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POLLUTION ENGINEERING TECHNIQUES



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An Overview Introduction to the Problem

Papers as submitted to the 2nd Annual International Pollution Engineering Congress, Philadelphia Civic Center, October 22-25, 1973



ann arbor science PUBLISHERS INC.

POST OFFICE BOX 1425 • ANN ARBOR, MICHIGAN 48106

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By Ann Arbor Science Publishers, Inc.
P.O. Box 1425, Ann Arbor, Michigan 48106

Library of Congress Catalog Card Number 74-75701
ISBN 0-250-40057-X

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Printed in United States of America

FOREWORD

There is a need for a book that will quickly and easily give reliable information about all of the principal problems encountered in pollution control, with some basic guidelines and proposals for solutions. We believe this book may to a reasonable degree fill this need.

If you are already well informed on all these questions, you won't need this book. If you are a manager, a teacher, a student—or a serious layman—it can give you a useful overview. Here are views of various responsible individuals working primarily in industry and government, with some in academia as well. The book can also serve the purpose of acquainting the person who works in one area of pollution with activities in other areas. *There is hardly a basic topic within the field that is not covered within these pages.*

Though not intended as a solution to all your problems, it is expected that you will find a useful introduction—an introduction to a reasonable and workable approach to one or more of the pollution problems you may encounter or are faced with now. It is hoped you will enjoy the informal style of presentation, that appears from time to time.

This small volume is the publication of the papers, as submitted to the 2nd Annual International Pollution Engineering Congress, held at the Philadelphia Civic Center, October 22-25, 1973, under the guidance of Clapp & Poliak, Inc., New York City.

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The Federal Water Pollution Control Act Regulatory Policy and Enforcement

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and

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Including as it does the City of Chicago and 116 other municipalities, the Metropolitan Sanitary District of Greater Chicago would find it difficult to follow all the Federal guidelines regarding water-borne industrial wastes. This paper explains why the District feels that its present system of charges is equitable and will produce the results contemplated by Federal law.

The Federal Water Pollution Control Act

Regulatory Policy and Enforcement

CECIL LUE-HING

EARL W. KNIGHT

The Metropolitan Sanitary District of Greater Chicago is a municipal organization that services an area of approximately 858 square miles, all in Cook County, Ill. The District serves the City of Chicago and 116 other outlying municipalities, including a population equivalent of approximately 10 million people. The primary service performed by the Sanitary District is the collection and treatment of combined municipal and industrial waste water, which totals in excess of 1 billion gallons per day. The area includes more than 13,000 business and industrial concerns.

The Sanitary District is different from most public systems, in that since its formation industrial wastes have been a significant portion of the volume treated, and prior to adoption of the new surcharge ordinance there never has been a direct charge for collection and treatment of waste.

The Sanitary District treatment and collection system was constructed from ad valorem tax receipts on a pay-as-you-go-basis; thus the final waste-handling costs do not include interest. At the present time it is estimated that industrial waste constitutes 17 per cent of the load on the system.

The District has exercised a measure of control over the discharge of industrial waste into its system since the construction of its activated-sludge plants in the early 30's; however, numerical limits were established in September of 1969.

Pretreatment Requirements

Section 307 (b) (1) of the Federal Water Pollution Control Amendments of 1972 requires that the administrator publish regulations establishing pretreatment standards for introduction of pollutants into publicly owned treatment works. The administrator has published pretreatment

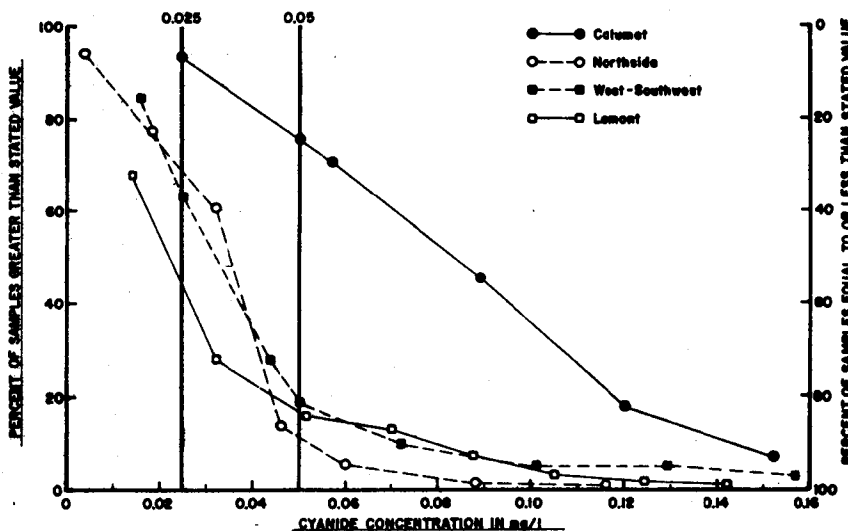


Figure 1

COMPARISON OF WASTE WATER QUALITY LIMITS FOR DISCHARGE TO A SANITARY
SEWER AS AGAINST DISCHARGE TO A WATERWAY

	MSD SEWER DISCHARGE LIMITS (mg/l)*	IEPA WATERWAY EFFLUENT LIMITS (mg/l)*
Chromium:		
Total	25.0	-
Hexavalent	10.0	0.3
Trivalent	-	1.0
Copper	3.0	1.0
Cyanide:		
Total	10.0	0.025
Readily Released at 150° F and pH 4.5	2.0	-
Iron:		
Total	50.0	2.0
Dissolved	-	0.5
Lead	0.5	0.1
Nickel	10.0	1.0
Temperature	150° F (max)	-
pH	4.5 - 10	5-10
Zinc	15.0	1.0
Cadmium	2.0	0.15
Hexane Solubles	100	15.0
Mercury	0.0005	0.0005

*All the above are as mg/l except temperature and pH

guidelines, which include a system for determining the number of pounds that may be discharged to the municipal sewer by twenty-seven different classes of industry.

The proposed regulations would allocate treatment plant waste-load capacity for specific pollutants among all existing sources discharging the pollutant.

The proposed system is workable where only a few industries and parameters are involved. Where there are several hundred dischargers with a variety of production rates and pollutant types, intermittent or seasonal discharge, frequent new sources, and frequent elimination of existing sources, the proposed system is unmanageable.

Enforcement would require a review of production rates versus pounds of pollutants and would, therefore, be totally dependent on company records. The enforcement procedure would not disclose or prohibit the discharge of excessive concentrations of toxic or hazardous pollutants if the total

poundage was not exceeded. This type of enforcement would be excessively costly, would not prevent the discharge of toxic and hazardous concentrations of pollutants, and should not be required for complex facilities. But it will still be necessary for public systems to regulate industrial waste through enforcement of appropriate concentration limits.

The allocation system described in the Federal guidelines will be used by the District for control of a specific parameter (cyanide), which is contained in the raw sewage at the Calmut Sewage Treatment Plant. Allocation is possible in this instance since most of the cyanide is discharged by three identified sources. Figure 1 shows the cyanide effluent concentrations for this plant compared with those for three other Metropolitan Sanitary District plants.

The present Sanitary District pretreatment requirements, adopted September 18, 1969, include numerical limits for fifteen pollutants. The

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO
1973 WATER RECLAMATION EFFLUENT DATA
FOR HEXANE SOLUBLES
(MAY, 1973 ONLY)

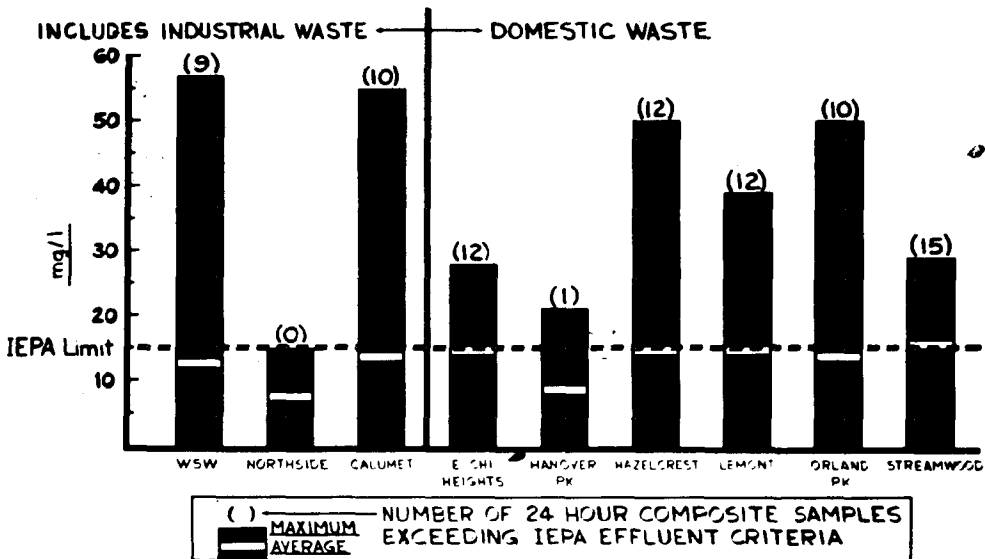


Figure 2

table shows Metropolitan Sanitary District pretreatment requirements and IEPA waterway effluent regulations. The limits have been demonstrated to produce effluent in compliance with State of Illinois waterway effluent standards, adopted in June 1967, with the exception of hexane solubles, cyanide, and mercury. Figure 2 shows the hexane-soluble effluent concentrations for Metropolitan Sanitary District treatment plants. A recently completed study indicates that Sanitary District plants receiving little or no industrial waste have approximately the same frequency of violations and maximum concentration of these three constituents as plants receiving substantial quantities of industrial waste.

The Sanitary District has completed studies that show the analytical procedures used for total cyanide have a variation in the analyses of plus or minus 0.024 mg/l at a concentration of 0.025 and that when this variation is considered, most MSD plants are in compliance with the cyanide effluent criteria.

Mercury effluent violations will continue

until the use of mercury in industrial applications is prohibited or technology is developed to treat industrial waste streams to the very low concentrations allowed (0.5 parts per billion).

The studies show that hexane-solubles violations will occur with approximately the same frequency at plants receiving industrial waste as at plants that do not receive it. The studies further show that completion of tertiary facilities at the treatment plants, together with the present high level of enforcement activity, should result in compliance with the hexane-soluble effluent limits.

User Charges and Industrial Cost Recovery

The Federal regulations require that permit applicants adopt a system of charges to insure that each recipient of waste treatment service pays its proportionate share of the cost of operation and maintenance (including replacement) and that the applicant receive firm, written commitment satisfactory to the regional administrator for payment by the industrial users of their proportionate share of the Federal contribution to

the cost of construction.

The District must assume that this requirement will not impose on it the necessity of changing its statutory fiscal system from one based on the ad valorem property tax and the industrial waste surcharge ordinance to one involving charges based solely upon use.

The District receives its operating revenue from its tax levy, which is regulated by state statute, and the receipts from its industrial waste surcharges.

On March 1, 1971, the District's industrial waste surcharge ordinance became effective and was subsequently found by the U. S. regional construction grant program director to meet the existing regulation. In October 1972, the Illinois Supreme Court held that this ordinance met the due process and equal protection requirements of both the Illinois Constitution and the U. S. Constitution.

The present system of ad valorem taxation insures the collection of monies due the District. Records indicate payments of real estate taxes in the Chicago area are 95 per cent the first year and payments in subsequent years bring the total collected to 98 per cent. A change to a direct user charge would cause fiscal chaos because the District services an area that includes, in addition to the City of Chicago, 116 other municipalities. Seventy-two of the municipalities purchase water from the City of Chicago for resale. All the 117 municipalities, and private utility companies as well, have separate water billing procedures. In addition, there are several thousand private wells that discharge unmetered water into the sewerage system. Within the City of Chicago, there are 348,026 non-metered (assessed rate) services out of a total of 512,403.

A direct user charge system would require the installation of more than 348,026 water meters and the development of a system to reimburse the 117 separate municipal departments for the processing of the user charges. The cost of installing the required 348,026 water meters to monitor residential sewage volume is estimated to be in excess of \$60 million, and it is estimated that the cost of reading the currently 348,026 non-metered services four times per year would be in excess of \$1,820,000 per year. A parallel but separate system for collection of industrial user charges would be required since each industrial charge must be computed in accordance with variability of the concentration parameters subject to unit cost.

The cost of installing and maintaining the necessary water meters, and the added cost for processing the user charge billing in the complex system currently in existence within the District,

would be prohibitive.

The District is thus unable to estimate its efficiency in collecting direct user charges but is convinced that collection will not be as efficient as property taxation.

The user charge contemplated by the proposed regulations presupposes that the treatment of water-borne wastes is the sole function of the grant applicant. The District, however, is charged by statute with the additional duties of flood control, solid waste disposal, pollution abatement and enforcement litigation, removal of obstructions to navigation in the District's waterways, the regulation of the diversion of Lake Michigan waters, and numerous other tasks.

In a multi-purpose agency such as the District, there exist extensive services that would not be funded by user charges but that are paid for by property taxes. Of primary import is flood control work. The cost of flood control and the attendant increment in the value of property cannot be determined by the number of gallons of waste which a discharger transmits to a given sewage treatment plant. The damage if such flood control projects were abolished for lack of funds would be measured in terms of the value of the real estate affected thereby. Conversely, the value of flood control projects is reflected in the increment in fair market value of the property. That increment in value afforded by flood control projects is paid by taxation of that increment as reflected in the market value of the property. Industry within the District includes almost every category known and combinations of every classification. The cost to administer this requirement would be prohibitive and exceed any projected benefit.

Finally, an individual user charge system would require the complete revision of the District's enabling legislation and the abandoning of a constitutionally tested industrial waste surcharge ordinance.

Therefore, the District has requested that the regional administrator determine that the existing combined property tax and industrial waste surcharge ordinance have worked reasonably well in apportioning the cost of treatment of water-borne wastes to the recipients of such service, and that it be deemed to be a proportionate charge as required by the Act. We are confident that the Metropolitan Sanitary District already meets this requirement.

Summary

The use of concentration limits for control of industrial waste discharge to municipal treatment systems has been demonstrated to produce the

required treatment plant effluent quality with certain exceptions. For mercury, cyanide, and hexane solubles additional limitations or controls will be required.

The application of user charges for complex

systems without additional revenue-producing methods is not justified by cost-benefit analyses and does not provide cost recovery for benefits which accrue to undeveloped property.

Discharge Permits and Related Compliance Requirements

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After December 31, 1974, those who discharge waste waters into navigable waters will have to obtain National Pollutant Discharge Elimination System permits. This paper explains the procedure in obtaining an NPDES permit, and discusses the meaning of such terms as "navigable waters," "best practicable control technology," and "best available technology economically achievable."

Discharge Permits and Related Compliance Requirements

ROBERT J. COURCHAIINE

The Federal Water Pollution Control Act Amendments of 1972, PL 92-500, hereinafter referred to as the Act, establish as a goal the elimination of discharges of pollutants into the navigable waters by 1985 and require that, wherever attainable, water quality be improved by July 1, 1983 to provide for the protection and propagation of fish, shellfish, and wildlife and to provide for recreation in and on the waters.

"Navigable waters" are defined in the Act as the waters of the United States and include all interstate waters, all navigable waters including all their tributaries, and any intrastate non-navigable rivers, streams, or lakes utilized by industries in interstate commerce, or utilized by interstate travelers for recreational or other purposes.

The Act requires that after December 31, 1974 point source dischargers of waste waters to the navigable waters must be in possession of National Pollutant Discharge Elimination System (NPDES) permits. The permit must set forth certain specific quantitative effluent conditions and appropriate compliance schedules. Violators of permit conditions may be subject to civil action for appropriate relief, including a permanent or temporary injunction, and may be punished by a fine of not less than \$2,500 nor more than \$25,000 per day of violation, or by imprisonment for not more than one year, or by both.

The Act requires dischargers to file an application for an NPDES permit on forms developed by the administrator of the U. S. Environmental Protection Agency (EPA) unless a complete application for the discharge was filed previously under the 1899 Refuse Act and the application accurately defines the current discharges. Persons wishing to begin new discharges must file a complete NPDES application no later than 180 days in advance of the date on which the discharge is to commence unless permission is granted for a later application.

Section 402 of the Act provides that states desiring to administer their own permit programs

may submit full and complete descriptions of their programs to the EPA administrator for approval. The administrator is to approve a state's program, and suspend issuance of NPDES permits, unless he determines that the state does not possess adequate authority to meet the requirements of Section 402(b) of the Act. The state must have authority to issue permits for terms not exceeding five years upon the same conditions relating to effluent limitations and water quality standards as are applicable to permits issued by the administrator. States must also have authority to abate violations of permits, including civil and criminal penalties, and be able to insure adequate public and agency notification of pending permit applications and meet other requirements of the Act and the regulations adopted thereunder.

Permit Processing

Upon receipt of an NPDES permit application the permitting agency is required to prepare a draft permit with proposed effluent limitations and a schedule of compliance. A public notice on the completed application must then be circulated within the geographical areas of the discharge and a comment period of not less than 30 days provided following the date of issuance of the public notice. During that time interested persons may request copies of the draft permit and other facts related to the discharge and may submit written comments. Such written comments are to be retained and considered by the agency in the formulation of the final determination on the NPDES application.

The permitting agency is required to hold a public hearing on a proposed permit following the 30-day comment period if it is determined that there is significant public interest. The applicant and any affected agency, person, or group may request or petition for a public hearing on NPDES applications during the 30-day period.

Permit Effluent Limitations

An NPDES permit must meet the effluent limi-

tations specified under Sections 301, 302, 306 and 307 of the Act.

Section 301 requires application of "best practicable control technology currently available" (BPTCA) by July 1, 1977 and "best available technology economically achievable" (BATEA) by July 1, 1983, both levels of treatment to be established by the administrator of EPA for industrial discharges. In defining "best practicable" and "best available" for a particular category, such factors as the age of the equipment and facilities in question, the process employed, the engineering aspects of the application of control techniques, process changes, and non-water quality environmental impact (including energy requirements) are to be taken into account. In assessing "best practicable control," the administrator is to make a balancing test of total cost and effluent reduction benefits. In some instances, this test may eliminate the application of technology that is high in cost in comparison with the minimal reduction in pollution that might be achieved. Cost is also a factor in determining "best available." "Best available" technology is the highest degree of technology that has been shown to be capable of being designed for plant-scale operation, and, therefore, costs for this treatment may be much higher than for treatment by "best practicable" technology. Economic feasibility will, however, also be a factor in interpreting the phrase "best available treatment." Cost effectiveness for either standard is to be confined to consideration of classes or categories of point sources and will not be applied to an individual point source within a category or class.

Having interpreted "best practicable" and "best available," the administrator is to promulgate guidelines, which will be the formula for determining what "effluent limitations" are to be imposed on dischargers. In these guidelines, he is to identify the degree of effluent reduction attainable through the application of the best practicable control and best available technology in terms of the amounts of constituents and the chemical, physical, and biological characteristics of the pollutants. These guidelines will then be applied in setting specific effluent limitations for dischargers.

In addition, the regulations are to identify control measures and practices to eliminate the discharge of pollutants.

By July 1, 1977 publicly owned treatment works are to meet effluent limitations based on secondary treatment as defined by the administrator and by July 1, 1983 they are to use "best practicable waste treatment technology."

Section 302 of the Act requires that all

dischargers must treat or control any discharge to the extent necessary to meet water quality standards, notwithstanding the effluent limitations required under Section 301. The Act sets forth that where application of the 1977 or 1983 treatment levels would not insure protection of public water supplies, agricultural and industrial uses, and the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the navigable waters, effluent limitations, including alternative effluent controls, shall be established.

Section 306 provides for the establishment of new source standards of performance by the administrator for various categories of industry. The standards are to insure that new plants are designed, built, equipped, and operated to minimize the discharge of pollutants. The standards are to reflect the greatest degree of effluent reduction which the administrator determines to be achievable through application of the best available demonstrated control technology, processes, operating methods, or other alternatives.

Section 307 of the Act requires the administrator to publish proposed regulations setting pretreatment standards for industry utilizing publicly owned treatment works and to establish effluent standards or prohibitions controlling toxic pollutants. The pollutants covered in pretreatment standards are those which are determined not to be susceptible to treatment by such treatment works or which would interfere with the operation of such works. The regulations must specify a time for compliance not to exceed three years from their promulgation. The administrator is to designate the category or categories of sources to which such standards shall apply. Pretreatment effluent standards may be more stringent for 1983 since the standards are to be updated from time to time.

The administrator is to issue a list of toxic pollutants and to establish standards for them. In determining effluent standards for the pollutants he designates as toxic, the administrator is to consider toxicity, persistence, and degradability factors. The administrator is to designate categories of sources to which the standards shall apply. The standards are to go into effect no more than one year after their promulgation. They are to be reviewed at least every three years and may be revised at any time.

Because of the dangerous nature of toxic materials, the Act authorizes state and Federal authorities to place controls on the discharge of known toxics before the promulgation of toxic standards. Toxic discharges are to be regulated

in accordance with the objectives of the toxic pollutant discharge control provision through either permits or other enforcement measures.

NPDES Permits

A discharger to the navigable waters must, works are not required to have an NPDES permit; however, they must meet the pretreatment standards and comply with any toxic effluent standard or prohibition promulgated in accordance with Section 307 of the Act.

Dischargers to the navigable waters must, by not later than December 31, 1974, have an NPDES permit which will contain an appropriate time schedule for achieving by not later than July 1, 1977 best practicable control technology as de-

fined by the administrator or a higher level of treatment or control if it is required to meet water quality standards. The permit will also contain appropriate restrictions on applicable toxic substances identified by the Administrator in Section 307 standards. The permits must specify monitoring and reporting requirements to demonstrate continuing compliance with the special conditions of the permit. Permits are to be issued for a fixed term but not for longer than five years.

For a complete description of the permit processing procedures and required terms and conditions of permits the reader is referred to guidelines for the NPDES issued in the Federal Register on May 22, 1973.

Industrial Pollution Control Facilities —Availability of Federal and Other Public Funds

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Since it recognizes that both the development of new pollution control technology and the installation of the control facilities will put a drain on corporate earnings, the Federal Government has provided means of economic support in both areas. This paper presents the possibilities for private industry, and includes figures that will assist a company in deciding on the financing method to be employed.

Industrial Pollution Control Facilities

—Availability of Federal and Other Public Funds

ROBERT H. ALDRICH

NEIL A. EISNER

The legislative mandate to industry is clear. Industry must operate its facilities and produce its products in such a manner as to minimize or eliminate the effect on the surrounding environment. This will require a change in methods of operation and development of new control technology. It will also cost substantial capital and operating dollars.

The Federal Government is cognizant of these costs and has developed programs to assist industry and municipalities in developing new treatment technology and in financing the capital facilities required to meet the new effluent standards. The intent of these Federal programs is twofold: to accelerate the compliance of industry and municipalities with new standards and to reduce the short-term impact these costs might have on the economy.

Financing incentives available to industry and municipalities include:

1. Federal grant programs.
2. Federal loan programs.
3. Federal tax incentive programs.
4. State tax incentive programs.

Federal Grant Programs

Industrial. The grant programs administered by the Environmental Protection Agency (EPA) are structured to assist industries in the development of new and improved technology and are not available to companies that wish to install pollution facilities of known design with known performance standards.

In the area of industrial water treatment, the EPA administers the Federal Research, Development and Demonstration Program. Grants in this area go to projects that meet these general criteria:

- a. The project must be of industry-wide interest.
- b. A demonstration project can be pilot or

full-scale, but it must involve technology that is an improvement on existing technology or new or novel technology.

- c. EPA requires a 25 to 30 per cent contribution by the grantee. This can include salaries and wages, capital and equipment, engineering, design — but not the value of land acquired or used.
- d. Grants are given to users of equipment and not to suppliers of systems or equipment.
- e. There is no limit on the grant, but generally, not more than \$1 million will be allowed.

Under this program, the total grants to industries for water pollution control have amounted to from \$42 million to \$45 million, or about \$7 million per year. Special grants are also available in the other areas of new technology for water pollution control. Included are grants for:

- a. Mining (\$7 million) — generally to states for development of new technology for control of acid runoff, and so on.
- b. Municipalities (\$8 million) — direct grants to municipalities for development of new and improved processes for handling domestic sewage.
- c. Agriculture (\$5 million) — grants to farmers, feed-lot operators, farm co-operatives, regional agriculture groups, and so on, for development of new technology to control agricultural water pollution problems.
- d. Hazardous materials (\$5 million) — grants to corporations with solutions to particular problems of oil spills, and so on.

Applications for grants under this program have been numerous. On request, the EPA will