the capacity of others to develop curricula and training materials tailored to the variety of needs that exist or are evolving. As noted previously, a full complement of information (formal courses of varying duration, correspondence courses, training aids, programmed instruction) may frequently be needed to respond comprehensively and at differing stages and levels of need.

To help build these capacities and develop the requisite information, EPA provides technical and financial support to others and helps channel the support and resources that can be provided by others, all specifically pointed to training in water pollution control. To accomplish this objective, EPA must coordinate closely with others, particularly with other Federal agencies whose support, resources, and programs share compatible objectives. EPA must also help coordinate the efforts of others and encourage parallel coordination among others to promote optimum allocation of resources.

In implementing this strategy and in supplementing the roles of others, EPA has focused its programs to:

- Support universities and individual students, mainly at graduate levels, in programs leading to professional careers in water pollution control.

- Provide a direct mechanism for continuing training of these and other personnel, conveying through this mechanism the results of technological advancements in the field.

- Expand the coverage of programs of other Federal agencies to channel their resources more effectively to the manpower training needs in water pollution control.

- Build the capacities of the states and two-year educational institutions to help provide an adequately trained corps of treatment plant operators and water pollution control technicians.

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In shaping its training programs, EPA has attempted to satisfy the unmet needs of the professionals and the operators and technicians who constitute the existing or potential manpower required to control water pollution. The EPA activities in water pollution control training are described and assessed in this section of the report.

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1. *EPA Training for Professionals*

EPA has long been a vital source of training support for professionals preparing for or engaging in the water pollution control effort. As authorized by the Federal Water Pollution Control Act of 1956 and its subsequent amendments, EPA has attempted over the years to respond to the entry, update, and upgrade training needs of these professionals through the following programs:

*Professional Training Grants:*¹ Awards to educational institutions for the establishment, expansion, and improvement of graduate level programs in water pollution control, including traineeships for participating students (principally masters degree candidates).

*Research Fellowships:*² Awards to individuals, primarily predoctoral students, for selected specialized research training in water pollution control.

*Technical Training:*³ Training in technical matters relating to the causes, prevention, and control of water pollution, including:

Direct training in specialized and advanced subjects, not generally available elsewhere.

Activities in support of technical training.

Additionally, EPA has recently established a program to facilitate the transfer of new technology from its developers to those who bear responsibility for operational applications.

Actions taken under these programs will be summarized and assessed in this subsection of the report; conclusions then will be drawn concerning their responsiveness in satisfying the needs for professional training left unmet by others.

a. *The Professional training grants program.*

(1) *Scope and Activities of the Professional Training Grants Program.* EPA is authorized⁴ to make grants for training projects

¹ Authorized and administered under subsections 5(a)(2) and 5(g)(3)(A) of the Act.

² Authorized and administered under subsections 5(a)(4) and 5(g)(3)(B) of the Act.

³ Authorized and administered under subsections 5(a)(5) and 5(g)(3)(C) of the Act.

⁴ Subsections 5(a)(2) and 5(g)(3)(a) of the Act.

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to, and to provide for the conduct of training by contract with, public and private agencies and institutions and individuals. The concentration of awards has been for graduate level training programs, considered for a number of years to be the area of greatest need. The Professional Training Grants Program has focused on the development of and the support of students in graduate level programs (primarily at the masters level) in areas relevant to water pollution control. A program for undergraduate training grants and scholarships oriented to the design, operation, and maintenance of treatment

plants was initiated recently and is reported in subsection III-C-2-c, below.

Professional training grants are designed to stimulate the development and improvement of graduate programs relating to water pollution control and to support, through traineeships, the graduate students participating in these programs. In this way, the programs produce a cadre of trained professionals prepared to contribute to water quality management through subsequent positions in teaching, research, consulting, or direct operation in staff capacities in the public or private sectors.

Institutions are encouraged to develop specialized and interdisciplinary training programs in order to produce the following kinds of professionals:

The environmental engineer who is qualified to work in the fields of construction, design, planning, or maintenance of water pollution treatment plants.

The biologist who is qualified to provide the data needed in the maintenance of approved water quality standards.

The chemist and the chemical engineer who can improve and devise processes for the more economical treatment of pollutants.

The lawyer, the economist, and the social scientist who will contribute to the efficient management and planning of water pollution control efforts.

As a general rule, grants are awarded to initiate new and needed programs or to support the expansion of a well-developed program where expansion is warranted on the basis of known major national needs. The grants are used to provide stipends and allowances for full-time preparation for a graduate or postgraduate degree, as well as to expand and improve staff, facilities, and equipment where the training programs are offered.

Grants are awarded annually for one year at a time as part of a training project. The planned project duration is limited to five years and may be renewed subject to application and review, as with the initial application.

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All grant awards are based on the following criteria:

Mission orientation of program and potential number and orientation of graduates.

Response to EPA needs and objectives and to overall national manpower requirements.

Scientific and technical excellence of proposed training program.

Status of other federally supported institutional programs.

Probable effectiveness of proposed program.

Extent of program need in geographic area.

Adequacy of staff and facilities.

Competency of staff to teach and conduct research in water pollution control areas.

Extent of innovation in approaches to curricula development and teaching methods.

Budget justification for requests.

Contribution of the institution to facilities and general support of the proposed program.

To ensure that programs will continue to respond to the latest trends and priorities in water pollution control, EPA awarded a grant in FY 1971 to the American Association of Professors in Sanitary Engineering (AAPSE) to help develop revised criteria and guidelines for professional training programs.

An annual review of all projects is made by the EPA Office of Water Programs (EPA/OWP) staff to determine program effectiveness in meeting project objectives. Review of proposed and existing programs is performed jointly by EPA/OWP staff and outside consultants (academicians and research personnel well-known and respected in the field, selected on the basis of their professional and academic standing). This approach has injected new ideas and ensured objectivity in the review process. As part of the review of existing programs, project sites have been visited periodically (approximately every three years) to determine overall effectiveness.

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Traineeships¹ supported by Professional Training Grants during FY 1970 to FY 1972 are as follows:

Academic year	Number awarded	Amount awarded
1970-71	788	\$3,781,756
1971-72	932	4,562,682

The grants were awarded to institutions and agencies which have ongoing programs in water pollution control and which have been consistently producing graduates to satisfy manpower and training needs in the water pollution control field. Exhibit IV-3 provides a summary of these awards for FY 1970 and FY 1971 by State.²

Under these grants, training was provided in the following disciplines:

Environmental Engineering.

Sanitary Engineering.

Environmental Chemical Engineering.

Environmental Systems Engineering.
 Agricultural and Environmental Engineering.
 Environmental Mining Engineering.
 Nuclear Environmental Engineering.
 Soils Environmental Engineering.
 Environmental Biology.
 Limnology and Aquatic Biology.
 Estuarine Biological, Physical and Chemical Oceanology.
 Water Chemistry.
 Interdisciplinary Environmental Programs.
 Environmental Economics.

EPA has encouraged the institutions receiving grants not only to develop water pollution control courses within multidisciplinary curricula, but also to consider total environmental needs which may cross

¹ Traineeships represent the number of trainee-year stipends (that is, full-time, year-long trainee positions). Given a trainee appointment covering an academic year of approximately nine months, the number of students supported generally exceeds the number of traineeships by approximately 30 percent.

² A complete listing of these awards by State, institution within the State, and amount awarded appears in the EPA publications, *Water Quality Control Training Grants, 1970 and 1971 Grant Awards*.

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EXHIBIT IV-3.—SUMMARY OF PROFESSIONAL TRAINING GRANTS AWARDED DURING FY 1970 AND FY 1971 BY STATE

State	Number of institutions and agencies		Number of awards		Amount awarded	
	FY 1970	FY 1971	FY 1970	FY 1971	FY 1970	FY 1971
Alabama	2	2	2	2	\$60,787	\$103,729
Arizona	1	1	1	1	25,763	46,513
Arkansas	1	1	1	1	44,666	54,861
California	3	5	4	6	213,768	380,086
Colorado	2	2	2	2	109,126	116,621
Connecticut	1	1	1	1	27,974	44,264
District of Columbia	1	1	1	1	43,606	33,236
Florida	1	1	1	1	47,278	106,962
Georgia	1	1	1	1	47,944	37,653
Hawaii	1	1	1	1	27,139	33,157
Illinois	3	4	3	4	156,465	245,041
Indiana	2	2	2	2	111,076	113,363
Iowa	2	2	2	2	81,211	99,204
Kansas	1	1	1	1	37,187	41,368
Kentucky	1	1	1	1	6,447	47,249
Louisiana	1	1	1	1	38,076	38,597
Maine	1	1	1	1	25,602	36,036
Maryland	1	2	1	2	52,782	105,118
Massachusetts	4	5	5	6	218,161	317,325
Michigan	3	3	3	2	264,907	83,415
Minnesota	1	1	2	2	20,834	32,831
Mississippi	1	1	1	1	34,863	44,150
Missouri	2	2	2	1	39,748	99,628
Montana	1	1	1	1	69,582	60,339
Nebraska	1	1	1	1	42,426	40,608
New Jersey	1	2	1	2	47,737	97,372

EXHIBIT IV-3.—SUMMARY OF PROFESSIONAL TRAINING GRANTS AWARDED DURING FY 1970
AND FY 1971 BY STATE—Continued

State	Number of institutions and agencies		Number of awards		Amount awarded	
	FY 1970	FY 1971	FY 1970	FY 1971	FY 1970	FY 1971
New Mexico	1	1	1	1	\$3,623	\$43,152
New York	4	6	6	8	296,991	286,621
North Carolina	2	2	3	2	97,586	92,622
Ohio	3	4	3	4	100,493	223,719
Oklahoma	2	3	3	4	117,343	151,173
Oregon	1	1	4	2	94,531	86,592
Pennsylvania	3	3	3	3	79,178	127,847
Rhode Island	1	1	1	1	19,166	30,938
South Carolina	1	1	1	2	99,656	116,713
South Dakota	1	1	1	1	23,143	33,750
Tennessee	1	2	1	1	65,816	45,487
Texas	4	4	4	2	268,409	145,336
Utah	2	2	3	3	116,683	138,878
Virginia	1	1	1	0	62,866	10,149
Washington	2	2	3	3	96,492	207,696
West Virginia	1	1	1	1	16,687	28,475
Wisconsin	2	2	6	6	327,938	334,808
Total	72	83	88	91	3,781,756	4,562,682

Number of active professional training grants		
	FY 1970	FY 1971
States	43	43
Institutions and Agencies ..	72	82
Grants	89	103

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and combine a number of traditional disciplines. In addition, it encourages them to propose programs in areas of particular local concern; for example, in FY 1971 EPA awarded a grant for development of a program on coastal and estuarine pollution. Similar programs are expected to be introduced in other institutions in the future.

In academic year 1970-1971 (FY 1970 funds), 1,028 individuals received support from professional training grants; in addition, over 2,000 other students took courses that were developed under funding provided by these grants. Renewed and continued Professional Training Grants in the same year supported the participation of 878 trainees, an increase of 19 percent over FY 1969. This increase involved only a 13 percent increase in the amount of funds programmed. This relatively inexpensive increase in trainee participation was achieved largely because the largest portion of investment in faculty, equipment, and curriculum development had been met in previous years.

In FY 1970, 12 new professional training grants were awarded, 72 awards were continuations of grants originally awarded within the previous four years, and four were renewals of programs initiated

five or more years previously. It is within this latter group that the economy previously mentioned can most often be obtained—increasing the number of trainees with a less than proportional increase in cost.

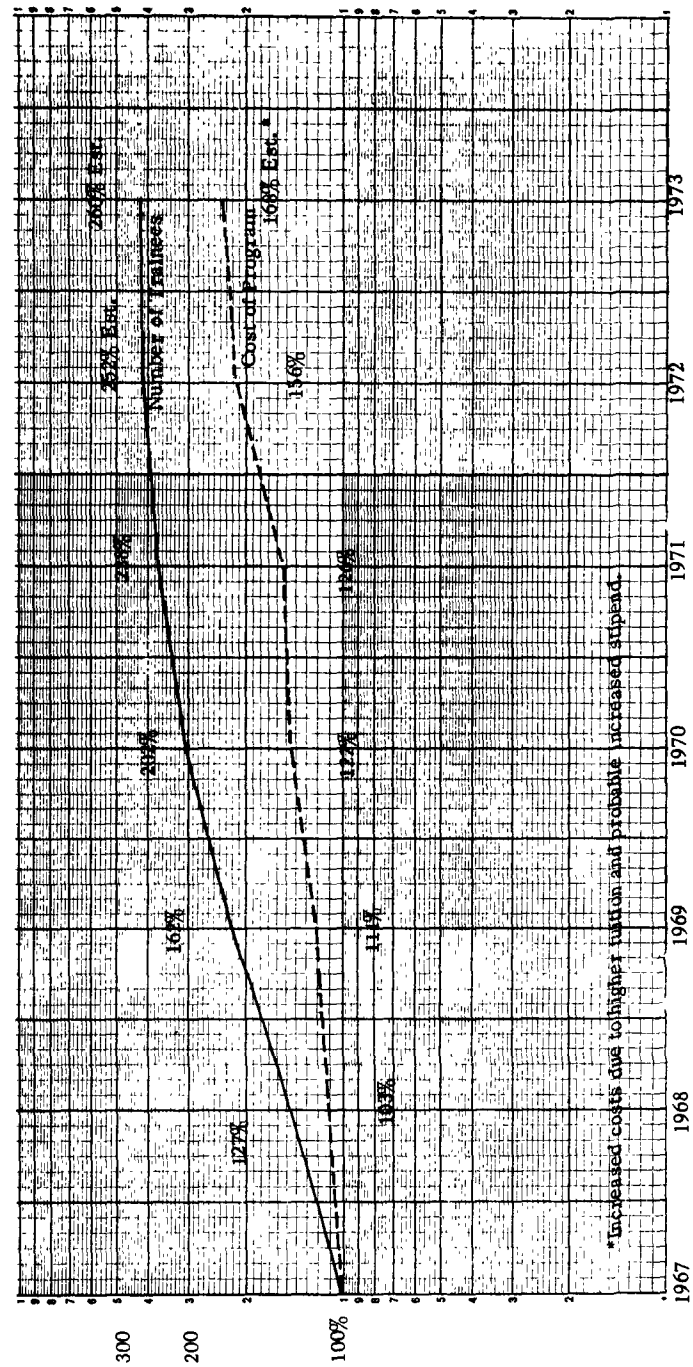
In academic year 1971–1972 (FY 1971 funds), 91 professional training grants were continued, renewed, or initiated, with emphasis placed on trainee support. These are expected to support a total of 1,051 trainees as compared to 1,028 trainees in FY 1970.

(2) *Assessment of the Professional Training Grants Program.* The overall effectiveness of the EPA Professional Training Grants Program can be measured by the economies it has produced. The experience of EPA Professional Training Grants Program directors, as well as on-site observation of virtually all of the 103 programs supported at 83 institutions through FY 1971, indicates that initial assistance in faculty support, equipment, acquisition, facilities adaptation, and similar expenditures are essential to provide the base for a new productive training program. The increase in trainee participation has been achieved because the largest part of the investment in faculty, equipment, and curriculum development costs have been met in previous years. (Over 79 percent of the EPA water quality programs are five years old or older.) Expenditures for non-student support over the last six years have been gradually reduced, and presently well over half of the EPA-supported programs spend less than 20 percent on non-student-support items.

Exhibit IV-4 compares the rate of EPA growth of expenditures for program costs with the corresponding rate of growth in number of trainees supported and projected for the six-year period from 1967 through 1972. It demonstrates vividly the multiplier effect resulting from the

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EXHIBIT IV-4
COMPARISON OF THE RATE OF GROWTH OF PROFESSIONAL TRAINING
GRANT PROGRAM COSTS WITH THE RATE OF GROWTH OF NUMBER
OF TRAINEES SUPPORTED (1967-1973)*



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initial investment and maturation of the supported programs. A more comprehensive view of professional training grant activities over the last decade appears in Exhibit IV-5.

As a result of this buildup of training capability and the maturation of the EPA-financed Professional Training Grant, it now costs approximately 50 percent what it cost in the early 1960's to train a water quality professional. Further, a significant number of students not requiring outside support have been attracted to the field.

Another measure of program effectiveness is the number of graduates who seek and obtain jobs in water pollution control. Less than 3 percent of the manpower trained under these grants have left the field of water quality management. The following table illustrates the broad range of water pollution control sectors entered by 869 graduate trainees whose present position is known:

Sector of employment	Graduate trainees	
	Percent	Number
Teaching/research	19	166
Private industry	17	150
Consulting engineering	27	232
Local government	5	42
State government	13	112
Federal government	19	167
TOTAL	100	869

A detailed breakdown of job designations of trainees for FY 1963 through FY 1970 appears in Exhibit IV-6.

Finally, the EPA Professional Training Grants Program has primarily national, rather than statewide or even regional, implications. Almost three fifths of the programs draw more than half of their students from outside the State, and about one third draw more than half of their students from outside the region. In over 85 percent of the programs, more than half of the graduates find jobs outside the State, and in 50 percent of the programs the majority of graduates find jobs even outside the region.

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EXHIBIT IV-5.—PROFESSIONAL TRAINING GRANTS PROGRAM ACTIVITIES 1962-1973

Academic year	Number of traineeships authorized	Number of trainees appointed	Number of professional training grants	Number of states involved	Number of institutions involved	Amount awarded
1972-1973	¹ 1,015	(²)	(²)	(²)	(²)	¹ \$4,650,000
1971-1972	932	¹ 1,051	91	43	82	4,562,682
1970-1971	788	1,028	88	43	72	3,781,756
1969-1970	633	607	79	39	61	3,201,543
1968-1969	509	522	75	38	60	3,064,997
1967-1968	391	493	71	37	58	2,908,842
1966-1967	323	422	67	36	51	2,499,998
1965-1966	250	336	57	32	42	2,000,000
1964-1965	192	256	54	30	39	2,016,290
1963-1964	114	147	35	19	24	1,100,000
1962-1963	67	79	23	13	16	693,102

¹ Estimate² Not Available

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EXHIBIT IV-6.—JOB DESTINATION¹ OF EPA-SUPPORTED PROFESSIONAL TRAINEES
[Fiscal Year 1963—Fiscal Year 1970]

Sector	Total		60		13		3		1		4	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Local government	42	3	37	3.5	1	1	.....	.....	.....	.....	4	4
State government	112	8.1	88	8.3	8	4	.....	.....	.....	.....	12	13
Federal Government	167	12.1	133	12.5	20	11	3	8	1	20	11	11
Consulting engineering	232	16.8	220	20.7	2	1	2	5	.....	.....	8	8
Industry	150	10.9	129	12.1	8	5	5	13	.....	.....	8	8
Teaching/research university	166	12	103	9.7	38	21	8	20	2	40	15	16
Teaching in college	38	2.8	14	1.3	24	13	.....	.....	.....	.....	.....	.....
Teaching in secondary schools ..	11	.8	4	.4	5	3	.....	.....	.....	.....	2	2
Military service	149	10.8	121	11.4	11	6	3	8	1	20	13	14
Left field of water quality	36	2.6	30	2.8	5	3	.....	.....	.....	.....	1	1
Unknown	99	7.2	62	5.8	23	13	2	5	.....	.....	12	13
Further education	178	12.9	121	11.4	33	19	13	33	1	20	10	10
Total	1380	100.0	1062	99.9	178	100	39	100	5	100	96	100
Pipeline (supported as of 30 June 1970)	448	100	297	66.2	73	16.2	21	5	6	1.3	51	11.3
Grand total	1828	100	1359	74	251	14	60	3	11	1	147	8

¹ All known permanent positions are water-quality-oriented with the exceptions of "Left Field of Water Quality" and possibly three Local Government, seven State, 23 Federal, 11 Secondary School Teaching, and 10 Industry positions which may not be so oriented. Total 90 or 6.5 percent maximum, 2.6 percent minimum left the field, primarily to go into air pollution or solid waste jobs.

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b. The Research Fellowship Program

(1) *Scope and Activities of the Research Fellowship Program.* EPA is also authorized¹ to establish and maintain research fellowships. These fellowships are provided primarily to increase the number and competence of scientists and engineers qualified to conduct independent research and advanced practice in water pollution control problems, in conjunction with teaching at the graduate professional level. The awards, which are nationally competitive, are made primarily to candidates for the doctoral degree in the engineering, physical sciences, biological sciences, or socioeconomic disciplines. (About 75 percent of the research fellows normally go into teaching or research.)

Fellowship awards are based on the following criteria:

Purpose of the study and objectives to be achieved; research method.

Relevance of training background to water pollution control.

Academic standing.

Credentials of the institution and sponsor under which the study is to be performed.

Applications for this program are reviewed with the objective of selecting the most promising students. The stringency with which applications are reviewed is reflected in the fact that, in recent review sessions, only about one third of those applications submitted were considered acceptable by EPA.

In both FY 1970 and FY 1971, the EPA Research Fellowship Program was funded for \$600,000. In FY 1970, it provided 105 fellowships at 51 institutions and agencies in 29 states and in four foreign countries; in FY 1971, it provided 108 fellowships at 58 institutions and agencies in 27 states and six foreign countries. Exhibit IV-7 provides a summary of these awards, by state.² A view of research fellowship activities over the last decade appears in Exhibit IV-8.

Expectations for FY 1972 are that 44 to 55 new fellowships will be awarded, 45 to 60 will be renewed, and 50 to 60 will be continued.

¹ Subsections 5(a)(4) and 5(g)(3)(B) of the act.

² A complete listing of these awards by State, institution within the State, and amount awarded appears in the EPA publications, *Water Quality Control Training Grants, 1970 and 1971 Grant Awards*.

EXHIBIT IV-7.—SUMMARY OF RESEARCH FELLOWSHIPS AWARDED DURING FISCAL YEAR 1970
AND FISCAL YEAR 1971, BY STATE

State	Number of institutions and agencies		Number of awards		Amount awarded	
	Fiscal year 1970	Fiscal year 1971	Fiscal year 1970	Fiscal year 1971	Fiscal year 1970	Fiscal year 1971
Alabama						
Arizona		1		1		\$6,600
Arkansas						
California	2	4	5	9	\$27,257	52,412
Colorado	2	2	2	3	11,400	12,440
Connecticut						
District of Columbia						
Florida	1	1	2	3	12,600	17,000
Georgia						
Hawaii						
Idaho	1		(¹)		(¹)	
Illinois	2	2	6	3	35,800	6,433
Indiana	3	3	3	6	16,600	30,100
Iowa	2	2	4	4	29,086	22,067
Kansas						
Kentucky						
Louisiana	1				(¹)	
Maine						
Maryland		1		1		5,100
Massachusetts	4	4	5	3	26,564	24,355
Michigan	4	2	12	8	63,911	39,108
Minnesota	1	1	1	2	5,100	10,400
Mississippi						
Missouri	1	2	3	5	19,134	24,250
Montana	1	1	3	3	17,000	18,200
Nebraska						
New Hampshire	1	1	2	1	12,816	5,367
New Jersey	1	1	6	2	32,053	8,000
New Mexico	1					
New York	4	5	9	14	40,437	66,743
North Carolina	2	2	2	3	16,150	18,124
Ohio	1					
Oklahoma	2	2	1	2	7,100	12,400
Oregon	1	1	1	2	5,889	10,400
Pennsylvania	1	4	8	5	41,886	24,350
Rhode Island	1	1	1	2	5,600	11,768
South Carolina	1	1	1	3	6,660	17,800
South Dakota						
Tennessee						
Texas	2	2	5	5	29,800	36,945
Utah	2	2	4	3	21,400	19,467
Virginia	1	1	1	1	5,100	5,300
Washington	3	2	3	2	20,162	14,100
West Virginia						
Wisconsin	2	1	12	8	60,515	51,073
Foreign	4	6	3	4	29,980	29,698
Total	51	58	105	108	600,000	600,000

¹ Continued with no additional funds.

NUMBER OF ACTIVE RESEARCH FELLOWSHIPS

	Fiscal year 1970	Fiscal year 1971
States	29	27
Institutions and agencies	51	58
Fellowships	149	161

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EXHIBIT IV-8.—RESEARCH FELLOWSHIP PROGRAM ACTIVITIES 1962-1973

Academic year	New research fellowships authorized	Total research fellowships awarded	Number of active fellows	Number of States involved	Number of institutions involved	Funds awarded
1972-73	¹ 50	¹ 105	¹ 155	¹ 28	¹ 56	¹ \$600,000
1971-72	46	108	161	27	58	600,000
1970-71	60	105	149	29	51	600,000
1969-70	46	91	168	29	51	592,094
1968-69	53	113	155	28	48	632,991
1967-68	47	103	147	24	46	622,411
1966-67	39	113	115	29	55	709,999
1965-66	48	101	145	28	51	616,715
1964-65	48	75	102	24	38	472,096
1963-64	40	45	64	25	37	269,019
1962-63	25	25	25	16	18	97,938

¹ Estimated

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(2) *Assessment of the Research Fellowship Program.* Overall effectiveness of the Research Fellowship Program is reflected by its function as the primary source of instructors for university training of professionals and the primary mechanism for building the capacity for research and training for professionals.

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c. The Direct Technical Training Program

(1) *Scope and Activities of the Direct Technical Training Program.* In addition to its other programs, EPA is authorized ¹ to "provide training in technical matters relating to the causes, prevention, and control of water pollution to personnel of public agencies and other persons with suitable qualifications." Under this authority, EPA provides its own program of direct training and related supportive activities to supplement the technical activities of others.

The EPA Direct Technical Training Program is directed to key Federal, State, local, and private personnel who hold responsibility for evaluation, prevention, abatement, and control of water pollution. Its purpose is fourfold:

To provide a continuing, comprehensive program of specialized and advanced technical training generally unavailable elsewhere.

To research and develop instructional technology, and to provide an instructor development program for individuals responsible for and/or conducting environment training or related activities.

To provide, on request, instructors and/or training materials in support of the training programs of other Federal, State, and local agencies.

To develop new training delivery methods, curricula, and materials, such as for use in correspondence courses.

Most direct training consists of short-term seminars, workshops, and courses of one- to two-weeks' duration. These courses are conducted by a highly trained and experienced staff of EPA professionals² at four regional centers and one national training facility:

Robert S. Kerr Water Research Center; Ada, Oklahoma.
Southeast Water Laboratory; Athens, Georgia.
National Training Center; Cincinnati, Ohio.
Pacific Northwest Water Laboratory; Corvallis, Oregon.
Edison Water Quality Laboratory; Edison, New Jersey.

¹ Subsections 5(a)(5) and 5(g)(3)(C) of the Act.

² Some instructors are drawn from elsewhere, including universities.

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A limited number are also given in field locations by special agreement with EPA.

The training programs are primarily oriented to professionals, although they are also available to subprofessionals in the water pollution control field. Specific training objectives include:

Broadening or improving the professional skills of experienced personnel.

Providing specialized and basic skills for professional and technical personnel recruited into water pollution control from other fields.

Assuming rapid application of new research findings in the field of water pollution control.

At present, a major problem in fully achieving the designed efficiency and effectiveness of existing pollution control facilities is that many of the operating personnel are underskilled and undertrained. Many of the short courses conducted under the Direct Technical Training Program concentrate on upgrading the skill levels of these employees, thus improving the operations of present abatement systems.

The courses given provide either overview summaries of the concepts, science, and techniques for abating and preventing pollution, or detailed reviews of new technological developments, operational methods, and research findings. They also address specific practical features of wastewater treatment design and operation, water quality evaluation in field and laboratory, and technical and administrative aspects of water quality management and water pollution control.

In FY 1971 the OWP conducted 37 scheduled short-course training programs. Additionally, it provided 22 special, unscheduled courses or workshops to satisfy specific training requirements of local, State, or Federal agencies. The total number of persons trained between April 1970 and September 1971 is shown in Exhibit IV-9 by water pollution control sector, occupation, and training site. The percent-

age of persons trained between FY 1969 and FY 1971 is shown in Exhibit IV-10 by water pollution control sector, educational level, and occupation.

In 1972, EPA plans to expand its Direct Technical Training Program in water pollution control in three specific areas: ¹

¹ Courses to be presented in 1972 are listed in the catalog, *Education and Training Programs*, EPA, OWP, July 1971-June 1972.

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EXHIBIT IV-9.—NUMBER OF PERSONS TRAINED UNDER EPA DIRECT TECHNICAL TRAINING PROGRAM,
BY WPC SECTOR AND OCCUPATION
[April 1970-September 1971]

	EPA training facility					
	Cinn.	Ada	Athens	Corvallis	Edison	Total
1. Number by WPC sector:						
EPA	228	6	44	33	31	342
D. Defense	80	8	10	41	43	182
Other Federal	87	8	63	237	48	443
State	157	48	92	108	33	438
Local	114	2	28	81	17	242
Foreign government	43	2	0	11	5	61
University faculty	40	2	12	33	3	90
University student	11	0	5	24	2	42
Industry	141	4	10	24	14	193
Consultant	39	0	6	6	6	57
Regional agency	11	0	0	4	4	19
Other	16	1	2	8	0	27
Total	967	81	272	610	206	2,136
2. Number by occupation:						
Administrator	34	9	13	16	55	127
Biologist	86	18	52	85	14	255
Chemist	154	7	43	42	20	266
Conservationist	1	1	0	9	0	11
Educator	22	1	1	11	2	37
Engineer	374	22	88	157	67	681
Geologist	2	5	11	8	2	28
Microbiologist	20	3	0	22	1	46
Oceanographer	2	0	2	4	2	10
Pharmacist	0	0	0	1	0	1
Sanitarian	17	1	9	27	7	61
Statistician	5	0	1	1	1	8
Technician	79	6	9	61	13	168
Treatment plant operator	38	0	9	60	0	107
Other	160	8	34	106	22	330
Total	967	81	272	610	206	2,136

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EXHIBIT IV-10.—PERCENTAGE OF PERSONS TRAINED UNDER EPA DIRECT TECHNICAL TRAINING PROGRAM, BY WPC SECTOR, EDUCATIONAL LEVEL, AND OCCUPATION
[Fiscal year 1969–Fiscal year 1971]

	Fiscal year 1969	Fiscal year 1970	Fiscal year 1971
Total students	1,297	1,480	1,630
	Percent	Percent	Percent
1. WPC sector:			
Federal	48	40	47
State-local	32	36	32
Educational Institutions	4	7	8
Industry-consultants	11	9	11
Foreign	4	4	7
Others	1	4	2
2. Educational level:			
Less than college	10	8	11
College, nongraduate	10	10	11
College, graduate (B.S., B.A.)	51	50	49
Masters	23	26	24
Ph.D.	5	5	5
3. Occupation:			
Engineer	38	32	30
Biologist-microbiologist	16	17	14
Chemist	14	17	12
Technician	8	8	8
Treatment plant operator	8	4	7
Administrator	4	4	6
Sanitarian	3	8	3
Other	9	10	20

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Development of self-sufficient training facilities, within the five training centers, to provide learner-centered instruction. Training facilities will ultimately contain 20 to 30 individual booths, each with its own audiovisual equipment, manuals, workbooks, programmed teaching slides, tapes, and filmstrips.

Formation of mobile training teams to provide training courses to reach small, isolated treatment plants nationwide.

Initiation of a correspondence training program. The development of material for this program will complement the materials for learner-centered training and will provide a wide variety of subject matter for individual study.

Additionally, the number of short courses will be expanded, and courses will be offered in regions that lack a permanent training facility. Federal personnel who will be working with programs related to State and local agency activities will form the single largest group of participants. State and local agency personnel will form the next largest group.

EPA estimates that the breakdown between classroom students and those participating in correspondence courses will be as follows:

Number of students	Fiscal year				
	1972	1973	1974	1975	1976
Classroom	2,000	2,330	2,800	2,820	3,000
Correspondence	370	450	520	530	600
Total	2,370	2,780	3,320	3,350	3,600

EPA also supports State training programs for professionals, technical, and operator personnel—on request—through technical consultation on the planning and development and dissemination of training courses. In addition, the agency arranges for guest appearances of instructors and provides instructional materials such as training manuals, course plans, and audiovisual training aids.

(2) *Assessment of the Direct Technical Training Program.* The ultimate measure of effectiveness of a training program, of course, is the degree of increased productivity of the trainees upon return to their work environment. This factor has been particularly difficult for EPA to determine because of staffing limitations for follow-up and evaluation activities.

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The effectiveness of the Direct Technical Training Program can be measured in other ways, however. First, the training provided through scheduled and unscheduled (special) workshops, seminars, and short-term courses has increased in volume during the last three years. This increase has been accomplished within restrictive funding and an actual reduction in available instructor man-hours. The increase in the number of courses presented and the number of students attending since 1969 is as follows:

Year	Courses	Students
1969	45	1,297
1970	57	1,560
1971	59	1,630

Second, there has been a steady increase in requests by local, State, and Federal agencies for professional assistance and instructional materials to satisfy their specific training needs. As indicated above, over 22 of these special courses were presented during FY 1971.

Third, several training innovations have been introduced. During 1971, EPA produced and pilot-tested a correspondence course on "Membrane Filter Techniques." It also prepared other innovative training materials (including course manuals, films, and videotapes) for use by its regional training facilities and by others outside EPA.

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d. *The Technology Transfer Program.*

(1) *Scope and Activities of the Technology Transfer Program.* Investment in research and development over the past few years has realized significant improvements in water pollution control technology. One of EPA's major concerns has been the development of programs which will permit maximum utilization of these advances. EPA recently launched a Technology Transfer Program intended to bridge the gap between research, development, and demonstration and implementation of results. Although its scope extends to all media and categorical programs, its orientation to water pollution control has been to make known the potential of both technology presently available and new technology as it is developed, in order to influence (i) prevention, detection, and clean-up techniques and (ii) design, installation, and operation of old and new wastewater treatment facilities. To date, the program has been primarily geared to transferring newly developed technology in the field of municipal water pollution control.

The primary objective of the municipal water pollution control technology transfer effort has been to have an immediate impact on the Construction Grants Program to prevent a major national investment in traditional wastewater treatment facilities that no longer offer the effectiveness, efficiency, or flexibility to meet present and future water quality standards and requirements. A longer term objective is to establish firmly the newly emerging technologies as practical and feasible alternatives, on a national basis, to be routinely considered and evaluated in the planning of wastewater treatment facilities. This objective encompasses the future inclusion of these technologies in the undergraduate and graduate curricula of our educational institutions.

To achieve its immediate primary objective, the Technology Transfer Program has been directed to the following target groups, listed in order of their importance:

Municipal, State, and private consulting design engineers.

Public administrative decision-makers with water pollution control policy responsibilities (such as mayors, councilmen, directors of public works, and city managers).

Conservation groups and the general public.

Each of these groups is discussed below.

(i) *Design Engineers.* Because the design engineers will put the new technology on the drawing boards, they have been identified as the priority target audience. The actual type of technology to be used in treatment facility design emanates in almost all instances from the municipality's

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consulting engineers. Review and acceptance of the design is normally a function of government staff engineers at both the municipal and State levels. All of these engineers must be effectively convinced that the new technologies are now practical and feasible—economically and technically—and ready for immediate full-scale use. Without acceptance by the engineering profession, the delay in bridging the gap between research and demonstration and full-scale implementation will stretch over many years.

(ii) *Public Decision-Makers.* Public decision-makers have traditionally relied almost completely on their consulting engineers for selection of appropriate wastewater treatment processes. They must now have knowledge as to the new treatment alternatives and economics that are rapidly becoming available. This knowledge will then become a key factor in evaluating recommendations by consulting engineers and overcoming the reluctance of both engineers and public officials to initiate new treatment technology. In many smaller municipalities, a generalized knowledge of available technology by public officials will be the only factor to overcome reluctance of smaller, less advanced consulting engineering firms to make a commitment to new technology.

(iii) *Conservation Groups and the General Public.* A non-technical knowledge of available technology by these groups allows more informed decisions by the public for bond issues, tax increases and other issues.

The transfer of technology is a complex process requiring close coordination and collaboration among all elements of the EPA/OWP organization, and particularly between the research and development and the manpower training and development functions. The technology must first be researched and extracted, then structured for dissemination to varying audiences with varying needs, and finally actually disseminated. The EPA Technology Transfer Program approaches the dissemination of technology in two ways:

Through “general awareness” training (that is, making known the fact that the technology is available) accomplished by means of briefings, seminars, newsletters, and so forth.

Through “detailed knowledge” training (for those who will need to apply the technology) accomplished by short-course training.

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So far, EPA has established mechanisms for providing general technological awareness training which are summarized below. It also intends to develop mechanisms for introducing detailed knowledge training into its Direct Technical Training Program and into the

curricula of existing programs outside EPA.

Major activities to date in the municipal wastewater treatment area include:

Presentation of two-day technical workshop/seminar programs for State, municipal, and private consulting engineers involved in the design of wastewater treatment facilities. Design seminars emphasizing the practical application of new technology (design criteria and parameters, capital and operating costs, results of research demonstrations, and experience and problems) were held between February and September 1971 in six EPA regions. Format of the program varied according to regional needs, determined in cooperation with the State water pollution control agencies. Future seminars are scheduled on a monthly basis, with each EPA region having at least one seminar before the end of 1971.

Development of design manuals for consulting engineers. All of the technical experience, data, and criteria evolving from the research and demonstration programs are being extracted from research reports and consolidated into design manuals which will enable the consulting engineer, for the first time, to receive complete and comprehensive design information. The lack of such publications in the past has been a major factor hindering widespread use of technology. Four design manuals (on phosphorous removal, granular carbon adsorption, upgrading existing treatment plants, and suspended solids removal) have been completed thus far and will be distributed nationally.

Monitoring of approximately 60 demonstration grant projects throughout the country for technology transfer applicability, timing, and methods.

Development of visual media presentations. Technical videotape presentations have been planned for use by EPA regions in introducing newly available technologies. One (on granular carbon adsorption) has been completed and three more are currently under way. In addition, a brief, nontechnical motion picture on phosphorous removal, intended for showing to public officials and conservation groups, is nearly completed, as is a motion picture exploiting an EPA phosphorous removal demonstration project at Richardson, Texas, to be used during both technical and semitechnical presentations. Another motion picture featuring a relocatable advanced waste treatment plant is under way.

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A technimated display booth describing the Technology Transfer Program is currently being used in various areas of the coun-

try. Additional booths on phosphorous removal, upgrading existing plants, and physical-chemical treatment have also been completed.

Many publications, in addition to the design manuals discussed above, are now available, under preparation, or being planned. These include technical brochures, newsletters, and a wide variety of technical publications prepared for the design seminars.

Plans are under way to conduct regional seminars for administrative decision-makers in water pollution control (such as city managers, public works directors, city councilmen, county commissioners, and heads of municipal and State water pollution control agencies). These workshops will be aimed at convincing responsible administrators that new technology is available for full-scale application and that it can be used effectively to meet water quality standards. As in the design seminars, these workshops will be slanted toward the specific technology needs of each region. EPA will also conduct a campaign to create public awareness through special programs directed toward students, conservation associations, civic groups, and so forth. Further, technical bulletins will be issued to supplement the *Federal Design Guidelines* published in October 1970.

(2) *Assessment of the Technology Transfer Program.* While results of this program can be assessed only over the long term, preliminary indications of program effectiveness are favorable. For example, the seminars for consulting engineers involved in the design of wastewater treatment facilities have been well received by the engineering community and by various professional organizations. EPA has received a flood of correspondence from consulting engineering firms, industries, and State and municipal engineers requesting technical information since the publication of several articles in technical journals briefly describing the Technology Transfer Program. Further, EPA technical personnel have made on-site visits in response to municipal and State requests for information on new technologies. These requests undoubtedly will increase as the program expands and becomes more widely known, thus establishing an effective dialogue between EPA and the engineering community.

The need for the Technology Transfer Program is obvious, and its value can be recognized as the initial mechanism for transferring the Federal Government's research investment to the practitioner. However, this program is only the first step in the transfer of new technologies. The technology presented to selected target groups provides the base for specific training courses designed to accommodate a more varied audience with needs for greater detail in both concepts and techniques.

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e. *Conclusions Regarding EPA Training for Professionals.* The Professional Training Grants and Research Fellowships Programs provide a nucleus of trained professional manpower in many disciplines at many degrees of professional competence to be applied to the control of water pollution. Over the years, these programs "... largely have been responsible for the reservoir of scientific and engineering manpower now available in the field of water pollution control."¹

Indeed, virtually all of the graduate-level programs related to water pollution control are supported by EPA. This support has been pointedly oriented to water pollution control, as distinct from the more general orientation of support from other Federal agencies. Programs have been developed, wherever possible, to deal with the practical problems of operations and management.

The Professional Training Grants Program is the primary source of funding for the preparation of professionals entering the field of water pollution control. Since most of the recipients under the Research Fellowship Program continue thereafter in research or teaching, EPA, in a sense, is making a capacity-building investment to produce future graduate professionals to enter the field of water pollution control.

The Direct Technical Training Program is essentially the only existing program that provides updating courses for professionals (and others) and thereby fills a major gap in professional training activities. It supplements the rather limited upgrade training activities of others. With the Technology Transfer Program, it provides a mechanism for transmitting rapidly the results and application of new research findings. EPA's supportive activities offer the potential to broaden the coverage of technical update and upgrade training and to improve the capacity of others to increase their penetration and coverage.

In sum, these programs help satisfy two distinct needs for professional training that are not otherwise satisfied by the other sectors: (i) primary financial support for entry training and (ii) direct programs and support for update and upgrade training. Nevertheless, as indicated in Part II, the quantitative needs exceed the capacity of EPA and others to respond.

¹ Robert A. Canham, Executive Secretary, Water Pollution Control Federation, Statement to the Subcommittee on Agriculture Environmental and Consumer Protection of the House Appropriations Committee, 5 May 1971.

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2. *EPA Training for Operators and Technicians*

As discussed in Section III-B, above, it is meaningful to distinguish among those elements of the work force who are in positions at the

lower levels of operations as opposed to those at the higher levels. This distinction is maintained in the following report on EPA training activities for operators and technicians.

For entry and upgrade training of lower level operators, EPA has collaborated with the Department of Labor (DOL) and the Department of Health, Education, and Welfare (HEW), in negotiating and administering *national MDTA-funded contracts* and has encouraged the states and localities to do likewise.

To overcome the limitations of these and other programs, to provide an alternate mechanism for the upgrading of existing operators and technicians, and to help build the capacity of others to do likewise, EPA initiated a *Pilot Program*¹ of projects designed for this purpose.

Finally, to respond to the undercapacity of educational institutions to prepare undergraduate students to enter the water pollution control field as technicians or upper level operators, EPA initiated an *Undergraduate Training Grants and Scholarship Program*.²

Each of these programs is designed to overcome the limitations of others whose training activities have not fully met the entry or upgrade training needs for water pollution control operators and technicians. The following report and assessment of EPA's activities will be followed by conclusions as to EPA's responsiveness to these unmet needs.

a. *National MDTA-Funded Contracts*. During the last two years, EPA established, in cooperation with the Departments of Labor and Health, Education, and Welfare, four training programs in waste treatment plant operations intended to fill the gap in lower level operator and technician training at the State and local levels. These programs, which are designed to bring trainees into the water quality field or to develop and increase their existing skills, include:

- Coupled On-the-Job Training;
- Institutional Training;
- Public Service Careers;
- Transition Training.

All four are supported by funds available under the Manpower Development and Training Act and are administered through Inter-agency Agreements by

¹ Authorized by subsection 5(g) (1) of the Act.

² Authorized by sections 16 and 18 of the Act.

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the EPA Office of Water Programs. Subcontracts are awarded by EPA to units of State government, municipalities, special wastewater treatment districts, vocational schools, community colleges, and universities. These programs, which are summarized in Exhibit IV-11 are discussed below.

Additionally, EPA works with State and local agencies to help them qualify for MDTA support, arranges training for instructors, provides teaching materials and curriculum development assistance, and otherwise assists State and local governments in getting training projects under way.

(1) *Coupled On-the-Job Training*

Scope and Activities of the EPA Coupled OJT Program. This program offers entry-level and upgrade operator training for the unemployed and underemployed in wastewater treatment plants through combined classroom and on-the-job training tailored to meet operational realities. Unlike traditional DOL programs, which provide training in a single facility, the national Coupled OJT Program established by EPA uses a twofold approach to training. Twenty-five percent of the subcontracts were awarded directly to large municipal wastewater treatment plants for the provision of centralized training; the balance were awarded to cities, community colleges, or councils of government to serve a number of treatment plants within the surrounding communities for the provision of decentralized training.

Under the decentralized approach, classroom instruction is given in one plant—during or between working hours, depending on the plant environment. Over-the-shoulder OJT is provided by the classroom instructor (who must have operational knowledge) in the plant where the trainee is employed. To eliminate gaps in coverage, two correspondence courses and audiotapes are available for self-study at home.

As noted in subsection III-B-3-c, similar MDTA-funded programs were managed by a number of State water pollution control agencies in FY 1971. The national program sought to assist those states without OJT programs and to supplement the existing programs, which were just under way and on a much smaller scale.

Initially, the program focused on improving the skills of operators already in place and, in turn, upgrading plant operations. Its objectives were to help trainees meet certification requirements and to reduce turnover and stabilize the existing work force. The first national contract (effective January 1969–October 1970) required that 10 percent of all trainees be new entrants and that the remainder be employed in a treatment plant prior to attending the program.

The length of the training course was 44 weeks and consisted of 330 hours of classroom instruction and at least 70 hours of over-the-

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shoulder OJT for each trainee. The first 100 hours of classroom instruction were normally devoted to basic courses in varied subjects such as mathematics, biology, and chemistry, which would help the

trainee during the following 230 hours of job-related courses and 70 hours of over-the-shoulder OJT.

The initial program was able to demonstrate that the MDTA funding mechanism works. Out of 1,055 trainees, 936 successfully completed the course. As a result of the program, the average trainee's salary increased from \$7,600 to \$8,600. The average increase was 13.2 percent, with the maximum individual trainee increase being 35.2 percent. Ninety-seven percent of all trainees in the program received some type of salary increase.

Of the 1,055 trainees enrolled, 81.2 percent successfully completed the course, with 93 percent of those passing the certification examination at the certification level for which they were permitted to test. Because a number of State certification agencies were persuaded to evaluate the course and to allow credit for completion, many trainees also received a higher level of certification and thus had a more advantageous position in the labor market. California and Iowa, for example, allowed the equivalent of one year's experience toward a higher level of certification. In addition, many trainees gained high school equivalency diplomas. The State of Washington granted one year of college equivalency, and the Metropolitan Sanitary District of Greater Chicago granted four years' experience credit for completion of the 44-week course.

The training was well received and highly praised by State and local officials and by plant operators, who indicated that motivation on the job was noticeably increased among operators who had participated in the training. At the start of the program, the employers were asked to rate the trainees' motivation. The results showed that only 15.3 percent were highly motivated at the beginning of the training. Upon completion of the training, the employers indicated that 65.4 percent were highly motivated.

The trainees themselves have given the program a high rating, according to a study recently completed by the University of Virginia and the Office of Water Programs under the auspices of EPA.¹ The study team surveyed operators at more than 80 percent of the ongoing training centers between June and December 1970. It reported that 97 percent of the respondents felt that the training was "worth it," 98 percent felt that the course should be continued, and 92 percent felt that they could improve or assist in improving the efficiency of their plants as a result of the training.

¹ *Sewage Treaters or Pollution Controllers?: Trainees View Their Jobs*, C. F. Longino, Jr., and C. S. Green III, University of Virginia; C. F. Kauffman, Environmental Protection Agency, Office of Water Programs, undated.

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Not only do the trainees rate EPA programs as excellent, but in

the annual State Program Plans, the State agencies speak very well of them. California, for example, stated, "There should be more and larger programs such as the one EPA has just sponsored here in California." The California subcontract was administered by the Water Quality Board for entry and up-grading of wastewater treatment plant operators.

Based on the success of the initial program, which cost \$1,031,775, the second national coupled OJT contract (effective November 1970–April 1972) was awarded to train 1,000 persons at a cost of \$1,260,000. The program under this contract represents a refinement of the initial training course in two major ways:

To increase the labor pool of wastewater treatment plant personnel 30 percent of the enrollees are new entrants (rather than the 10 percent originally required).

To be responsive to local conditions and needs, training time is optional. Duration of training varies from 24 weeks (two courses with 10 trainees each) to 48 weeks (one course with 20 trainees), but all trainees receive essentially the same number of hours of classroom instruction and OJT.

As of September 1971, 480 persons had completed training under the second contract, and 558 are presently enrolled.

Summaries of the first and second national coupled OJT contracts are included in Exhibit IV-11.

Assessment of the EPA Coupled OJT Program. As discussed previously, many graduates of the first national Coupled OJT Program received promotions, earned higher salaries, and passed certification examinations. In addition, many earned high school equivalency certificates and college credits. The second national program is still under way, but monitoring reports indicate an even higher level of success for the second program.

A major strength of the program has been its mobility in reaching out to the small wastewater treatment plant through decentralized OJT and its introduction of the classroom instructor into the treatment plant for program coordination and continuity. One problem encountered with this approach has been the resistance of some employers to the provision of OJT by the classroom instructor—an "outsider"—rather than by a representative of the plant. These employers have expressed concern that the OJT instructor's role would be one of a critic—without knowledge of or sensitivity to the particular plant environment. For the most part, this resistance has been overcome through demonstration of the instructors' capability to provide objective training and through their in-depth knowledge of wastewater treatment plant operations.

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EXHIBIT IV-11.—SUMMARY OF NATIONAL MDTA-FUNDED CONTRACTS

A. Summaries of First and Second National Coupled OJT Contracts

Resume of the First National Coupled OJT Contract

Date contract was signed	21 January 1969
Termination date	31 October 1970
Total Amount of Contract	\$1,031,775
DOL portion	645,640
HEW (Office of Education) portion	386,135
Total Number of Trainees starting program	1,055
Total Number of Trainees completing program	936
Training started in Butler, Pennsylvania, in May 1969	

Sponsor/Subcontractor	Trainees entered	Trainees completed	Training location
Pennsylvania (State)	78	70	Phila., Penn Hills, Bethel Park, Butler, and Meadville.
St. Louis MO (Metro Dist)	26	18	St. Louis.
Detroit, MI (Metro Dist)	39	36	Detroit.
Des Moines, IA (City)	23	23	Des Moines.
North Central Texas (C.O.G.)	52	52	Houston and Dallas.
Indianapolis, IN (Voc School)	20	15	Indianapolis.
South Bend, IN (Voc School)	22	18	South Bend.
Omaha, NB (City)	28	17	Omaha.
Lexington, KY (Univ. of KY)	42	40	Lexington.
Seattle, WA (City)	20	19	Seattle.
Lafayette, IN (Voc School)	42	25	Lafayette.
West Virginia (University)	49	41	Charleston and Athens.
Ft. Lauderdale, FL (City)	20	15	Ft. Lauderdale.
Southern Illinois University	24	22	Edwardsville, Ill.
Louisiana (State)	23	23	New Orleans.
California (State)	142	133	Sacramento, Santa Barbara, Santa Rosa, Orange County.
Northwest Arkansas (C.O.G.)	23	23	Fayetteville.
Maryland (State)	55	52	Charles County, Hagerstown.
Denver, CO (Metro Dist)	24	21	Denver.
Houston, TX (University)	38	30	Houston.
Chicago, IL (Metro Dist)	44	33	Chicago.
Portland, OR (City)	42	41	Portland.
Cleveland, OH (City)	28	26	Cleveland.
Gary, IN (Voc School)	24	21	Gary.
Ann Arbor, MI (Community College)	23	23	Ann Arbor.
New York, NY (City)	20	17	New York.
Rockland County, NY (Sewer Dist)	18	18	Rockland County.
Pensacola, FL (City)	28	28	Pensacola.
St. Louis, MO (City)	38	36	St. Louis.

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Resume of the Second National Coupled OJT Contract
 Effective date 2 November 1970
 Termination date 30 April 1972
 Total Amount of Contract \$1,260,000
 Total Number of Trainees under Contract 1,000

Sponsor/Subcontractor	No. of trainees	Starting date	Training location
Omaha, NB (City)	40	11/ 2/70	Omaha, NB.
Southern Illinois University	20	11/ 2/70	Edwardsville, IL.
California State Water Resources Control Board ..	100	11/ 2/70	Santa Barbara, Visalia, Santa Rosa, Orange Coast.
South Carolina Pollution Control Authority	20	7/ 1/71	Greenville, SC.
Hippevia Regional Institute	20	11/ 2/70	Lafayette, IN.
Charles County Community College	60	11/ 2/70	Cumberland, La Plata, Baltimore, MD.
North Central Texas C.O.G.	40	11/ 2/70	Arlington, TX.
Northwest Arkansas Regional Planning Commission	20	12/ 1/70	Fayetteville, AR.
Mallory Technical Institute	20	11/ 2/70	Indianapolis, IN.
University of Kentucky	60	2/18/71	Lexington, KY.
Metro. Planning Commission	20	12/ 7/70	Kansas City, MO.
Portland, OR (City)	40	11/ 9/70	Portland, OR.
North Dakota State Dept. of Health, Div. of Water Supply & Poll. Control.	40	1/ 4/71	Devils Lake, Minot, Bismarck, ND.
North Carolina State Dept. of Water & Air Resources.	40	6/ 1/71	
Utah Division of Health	20	1/ 4/71	Salt Lake City, UT.
Florida Division of Health	20	1/15/71	Ft. Walton Beach, Miami, FL.
Northwest Technical Institute	20	11/ 2/70	Gary, IN.
Louisiana Dept. of Health	20	3/15/71	New Orleans, LA.
West Virginia University	20	4/19/71	Parkersburg, WV.
St. Joseph Valley School	20	3/ 2/71	South Bend, IN.
DC Dept. of Sanitary Engineering	20	4/ 1/71	Washington, D.C.
New Mexico Health and Social Services Dept.	20	4/19/71	Las Cruces, Silver City, NM.
Metro. Sewer Board	20		St. Paul, MN.
Rockland County Sewer Dist. #1	20	3/ 3/71	New City, NY.
Mississippi Air & Water Pollution Control Commission.	20	3/15/71	Hattiesburg, MS.
Nevada Dept. of Health, Welfare and Rehabilitation	20	3/15/71	Carson City, NV.
Connecticut Department of Labor, Employment Service.	40	6/28/71	
Community College of Denver	20	6/ 1/71	Denver, CO.
Metro. Sewer District of Greater Chicago	40	6/ 1/71	Chicago, IL.
Dept. of Public Works, VI	20	5/24/71	Virgin Islands.
S.T.A.T.E., College of Engineering, Brookings, SD.	20		
State Dept. of Health, Helena, MT	20	7/12/71	Helena, MT.
PSI, Dept. of Education	20	7/ 1/71- 1/27/72 10/31/71- 4/30/72	Harrisburg, PA.
Miami-Dade Junior College	20-25	10/ 4/71	Miami, FL.
Junior College District of College, Newton and McDonald Cos.	20	7/19/71	Neosho, MO.

B. Summary of Institutional Training Program

Sponsor/Subcontractor	No. of trainees	Starting date	Training location
Charles County Community College	40	1/25/71	La Plata, MD.
Kirkwood Community College	60	2/ 1/71	Cedar Rapids, IA.
Atlanta Area Technical School	40	2/22/71	Atlanta, GA.
Delaware State College	40	2/ 1/71	Dover, DE.
Columbus Technical Institute	40	5/ 3/71	Columbus, OH.
Brevard Community College	40	6/21/71	Cocoa, FL.
Delgado Junior College	40	6/21/71	New Orleans, LA.
Penn Valley Community College	40	6/22/71	Kansas City, MO.
Miami Dade	20	9/ 7/71	Miami, FL.

C. Summary of Public Service Careers Program

Sponsor/Subcontractor	No. of trainees	Starting date	Training location
State Planning & Grants Div.	100 entry	12/70	Columbia, SC.
	100 upgrade		
North Central Texas Council of Governments ..	90 entry	11/70	Arlington, TX.
	71 upgrade		
Texas Water Quality Board	100 entry	1/71	Austin, TX.
	100 upgrade		
Public Works Comm.	25 entry	1/71	St. Thomas, VI.
	23 upgrade		
Pollution Abatement Div.	50 entry	1/71	Richmond, VA.
	50 upgrade		
Wisconsin Board of Vocational, Technical & Adult Education.	50 entry	1/71	Madison, WI.
	50 upgrade		

D. Summary of Transition Training Program

Sponsor/Subcontractor	No. of trainees	Starting date	Military Installation
Charles County Community College, La Plata, MD. .	70	11/ 9/70	Ft. Belvoir, VA.
Fayetteville Technical Institute, Fayetteville, NC. .	70	12/ 7/70	Ft. Bragg, NC.
El Paso Independent School District, El Paso, TX..	70	12/ 1/70	Ft. Bliss, TX.
Central Texas College, Killeen, TX.	70	1/18/71	Ft. Hood, TX.
Orange Coast Community College, Costa Mesa, CA.	30	1/11/71	El Toro Marine Base.
Contra Costa Community College District, Martinez, CA	40-48	9/ 7/71	Treasure Island, NAS, CA.
Sinclair Comm. College, Dayton OH.	40-48	9/ 7/71	Wright-Patterson AFB.
Clover Park Voc. Tech. Inst., Tacoma, WA.	30	7/12/71	McCord AFB.
San Diego Community College District, San Diego, CA	40-48	8/16/71	San Diego NAS.
Sumter Area Tech. Ed. Center, Sumter, CS.	40-48	7/26/71	Shaw AFB.

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(2) Institutional Training

Scope and Activities of the EPA Institutional Training Program.

Another potential source of manpower for wastewater treatment operation is provided through institutional training. This type of training is often referred to as "train now, employ later." Although a number of these programs (such as the Concentrated Employment Program) have been available to the unemployed, their orientation has been generalized and multioccupational. EPA/OWP administers a national institutional water pollution control training program with funds being provided by interagency agreement with DOL and HEW. This agreement was negotiated in FY 1971 to initiate nine pilot regional manpower training centers.

Traditionally, institutional training provides basic education in the classroom for the unemployed. A distinctive feature of the EPA program is that half of the instruction is practical "hands-on" training in a wastewater treatment plant, even though the trainee is not employed by the plant. The program is still in the first year of operation, and each local sponsor is showing improvement in the system of recruiting trainees, conducting courses, and providing employment opportunities for graduates.

The program is conducted by community colleges or vocational training schools and currently provides for a total enrollment of 360 persons. Each institution enrolls 40 trainees referred by the State Employment Service (20 during the first 22-week training cycle and the balance during the second 22-week cycle). Cooperative arrangements are effected between the training institutions and publicly owned local waste treatment facilities for the "hands-on" portion of the program.

Trainees receive 440 hours of classroom instruction covering basic education related to plant operations, operating theory and technique, and 440 hours of hands-on training in a treatment plant. State Employment Services are urged to recruit Vietnam veterans whenever possible. The training costs approximately \$734,000, plus an additional \$700,000 allotted by the DOL for training and subsistence allowances.

The second section of the program will enroll the balance of the trainees, who will complete training early in 1972. A summary of program activities is included in Exhibit IV-11.

Assessment of the EPA Institutional Training Program. The Institutional Training Programs are providing an excellent source of supply for trained personnel at the entry level. Trainees referred to the program through local Employment Service Offices meet MDTA eligibility guidelines, and a substantial number are Vietnam war veterans. All are seeking vocational training and career job opportunities.

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Although the program is not yet 50 percent complete, a review of the first graduating classes indicates a high degree of trainee completion and job placement. Of the 174 enrollees in the first phase of the program, 51 had completed training as of 15 September 1971, and 100 were still in training. While 45 of the 51 graduates have been referred to job opportunities, it is too early to determine the actual number accepting job offers; however, it is thought to be substantial.

There are numerous representative examples of the success of the program. Five trainees from the Virgin Islands completing the course

conducted by the Atlanta Area Technical School received immediate employment with the Department of Public Works in the Virgin Islands. All of the first section (16) from the Kirkwood Community College in Cedar Rapids, Iowa, passed the entry-level State Certification Examination. Job recruiters were contacting the trainees prior to their completion of the course, and all of the trainees were referred to jobs in Illinois, Iowa, and Minnesota. The City of Dubuque, Iowa, hired three graduates, one as a laboratory technician and two as plant operators.

EPA/OWP is now disseminating information about the availability of trained graduates from these programs so that personnel recruiters in need of such manpower can schedule visits to the campuses of sponsoring institutions. As information on the availability of such graduates reaches proper officials, it is expected that the demand will far exceed the current supply.

A second institutional training program is now being discussed with officials of DOL and HEW to continue and expand current efforts.

(3) *Public Service Careers (PSC)*

Scope and Activities of the EPA Public Service Careers Program. With the initiation of the Public Service Careers Program, and specifically its Plan "B," which is tailored to channel funds from Federal to State and local agencies, EPA negotiated an interagency agreement with DOL to train 922 disadvantaged persons newly or previously employed in wastewater treatment plants. Four states—Texas, Virginia, South Carolina, Wisconsin—and the Virgin Islands were awarded contracts to participate in the EPA program, which began in November 1970 and will cost \$1,700,000.

EPA has approached the PSC program with the overriding thought that men are poor because they are disadvantaged, and that if the disadvantage can be removed, they will be able to overcome poverty now and in the future. In keeping with this approach, employers participating in EPA's PSC program have been encouraged to develop vacancies for disadvantaged persons by moving presently employed persons upward and releasing their former jobs for new entry-level trainees. Almost all sponsoring agencies have subscribed to the theory of upward mobility for current employees and have secured agreement for employers to furnish vacancies for entry-level jobs.

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This approach has resulted in an initial disproportion of entry to upgrade training. Agreement between DOL and the EPA/OWP called for a total of 490 entry-level trainees and 432 upgrade trainees. As of 31 August 1971, total enrollment of the program was 876, of

whom 354 were at the entry level and 522 were being trained for upgrade positions.

In addition to providing training and supportive services, program sponsors are responsible for finding existing job vacancies within their jurisdictional limits and for cooperating with regional, county, and municipal governments in filling these positions.

A summary of PSC program activities is included in Exhibit IV-11.

Assessment of the EPA Public Service Careers Program. As previously discussed, the overall objective of the Public Service Careers Program is to provide, through training, permanent employment for disadvantaged persons in governmental agencies at all levels and to stimulate the upgrading of current employees.

EPA's PSC Program has been extremely successful. As of 31 August 1971, a total of 876 trainees had been enrolled. Although contract commitments call for a total of 922 trainees, it appears this will be exceeded by 40 percent upon contract termination date, 30 June 1972. Terminations have been at a minimum, with only 7 percent reported as of this date.

Great emphasis has been placed on recruiting young persons for training in entry-level positions. Currently approximately 51 percent of the entry-level candidates are under 30 years of age. Projects report a total of 130 black enrollees and 82 with Spanish surnames. There are 15 female enrollees, with 11 receiving upgrade training. Thirty-three of the entry-level enrollees are handicapped, and 246 have less than a high school education.

(4) Transition Training

Scope and Activities of the EPA Transition Training Program. Recognizing the potential manpower for water pollution control represented by returning servicemen who already have basic skills as a result of their military experience and training, EPA negotiated an interagency agreement with the Departments of HEW and Defense to establish a program of transition training in entry-level operator positions. The purpose of the Transition Training program is to provide veterans with marketable skills for employment in wastewater treatment plants through retraining before discharge from the service.

Over 500 servicemen will be trained in this program, which began during November 1970. Basic education and OJT are provided by 10 joint facilities (military institutions with or near wastewater treatment plants and nearby academic institutions). Duration of the course is determined

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by each service. Trainees at Army bases are given 240 hours of coupled OJT and those at Air, Navy, and Marine bases are given 480

to 640 hours. Total cost of the program—including the cost of instructors, supplies, equipment, program administration and supervision, and job location assistance—is \$470,807. EPA Transition Training Program activities are included as part of Exhibit IV-11.

In addition to managing the national contract for Transition Training, EPA performs several other related functions. First, it coordinates efforts to place successful trainees in water pollution control plant jobs upon their separation from military service. (About 70 percent of the servicemen who have already completed the Transition Training Program have gone directly into operator trainee jobs in wastewater treatment plants or into advanced water pollution control training programs.)

EPA also has a responsibility to provide job counseling for veterans with whom they come in contact or who contact EPA. As shown on the chart at the end of subsection III-B-3-c, several options are open to veterans for training in water pollution control. In the future, EPA intends to encourage veterans to further their training—either by enrolling in an Institutional Training Program or a junior or community college offering a one- and two-year curriculum in water and wastewater technology or by seeking employment in a treatment plant offering EPA- or State/local-sponsored coupled OJT—in order to qualify for higher level jobs.

Second, EPA—through direct contact with VA offices—encourages the Veterans Administration to channel veterans into water pollution control occupations and training programs. For example, it has distributed guidelines to VA State agencies which approve wastewater treatment plant operator training programs, recommending the following:

Option I: Enrollment in an EPA-sponsored operator training program if the trainee is within commuting distance of one of EPA's training projects.

Option II: Enrollment in a training project equivalent to the EPA-sponsored program, which may be sponsored by a State or local water pollution control agency, if the trainee is within commuting distance of the training project.

Option III: Enrollment in a correspondence course which could be administered by the State water pollution control agency and/or EPA's Manpower and Training regional and headquarters organizations if no training projects are available or accessible under Options I and II.

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Under Option III, basic education and operator theory training could be provided by a correspondence course manual for wastewater

plant operators prepared by Clemson University or Sacramento State University. On-the-job training in plant operating techniques could be provided in accordance with an OJT-apprentice-type training schedule prepared by EPA. The schedule covers a 13-month program for graduates of the Transition Training Program and an 18-month program for veterans who did not receive transition training. OJT instruction would be provided by an experienced, qualified waste treatment plant operator who would also coordinate and relate the correspondence course training with the on-the-job training.

Third, EPA encourages employers to develop in-house OJT programs for waste treatment plant operators and provides guidelines for curriculum and training materials.

Assessment of the EPA Transition Training Program. Of the 277 enrollees in programs to date, 108 are still in training. One hundred fifty-three have completed the program, with 145 given opportunities for employment. Eight are seeking additional training. Three graduates were provided job opportunities but decided to return to civilian employment in various jobs outside the field of pollution control.

Several trainees have excelled in their jobs, due to the high level of training they received under EPA Transition Programs. One trainee, a graduate of a 240-hour course at Fort Bliss, Texas, scored the highest grade among 50 applicants for a position in the El Paso Public Utilities System. Included in the 50 applicants were men with as much as two years' previous experience.

In addition to the high degree of satisfaction expressed by the trainee is the even greater appreciation of various employers throughout the United States, Puerto Rico, and Canada. Several employers have commented on the maturity, dependability, and competence of the trainees graduating from this program. The application of these highly trained personnel guarantees a superior level of performance in water pollution control activities.

(5) *Assessment of National MDTA-Funded Projects.* The four national operator training programs funded by DOL under MDTA have had a positive impact, demonstrating that the disadvantaged—the unemployed, the underemployed, and the minority groups—can be successfully trained for a variety of water pollution control jobs and that application of the career ladder concept can be highly effective in improving public service in this area. The establishment and implementation of these programs, however, has inevitably posed certain problems for EPA. First, given the funds for program development, it has been necessary to convince potential sponsors that such training will satisfy an unmet need and that it will be feasible. For example, can the disadvantaged be trained for entry-level operator jobs? Will employers—leery of the connotations of “dis-

advantaged”—resists programs for their training and

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employment? Experience with the programs thus far, particularly coupled OJT and Public Service Careers, has demonstrated to the State and local agencies both *need* and *feasibility*. Indeed, they have been vital in supplementing the independent and collective efforts of the states and localities to provide entry and upgrade training for lower level operators.

A second area of concern has been how to find and train instructors for the programs once they have a sponsor. In all cases, the emphasis has been on seeking out high-level operators who can be trained to be educators, rather than educators who must be trained in operational theory and technique. The advantages of such an approach are obvious: instructors with successful experience in the field are well-grounded in waste treatment plant operations and qualified to perform OJT, thus ensuring program continuity through coordination of basic education and theory with practical application.

Initially, EPA headquarters staff used selected portions of the Area Manpower Instructor Development System (AMIDS) to train instructors for the MDTA-funded operator training programs. Using the AMIDS package as a generalized base, the EPA staff subsequently developed its own tailored program, referred to as Phase I Instructor Training. The Phase I program essentially represents a refinement of AMIDS tailored to the water quality environment. It is now offered as the basic education course for instructor development under the EPA Technical Training Program.

Continuation of the four MDTA-funded operator training programs depends on annual funding by DOL and HEW. If program funding does not continue at existing or expanded levels through the mechanisms provided, then some other mechanism must be sought—either through a set-aside or an interagency agreement—to obtain the funds required by EPA. Without the assurance of continued and expanded funding, uncertainties will exist and planning for meeting future operator training needs will be hampered.

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b. *The Pilot Program.* Because the focus of MDTA has been on basic education and entry-level skills for the disadvantaged entering the wastewater treatment field and on skills improvement for the underemployed at the lower operator levels, certain training needs of operators and technicians remain unmet by the DOL programs. These needs include:

Alternative entry and upgrade programs for lower level operators who do not meet the eligibility requirements of or who are

not reached accessibly by the MDTA programs.

A comprehensive program for upgrading and updating the managerial and technological skills of technicians and higher level operators and to increase the capacity of others to do so. In addition, the MDTA programs do not address a number of peripheral concerns such as innovative techniques and approaches to operator training, advanced instructor training, and curriculum development. They also do not address the more immediate need for qualified technicians and higher level operators.¹

To provide a more comprehensive approach to training in wastewater treatment plant operations, subsection 5(g)(1) of the Act authorized EPA to develop:

“a pilot program, in cooperation with state and interstate agencies, municipalities, educational institutions, and other organizations and individuals of manpower development and training and retaining of persons in, or entering into, the field of operation and maintenance of treatment works and related activities.”

The Pilot Program is intended to supplement—not supplant—other manpower training programs such as those funded under MDTA. Its purpose is to demonstrate that with the use of innovative techniques and approaches, management training and advanced training in wastewater treatment operations will satisfy a need presently unmet at the State and local levels in order to accomplish these objectives:

Provide an adequate supply of trained personnel to operate and maintain existing and future wastewater treatment works and related activities.

Enhance substantially the proficiency of those engaged in such activities.

¹ Grants and Scholarship Programs, discussed subsequently, will provide benefits only over the long term, and funding for these programs has been limited.

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Using funds from the FY 1971 supplemental appropriation, EPA initiated three programs under the pilot program: (i) advanced instructor training, (ii) specialized training in advanced wastewater treatment, and (iii) grants for special State projects. The first two programs represent compelling national needs; the third represents the most compelling needs of individual states.

The total number of trainees to be supported under each project and the approximate cost (amount of grant) of each project is as follows:

Program	Total number of trainees	Total amount of grant
Advanced Instructor training	50	\$39,174
Specialized training in advanced wastewater treatment	190	183,114
Grants for special state projects	2,945	734,416
Total	3,185	956,704

Summary descriptions of each program appear in Appendix B.

(1) *Advanced Instructor Training.* Instructors of the basic operator training courses also required upgrade training in advanced teaching techniques to instruct these and higher level training programs. A pilot project was initiated to satisfy this compelling need.

This project, referred to as Phase II Instructor Training, provides advanced education techniques to operator training instructors who have already learned basic education skills. It represents a refinement of the basic Phase I training course currently offered under EPA's Technical Training Program. The course emphasizes motivation, sensitivity training, design of effective instructional techniques, and evaluation and utilization of learning resources.

A grant of \$39,174 was awarded to Drake University to develop and conduct the Phase II training, which began in June 1971. Between 40 and 50 instructors have enrolled in the course, and two sessions have been completed. Participation in the course provides the advantages of contact with professional educators, more sophisticated education skills, and the opportunity for both college credit and upgrading of instructor credentials.

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(2) *Specialized Training in Advanced Wastewater Treatment.* When the Pilot Program was authorized, few programs on advanced wastewater treatment operations were offered at the State and local levels. EPA awarded two grants under the Pilot Program for development of two advanced experimental and demonstration projects to provide intensive technical training in the operation of wastewater treatment processes for advanced waste treatment operators, treatment plant supervisory personnel, public works department personnel, and others with a need for such training. Both recipients of these grants, the Tennessee Department of Public Health and the Texas Engineering Experimental Station, were selected on the basis of the unique contribution they could make to the program. Both contractors have well-qualified staff personnel capable of conducting the programs. The total cost of the two advanced wastewater treatment programs, including trainee subsistence and travel, will be approximately \$183,000. Each of these programs is discussed briefly below.

Tennessee Program. The State of Tennessee is in an area currently moving from primary to secondary treatment, and the State Department of Public Health was in the process of establishing a training laboratory, usable for such courses, at the time the grant was awarded. The program is regional in concept and is designed to reach 60 trainees from states in the southeast region of the United States. Enrollees receive four weeks of classroom instruction, followed by on-site plant visits. Participants from the State of Tennessee will receive additional on-the-job training over a four-week period following the classroom phase of the program. The pilot program will be used to develop a blueprint for similar regional and State programs.

Texas Program. The Texas Engineering Experimental Station, with a large research and development investment, is in one of several states moving from secondary to tertiary treatment; it already had a training laboratory at the time of the grant award. The Texas program was regional in concept at inauguration but was designed to become national as it developed. The program will provide training in advanced wastewater treatment to 130 participants from several sections of the nation, especially for plant personnel from systems utilizing (or soon to utilize) advanced treatment processes. Courses will be conducted in several locations throughout the nation and at the Texas Experimental Station.

(3) *Grants for Special State Projects.* A wide range of operator training needs had been identified by State water pollution control and other public agencies across the country. Given the availability of funds under the Pilot Program, the states were asked to suggest innovative projects representing their most compelling needs. Each EPA region then selected at least one training project for development and implementation, based on the following criteria:

Replicability.

Geographic diversity.

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Potential for problem-solving.

Coverage (for example, management training for decision-makers, electrical and instrumentation courses, correspondence study programs, and so forth).

Final selection of projects for award was made by EPA/OWP headquarters staff, based on (i) regional recommendations, and (ii) the project's potential for filling a recognized void in training activity. Further, consideration was given to the overall potential of the projects to demonstrate comparative approaches to training.

Twenty-four grants were awarded to 18 states, one region (New England), and Puerto Rico for development of operator or operations-

related training and information programs. These projects cover the following major areas of need among the states:

(i) Management training for first-line supervisors to expand and upgrade administrative skills of persons involved in operation and maintenance of wastewater treatment facilities to improve overall plant efficiency and personnel performance.

(ii) Phosphorus removal training programs. These programs must assist in demonstrating feasible removal processes as states are now legislating for removal by the end of 1972.

(iii) Electrical and instrumentation courses for plant personnel to provide expertise in preventing plant shut-down as a result of minor electrical and instrumentation problems. In other words, preventive maintenance training in these critical areas.

(iv) General skill improvement training for higher level plant personnel (operators and technicians) that cannot be trained under U.S. Department of Labor programs.

(v) Information and orientation seminars for local officials and policy decision-makers to demonstrate their unique function in the solving of pollution problems in their own sectors.

(vi) Correspondence study programs to reach plant personnel in rural (and hard to reach) areas unable to participate in

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ongoing training programs. For this purpose, the Environmental Protection Agency has, through a grant with Sacramento State College, developed a correspondence field study program and is making it available (at no cost) to 2,000 enrollees.

Exhibit IV-12 provides the number of grants awarded for the development of programs to meet these needs.

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EXHIBIT IV-12.—NUMBER OF GRANTS AWARDED FOR SPECIAL STATE PROJECTS BY PROGRAM COVERAGE

Program coverage	Number of grants awarded
Training	
Skills improvement and upgrade of operator personnel	10
Proficiency improvement of operators and personnel engaged in operator-related activity	1
Training of entry-level personnel and existing operators; skills improvement of laboratory personnel	1
Training in laboratory techniques	1
Training in phosphorous removal techniques	1
Mobile laboratory for skills improvement of operators and personnel engaged in related activity	1
Field training unit for operator training	1
Training in planning and supervision of OJT, in-service and external training for operators and supervisors; training of instructors, teachers, and plant supervisors in the conduct of training courses; instruction for health department and other regulatory inspectors in conduct of operations and maintenance inspections	1
Supervisory training	1
Management training	2
Information-oriented seminars for State and local officials; training for regulatory personnel	1
Orientation seminars for local officials and citizens	1
Curricula and materials development	
Development and Implementation of curricula for water pollution control personnel	1
Development of standard operating procedures and technical training materials	1

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Each state conducts its own training programs or contracts for its performance. EPA provides technical assistance, particularly for developing curricula and training materials.

Approximately 2,945 persons will be trained under these programs, for a total cost of about \$734,416. Program development began during May 1971; training began during the first quarter of FY 1972.

(4) *Assessment of the Pilot Program.* It is too early to evaluate the Pilot Program, as projects were not initiated until the end of FY 1971. The EPA regional offices are presently developing criteria for assessment of each project, which will be monitored and reviewed monthly. There are early indications that requests for enrollment far exceed the funded capacity to provide training. The pilot projects presently supported by funds authorized under Sections 5(g)(1) represent only a small portion of the needs termed critical by the states.

The limited nature but significant potential of the program was recognized when it was initially proposed. Senator Muskie, in a statement to the Senate in October 1969 indicated:

The [Public Works] Committee recognizes that a great deal more than a pilot program will be required if Federal funds for sewage treatment plant construction are invested wisely, but it believes that experience with a pilot program would provide a sound base for expanded legislation in the near future.¹

The Pilot Program is an important step in encouraging, guiding,

and financially assisting the states to meet the substantial training needs generated by the accelerated wastewater treatment plant construction program. Because the states have not had, nor do they presently possess, the resources (funds, instructional staff, or training programs) to properly assume this responsibility, the Pilot Program represents the primary vehicle through which the states can build their capacities to help provide an adequately trained work force to protect and effectively utilize this investment.

Toward this objective, the Pilot Program has:

Established a mechanism to immediately initiate the training necessitated by the accelerated program.

Provided an initial framework upon which the states can build and for which they can eventually assume responsibility.

¹ *Congressional Record*, 7 October 1969, S. 12038.

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c. Technical Training Grants and Scholarships for Undergraduate Study.

(1) *Scope and Activities of the Undergraduate Technical Training Grants and Scholarships Program.* Entry training programs to prepare students for positions as technicians or higher level operators have been woefully inadequate. To help expand programs for preparation of students to enter positions relating to the design, operation, or maintenance of treatment plants and other related facilities, EPA initiated the Undergraduate Training Grants and Scholarship Program.

Section 16 of the Act authorizes the award of:

...grants to or contracts with institutions of higher education
...to assist them in planning, developing, strengthening, improving, or carrying out programs or projects for the preparation of undergraduate students to enter an occupation which involves the design, operation, and maintenance of treatment works and other facilities whose purpose is water quality control.

The objectives of this section are:

To plan, develop, or expand training programs at this level.

To train and retrain faculty.

To support innovative and experimental programs of cooperative education.

To develop and research teaching materials and to plan curriculum.

Section 18 authorizes the award of "scholarships for undergraduate study by persons who plan to enter an occupation involving the operation and maintenance of treatment works."

Although a limited appropriation has precluded initiation of the

scholarship program, two areas of training have been addressed under Section 16:

Training of qualified high school students at two-year institutions in the *operation and maintenance* of waste treatment and related facilities.

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Improvement of the training of junior and senior bachelor degree engineering students in the *design* of waste treatment facilities at four-year colleges.

Training to meet the first area will produce qualified entrants for senior operator and technician positions. This training compliments that performed under the Pilot Program (for skill improvement of currently employed operators and technicians) and MDTA training (entry and upgrade training for lower level operators). It is intended to fill the gap between lower level operator training and four- or five-year professional training, particularly at the technician and senior operator levels. Under this program, training grants have been awarded to technical schools, junior colleges, and similar institutions to develop and test new approaches to curricula development.

In the past, and even still in many jurisdictions (units of government), plant supervisors must have a B.S. degree. There is, however, a shortage of personnel with this qualification, particularly in medium-sized wastewater treatment plants where salaries may be too low to attract baccalaureate professionals. Further, often the job responsibilities of plant supervisors do not require the B.S. degree. The State of New York, for example, recently downgraded the educational requirements for certification of plant supervisors to a two-year Associate of Science degree.

In anticipation of other jurisdictions adopting similar requirements, EPA has used the funds appropriated under Sections 16 and 18 of the 1970 Water Quality Improvement Act to assist educational institutions and students involved in technician-oriented training programs. Both sections of the act are intended to alleviate a critical shortage of skilled engineering aides, scientific technicians, and senior treatment plant operators. Grants and contracts with two-year technical schools and community colleges will prepare high school graduates for supervisory or senior level operator or technician positions in wastewater treatment plants, advanced treatment systems, and regulatory agencies.

Sections 16 and 18 have not been fully implemented as a result of budgetary constraints. Although \$12 million was authorized for FY 1970 and \$25 million for FY 1971 and FY 1972, no funds were appropriated for 1970, only \$331,000 was appropriated for 1971, and \$346,000 for 1972.

In order to save a year in initiating its program of financial assistance, EPA in FY 1971 awarded Clemson University, Clemson, South Carolina, a grant of \$54,017 out of FY 1970 Professional Grant monies—originally scheduled for support of more advanced training. The purpose of the grant was twofold:

To help establish criteria for the selection of undergraduate institutions offering design, operation, and maintenance training.

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To develop curricula guidelines for two-year post-high-school wastewater technology training programs.

Clemson subsequently received a supplement of \$12,737 to develop criteria for the design of engineering curricula pertaining to undergraduate programs oriented to the design of wastewater treatment plants.

The \$331,000 appropriated for FY 1971 was used to award grants to seven institutions for further planning and design of the curriculum material and for initiating training programs and/or materials development. Award was based on capability to develop the undergraduate programs and on the availability of trainees to enroll in them.¹

Three of these institutions (Charles County Community College, Linn-Benton Community College, and the Greenville Technical Education Center) have completed development of program curricula based on the guidelines prepared by Clemson University and have opened their degree programs this fall. Curricula will vary among the institutions but will essentially cover wastewater treatment operations, including classroom theory and "hands-on" training in a nearby cooperating wastewater treatment plant, as well as algebra, chemistry, general biology, ecology, microbiology, hydrolics, practical physics, and several liberal arts courses. About 20 students will attend each program. Graduates will receive an Associate of Science degree and will be eligible—under voluntary or mandatory state certification programs—to be superintendents (plant chiefs) of medium-sized wastewater treatment plants.

(2) *Assessment of the Undergraduate Technical Training Grants and Scholarships Program.* It is too early to provide a meaningful assessment of effectiveness, as the undergraduate programs are just getting started.

As the shortage of manpower for water pollution control becomes more acute, the importance of senior-level entry training increases because of the entrant's ability to assume responsibilities previously reserved for the professional level. However, budgetary constraints will severely limit the number of undergraduates who will be trained

in FY 1972 in the design, operation, and maintenance of water treatment works and related facilities. With construction grants presently funded at \$2 billion annually (which may be increased to \$3 billion), and with a growing manpower requirement to service these facilities, as established in Part II, the monies for activities conducted under Section 16 and 18 must be increased.

¹ These awards are listed by State, institution within State, and amount awarded in the EPA publication, *Water Quality Control Training Grants, 1971 Grant Awards*.

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PART V.—CONCLUSIONS AND RECOMMENDATIONS

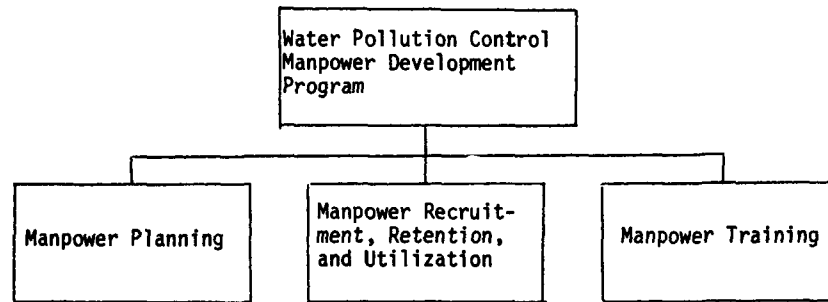
SUMMARY OF CONCLUSIONS

Acting pursuant to the Federal Water Pollution Control Act, EPA administers the Federal Water Pollution Control program. This program includes a broad spectrum of activities related to water pollution control that are conducted in partnership with the states and local governments, private organizations, and other Federal agencies. Generally, the Federal program provides that the states and their subdivisions have primary responsibility for conduct of water pollution control activities, while the Federal Government provides financial and technical assistance to support their efforts. Only when performance gaps are apparent will the Federal Government assume primary responsibility.

All of the program activities require the application of manpower for their accomplishment. Accordingly, one aspect of the Federal program is activities designed to ensure that manpower in adequate numbers and with requisite skills will be available at the times and places needed, that available manpower are effectively and efficiently utilized, and that the members of the labor force find personal satisfaction from their jobs.

This report has focused on these manpower activities. In doing so it has followed the EPA concept of a water pollution control

manpower development program with three interdependent units:



The report responds to the requirement of subsection 5(g) (4) of the Federal Water Pollution Control Act requiring a report to the Congress on manpower and training actions taken under subsection 5(g) and comments

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on the effectiveness of other training programs in the field. It also provides estimates of future manpower and training needs.

In summary, Part II of this report points out that EPA has conceptualized a method for forecasting the supply and demand for water pollution control manpower. This method is one component of the overall manpower planning program. As conceptualized, the planning program is intergovernmental and interagency, with the states having the pivotal role. It includes the needs of both private and public employers. The system forecasts manpower and enters update and upgrade training needs by occupation, labor market location, and time frame. Under the other planning program component, action plans are then developed at all levels to fulfill these needs.

EPA has initiated the development of the planning tools and base data necessary to operate the program. The program is not yet fully operational but is approaching the stage of field installation. This necessitates providing State and local personnel with substantial training and technical assistance in its application, since presently the State and local governments have limited capacities for manpower planning. The report concludes that EPA should complete implementation of the planning program since its outputs are necessary as a basis for rational manpower and training actions in this sprawling and institutionally complex industry.

The report goes on to set forth an interim forecast of manpower and training needs through 1976, which has been specially developed for this report pending full implementation of the manpower planning system. While this interim forecast is subject to some questions

because of data qualifications, EPA believes it is a good indicator of the order of magnitude of the manpower and training needs. In summary, this forecast is presented in Exhibit V-1. The anticipated rapid growth of the water pollution control work force is shown in Exhibit V-2. The forecasted training requirements are set forth in Exhibit V-3.

The largest increase indicated by the forecast is for more operators. The increase projected in the number of waste treatment plants coupled with the increased sophistication of treatment processes are expected to result in an increase in operator training requirements as well. EPA observations and a report by the General Accounting Office (GAO) indicate that the effectiveness and efficiency of existing treatment plants is already impaired by understaffing and under-training of operators.

The report further concludes that there will be a need for more sanitary engineers, primarily because of the increasing technological sophistication of the water pollution control process. Further, it concludes that specialized water pollution control training is necessary in substantial quantity for other professionals entering the field. Also there is a substantial demand for update training for all professionals.

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EXHIBIT V-1.—ADDITIONAL MANPOWER REQUIRED BY 1976*

Personnel category	Sector	Nongovernmental	Local	State	Federal non-EPA	EPA	Personnel category total 1976
Professional		10,200	1,300	3,400	1,300	600	16,800
Technician		18,400	1,200	400	200	200	20,400
Operator		33,300	8,900	...	1,400	...	43,600
Other		10,400	11,700	800	400	600	23,900
Total**		72,300	23,100	4,600	3,300	1,400	104,700

*The bases for these figures are set forth in Part II-D of this report.

**An undetermined portion of this total will be employees assigned on a part-time basis to water pollution control activities.

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EXHIBIT V-2.—LABOR FORCE GROWTH 1971 TO 1976

Personnel category	1971 manpower engaged	1976 manpower requirements	Percentage increase
			Percent
Professional	25,400	42,200	66
Operator	49,300	92,900	88
Technician	26,900	47,300	77
Other	47,800	71,800	50
Total	149,400	254,200	70

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EXHIBIT V-3.—FORECASTED TRAINING REQUIREMENTS
[Average annual load—1972-1976]

Personnel category	Sector	Nongovernmental		Local		State		Federal non-EPA		EPA		Total	
		Entry	Update	Entry	Update	Entry	Update	Entry	Update	Entry	Update	Entry	Update
Professional		2,960	9,140	500	2,480	880	1,920	520	2,640	160	1,260	5,020	17,440
Operator		8,260	16,020	3,480	17,080	...	...	520	2,460	...	...	12,260	35,560
Technician		5,160	14,860	480	2,300	100	260	140	960	40	280	5,920	18,660
Other		2,580	3,280	400	1,260	60	280	180	...	3,220	4,820
Total		18,960	43,300	4,860	23,120	980	2,180	1,240	6,340	380	1,540	26,520	76,480

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With regard to technicians, the report notes that there will be an increased demand for upper level, highly trained technicians and that substantial update training for the present work force will be required.

Part III of the report addresses the recruitment, retention, and manpower utilization activities undertaken by EPA to fulfill manpower and training needs. It notes that these activities have been largely adjuncts of programs financed by the Manpower Development and Training Act or by EPA research and development funds, rather than by funds authorized under subsection 5(g). The report concludes that when these programs are taken together, they probably only begin to reap the benefits in terms of reductions in manpower and training requirements that could be obtained by the systematic and widespread application of such techniques by all water pollution control employers.

Of special note, Part III examines operator certification. In a review of the current situation, it notes that 47 states now have certification requirements of some kind, but in only 31 is it mandatory. Further, the standards for certification vary substantially from state to state. It also notes that operator certification is of benefit in various ways to the operators, to the employers, and to the public. Therefore, EPA intends to encourage mandatory certification by all states.

Part IV of the report reviews the water pollution control training activities of EPA and of others—including educational institutions, associations, private industry, local agencies, State agencies, and Federal agencies. The non-EPA organizations carry on this training for all classes of personnel in a random pattern that defies brief summarization. However, as the report makes clear, in total these non-EPA sources do not conduct sufficient training to meet overall manpower and training needs. Further, in respect to “one-time educational efforts”—such as the development of curricula and training materials—the non-EPA organizations tend to be inefficient because of overlap of efforts and results.

As Part IV goes on to detail, under the authority of the Federal Water Pollution Control Act [particularly subsection 5(g) and Section 16] and, with regard to operator training, as an agent of other Federal departments, EPA has mounted programs in cooperation with State water pollution control agencies to fill the training gap for all categories of personnel. Exhibit V-4 outlines these programs and shows EPA's contribution to each program.

The report concludes that generally these programs have been successful in providing well trained manpower for water pollution

control. Collectively, they represent a functioning mechanism thrusting in the right direction.

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EXHIBIT V-4.—SUMMARY OF EPA TRAINING PROGRAMS

Program	EPA authority	EPA contribution
Professional Training Grants.	Subsection 5(g)(3)(A) of the Federal Water Pollution Control Act.	Financial support to educational institutions for graduate-level programs in water pollution control.
Research Fellowship . . .	Subsection 5(g)(3)(B) of the Federal Water Pollution Control Act.	Awards to graduate students for specialized research training in water pollution control.
Direct Technical Training.	Subsection 5(g)(3)(C) of the Federal Water Pollution Control Act.	Direct training and training support for others in technical matters relating to the causes, prevention, and control of water pollution.
Technology Transfer . . .	Subsection 5(g)(3)(C) of the Federal Water Pollution Control Act.	Direct training to practicing professionals, public decision-makers, conservation groups, and the general public.
MDTA		
Coupled OJT } Institutional Training }	Agent for the Departments of Labor (DOL) and Health, Education, and Welfare (DHEW) under the Manpower Development and Training Act (MDTA).	Program administration for entry-level operator training.
Public Service Careers	Agent for DOL under MDTA.	Program administration for entry-level operator training.
Transition	Agent for DHEW and the Department of Defense.	Program administration for entry-level operator training.
Pilot Program	Subsection 5(g)(1) of the Federal Water Pollution Control Act.	Direct training, financial support, and training support for update and upgrade operator training.
Undergraduate Training Grants.	Section 16 of the Federal Water Pollution Control Act.	Financial support to undergraduate institutions to conduct programs in water pollution control; facilities design and facilities operation and maintenance.
Undergraduate Scholarships.	Section 18 of the Federal Water Pollution Control Act.	Awards to undergraduate students for study leading to careers in the operation and maintenance of wastewater treatment facilities.

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APPENDIX A.—MANPOWER AND TRAINING NEEDS RESULTING FROM OTHER SOURCES OF WATER POLLUTION THERMAL POLLUTION

The growing demands for electric power continues to require a tremendous expansion of power-generating facilities. Water is used in the production of almost all electric power now generated—

whether hydroelectric, fossil-fueled, or nuclear-powered plants. Two of these generating methods, fossil- and nuclear-fueled steam electric plants, produce large amounts of waste heat that causes thermal pollution.

Installation of facilities such as long discharge lines or cooling towers to control thermal pollution will affect cost factors and require more space for the plant. The increasing use of nuclear power adds another potential hazard to the environment—radiation.

More stringent controls on the discharge of heated effluents and a greater research effort to improve thermal standards and abatement technology are expected to ensure compliance with water quality standards. Additionally, today EPA, the Atomic Energy Commission, and the Department of Health, Education and Welfare, are working together to develop standard radiological criteria for water. Presently there are nearly 2,000 private power plants, 1,000 municipal plants, 140 power distribution and State plants, 170 Federal plants, and 1,480 public and cooperative plants, for a total of nearly 4,800 power plants. Future environmental efforts in this area will undoubtedly require additions to engineering departments and scientific research staffs. Nevertheless it is conservatively estimated that presently, 3,000 professional and 3,000 blue-collar workers require varying degrees of in-depth thermal pollution control training and thousands of others require short-course training.

FEEDLOT POLLUTION

Both the increasing number of animals raised and the modern methods of raising these animals contribute to the increased pollution of waters from animal waste. Feeding operations for beef cattle, poultry, and swine, along with dairy farms, are the major sources of actual or potential water pollution from animal wastes; they contribute approximately 1.7 billion tons of waste per year, a good percentage of which reaches our waterways. A number of waste handling and control methods have recently become available which vary widely in complexity and cost. Many States are just beginning to survey feedlot and other agricultural operations to determine the pollution potential and necessary measures to deal with the problem. Projects have been initiated with the Department of Agriculture to demonstrate available techniques for treating runoff from animal feeding operations and for preventing its discharge to receiving waters.

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Presently there are 3,400 feedlots of sufficient size to warrant a minimum of one individual full-time per feedlot, fully cognizant and

totally responsible for implementation of effective methods and techniques to control water pollution. Additionally, many thousands of other agricultural personnel directly or indirectly involved in animal raising on intermediate (33,000) and small (105,000) feedlots will require short-course training in effective measures to prevent water pollution. Most training will be conducted by the agriculture extension services of the Federal and State governments.

OTHER AGRICULTURAL WASTES

There is an increasing concern about the short- and long-term environmental effects of runoff from farm lands which contains a variety of chemicals, including pesticides, herbicides, insecticides, and fertilizers. Although soil conservation methods have made some inroads in controlling runoff, much is left to be done. A number of Federal agencies, in cooperation with State and local authorities, are working on research projects devoted to the search for chemical or biological control methods which will sustain agricultural productivity while reducing the possibility of environmental damage and destruction of aquatic life and wildlife. Such methods to control leaching by irrigation, such as lining canals, are becoming available, and in some areas the possibility of using desalination plants is being studied. Overall, however, the water quality problems caused by irrigation return flows are difficult and expensive to control.

The Office of Pesticides Programs in EPA is developing the scientific knowledge necessary for the development of water quality criteria for pesticides. This requires increased research on the effects of pesticides and the search for less harmful pesticides, expanded monitoring, investigation to identify critical areas, and closer inter-agency coordination with the Departments of Agriculture and Health, Education, and Welfare. However, with over 30,000 agricultural businesses presently in the U.S., much needs to be done to educate these people in the causes of and solution to agricultural water pollution. Scientists and engineers experienced and educated in abatement and control techniques will make up the backbone of the technology transfer to these businesses.

MINE DRAINAGE

Mine drainage, one of the most significant causes of water quality degradation and destruction of water uses, degrades water primarily by chemical pollution and sedimentation. Acid formation occurs when water and air react with the sulfur-bearing minerals in the mines or refuse piles to form sulfuric acid and iron compounds. Prevention of acid and sediment drainage from mines can be accom-

plished through renovation of the mineral area. Regrading and revegetation can also be effective means of mine drainage control. Other methods of control may involve hydraulically sealing mines, diversion and/or control of underground

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drainage, and use of chemicals or biological inhibitors to reduce the formation of acid. Neutralization is the most common method of treating acid drainage. In addition, laboratory studies have shown that an inert gas atmosphere which displaces oxygen will prevent mine acid formation. Mining, civil, and chemical engineers, geologists, and hydrologists are now required to turn their attention to mine pollution control. With an estimated 8,000 operating mines employing nearly 125,000 people, and a similar number of inoperative or closed mines, it is conservatively estimated that short-course, technology-transfer-type training is required for approximately 9,000 mining engineers, inspectors, superintendents, and related professional and blue-collar personnel.

OIL AND HAZARDOUS SUBSTANCES

Dumping and accidental spilling of oil and other hazardous materials continue to increase (with presently approximately 10,000 spills each year), and constitute major pollution threats to the water resources of the Nation. Pollution by oil and hazardous substances may occur in any of our waterways and coastal areas, or on the high seas as a result of deliberate dumping, accidental spills, leaks in pipelines, leaks in drilling rigs or storage facilities, or the breakup of transportation equipment. Federal prevention, control and enforcement activities are provided for under the 1970 Water Quality Improvement Act. In conjunction with development of plans with the Department of Transportation and other Federal agencies to prevent and control oil spills, planning has been undertaken to handle accidents of other hazardous substances. There is a substantial body of conventional, "good common sense" preventative technology and operating practices currently available which are not being fully used. Nevertheless, the technology for containing, removing, disposing of, and cleaning up the damage from spills must be classed as primitive and requires a considerable research effort. Today there are over 125 fully integrated oil companies, 7,000 independent crude oil companies, 250 refineries, and over 30,000 bulk plants employing over 425,000 people.

As the state of the art develops, petroleum and chemical engineers, geologists, hydrologists, and operational and maintenance personnel totalling conservatively between 10,000 and 20,000 in the refining,

drilling, and production of oil will require short-course and in-depth types of training over the next five years.

SEDIMENTATION AND EROSION

Sediments produced by erosion are the most extensive pollutants of surface water—contributing approximately 2 billion tons of sediment per year. The dirty brown or gray appearance of a river or reservoir after a rainstorm is due to sediments washed in from croplands, unprotected forest soils, overgrazed pastures, or the bulldozed “developments” of urban areas. Sources of sediment are diffuse and therefore often difficult

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or costly to control. Where feasible, erosion prevention provides the most effective method for sediment control. However, abatement and control will be achieved through improved technology and management practices for controlling this type of pollution, and by State and local enactment of permit and inspection measures at construction sites. Although it is known that in order to control sedimentation and erosion, soil engineers, soil conservationists, farm operators, irrigation engineers, construction personnel, and similar types of people will require skill improvement and update training, a realistic estimate of their numbers is not yet obtainable.

WASTES FROM WATERCRAFT

It has been determined that approximately 46,000 Federally registered commercial vessels, 65,000 unregistered commercial fishing vessels, 1,600 Federally owned vessels, and 8 million recreational watercraft use the navigable waters of the U.S. The potential pollution from just the sewage from these vessels is estimated to be equivalent to the sewage produced by just over 500,000 persons. At the present time, a very small percentage of watercraft are equipped with sewage treatment devices. Other significant pollution from vessels is often evident when ships discharge bilge and ballast water containing oil and a variety of other substances.

The Water Quality Improvement Act provides for Federal performance standards for water pollution control equipment on commercial and private vessels. In addition, procedures to certify the marine sanitation devices to ensure their compliance with the established standards will be required. Federal agencies—including the EPA, the Navy, the Corps of Engineers, and the Coast Guard—are presently developing, testing, and installing packaged treatment and control equipment on Federal vessels. In some cases, this will necessitate pump-out on shoreside treatment facilities. It is conserva-

tively estimated that between 10,000 and 20,000 vessel operators will require formal orientation training in the operation and maintenance of inboard sewage treatment plants and that an additional 2,500 Coast Guard personnel, marine engineers, power squadron leaders, and various State and local marine authority personnel will require varying degrees of advanced training.

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APPENDIX B.—FEDERAL WASTE TREATMENT FACILITIES DATA SHEET

Capacity (in gallons per day)	Number, type, and function of facility												Total
	Industrial					Sanitary							
	P	PS	T	P	T	P	PS	T	P	PS	T		
1.0 mgd or more	16	60	0	15	0	0	113	0	0	0	31	173	0
100,000 to 999,999	9	50	0	52	5	1	316	5	1	3	62	369	5
10,000 to 99,999	3	13	0	99	61	0	623	61	0	6	102	642	61
1,000 to 9,999	1	4	0	801	101	0	1,228	101	0	0	802	1,232	101
999 and under	20	2	0	3,411	8	1	2,298	8	1	0	3,432	2,300	8
Grand totals .....	.....											4,429	175

MGD = Million gallons per day.

P = Primary treatment only.

PS = Primary and secondary treatment.

T = Tertiary treatment.

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APPENDIX C.—SUMMARY OF EPA PILOT PROGRAM

Grantee	Training site	Amount of grant	Starting date	Number of trainees	Summary of training program
Drake University	Des Moines, Iowa	\$39,174	6/1/71	50	I. Advanced Instructor Training Improve the instructional skills of trainers; emphasis on motivation, sensitivity training, designing effective instructional practices, and evaluation and utilization of learning resources.
Tennessee Department of Public Health.	Middle Tennessee University.	81,950	6/1/71	60	II. Specialized Training in Advanced Wastewater Treatment Demonstrate innovating and unique training procedures for the operation, maintenance, and control of advanced biological waste treatment processes and facilities. These pilot program training methods will be utilized in developing regional or national programs.
Texas engineering experiment station.	Dallas Water Reclamation Research Center.	101,164	7/1/71	130	One-year training program including: 5-day courses in chemical-physical waste treatment processes utilizing a pilot plant for providing intimate operating experience. Three such courses offered to twice as many students in Dallas and two other locations. Special operational instruction in activated sludge and AWT maintenance and control to 20 commuting students from the Dallas/Ft. Worth area.
California State Water Resources Control Board.	San Marcos, Calif.	110,390	5/1/71	155	III. Grants for Special State Projects Training of wastewater treatment plant operators and related activity personnel to improve substantially their proficiency in operating, maintaining, supervising, designing, and managing facilities through a "problem-oriented" approach to environmental enhancement. Training site will include an operating wastewater treatment facility.
Central Nebraska Technical College.	Hastings, Nebr.	30,000	7/1/71	20	[p. C-1] Development and implementation of curricula designed to develop adequate and appropriate educational competencies for personnel responsible for the prevention of contamination of water resources by those hazardous materials which endanger human health and environment.
Charles County Community College.	La Plata, Md.	30,367	7/1/71	0	A pilot program to develop waste treatment plant standard operating procedures and technical training materials related to waste treatment plant operations.

APPENDIX C.—SUMMARY OF EPA PILOT PROGRAM—Continued

Grantee	Training site	Amount of grant	Starting date	Number of trainees	Summary of training program
Charles County Community College.	La Plata, Md.	\$15,111	9/1/71	120	<p>III. Grants for Special State Projects—Continued</p> <p>Project A—Seminars for State and local elected officials to provide information concerning water pollution control programs, legislation, regulations, and fundamentals of wastewater plant operations and maintenance, including the need for well-trained personnel to operate the plants.</p> <p>Project B—Training program for State and local regulatory personnel of WPC plant personnel concerning practical aspects of water pollution control and plant operation and maintenance, including WPC plant inspection and evaluation procedures.</p>
Colorado Water Pollution Control Division.	Grand Junction, Colo.	20,835	7/1/71	20	Have a trained coordinator who will organize and conduct a training program for scattered wastewater treatment plant operators utilizing classroom and OJT instruction for 20 trainees. The coordinator will work with the State Vocational Education Department and Community Colleges to assist the program and provide additional training opportunities.
Georgia Water Quality Control Board.	Atlanta, Ga.	31,960	6/2/71	30	Improve the skills and upgrade present wastewater treatment plant operators. The trainee will receive basic education in areas of math, communications, science, and plant unit operations with the goal of adding substantially to the proficiency of persons employed at all levels of waste treatment operations.
Greenville Technical Education Center.	Greenville, S.C.	16,884	7/1/71	12	This training program, designed for supervisory personnel employed by wastewater treatment facilities, will serve to increase the theoretical knowledge level of the participants, increase their understanding of supervisory responsibilities, and help develop training programs in the individual plants of the Piedmont area of South Carolina.
Jefferson County Commission (engineering dept.).	Birmingham, Ala.	20,960	7/1/71	25	Improve the skills and upgrade present wastewater treatment plant operators. The trainee will receive basic education in areas of math, communications, science, and plant unit operations with the goal of adding substantially to the proficiency of persons at all levels of waste treatment operations.
The Kentucky Municipal League.	Kentucky State Parks	7,994	7/1/71	20	Educate municipal officials and "decision-makers" as to the importance of water quality control in view of new standards. Students would be shown the importance of well-trained operating personnel in their wastewater treatment facilities in order to meet their obligations in the field of water quality control.

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Linn-Benton Community College.	Albany, Ore.	74,753	7/1/71	120	Provide present wastewater treatment plant operators with the perspective and training necessary to make a contribution to the solution of environmental problems caused by modern wastewater treatment plants not being operated and maintained at peak efficiency.
Louisiana State Department of Health.	Various plants and labs ...	26,931	7/1/71	40	Planning and supervision for various OJT, in-service, and external training programs for water pollution control plant operators and supervisors, including CAMPS projects, and prepared operators for certification examinations. Also provides training of instructors, teachers, and plant supervisors in the conduct of water pollution control training courses, and instruction for health department and other regulatory inspectors in the proper conduct of operation and maintenance inspections.
Michigan Department of Public Health.	Lansing, Mich.	77,308	6/30/71	150	8 weeks of training on operation, control, and maintenance of phosphorus removal from sanitary wastewater. Two-phase program: Phase A consists of one day (or half day) classroom instruction each week for 7 weeks. Phase B consists of a 5-day week on lab instruction of analytical techniques needed for control of the process. Each section will serve the plants within a compact multiple county area with the classroom instruction presented at a location central to the service area. All lab training will be conducted adjacent to the available dorm and dining facilities.
Mobile Water Service System.	Mobile, Ala.	10,000	6/23/71	20	[p. C-3] Two 24-week sessions on the operation and maintenance of the electrical equipment control and instruments in use at the Mobile Water Service Treatment and Handling facilities.
New England Inter-state Water Pollution Control Commission.	Mobile Lab	82,665	6/28/71	180	Training of wastewater treatment plant operators and related activity personnel to increase the operating efficiency of existing wastewater treatment facilities and sewage collection systems through the upgrading of skills of present plant employees.
New York State Department of Environ- mental Conservation.	New York City, Buffalo, Syracuse.	31,854	6/14/71	340	Training of 280 Grade II Wastewater Treatment Plant Operators at 2-week Grade II Schools and 60 Grade III Wastewater Treatment Plant Operators at 1-week Grade III Wastewater Treatment Plant Operators Schools.

APPENDIX C.—SUMMARY OF EPA PILOT PROGRAM—Continued

Grantee	Training site	Amount of grant	Starting date	Number of trainees	Summary of training program
III. Grants for Special State Projects—Continued					
North Carolina Department of Water and Air Resources (water quality division).	Various colleges	\$15,000	7/1/71	30	Increase operating efficiency of existing wastewater treatment facilities through upgrading skills of present plant employees and training that will lead to certification of personnel employed as wastewater treatment operators. (44-week course at community colleges and technical schools.)
Oklahoma City—County Health Department	Oklahoma City, Okla.	20,595	6/24/71	25	330 hours of classroom and 70 hours of over-the-shoulder training designed to improve skills of present plant employees in order to obtain optimum operational efficiency.
Piedmont Technical Education Center.	Greenwood, S.C.	2,510	7/1/71	30	Three 8-hour days of concentrated effort in the areas of human aspects management, with emphasis on the human needs of those being managed; increasing human value, making better use of time, how to motivate people; problems of temperament, how to predict human behavior, and individual communication.
Pennsylvania Department of Education/Public Service Institute.	Harrisburg, Pa. (various schools).	23,600	7/1/71	1,000	Improve skills of present employees in the wastewater treatment field, necessitated by Act 322, Commonwealth of Pennsylvania Certification Act. Section I—twenty 40-hour classroom/OJT courses; Section II—twelve 20-hour classroom, OJT courses held for Pennsylvania Department of Environmental Resources
Southwest Technical Institute.	East Camden, Ark.	40,000	7/1/71	160	A field training unit to carry the training program to the operator in his local area for the purpose of certification as a sewerage plant operator.
University of Kentucky Research Foundation.	Lexington, Ky.	12,236	7/1/71	10	Train entry-level and existing operating personnel, and improve skills of lat personnel so they can perform required analyses of new or proposed standards.
University of Missouri	Columbia, Mo.	11,931	6/1/71	300	Series of 1-day seminars to orient local officials and citizens regarding the State-local-Federal responsibilities for wastewater management.
Virginia State Water Control Board.	Various State labs	15,000	7/1/71	70	Intensive training in standard sewage plant laboratory techniques and theory for wastewater personnel charged with the responsibility for testing and reporting procedures. Program to be presented at sewage treatment plant labs, 6 hours per week for 10 weeks.

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