Photo credit: Courtesy of Greenpeace

Chapter 8
Managing Industrial Effluents

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INTRODUCTION

The direct and indirect discharge of industrial effluents[1] is a widespread practice that contributes substantial quantities of pollutants to marine as well as non-marine waters. The location, composition, and magnitude of these discharges are all important in assessing their ability to cause or contribute to environmental and human health problems.

Industrial effluents are only a subset of the range of materials disposed of in marine waters, yet they provide a good illustration of the complexity of the issues involved in marine waste disposal. The information presented here generally applies to all industrial dischargers, whether their wastewaters enter marine or freshwater environments, because the statutory and regulatory framework governing industrial discharges usually does not distinguish between discharges into freshwater and marine environments. [2]

Estuaries and coastal waters have been used for disposal more frequently and have been more severe] y affected than have open ocean waters. Essentially all direct and indirect industrial discharges to marine environments occur in estuaries and coastal waters, the majority of discharges occurring in estuaries. [3] In addition, direct and indirect industrial discharges to rivers that subsequently drain into estuaries and coastal waters are another significant source of pollutants to marine waters, though this source is difficult to quantify.

Large quantities of toxic pollutants are entering marine environments, particularly estuaries and coastal waters. Legal discharges of industrial effluents (contributed either directly to receiving waters or indirectly to publicly owned treatment works, or POTWs) often contain substantial amounts of toxic pollutants; indeed, in the aggregate, industrial discharges represent the largest source of toxic pollutants entering the marine environment.

The large quantities of waste entering estuaries and coastal waters through industrial discharges reflect several factors:

1. the concentration of population and industrial activity in coastal regions,
2. the cost savings to waste generators that use marine disposal as opposed to other alternatives, and
3. a statutory and regulatory approach that authorizes discharge-levels based more on technological capabilities than on resulting water quality.

The net effect of these factors is a considerable degree of ' 'acceptance' of the routine (but environmentally very significant) discharge of effluents into estuaries and coastal waters, especially when contrasted with the public and government attention focused on dumping of industrial and municipal wastes in the open ocean. This dichotomy is one reflection of the very different philosophical approaches embodied in the two major statutes governing marine waste disposal: the managerial perspective of the Clean Water Act and *the* more restrictive perspective of the Marine Protection, Research, and Sanctuaries Act (see ch. 7).

[1] Industrial effluents are wastewaters that are discharged through pipelines. They can be either legally discharged *directly* into receiving waters or *indirectly* via sewerage systems operated by publicly owned treatment works (POTWs). Both practices are regulated through programs established under the Clean Water Act (CWA). Direct dischargers are regulated through the National Pollutant Discharge Elimination System (NPDES) and indirect dischargers fall under the National Pretreatment Program. Both programs have State or local, as well as Federal, components.

'Industrial discharges into coastal waters (as defined in this report) are distinguished by the CWA and thus are a partial exception to this generalization, CWA Sec. 403 requires that discharges into the ' 'territorial sea, contiguous zone, or open ocean be in compliance with the Ocean Discharge Criteria (40 CFR 125, Subpart M). Under this provision, most industrial discharges into estuaries would not be required to meet the Ocean Discharge Criteria; however, industrial discharges into coastal waters would be subject to the criteria. When promulgating the criteria in 1980, EPA estimated that about 230 land-based point source discharges, as well as fixed offshore facilities required to obtain NPDES permits (e. g., the approximately 3,000 offshore oil and gas platforms), would be affected (45 FR 65944, Oct. 3, 1980). See ch. 7 for further discussion of the Ocean Discharge Criteria.

[3] Ch. 3 presents data on the extend of this activity that specifically affects marine environments. This chapter presents data for all L', S. waters.

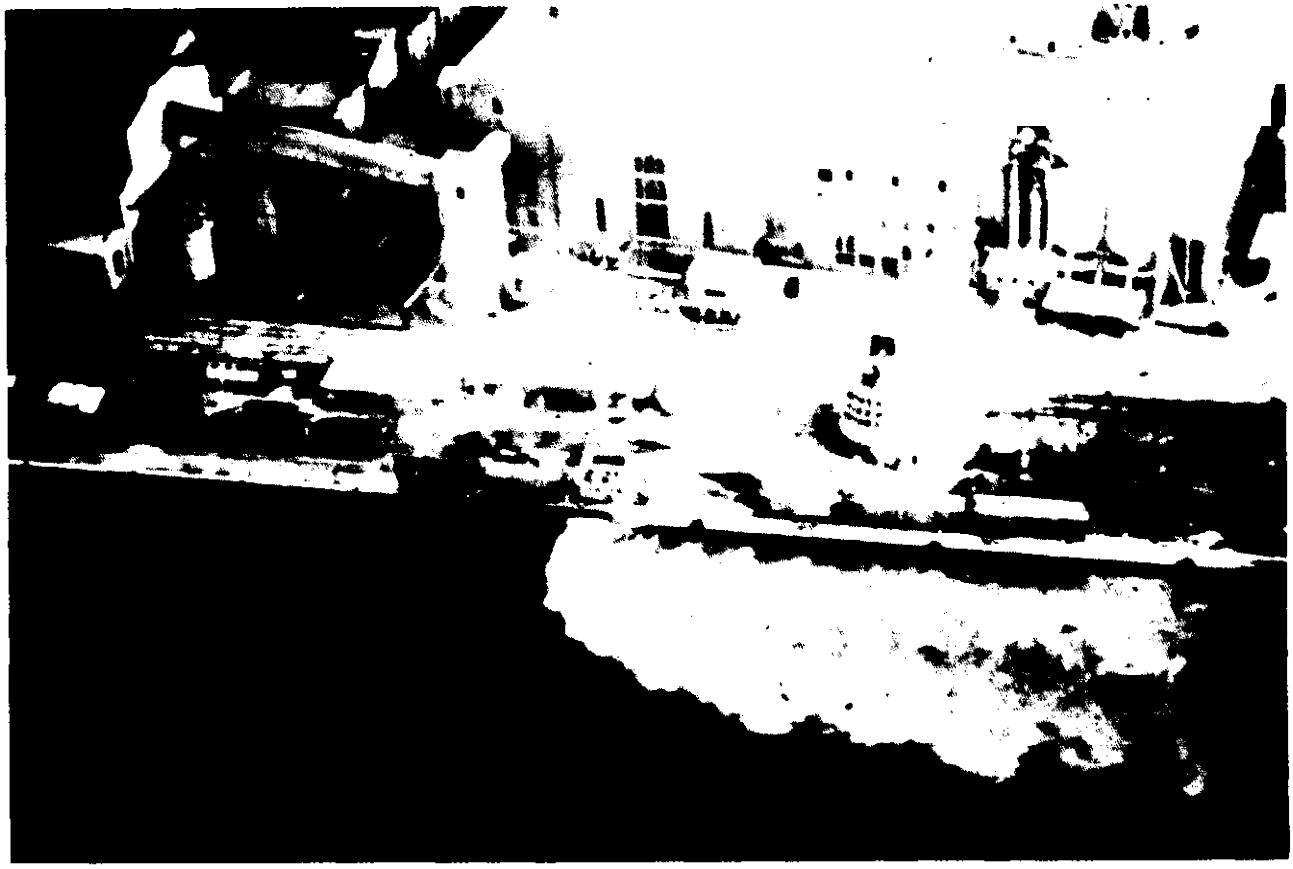


Photo credit: **Northeast Technical Services** *Administration, U.S. Food and Drug Administration*

More than 1,300 major industrial facilities discharge wastes directly into U.S. marine waters, mostly into estuaries. Thousands of others discharge into rivers that carry pollutants into these waters, or into POTWs that subsequently discharge into marine waters. These various industrial discharges are the largest sources of the organic chemicals and many metals found in many estuaries and coastal waters.

EXISTING REGULATORY FRAMEWORK FOR POINT SOURCE POLLUTION CONTROL

The NPDES Program

The Clean Water Act (CWA) regulates the discharge of wastes into the navigable waters of the United States, including estuaries and coastal waters. This act, passed in 1972, established the National Pollution Discharge Elimination System (NPDES, 40 CFR 122) to regulate these point source discharges. Under NPDES, all point sources—both industrial and municipal—that *directly* discharge into waterways are required to obtain permits that regulate their discharges.[4]

[4]In addition to complying with general treatment requirements specified in NPDES permits, municipal sources (i.e., POTWs) and industries discharging to POTWs must also comply with applicable requirements under the National Pretreatment Program.

General Structure

The NPDES program contains four essential operational elements:

1. The *discharge permit* is the basic "currency' of the NPDES program. Each permit specifies effluent limitations for particular pollutants, monitoring requirements (including a schedule), and reporting requirements for information characterizing and quantifying a facility's actual discharge. If compliance with final effluent limitations has not yet been achieved, a permit (or more typically, a separate order) is issued that contains interim limitations and a compliance schedule.

2. A system based on self-reporting by permitters is the basic approach used to provide the information necessary to determine whether effluent limits specified in a permit are being met. The entire system therefore heavily relies on permittee integrity in reporting results of self-monitoring.
3. Compliance *monitoring* encompasses those activities intended to determine whether facilities are achieving the requirements contained in their discharge permits. Such activities include conducting inspections, reviewing reports submitted by permitters, monitoring to verify industry-reported data, and compiling statistical information to assess compliance.
4. *Enforcement* includes all actions taken in response to an identified instance of noncompliance, including determination of the appropriate response based on the severity of a violation and other factors, and initiating and escalating the response until compliance is achieved.

Permit issuance, receipt of data submitted by permitters, compliance monitoring, and enforcement are the primary responsibility of States (if they have been approved to administer their State's NPDES program under CWA Sec. 402) or Environmental Protection Agency (EPA) Regions (under CWA Sections 309 and 504), although EPA Headquarters and the Department of Justice can initiate or intervene in enforcement actions. [5] Thirty-seven States and one Territory (the Virgin Islands) have approved NPDES programs (503).

Regulated Pollutants

The 1972 CWA focused on controlling *conventional* pollutants. It soon became apparent, however, that *toxic* and *non-conventional* pollutants in wastes such as industrial effluents, sewage sludge, and dredged material also were causing adverse impacts. [6] In 1977, Congress amended CWA to provide additional regulation of toxic and non-conventional pollutants from specific industrial categories within the framework of the NPDES permitting and compliance process. [7]

A list of 65 classes of toxic ' 'priority pollutants' and 21 primary industrial categories to be regulated by EPA were included in the 1977 CWA Amendments. This list arose out of a Settlement Agreement of a suit brought against EPA by the Natural Resources Defense Council. [8] EPA subsequentl, divided the 65 classes into 129 priority pollutants, an amount later reduced to 126 pollutants (40 CFR 122, app. D). The 21 industrial categories were subdivided into 34 categories (40 CFR 122, app. A); 9 of these were specifically exempted from regulation by categorical standards, leaving about 25 primary industrial categories for which categorical effluent guidelines for priority pollutants were to be promulgated (table 13). [9] An additional 35 industrial categories not included in the amendments were designated as secondary; development of effluent guidelines for priority pollutants in these industries was deferred until an unspecified later date (503).

Compliance Monitoring and Data Management

Several tools have been developed to monitor compliance, identify cases of noncompliance, and manage data (box T).

Enforcement

EPA has revised its national Enforcement Management System (EMS) (673) to provide better guidance on enforcement to EPA Regions and delegated States, and to provide a greater degree of nationwide consistency in administrative responses to in-

[5] Sec. 305 of CWA also authorizes private citizens or their representatives to bring enforcement suits against dischargers. While this approach represents an increasingly effective means of strengthening enforcement, it is beyond the scope of this report. For further information on this topic, see refs. 45, 453, and 501.

[6] See box A in ch. 1 for definitions of these classes of pollutants.

[7] Municipal dischargers (i. e., POTWs) arc required to meet standards different from those for direct industrial dischargers. Regulations for most POTWs specify a minimum level of treatment (termed "secondary' that is measured in terms of reduct ion of conventional pollutant parameters. As an alternative to requiring POTWs to employ technological means for controlling toxic and non-conventional pollutants introduced through indirect industrial discharges, CWA provides for such control through industrial pretreatment programs, Discharges from both POTWs and industrial facilities must also meet applicable State water quality control standards where they havebeen developed.

[8] *NRDC v. Train 8* ERC 2120, June 8, 1976; *NRDC* v. *Costle*, *12* ERC 1833, Mar. 9, 1979; modified by additional orders of Oct. 26, 1982, Aug. 2, 1983, and Jan. 6, 1984

[9] The actual number of categories has changed as categories have been exempted, combined, or separated.

Table 13.—industrial Categories Subject to Regulation Under the NPDES and Pretreatment Programs as Significant Sources of Toxic Pollutants[a]

	Number of indirect dischargers	Number of direct dischargers
Aluminum forming	64	42
Battery manufacturing	134	15
Coal mining		10,375
Coil coating I	29	29
Coil coating II	80	3
Copper forming	45	37
Electrical and electronic components I	244	83
Electrical and electronic components II	21	1
Foundries	499	301
Inorganic chemicals I	21	114
Inorganic chemicals II	17	35
Iron and steel	160	738
Leather tanning	141	17
Metal finishing and electroplating	10,200	*2,800*
Nonferrous metals forming	151	*51*
Nonferrous metals manufacturing I	*85*	79
Nonferrous metals manufacturing II	40	33
Ore mining	0	515
Organic chemicals and plastics and synthetic fibers	535	*1,082*
Pesticides	39	*42*
Petroleum refining	47	*164*
Pharmaceuticals	392	*80*
Plastics molding and forming	1,145	810
Porcelain enameling	50	28
Pulp and paper	261	355
Steam electric	93	?
Textile mills	1,047	229
Timber processing	47	?
Total	15,597	>18,058

[a]The number and names of categories listed here do not correspond exactly to those indicated in the text or the Code of Faderal Regulations, due to subsequent joining or dividing of categories by EPA. The numbers include only those dischargers that are regulated under categorical standards.

SOURCES: Office of Technology Assessment, 19S7; based on U.S. Environmental Protection Agency, Office of Regulations and Standards, Monitoring and Data Support Division, *Summary of Effluent Characteristics and Guide/lnes for Selected Industrial Point Source Categories: Industry Status Sheets* (Washington, DC: Feb. 28, 1986); except for data from the proposed or final rules for the Steam Electric and Timber Processing categories, from Science Applications International Corp., Overview of Sewage *Sludge and Effluent Management,* contract report prepared for US. Congress, Office of Technology Assessment (McLean, VA: March 19S6).

stances of noncompliance. First developed in 1977, the original EMS was used by few States and EPA Regions; current policy, however, mandates development of a formal enforcement system consistent with the revised EMS. The revised version specifies time frames within which enforcement actions against ' 'significant noncompliers' must be initiated and also specifies procedures for identifying, initiating, and following through with appropriate enforcement actions. In addition to maintaining an inventory of permits and processing submitted data, States or Regions are expected to:

- conduct "enforcement evaluations' to determine an appropriate level of enforcement action and an associated time frame, based on guidelines and procedures developed for the various predetermined categories of violation. Factors to be considered include: the magnitude and duration of the violation; the compliance record of the permittee and past enforcement actions taken; the expected deterrent effect of the response based on experience from comparable situations; and consideration of fairness, equity, and national consistency.
- institute formal enforcement actions and follow-through wherever-necessary, usually triggered by a failure to comply through less formal means within a specified period of time.
- initiate field investigations (i. e., inspections) in support of enforcement actions according to a systematic "annual compliance inspection plan.

EPA expected approved States and EPA Regions to revise and formalize their enforcement policies to meet the new requirements and be consistent with the new EMS by the end of fiscal year 1986. However, the Federal Government has only limited ability to ensure that States do so.

Enforcement Tools Available to Administering Agencies.—Once an NPDES permit violation is identified, two primary levels of enforcement responses are used:

1. Informal enforcement responses include inspections, phone calls, violation letters, and Federal Notices of Violation. The latter, which is sent to the permittee and the administering State agency, can require certain steps to be taken according to a specified schedule.
2. Formal enforcement responses require written notification that specifies: 1) actions to be used to achieve compliance, 2) a timetable, 3) the consequences of noncompliance that are enforceable without having to prove the original violation, and 4) the legal consequences

BOX T.-Tools for Compliance Monitoring and Data Management Under NPDES*

Tracking Compliance and Identifying Noncompliance

d **Monitoring Reports (DM**

i **self-monitoring activities. D**
periodically (typically
i **(major and minor),**
the results of all monitoring required by th
mit, and are to be submitted to EPA on a m
or quarterly basis. Certain serious permit viola-
tions are to be reported at the time they occur, usu-
ally by phone.

- **Inspections** can in principle be used to collect samples to detect violations, but because of limited resources they are primarily used to verify reported noncompliance and to support formal enforcement actions.
- **Quarterly Noncompliance Reports (QNCRs)** are required to be prepared by EPA Regions or approved States. QNCRs document certain instances of noncompliance by major permittees that occurred during the previous quarter. The most recent rules distinguish between Category I noncompliance (quantifiable, and therefore consistent nationwide) and Category II noncompliance (dependent on professional judgment, and therefore subject to variability). All instances of noncompliance that exceed Certain criteria"* for magnitude, duration, and frequency—and any enforcement taken—must be reported each quarter until resolved; permitters under enforcement orders must be listed until compliance with both the orders and permits is achieved.

* **Semi-Annual** statistical **Summary Reports (SASSRs), prepared by** EPA **Regions or delegated** States, are more comprehensive **than QNCRs** in that they **must list all instances in which a major permittee** had two or **more violations of the same** permit **limitation** in **any 6-month period, regardless of whether other criteria** are **met. Both QNCRs and SASSRs** are **intended to help EPA** with **oversight of** Regional and **State compliance programs.**

Measuring and Ranking Instances of Noncompliance

EPA has evolved a complex system for ranking instances of noncompliance so the limited resources allotted to enforcement activities are directed toward the most serious violations. A multi-step process is used to identify and evaluate noncompliance. First, an initial screening of DMR data is performed to identify all instances of noncompliance with permit
enforcement
exceed specified criteria p r i t y r e v i e w b y a **toofessional** i n e if an enforcement **action should be initiated,** violations **are further ranked to determine** whether the enforcement **response should** a l **or** formal. Two sets of **criteria have been** developed **for** evaluating violations **limits, rent** m p l i a n c e s c h e d u l e s, o r **reporting requirements** i n p e r m i t s o r **enforcement orders:**

- **Violation Review Action Criteria (VRAC)** specify **minimum thresholds for the duration and frequency of violations** which require **professional review,** but **not necessarily formal** enforcement responses. **The VRAC have been** developed nationally, and can **only be modified** by States to be **more** stringent.***
- **Significant Noncompliance (SNC):** EPA has **developed a further** s@ of criteria to **define** instances **of significant** noncompliance. All instances of **SNC must** be reported on **QNCRs.** Moreover, **EPA specifies** that **all SNC** violations must be **corrected (generally** within one quarter) or a ***formal*** **enforcement** response be initiated prior to its **appearance on a** second **QNCR** (generally within 60 **days of the first QNCR), unless** an acceptable **justification for other** (or no) action is provided. **If States or Regions fail to** act on **this** schedule, EPA **has the** a u t h o r i t y a n d r e s p o n s i b i l i t y **to do so.**

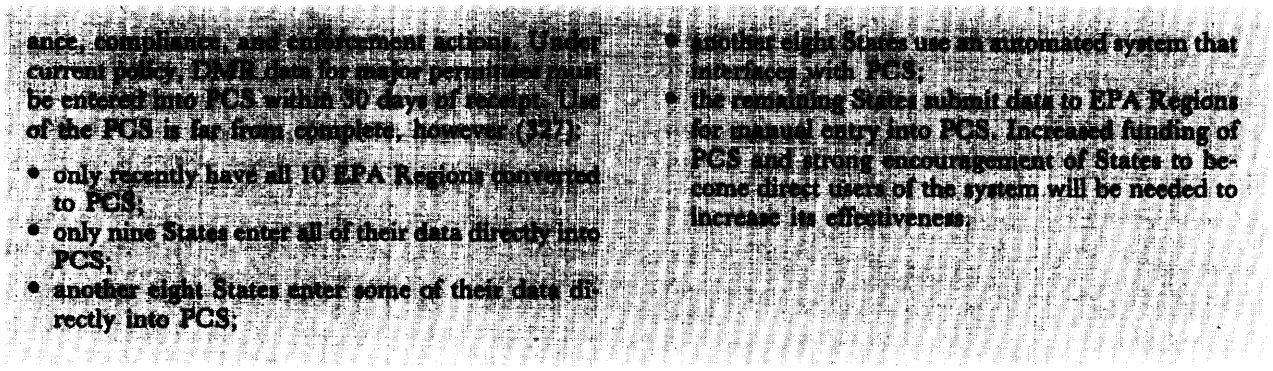
Data Management

Permit Compliance System (PCS): PCS, an automated data system, is intended to serve as EPA's **primary management tool for** tracking permit **issu-**

*The basic tools for carrying out these activities for indirect dischargers are discussed in the section describing the National Pretreatment Program.

**QNCR criteria are specified in the QNCR Regulation, 40 CFR 123.45.

***For violations of effluent limits specified ill permits, VRAC are intended to identify a broader range of violations than the criteria& determining which violations must be reported on QNCRs; e.g., only the number of violations—not their magnitude-is a factor. However, for effluent limits specified in enforcement orders, and for schedule and reporting violations, the VRAC and QNCR criteria arc equivalent.



of noncompliance. Two basic types of formal enforcement actions are available:

—An administrative order (AO) generally specifies actions to be taken by a permittee to return to compliance, and a schedule for doing so; AOs issued by EPA cannot be used to assess penalties, although noncompliance is itself an enforceable violation. AOs are generally the first course of formal action because of their expedience and low cost. More than 1,600 AOs were issued by EPA Headquarters or Regional Offices for CWA violations in 1984 (327).

–Judicial referrals are civil actions filed by the State attorney general in an approved State, or otherwise by the Department of Justice. Such referrals are much more lengthy and costly procedures, and fewer than 100 such actions were initiated at the Federal level in 1984 (327).

Currently, court action is the only option available to the Federal Government that can result in the imposition of a financial penalty. Because of the slowness of this procedure and the low penalties that often result, however, it is generally considered an insufficient enforcement mechanism (see discussion of the enforcement issue later in this chapter). Moreover, insufficient resources for enforcement in EPA Regions and Headquarters effectively limit the number of judicial actions that can be undertaken. Some States have the legal authority to impose administrative penalties, and EPA recently was granted comparable authority through amendments to the CWA adopted in the Water Quality Act of 1987. Such authority should greatly enhance the capability of EPA to mount appropriate and timely enforcement actions against violators.

Evaluation of Program Performance .-Under the EMS, two levels of review are mandated to evaluate the performance of administering agencies (i. e., approved States or EPA Regions). [10] First, EPA Headquarters is to perform midyear evaluations of the progress of EPA Regions in implementing the EMS. Second, Regional offices are to conduct reviews of approved State programs, including file audits. The new requirements of the EMS will be the benchmark for measuring system performance.

The National Pretreatment Program

In addition to discharging pollutants directly into receiving waters, industrial facilities also discharge into sewerage systems operated by POTWs; these discharges are designated as "indirect' to distinguish them from "direct" discharges into rivers and other waterbodies. In 1977, Congress broadened the effective scope of CWA by mandating additional regulation of pollutants in indirect industrial discharges (CWA Sec. 307(b)). To meet this mandate, in 1981 EPA developed the National Pretreatment Program (40 CFR 403).

General Structure

The National Pretreatment Program is designed to protect POTWs and the environment by preventing the introduction of industrial wastes that might upset or interfere with POTW operations, pass through the POTW untreated, or contaminate sewage sludge. Under this program, all POTWs are responsible for enforcing General Pretreatment Regulations, and some POTWs are also required to enforce National Categorical Standards.

[10] These requirements are spelled out in the National Guidance for Oversight of NPDES Programs, issued June 28, 1985.

The General Pretreatment Regulations establish industrial, local, State, and Federal responsibilities for implementing the program. They also contain standards that prohibit the discharge into a POTW of pollutants which could cause fire or explosion, obstruct ion of flow, corrosion, interference or upset, or excess heating of wastewater entering the POTW. These general regulations apply to all industrial and commercial establishments that discharge into POTWs.

The National Categorical Standards contain specific pretreatment standards for the "categorical industries that are subject to regulation as significant sources of toxic pollutants (see table 13). A subset of the Nations POTWs, chosen on the basis of high wastewater flow and/or significant industrial inputs, must develop individual pretreatment programs that meet national specifications and must enforce these categorical standards against their indirect dischargers.

The General Pretreatment Regulations also include a provision for regulating industrial discharges of pollutants not covered by categorical standards. If a POTW experiences operational or pass-through problems that are related to industrial discharges of pollutants, POTWs are mandated to develop their own limitations on these discharges (termed ' 'local limits' '). Local limits can be more stringent than categorical regulations if this is needed to prevent pass-through or interference; they can also be developed to cover pollutants or industries not regulated by categorical standards.

Federal, State, POTW, and Industrial User Responsibilities

Responsibilities under the National Pretreatment Program are closely linked to the administration of NPDES program. Two general areas of responsibility are established. The *Approval Authority* (typically a State or EPA Region) is responsible for overseeing the development and implementation of individual POTW pretreatment programs. The *Control Authority* is responsible for ensuring that indirect industrial dischargers achieve and maintain compliance with pretreatment standards and requirements. Once an individual POTW program is approved, the POTW becomes the Control Authority. [11]

[11] In large municipalities with several POTWs, the municipality is often designated as the Control Authority.

States that have received NPDES program authority can also be approved to administer the pretreatment program (i. e., become the Approval Authority). To be approved, the State must demonstrate that it has the authority, resources, and procedures required to approve, oversee, and ensure enforcement of individual POTW pretreatment programs. EPA Regions serve as Approval Authority for nonapproved States, and provide general oversight, guidance, and enforcement assistance for approved States. Under certain circumstances, States with Approval Authority may design a program under which the State is also the Control Authority.

Of the 37 States and 1 Territory with EPA-approved NPDES programs, 24 also have approved pretreatment programs and hence are Approval Authorities (327). Six of these States have opted to assume Control Authority as well, so that POTWs in these States are not required to develop comprehensive individual pretreatment programs. [12]

In general, all POTWs with a total daily flow of more than 5 million gallons, and smaller POTWs with significant industrial inputs, are required to develop and implement individual POTW pretreatment programs. Currently, only about 1,500 of the more than 15,000 POTWs in the United States meet these criteria (32 7). Of these about 40 percent have an average flow of more than 5 million gallons per day (mgd). These 1,500 POTWs receive an estimated 82 percent of the total industrial wastewater flow entering the Nation's POTWs and over 90 percent of the wastewater flow originating from industries subject to categorical pretreatment standards (666). These POTWS also generate more than 75 percent of the sludge in the United States (503).

As of October 1986, EPA had approved more than 95 percent of the required individual POTW pretreatment programs (data from Strategic Planning and Management System, Office of Water Enforcement and Permits, U.S. EPA). Many of the approved programs, however, are only in the early stages of being implemented (e. g., ref. 497).

Industrial facilities that discharge wastewater to POTWs (termed "industrial users' but which are

[12] Texas operates its own permitting program for both direct and indirect dischargers, alongside the NPDES program administered by EPA Region VI.

not subject to categorical standards must still comply with the General Pretreatment Regulations (see above), as well as additional permit, **monitoring,** or reporting requirements developed by States or POTWs. For categorical industrial users, responsibilities specified in categorical regulations include complying with technology-based effluent limitations on pollutants of concern, monitoring discharges on a periodic basis, and reporting monitoring data and compliance status to control authorities. [13]

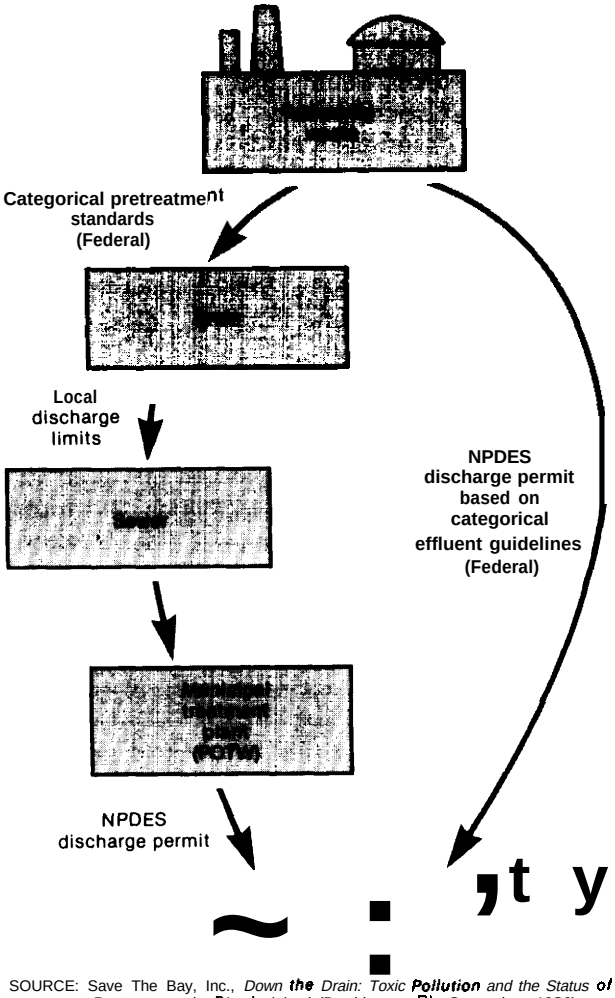
Types of Standards for Direct and Indirect Dischargers

Several different types of standards have been developed to regulate industrial discharges of wastewater and pollutants to POTWs or receiving waters. Figure 30 schematically illustrates the relationships between these standards and indicates where they apply within the overall regulatory framework for water pollution control.

Technology-Based Standards

The effluent limits set in NPDES permits to control *direct industrial dischargers* are primarily technology-based standards applied to individual pollutants. Existing direct industrial dischargers were initially required to meet interim standards based on the "best practicable control technology currently available' (BPT). The next levels of limitations imposed on industrial effluents are termed ' 'best available technology economically achievable" (BAT), designed primarily to control toxic and non-conventionzd pollutants, and ' 'best conventional pollutant control technology" (BCT), designed to control conventional pollutants. Finally, new industrial facilities are required to comply with ' 'new source performance standards' (NSPS), which are generally comparable to BAT and BCT.

Figure 30.—Regulatory Framework and Standards for Industrial Discharges



SOURCE: Save The Bay, Inc., *Down the Drain: Toxic Pollution and the Status of Pretreatment in Rhode Island* (Providence, RI: September 19S6).

As described previously, *municipal dischargers* (POTWs) are required to meet standards different from those for direct industrial dischargers. Technology-based regulation of POTW discharges focuses almost exclusively on conventional pollutant control through the requirement that POTWs achieve "secondary' levels of treatment (ch. 9),

Indirect industrial dischargers must comply with technology-based pretreatment standards for existing sources (PSES) or pretreatment standards for new sources (PSNS). These standards, in combination with the fact that POTWs incidentally remove some pollutants prior to discharging wastewater (ch. 9), are intended to establish pollutant

[13] Three types of reports are required of categorical industrial users (40 CFR 403. 12), each containing information on the composition of a facility's discharge with respect to those pollutants regulated by categorical standards. Baseline Monitoring Reports (BMRs) and Compliance Reports comprise the initial reporting of conditions after pretreatment standards are effective and after the final compliance date is reached, respectively. Semi-annual reports are required so that continued compliance status can be periodically verified. EPA recently has proposed revisions to the General Pretreatment Regulations (51 FR 21454, June 12, 1986) which are intended to clarify and expand requirements applicable to reporting and monitoring for industrial users. Among other things, these revisions would provide the authority for POTWs to extend some of these requirements now applicable only to categorical industries to noncategorical industrial users as well.

control which is roughly equivalent to that achieved by the BAT and BCT standards for direct dischargers. In addition, indirect dischargers must comply with local limits where they exist; such limits can be developed by POTWs or States to prevent toxic pollutants from disrupting POTW treatment processes or from passing through a POTW into receiving waters.

Water Quality-Based Standards

Section 303 of CWA mandates that additional standards based on the health and desired use of individual waterbodies be developed for all waters of the United States. Such standards are to be used to supplement technology-based controls on point source dischargers and other sources where the technology-based standards are not capable of meeting water quality objectives. Water quality-based standards have been the subject of much debate and they are analyzed in detail later in this chapter.

QUANTITIES OF PRIORITY POLLUTANTS IN INDUSTRIAL DISCHARGES

Types and Numbers of Industries Regulated Under the Clean Water Act

Almost 60,000 industrial facilities[14] and 15,000 POTWs are regulated as *cfirect* dischargers under NPDES and are required to comply with technology-based standards, as well as State water quality-based standards where they have been developed. Over 130,000 industries and commercial establishments have been identified as indiect industrial dischargers into POTWs.[15] Of these, 14,000 to 16,000 are in industries covered by categorical standards*[G] (see table 13). While all indirect dischargers must comply with the General Pretreatment Regulations (as well as any local limits imposed by individual POTWS), only this subset must comply with the National Categorical Standards. (Table 13 lists only those dischargers in selected industries for which categorical standards have been promulgated or proposed.) Several other industrial categories have been granted exemptions from categorical standards (table 14).

Thus, approximately 75,000 direct and indirect industrial dischargers, and about 15,000 municipal facilities, are subject to federally derived standards. An additional 85,000 or more indirect dischargers must comply only with the General Pretreatment

Table 14.—Industrial Categories Granted Exemptions From Categorical Standards[a]

Category	Number of facilities
Adhesives and sealants	307
Auto and other laundries	90,800
Carbon black	12
Explosives	28
Gum and wood chemicals	21
Paint and ink formulation	1,217
Paving and roofing materials	NA
Photographic equipment and supplies	112
Rubber manufacturing	1,576
Printing and publishing	38,763
Soaps and detergents	NA

NA = data not available.
aThe number and names of categories listed here do not correspond exactly to those indicated in the text or the Code of Federal Regulations due to subsequent joining or dividing of categories by EPA.
bTotal includes direct and indirect dischargers but excludes zero dischargers.
cOnly portions of these industrial categories have been exempted.

SOURCES Science Applications International Corp., *Overview of* Sewage *Sludge and Effluent Management*, contract report prepared for U.S. Congress, Office of Technology Assessment (McLean, VA: March 19S6); and U S Environmental Protection Agency, Office of Water Regulations and Standards, *Report to Congress on the Discharge of Wastes to Publicly Owned Treatment Works (The Domestic Sewage Study)* (Washington, DC: February 1986)

[14] This total includes about 50,000 individually permitted facilities and about 10,000 additional facilities in industrial categories which have been or will be granted general permits (e. g , offshore oil and gas operations). See the discussion below about permit backlogs for further detail on general permits.

[15] This total includes the following number of facilities from exempted or noncategorical industries: 69,000 industrial and commercial laundries: 39,000 printing and publishing facilities; 7,000 timber products processing facilit ics, 1,100 plastics molding and forming facilit ies; 970 textile mills; and 750 paint manufacturers or formulators. These data are from EPA Industrial Technology Division's database (cited in ref. 666).

[16] This range, the accuracy of which is unknown, is derived by adding estimates for the number of individual facilities in each of the categorical industries taken from EPA's development documents (503,666). Approximately two-thirds (10,600) of these facilities are elect roplaters or metal finishers.

Regulations and any additional local limits developed by POTWs or States.

Amounts of Wastewater and Priority Pollutants Generated

Total industrial wastewater flow is roughly estimated to be 18 billion gallons daily, or 6.4 trillion gallons per year, with about three-fourths originating from direct dischargers and one-fourth from indirect dischargers (255,256,666).

Prior to treatment, raw wastestreams from direct and indirect dischargers contain large quantities of toxic metals and organic chemicals. EPA's Monitoring and Data Support Division (MDSD) maintains a database of flow and composition estimates for wastewaters of selected categorical industries. These data provide a way to estimate the quantity of metals and organic chemicals present in industrial wastewaters; however, this is a conservative estimate for several reasons:

- Only some of those industries for which categorical standards have been promulgated or proposed are included. In addition, pollutants from noncategorical industries are excluded.
- Only a fraction of all priority pollutants are included. 17
- Nonpriority pollutants are not included in the estimates.

The MDSD data (tables 15 and 16) indicate that a minimum of about 400 million pounds of priority metals and about 170 million pounds of priority organic chemicals are present in the raw wastewaters generated by *direct* dischargers in categorical industries each year. Raw wastestreams from *indirect* categorical dischargers are estimated to contain a minimum of 200 million pounds of priority metals and almost 60 million pounds of priority organic chemicals annually (665). Together, well over 800 million pounds of priority pollutants are present in raw wastewaters annually generated by categorical industries discharging to POTWs or the navigable waters of the United States.

Table 15.-Expected Reductions in Discharges of Priority Metals and Organic Chemicals by Selected Categorical Industries, Assuming Full Compliance With and Implementation of BAT and PSES Controls (summary of table 16)

	Raw	Full controls	
Type of discharge	Amount[a]	Amount[a]	Percent reduction from raw[b]
Priority metals:			
Indirect dischargers	198	6.8	96.60/0
Direct dischargers	403	6.4	98.4
Total	601	13.2	97.9 "/0
Priority organic chemicals:			
Indirect dischargers	56	8.3	85.30/o
Direct dischargers	172	1.7	99.0
Total	228	10.0	95.6°\o

[a] All amounts are millions of pounds per Year.
[b] p$_{ercen}$t reduction in amount of toxics as compared to amount in raw waste stream.

SOURCE: Office of Technology Assessment, 1967; based (except as noted in table 16) on U.S. Environmental Protection Agency, Office of Regulations and Standards, Monitoring and Data Support Division, Summary of *Effluent Characteristics and Guidelines for Selected Industrial Point Source Categories: Industry* Status *Sheets* (Washington, DC: Feb. 26, 1986)

Projected Removal of Priority Pollutants Through Full Treatment

Full implementation of, and compliance with, categorical standards would achieve major reductions in the amounts of priority pollutants discharged by these industries. Tables 15 and 16 summarize data on the estimated reductions that could be achieved *under full implementation* of BAT (for direct dischargers) and PSES (for indirect dischargers) categorical standards. These data are drawn from performance models of control technologies mandated under standards already in place or proposed (665). The total quantity of priority pollutants present in discharges of fully regulated wastestreams is projected to be only about 3 percent of the levels in the raw wastewaters. Even at this level of removal, however, more than 13 million pounds of priority metals and 10 million pounds of priority organic chemicals will be discharged an-

[17] Only those priority pollutants identified in the development document for a particular industrial category are included; only a subset of these are specifically regulated under BAT or PSES standards, based on consideration of the amount present in the wastewater and engineering and economic feasibility. For example, 8 priority metals and 32 priority organic chemicals are listed for the leather tanning industry. However, BAT and PSES specify a limit on only one metal (chromium) and no organic chemicals, even though a number of the other priority pollutants are present in significant amounts. Reductions in total suspended solids and other conventional pollutants—achieved through BPT for direct dischargers and POTW treatment for indirect dischargers—are relied on to achieve incidental removal of most of the unregulated substances; in addition, compliance with a BAT or PSES limit on one priority pollutant might also achieve incidental removal of others.

Table 16.—Expected Reductions[a] in Discharges of Priority Metals and Organic Chemicals by Selected Categorical Industries, Assuming Full Compliance With and Implementation of BAT and PSES Controls

	Priority metals						Priority chemicals					
	Indirect dischargers			Direct discharge=			Indirect	Indirect		Direct dischargers		
	Raw	PSES[b]	Percent removal[c]	Raw	BAT[b]	Percent removal	Raw	PSES	Percent removal	Raw	BAT	Percent removal
Aluminum forming	1,192	8	99	736	16	98	1	0	100	736	16	98
Battery manufacturing	**3,495**	2	100	566	1	100	0	0	0	0	0	0
Coil coating (1)	**363**	2	99	251	1	99	3	0	100	2	0	100
Coil coating (11)	**76**	18	77	3	1	78	85	2	98	3	0	100
Copper forming?	**8,780**	**10**	100	7,219	9	100	37	1	97	31	3	90
Electrical and electronic components (1)	**147**	**135**	8	63	38	39	281	42	85	**102**	**19**	**82**
Foundries	**12,317**	**13**	100	12,827	16	100	686	5	99	**562**	**5**	**99**
Inorganic chemicals (1)	**2,300**	**24**	99	6,067	208	97	0	0	0	**0**	**0**	**0**
Inorganic chemicals (11)	**195**	1	99	394	17	96	0	0	0	**0**	**0**	**0**
Iron and steel	18,402	**361**	98	269,606	750	100	**18,635**	*847*	95	**30,957**	**77**	**100**
Leather tanning	5,321	**475**	91	899	17	98	**517**	*142*		**76**	**2**	**98**
Metal finishing/electroplating	136,684	**3,754**	97	62,446	1,704	97	**8,815**	*92*	99	**2,429**	**42**	**98**
Nonferrous metals forming	215	1	100	631	1	100	**0**	0	0	**2**	**0**	**100**
Nonferrous metals (1)	131	**3**	98	331	45	86	**0**	0	0	**171**	1	**99**
Nonferrous metals (II)	249	**0**	100	750	3	100	**0**	0	0	**9**	**0**	**100**
OCPSF[e]	5,519	**23**	100	34,999	102	100	**18,698**	17	100	**118,420**	**123**	**100**
Petroleum refining	291	**291**	0	1,488	291	80	**1,222**	1,222	0	**6,248**	**38**	**99**
Pharmaceuticals	125	**125**	0	26	26	0	**212**	112	*47*	**43**	**23**	**47**
Plastics molding and forming	26	**26**	0	41	29	30	**29**	29	0	**42**	**37**	**12**
Porcelain enameling	527	**15**	97	277	8	97	**0**	0	0	**0**	**0**	**0**
Pulp and paper	864	**864**	0	2,865	2,752	4	**5,645**	5,582	1	**11,052**	**1,131**	**90**
Textiles	725	**603**	17	590	360	39	**1,329**	214	84	**914**	**173**	**81**
Total	197,944	6,754	97	403,075	6.395	98	56,195	8,307	85	171,799	1,690	99

[a] All quantities are in thousands of pounds per year

[b] Amounts expected to be discharged under full implementation of, and compliance with, PSES or BAT categorical standards See text for definition of PSES and BAT; note that indirect removals are mandated through PSES standards; direct removals are mandated through BAT standards

[c] percent reduction in amount of priority metals or organic chemicals relative to amount in raw wastewater.

[d] Data for the Copper Forming Category are derived from u S Environmental Protection Agency, *Final Development Document for Effluent Limitations and Standards for the Copper Forming Point Source Category,* EPA 440/1-841074, table X-19, p 467 (Washington, DC: March, 1984), during a review of a draft of this OTA report, EPA found that the primary source of Information for this table (see below) contained incorrect data for this category

[e] Data for th, Organic Chemicals and Plastics and Synthetic Fibers (OCPSF) category are taken from a "Correction f.Jotlce/Notice of Availability" published by EPA (50 *Federal Register* 41528, Oct 11, 1985) These data are the most recent available estimates for the OCPSF category and have been revised downward from previous estimates. They should not be regarded as final, however, as they may be subject to further revision

SOURCE Off Ice of Technology Assessment, 1987, based (except as noted) on U S Environmental Protection Agency, Off Ice of Regulations and Standards, Monitoring and Data Support Division, *Summary of Effluent Characteristics and Guidelines* for Selected Industrial Point Source *Categories Industry Status Sheets* (Washington, DC: Feb 28, 1986)

nually in wastewaters originating from categorical industries (665). [18]

Direct dischargers account for more than twice as many of the priority pollutants present in raw wastewaters than do indirect dischargers (69 percent v. 31 percent); in contrast, most (about 65 percent) of the priority pollutants expected to be discharged upon full implementation of BAT and PSES controls will originate from indirect sources. However, pollutants in indirect discharges are subject to additional ' 'incidental' removal as a result of treatment at POTWs, so that further reductions are achieved prior to their discharge to waterbodies. [19]

About 80 percent of all indirectly discharged industrial wastewater enters POTWs that are required to have individual pretreatment programs, and a similar percentage receives secondary or higher levels of treatment at POTWs (255,503; also see ch. 9).[20] As discussed previously, the intent of the national categorical standards is to achieve a total reduction—through a combination of pretreatment by industries and incidental removal by POTWs —in discharges of priority pollutants by regulated indirect dischargers that is roughly equivalent to the levels resulting from implementation of BAT and BCT standards for direct dischargers.

Removal of Priority Pollutants Achieved to Date

The partial implementation achieved to date of standards developed under the NPDES and National Pretreatment programs has significantly reduced the amounts of priority pollutants in direct and indirect discharges from some categorical industries. However, the Nation is far from achieving full implementation of, and full compliance with, categorical standards. Moreover, these standards only apply to some industries and pollutants, so even if fully effective, significant quantities of toxic pollutants will remain unregulated by categorical standards.

Unfortunately, existing data do not allow an accurate assessment of how close these programs are to achieving full removal of regulated pollutants. The MDSD database does contain estimates of ''current' discharges for industries with categorical standards in place. These estimates are highly questionable, however, because the current discharge is assigned the same value as the discharge expected under full implementation of BAT or PSES, even though implementation of and/or compliance with the standard is far from complete in many cases (e. g., metal finishing and electroplating). These and other shortcomings cast sufficient doubt on estimates of current discharges so as to preclude their use in estimating the extent of removal of priority pollutants achieved to date.

For particular industries, more reliable data are available in some cases and reveal considerable variation in progress toward achieving full BAT or PSES reductions. For example, EPA's most recently published estimates for the Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) industry (50 FR 41528, Oct. 11, 1985) suggest that technology already in place is achieving pollutant removals of more than 99 percent for *direct* dischargers, resulting in discharges that are only about fivefold higher than that expected under the most stringent BAT standards proposed .21 For indirect dischargers, however, these same data indicate only a 4 percent removal, vastly less than the removal expected under full implementation of PSES.

[18] It is important t. remember that these removal estimates are only for a subset of priority pollutants and do not include any nonpriority substances. Nor do they include any pollutants from noncategorical industries.

[19] Many pollutants removed from industrial wastewaters treated at POTWs will become contaminants of municipal sludge, generating a different set of disposal problems. This issue is discussed in detail in ch. 9.

[20] In marine waters areas, a smaller percentage of total wastewater flow into POTWs—and presumably indirectly discharged industrial wastewater as well—receives secondary or higher treatment. About 39 percent of the wastewater entering POTWs discharging to coastal waters, and 60 percent of that entering POTWs discharging to estuaries, receives secondary or higher treatment (503). This is probably due in large part to the fact that a number of large coastal POTWs have been granted or have applied for waivers from achieving secondary treatment under CWA Sec. 301(h). The fraction of total POTW flow contributed by industrial dischargers is also slightly lower in marine waters: 14.5 percent v. 17 percent nationally.

[21] OCPSF industry representatives argue that this level of removal has been accomplished—even in the absence of final regulations—by installing the appropriate pollutant controls either in anticipation of the regulations or in response to permit limits that have been developed using the best professional judgment (BPJ) of the permit writers (R. Schwer, E.I. DuPont de Nemours & Co., pers. comm., November 1986),

Reducing Priority Pollutants in Specific Industries

Table 15 presents data on selected primary industrial categories, indicating a) the quantities of priority pollutants in their raw wastewaters, and b) the quantities expected in their discharges assuming full compliance with categorical standards. Direct and indirect dischargers, and priority metals and organic chemicals, are considered separately. Several conclusions can be drawn from these data:

- Whether for raw or fully regulated (PSES/BAT) wastestreams, a few industries tend to dominate the picture, for both direct and indirect discharges, In each case, the top 3, 4, or 5 industrial categories comprise 90 percent or more of the total amount of priority metals or organic chemicals present in wastewaters.
- The effectiveness of BAT or PSES levels of control varies greatly among different industries, ranging from very low removal (pulp and paper) to essentially full removal (organic chemicals, plastics, and synthetic fibers[22]). Under full implementation of standards, however, most industries are predicted to achieve more than 90-percent removal.

[22]Estimates for this industrial category are based on the cent rols specified in the *proposed* categorical regulation.

ISSUES IN THE MANAGEMENT OF INDUSTRIAL EFFLUENTS

A number of issues remain regarding the adequacy of the current framework that regulates industrial discharges. These issues primarily concern major constraints on the development and implementation of the NPDES and pretreatment programs. Four key areas of deficiency need to be addressed:

1. delays in program implementation, including:
   —delays in promulgation of Federal regulations, and
   —unpermitted sources and permit renewal backlogs;
2. gaps in program coverage, including:
   —nonregulated industries,
   —nonregulated toxic pollutants, and
   —permit deficiencies;
3. inadequacy of regulatory compliance and enforcement, including:
   —self-reporting: quality and completeness of discharge data,
   —extent of noncompliance with effluent discharge limits, and
   —effectiveness of enforcement; and
4. additional issues facing the pretreatment program, including:
   —lack of incentives for POTW program implementation and enforcement, and
   —hazardous waste in sewers.

In addition to these four areas, several other problems that adversely affect the management of industrial effluents are often identified. These include: 1) the inadequacy of resources available for permitting, compliance monitoring, and enforcement activities; 2) a need for better management of the data collected from dischargers to allow centralized access for assessing program performance and progress; and 3) inconsistent policy, methodology, and performance among EPA Regions, States, and local authorities with respect to implementing and enforcing water pollution control programs.

Delays in Program Implementation

Delays in Promulgation of Federal Categorical Regulations

In the absence of final categorical regulations, it is difficult for POTWs and other regulatory bodies to carry out enforcement against dischargers. Regulations for some significant industrial categories (e. g., organic chemicals and plastics) have been proposed, but not yet promulgated (table 17). Uncertainties about the final form of these regulations have caused delays in the implementation of treatment technologies in these industries. Even where final regulations exist, scheduled pretreatment compliance dates have in many cases not yet been

Table 17.—Final and Proposed Regulations for Categorical Industries

	Date of promulgation	Effective date[a]	Date of PSES compliance
Timber processing	1-26-81	3-30-81	1-26-84
Electroplating: [b] Integrated	1-28-81	3-30-81	4-27-84
Nonintegrated	1-28-81	3-30-81	6-30-84
Iron and steel	5-27-82	7-10-82	7-10-85
Inorganic chemicals I	6-29-82	8-12-82	8-12-85
Textile mills	9-02-82	10-18-82	N/A[c]
Coal mining	10-13-82	11-26-82	N/A[d]
Petroleum refining	10-18-82	12-01-82	12-01-85
Steam electric	11-19-82	1-02-83	7-01-84
Pulp and paper	11-18-82	1-03-83	7-01-84
Leather tanning	11-23-82	1-06-83	11-25-85
Porcelain enameling	11-24-82	1-07-83	11-25-85
Coil coating I	12-01-82	1-17-83	12-01-85
Ore mining	12-03-82	1-17-83	N/A[d]
Electrical and electronic components I	4-08-83	*5-19-83*	7-01-84
(arsenic subcategory)	4-08-83	*5-19-83*	11-08-85
Metal finishing	7-15-83	*8-29-83*	2-15-86
Copper forming	8-15-83	*9-26-83*	8-15-86
Aluminum forming	10-24-83	*12-07-83*	10-24-86
Pharmaceuticals	10-27-83	*12-12-83*	10-27-86
Coil coating II	11-17-83	*1-02-84*	11-17-86
Electrical and electronic components II	12-14-83	1-27-84	7-14-87
Battery manufacturing	3-09-84	4-18-84	3-09-87
Nonferrous metals I	3-08-84	4-23-84	3-09-87
Inorganic chemicals II	8-22-84	10-05-84	8-22-87
Plastics molding and forming	12-17-84	1-30-85	N/A[c]
(phthalates subcategory: action due)	*6-??.87e*	7	**N/A**
Nonferrous metals forming	*8-23-85*	10-07-85	*8-23-88*
Nonferrous metals II	*9-20-85*	11-04-85	*9-20-88*
Foundries	*10-30-85*	12-13-85	*10-31-88*
Organic Chemicals and Plastics and Synthetic Fibers ...proposed	3-21-83[f]	?	?
Pesticides ...issued	10-04-85	?	?
withdrawn	12-15-869		

[a]BAT standards take effect as specified by the compliance schedule written into individual NPDES permits issued after the effective dateof the regulation.
[b]Existing job shop electroplaters and independent circuit board manufacturers must comply only with the electroplating regulations. All other electroplating subcategories are also covered by metal finishing regulations.
[c]No pretreatment standards were promulgated for these categories because they were exempted under Paragraph 8 of the NRDC consent decree.
[d]No pretreatment standards were promulgated for these categories because they contain no indirect dischargers.
[e]This subcategory is under study to establish treatability data for possible future regulation. Final aCtiOn is expected in June 1987 (51 *Federal Register 4526,* Apr. 21, 1986). EPA expects to exempt this subcategory from pretreatment standards under Paragraph 8 of the NRDC consent decree (as was previously done for the rest of the industry),
[f]It is unclear when final regulations will be issued for this category (51 *Federal Register* 44082, *Dec. 8,* 1986).
[g]Final regulations (BAT, PSES) for the pesticides industry were issued in 1985, but subsequently withdrawn by EPA (51 *Federal Register 44911,* Dec. 15, 1986). No date for reissuance of the regulation was provided.

SOURCE: Office of Technology Assessment, 1987; based on *Federal Register* notices cited in the appropriate sections of 40 Code of Federal Regulations, Sections 401 to 460, except as noted above.

reached. As of the end of 1985, final compliance dates had not yet passed for half of the industrial categories for which pretreatment regulations have been issued; only five more compliance dates were reached by the end of 1986, leaving nine categories still without final regulations in effect. 23

Final regulations for all but two of the primary categorical industries, OCPSF and Pesticides, have now been promulgated. Regulations for pesticides have been promulgated, but were challenged in court and are being raised. 24 Moreover, the one remaining industry for which standards have never been issued (OCPSF) is the category contributing the most priority organic chemicals in its raw wastewaters (table 16).25 In addition, compliance dates for the seven latest regulations to be promulgated will not be reached until well into 1987 and 1988 (table 17).

The effect of delays in issuing final regulations can be very different for direct and indirect dischargers. In the absence of final regulations, technology-based limits based on the best professional judgment (BPJ) of the permit writer are often written into NPDES permits for *direct* dischargers. In the same situation, however, *indirect* dischargers are only subject to local limits (if they exist), which are based largely on the ability of the POTW to meet its own NPDES permit limits or sludge disposal requirements. This factor may in part account for the major differences in the levels of pollutant removal achieved by direct and indirect dischargers in the OCPSF industry in the absence of final categorical regulations.

[23] Final compliance dates with pretreatment standards are specified for indirect dischargers, and are required under CWA Sec. 307 to be no more than 3 years after the date of promulgation. For direct dischargers, compliance dates are written into permits, typically in the context of a compliance schedule. Sec. 307 specifies that compliance should generally be required within 1 year, but in no case more than 3 years, after promulgation of the BAT standards. However, delays in renewing permits (discussed later in this chapter) may further lengthen the period before compliance must be achieved.

[24] Final regulations for the Pesticides Industry actually were promulgated on Oct. 4, 1985 (50 FR 40672). Various aspects of the rule were challenged in the Court of Appeals, however, and EPA subsequently discovered significant errors as well. Under Court order, EPA remanded the regulation on Dec. 15, 1986 (51 FR 4491 1).

[25] It is unclear when final regulations will be issued for the OCPSF category. EPA recently announced its intention to file for an extension of its deadline (set by the Court at Dec. 31, 1986) for promulgation of final regulations and has asked interested parties to comment on several new proposals (51 FR 44082, Dec. 8. 1986).

Unpermitted Sources and Permit Renewal Backlogs

Lack of Ability To Identify Facilities That Have Not Applied for Permits.—Many (if not most) States and Regions lack a systematic method for identifying nonfilers, instead relying on informal approaches such as citizen complaints. EPA and State permit officials generally believe that all major dischargers have been identified and have applied for permits (576), although data supporting this claim are not available.

Several studies, however, suggest that unpermitted facilities may be significant sources of pollutants in at least some areas (462,576). In Puget Sound, for example, many nonpermitted commercial and industrial facilities were recently identified and as much as 20 percent of the toxic pollutants entering Puget Sound are estimated to originate from such nonpermitted discharges (462).

Backlog in Processing Submitted Applications for Initial Permits.—The backlog in issuing new NPDES permits was a major problem in the late 1970s and early 1980s. The extent of this backlog varies greatly: 1) among EPA Regions and approved States, 2) between municipal and industrial dischargers, and 3) between major and minor dischargers. EPA national statistics for 1982 indicated more than 16,000 unprocessed permit applications, only about 200 (1. 3 percent) of which were from major dischargers (576).[26] Studies of individual States documented a similar situation (576). The State of Washington has eliminated its backlog of unissued initial permits for major dischargers, and is now concentrating efforts on "significant minor' dischargers (462).

Resource limitations are routinely cited as the major factor that forces permitting efforts to focus primarily on renewals, new sources, and major dischargers. This factor appears to be the primary reason for the backlog in general and for the much lower rate of permitting for minor dischargers.

Backlog in Renewing Expired Permits.—EPA and delegated States also face the continual, and

[26] EPA argued that the backlog was probably overstated because it included an unknown number of facilities that did not require a permit. This argument would apply almost exclusively to minor dischargers.

in many cases increasing, task of renewing permits that have expired. While an expired permit is still enforceable, the opportunity is lost to review and upgrade permits in a timely manner. Moreover, each expired permit that is not reissued represents a de facto permit length longer than the 5-year term intended under CWA.

Most initial NPDES permits were issued in 1973 and 1974, with expiration dates set for 1978 and 1979. As of the end of 1982, EPA reported 34,000 expired (and not reissued) permits. About 13 percent (4,400) of these were for major dischargers, the remainder for minor dischargers. Over half of these permits had been expired for more than 22 months (576). A similar picture existed in the five States that GAO examined in detail.

Several factors have been cited as causes for this backlog:

- the lack of BAT guidelines for use in upgrading effluent limits,
- heavy reliance on BPJ as a substitute for BAT and BCT guidelines,
- a shortage of resources devoted to permit issuance,
- the need to develop general permits for certain categories of minor dischargers which do not require individual permits, and
- low management priority placed on renewing permits for minor dischargers.

EPA recently has increased the resources devoted to permit issuance and renewal, and has promulgated most of the BAT regulations it was required to develop. These efforts were taken in part to meet a national goal of eliminating the permit backlog for major dischargers by the end of fiscal year 1985, one that was largely met by EPA Regional offices, but not by many approved States.

Recent EPA data suggests a considerable reduction in the national backlog for major dischargers, although a substantial fraction of major permits and an even larger fraction of minor permits remain expired (327). Thirty-four percent of all major industrial and 13 percent of all major municipal permits are expired. This is a total of 1,810 expired permits, compared to the 4,400 reported in 1982. Many approved States continue to have even larger backlogs, however. For example, in Washington half of all permits (and one-quarter of those for major dischargers) are currently expired (462).

EPA is addressing the minor discharger backlog by developing general permits to cover an estimated 10,000 minor dischargers .*7 A second, more controversial approach has been EPA's legislative proposal to extend the term of NPDES permits from the current 5 years to 10 years (242). EPA argues that this change would reduce the annual permitting workload, and presumably the backlog; modification of permits would still be required to incorporate ''significant new standards. Opponents view this proposal as a ' 'paperwork' solution that would further reduce the opportunity to review and upgrade permits at the frequency originally intended by CWA.

Gaps and Deficiencies in Coverage of Toxic Pollutants

Nonregulated Industries

Some entire categories of industrial dischargers, such as car washes and other commercial laundries or paint and ink formulators, are exempted from BAT effluent guidelines and pretreatment standards (see table 14).[28] In addition, certain subcategories of other industrial categories, for example, adhesives and sealants, are exempted. Finally, pretreatment standards for some industrial categories, such as textile mills and plastics molding and forming, were proposed but never promulgated.

These and other categories can contribute significant amounts of toxic pollutants to surface waters or POTWs. The laundries and textile mills categories together account for approximately 22

[27] Such permits have been issued or proposed for activities such as offshore and coastal oil and gas facilities, coal mining, animal feedlots, construction sites, noncontact cooling water, petroleum storage and transfer, deep seabed mining, and seafood processing. Currently, general permits cover about 7,700 facilities (E. Ovsenik, Office of Water Enforcement and Permits, EPA, pers. comm., January 1987).

[28] Reasons given for exempting these industries from effluent limitations for toxic pollutants include: presence of insignificant levels of pollutants, no or few direct or indirect dischargers, economic constraints, no new plants expected, presence of pollutants for which removal technology does not exist, etc. These facilities must still obtain and meet effluent limitations specified in their NPDES permits; in the absence of categorical standards, however, limitations are likely to be specified only for conventional pollutants or to rely on the best professional judgment (BPJ) of the permit writers for toxic pollutants.

percent of the total industrial flow into POTWs, Approximately 91,000 laundries, including 22,000 car washes, have a total wastewater flow of 526 million gallons per day; this wastewater contains at least 13 priority pollutants. About 1,000 textile mills discharge 312 million gallons per day to POTWs; pollutants identified in these wastewaters include several priority metals and organic chemicals (503).

Other industries not included by EPA on its original list of industrial categories may also be significant sources of toxic pollutants. These industries include treatment, storage, and disposal facilities for hazardous wastes; drum and barrel reconditioners; solvent reclaimers; battery salvagers; septage haulers; and automotive radiator shops. 29

Many small dischargers within industries that have categorical regulations are exempted from the regulations because of the potentially heavy economic burden of meeting effluent standards. For example, electroplating job-shops that discharge less than 10,000 gallons per day of wastewaters containing chromium, copper, nickel, or zinc are specifically exempted from pretreatment regulations. In some cases, however, such low-volume discharges can contain high enough concentrations of toxic pollutants to upset POTW operations. Although local limits (which are authorized and enforceable under Federal law) could be used to regulate such discharges, POTWs face many obstacles in developing such limits, particularly in the absence of Federal standards or guidance (503,653,666).

Nonregulated Toxic Pollutants

Many toxic pollutants in industrial wastewaters are not regulated by national standards for a variety of reasons—for example, lack of data on the presence of certain pollutants in a wastestream; lack of analytical means for measuring certain pollutants; lack of technological means to control certain pollutants; low regulatory priority; or the diversity and complexity of individual plants or processes within an industrial category.

Categorical regulations generally contain standards for only a fraction of all priority pollutants. Development of a standard only occurs if three conditions are met: 1) the pollutant is present in high amounts, 2) the technology for its control is available, and 3) the implementation of that technology is economically feasible. Thus, many priority pollutants —in particular, priority organic chemicals— may be present in high concentrations but remain unregulated for technological or economic reasons. For example:

- EPA has not developed limits for phthalates generated by the plastics molding and forming industry because it does not have sufficient data on technologies for controlling these chemicals (51 FR 14526, Apr. 26, 1986).
- While pretreatment standards have been developed for the petroleum refining industry, they contain no limits on priority organic chemicals, even though this category is a very significant source of such pollutants, accounting for almost 15 percent of the expected discharge of priority organic chemicals to POTWS under full PSES implementation. 30
- As a result of the much greater focus on metals than on organic chemicals, full implementation of EPA's categorical pretreatment standards is predicted to greatly reduce total inputs of priority metals to POTWs, but to reduce priority organic chemicals by only 47 percent (666).3'

Other facilities that discharge priority pollutants but are not regulated by national standards include those that: 1) contribute wastes to POTWs that are either not required to or have not yet developed an individual pretreatment program, and 2) are in *noncategorical* industries. About 30 percent of the priority pollutants that enter POTWs originate from noncategorical sources (503). Available data suggest that roughly equal amounts originate from domestic households and from noncategorical industries or commercial establishments.

[29] Estimates of the amount of hazardous chemicals introduced by these industries into POTWs are presented in ref. 666.

[30] These data and comparable information for numerous other industrial categories are discussed in detail in ref. 666.

[3] I This low percentage results from two factors: the relative lack of standards specified for organic chemicals, and the significant contribution of priority organic chemicals by noncategorical (and relatively unregulated) industries. The latter factor largely accounts for the difference between this removat estimate and the higher estimate (85 percent) indicated in table 15.

Finally, both NPDES and the pretreatment programs have limited ability to address discharges of nonpriority pollutants. Categorical standards have focused almost exclusively on the 126 priority pollutants. However, numerous additional toxic pollutants are known to be present in significant quantities in both direct and indirect discharges. Data collected by EPA for the OCPSF industrial category indicates that this industry's raw wastewaters contain 2.5 pounds of nonpriority organic chemicals—including such toxic compounds as formaldehyde and methanol—for every pound of priority organic chemicals. Other categories, such as the pesticides and pharmaceuticals industries, are also significant sources of toxic nonpriority pollutants (666).

In principle, categorical standards, local limits, or water quality-based standards can be used to control nonpriority pollutants, and in some cases these approaches have been developed. However, these types of controls do not currently provide a systematic means for addressing pollutants that fall outside the primary focus of the CWA pollutant control programs.

At least two legal mechanisms for regulating these additional toxic pollutants are available, but they have only been used to a limited extent. Section 307(a) of C WA gives EPA the authority to add substances to the priority pollutants list, but this authority has not been used to date. Under paragraph 4(c) of the Consent Decree reached between EPA and the Natural Resources Defense Council, EPA is required to identify, and possibly regulate, toxic pollutants that might violate the objectives of the NPDES and National Pretreatment programs but that are not listed as priority pollutants. In one survey of industrial wastewaters, EPA detected the presence of over 1,500 compounds; of the more than 400 that were specifically identified, 6 compounds were chosen as candidates for future regulation due to their presence in significant amounts and their human or aquatic toxicity (666). No standards have yet been developed, however, due to lack of information on the ability of in-place or other available control technologies to remove these pollutants.

Permit Deficiencies

Lack of Limits on Toxic Pollutants.—Typically, discharge permits specify numeric limits for most or all conventional pollutants, but far fewer limits are specified for priority metals or organic chemicals. While the development and introduction of BAT guidelines will help alleviate this deficiency, several aspects of this problem remain:

- Monitoring for priority pollutants other than those *known* to be present (and therefore specified in the discharge permit) is rarely required, so that the presence of additional priority pollutants in a discharge often is not documented.
- Even where the presence of priority pollutants has been reported by permitters or discovered through sampling, limits for such pollutants often have not been included in permits. For example, an audit of 44 permitters discharging into Puget Sound that reported the presence of priority pollutants revealed only 14 that had any limitations on the reported substances (462).
- While technically a violation of CWA, the discharge of a pollutant for which no standard exists in the permit is unlikely to be identified or treated as a violation.
- Water quality-based standards have not been developed by most States for most priority pollutants, hampering the introduction of water quality-based discharge limits on these substances into individual permits. Even where developed, the standards do not address sediment contamination, which is probably the more important "sink' for most metals and organic chemicals of concern (see section later in this chapter on water quality standards).

Heavy Reliance on Best Professional Judgment (BPJ) in the Absence of Standards.—Whenever national standards for a particular industry or pollutant do not exist or have not yet been developed, individual permit writers must rely on their BPJ. At least two levels of discretion are involved: determining which, if any, pollutants should be limited, and setting the actual level. Both elements can

be significant sources of inconsistency in setting discharge limits. 32

' 'Backsliding' on Permit Limits During Renewal. —The CWA's goal of achieving zero discharge of pollutants by 1985 was based on a ' 'ratchet' approach in which discharge limits would be made increasingly stringent in successive perm its. Indeed, current Federal regulations require that a reissued permit "be at least as stringent" as the previous permit, unless certain exceptional conditions are met (40 CFR 122 .44(1)). [33]

However, some "second round' permits incorporating BAT limits on toxic pollutants have been found to contain weaker limits than those imposed in the "first round" permits. For example, in a 1985 study of 16 major industrial dischargers in the Puget Sound basin, 14 of the renewed permits had been weakened for at least 1 pollutant, and 8 were weakened for at least 3 pollutants (458). Many of the weakened limits were for conventional pollutants based on BPT standards promulgated a decade ago. Overall, for those pollutants specified in both sets of permits, standards for 40 percent of the pollutants had been weakened, 27 percent had been strengthened, and 33 percent remained unchanged,

Justification for such changes may often exist, particularly given the extensive use of BPJ in setting initial limits. However, there appears to be a disturbing lack of appropriate means for communicating or explaining such changes to the public during the renewal process (458,462).

Inadequacy of Regulatory Compliance and Enforcement t

Various elements of the NPDES and pretreatment programs determine their effectiveness in ensuring compliance with permits or other means of controlling the discharge of pollutants from point sources. Significant problems occur in three areas: quality and completeness of data submitted by regulated facilities, extent of noncompliance, and effectiveness of enforcement.

Information available on these issues is often far from complete or is regional and selective in nature, and thus may not always be representative of the national situation. Moreover, data may not be entirely current, an inherent problem in light of frequent changes in program design, permit status, available resources, agency priorities, and regulations. Finally, much of the information needed for a thorough national analysis is often unavailable, or is inaccessible due to the relatively primitive state of development of national databases .74

Self-Reporting: Quality and Completeness of Discharge Data

The efficacy of the entire NPDES program rests on the ability of agencies to obtain reliable data characterizing the discharges of permitted facilities. Given the immense number of such facilities, NPDES relies on a self-reporting system in which facilities are required to monitor their discharges and regularly report the results to the appropriate EPA Region or delegated State. Administrative review of reported data is the only systematic means of identifying instances of noncompliance, although inspections are occasionally used to supplement industry reporting.

Several problems with this self-reporting system have been identified. The foremost and most obvious of these is that such a system relies to a large extent on the integrity of permitters to submit accurate information. In order to generate reliable data, a self-reporting system must include effective deterrents to counter the obvious incentive to fal-

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[32] BPJ has been identified as the ' 'least consistent link in the current discharge permit system (462). and causing a "movement from the issuance of consistent conditions to those tailored to the needs or pressures from each individual permittee'' (392).

[33] For example, a Permit Jim it may be loosened if proper operation of the required control technology s(ill does not arh ieve the requ I red limit, or if' lower levels are based on newly issued national standards and the in itial levels were set us ing BPJ In any case, the new standards can not be set below water quality-based standards or technology-based effluent guidelines

[34] This discuss io, of nece ssity relies heavily on particular sou cc\ of information, for example the thorough and up-to-date information compiled by the Puget Sound Water Quality Authority (46 1.462) and the less current "random surveys'' conducted by GAO (574,576,689) While such information may not fully identify or accurately represent problems in all States or EPA Regions, these data are generally consistent with other available information and provide a reasonable picture of problems facing water pollution control programs in all parts of the Nation Wherever possible, the most recent data available from EPA arc included; in many cases, these data indicate renewed attention to or substantial improvements in existing problems

sify information rather than comply with discharge limitations. Such deterrents require that the system be able to detect and penalize those who violate reporting requirements.

These deficiencies call into serious question the adequacy of the mechanisms available to EPA and the States to verify information received through the NPDES self-monitoring system. In the face of declining resources available for such activities, this crucial link in the current compliance and enforcement program is unlikely to be strengthened.

Violations of Reporting Requirements .—Failure to submit a discharge monitoring report (DMR), or submission of incomplete data, are obvious means of concealing serious noncompliance with discharge limitations. One study of major industrial and municipal NPDES permitters in six States found that 8 percent failed to submit a DMR at least once during an 18-month period, and that 37 percent had submitted one or more incomplete DMRs (576).[35] However, this rate of compliance is an apparent improvement in the DMR submission rate for industrial dischargers compared with that found in an earlier study (574).

EPA or State response to reporting violations varies, but in general such violations appear to have received little or no attention. [36] As an extreme example, a recently identified major discharger into Puget Sound had not submitted a DMR for 30 consecutive months, yet no action had been taken by the permitting authority (462).

Quality of Reported Effluent Sample Analyses. —In several surveys of the quality of chemical analyses of effluent samples submitted by major NPDES permitters, EPA found that significantly more than half of all permitters reported unacceptable data[37] for one or more effluent parameters, and that 20 to 25 percent of all analyses were of unacceptable quality (576).

In many cases, poor performance was due to a high rate of *reporting* errors, rather than analytical errors. While in principle easier (and less expensive) to correct, such errors call into question the integrity of permitters as well as the reliability of submitted data.[38]

Adequacy of EPA's and States' Abilities To Verify Information. —Compliance sampling inspections (CSIs)—during which effluent samples are collected for the purpose of verification-are the primary tool available to EPA and States to verify the data submitted by dischargers. 39 CSIs are employed primarily in cases where noncompliance has been reported or is suspected (327,576). In 1982, for example, only 7 percent of New Jersey's and 5 percent of New York's major dischargers received CSIs. Nationwide, EPA statistics showed a large decrease in CSIs performed during the period 1979 to 1981; there was a 20 percent reduction for municipal sources and an almost 50 percent decrease for industrial dischargers. [40] Inadequate resources were cited as the primary reason for the decline, a problem which may have been partially alleviated in subsequent years (468).

As further illustration of the infrequent use of CSIs, guidelines in the State of Washington strongly encourage annual CSIs for all major dischargers, including collection and analysis of effluent samples. A recent analysis found, however, that only one-sixth of dischargers into Puget Sound had ever received a CSI (over a 10-year period);[41] analysis for priority pollutants had been conducted for only five dischargers (462). Moreover, it is standard practice in the State to announce inspections and field sampling in advance, raising concerns over how representative of typical effluent such samples actually are.

[35] DMRs are required to be submitted quarterly *or* monthly. Two percent of GAO's sample **did** not submit DMRs for 3 or more quarters or 5 or more months during the survey period; 11 percent submitted incomplete DMRs for 3 or more quarters or 5 or more months during this period.

[36] This type of violation is now an instance of Category I noncompliance, and therefore must be reported in Quarterly Noncompliance Reports (QNCRs; see 40 CFR 123.45 (a)(2)(ii)(D)).

[37] "Unacceptable" results were those that were either higher or lower than the acceptable limits established by EPA's Quality Assurance Program, determined on a case-by-case basis for pollutants actually specified in a discharger's permit.

[38] The data cited by GAO (576) did not indicate what fraction of errors were *below* acceptable limits; consistently low errors would be expected if deliberate falsification were the cause.

[39] Several other types of inspections of NPDES permitters are also conducted, but do not involve collection of effluent samples,

[40] The number of other types of inspections—compliance evaluations and performance audits—actually increased significantly during fiscal years 1979 to 1981. These are considerably less expensive and time-consuming than CSIs.

[41] This fraction included only about half of Puget Sound's major industrial dischargers.

Extent of Noncompliance With Effluent Discharge Limits

This discussion separately considers compliance for direct dischargers (municipal and industrial facilities regulated under the NPDES program) and for indirect dischargers (regulated under the National Pretreatment Program).

Direct Dischargers.—Estimates of the extent of permittee noncompliance with NPDES permits are quite disparate (238,392,462,574,576,689). A major source of variability—and controversy —surrounding these estimates is the criteria used to define noncompliance, particularly *significant noncompliance (SNC).*[42]

In particular, different criteria have been used by EPA and Congress' General Accounting Office (GAO) to determine SNC (table 18). (EPA has since partially revised its criteria, as discussed in table 18.) As a result, GAO and EPA have reported considerably different SNC estimates, even using the same raw data. For example, based on its review of dischargers in six States, GAO found that about 80 percent exceeded one or more permit limits at least once during an 18-month period; almost half of the permitters who exceeded their permit limits did so for more than 6 of the 18 months, and about 20 percent did so for more than 12 of the 18 months. Based on GAO's criteria, one-quarter of all dischargers were in SNC at least once (576).

EPA took issue with several of GAO's findings, in particular those regarding SNC. EPA's data for the same six States indicated a SNC rate 7 to 12 percent lower than that found by GAO over the same time period. Nationally, EPA reported SNC rates of 18 percent for municipal and 16 percent for industrial dischargers.

Regardless of the criteria used, it is clear that noncompliance is a major and continuing problem. At the same time, some progress has been made: industrial compliance has improved considerably over the last several years, and it has consistently exceeded the degree of *municipal* compliance. EPA data for the first quarter of 1985 indicated that only 5 percent of major industrial facilities were in SNC. Similarly, as of the third quarter of 1985, only 6

[42] Another source of variability is in the interpretation of how significant a particular rate of permit violations really is. Essentially all studies express noncompliance in terms of the number of facilities with at least one permit limit violation in a given time period. These facilities, however, may be in full compliance with many other permit limits during the same period. EPA argues that it is also important to examine the number of limits that are exceeded relative to the total number of possible exceedances (i. e., the number of limited parameters in each permit times the number of permits) to fully appreciate both the magnitude of the compliance problem and the success or failure rate (651).

Table 18.—Criteria Used To Identify "Significant Noncompliance"

Environmental Protection Agency	General Accounting Office
Based on magnitude and frequency:	***Based on magnitude and frequency:***
• ***2*** exceedances of a monthly average limit in any 6-month period that meet the following criteria: —40% over limit for conventional pollutants and "non-toxic" metals —20% over limit for toxic pollutants —discretionary for fecal coliforms or pathogens	. 4 consecutive exceedances of an average limit by at least 50% during its 18-month survey period
Based on frequency only:	
• ***4*** exceedances of a monthly average limit (by any amount) in any 6-month period for any pollutant	
Other criteria:	***Other criteria:***
• Excludes permitters on interim limits and/or construction schedules	. Includes permittees on interim limits and/or construction schedules (about 25% of GAO's sample)
• Excludes permitters returned to compliance by end of quarter[b]	

[a] This criterion was used by EPA at the time of the GAO analysis; EPA has since revised its definition So as to include any violation which is Of concern to the agency, including those by facilities on interim limits or construction schedules,

[b] Using this criterion, if a permittee were i, significant noncompliance during the first two months of a quarter, but returned to compliance in the third month, it would not be reported This criterion was used by EPA at the time of the GAO analysis; EPA has since revised its definition so as to eliminate this possibility.

SOURCES Office of Technology Assessment, 1987; based on 50 Federal Register 34648, Aug. 26, 1985 (for EPA's definitions), and U.S. Congress, General Accounting Office, *Wastewater Dischargers Are Not Complying With EPA Pollution Control Permits,* Report to the Administrator, Environmental Protection Agency (Washington, DC: Dec. 2, 1983) (for GAO's definitions)

percent of *completed* major POTWs were in SNC (table 19). However, over one-third of all major POTWs had not yet completed the construction needed to meet treatment requirements, and 15 percent of these were in SNC with their interim limits.

In marked contrast to EPA's latest national statistics, a considerably less optimistic picture was recently reported by the State of Washington (462). Using EPA's definition of SNC, 41 percent of the State's major municipal and industrial facilities were in SNC during the second half of 1985; moreover, the SNC rate was considerably worse for industrial facilities than for municipal facilities (50 percent v. 31 percent).

Whether the Washington survey is representative of other dischargers in the State or in other parts of the country is not known. Nevertheless, these results clearly indicate that, even if national average compliance rates are as high as reported by EPA, certain regions of the country are experiencing compliance rates far below average.

Two related factors are responsible for the differences seen in SNC rates for industrial and municipal dischargers. First, far fewer municipal facilities (65 percent) have completed the construction needed to achieve compliance than have industrial dischargers (94 percent) (327). Second, EPA initially adopted a less aggressive enforcement policy toward municipal facilities, in part because of the uncertainties or delays associated with Federal funding for construction (576). EPA has subsequently issued a new National Municipal Policy (49 FR 3832, Jan. 30, 1984), which adopts a more aggressive stance. 43

Data concerning compliance rates for *minor* dischargers generally are not available, although the reduced attention paid to them in permitting and enforcement strongly argues that their extent of compliance is likely to be considerably lower than for major dischargers. Of an estimated 12,000 minor POTWs nationwide, almost 3,400 (28 percent) had not met the statutory deadlines of' CWA or were not in compliance with their NPDES permits as of October 31, 1985 (327).

Indirect Dischargers.—Relative to direct discharges, less information is available on the compliance of indirect dischargers with pretreatment regulations. The National Pretreatment program is newer and less developed than the NPDES program for direct dischargers. Moreover, the specified deadlines for final compliance with pretreatment standards in seven industrial categories will not occur until 1987 and 1988, and final regulations for two additional categories (OCPSF and Pesticides) are yet to be issued.

Another major obstacle is the fact that the primary authority and responsibility for regulating such facilities and determining compliance is far more decentralized than is the case in the NPDES program. The primary authority can be a POTW, a State, or an EPA Region. Of the more than 15,000 POTWs in the United States, the EPA required about 1,500 to develop pretreatment programs.[44] To date, 24 States have received authority to approve and oversee individual POTW pretreat-

Table 19.—Municipal Treatment Plants (POTWs) in Significant Noncompliance as of Sept. 30, 1985

	Number of permits	Number in SNC[a]	Percent of permits
Completed major POTWs	2,506	158	6%/0
Major POTWs on compliance schedules and/or interim limits	1,219	180	15%
Total major POTWs	***3,725***	***338***	9%

[a]SNC = significant noncompliance.

SOURCE: Management Advisory Group to the EPA Construction Grants Program, *Report to EPA: Municipal Compliance With the National Pollutant Discharge Elimination System* (Washington, DC: June 19S6).

[43]The compliance deadline for municipal facilities was Originally 1977 but is currently July 1, 1988. EPA's National Municipal Policy now indicates that compliance with the 1988 deadline is mandator}' for all municipal facilities, regardless of whether the} receivcd Federal funding.

[44]These POTWs were to have developed programs by Sept 30. 1985, or be referred to the Department of Justice. As of June 1985, only 1, 100 programs had been approved, and 9 civil actions had been initiated against POTWs lacking approved programs (503). As of October 1986, however, all but 30 had approved programs; 18 of these remaining POTWs had been referred for judicial action. An additional 60 POTWs were identified as needing to develop pretreatment programs because of the presence of new industrial users or environmental problems; these POTWs are currently on schedules to develop programs. (These most recent data were obtained through personal communication from the Strategic Planning and Management System (SPMS), Office of Water Enforcement and Permits, U.S. EPA, January 1987).

ment programs; EPA Regions bear these responsibilities for the remaining States.

Several additional factors complicate the measurement, as well as achievement, of compliance for indirect dischargers. No national tracking system (comparable to the PCS for direct dischargers) currently exists for compiling and analyzing the self-reported data required of industrial users. Moreover, the size of the regulated universe of the pretreatment program is considerably larger than that of the NPDES program. An estimated 100,000 to 140,000 indirect dischargers are subject to General Pretreatment Regulations; approximately 15,600 of these fall into industries which are also subject to Categorical Pretreatment Standards (see table 13).

Despite these limitations, some attempts have been made to examine compliance rates for indirect industrial dischargers, particularly in the electroplating industry. In a 1984 survey of selected major national electroplating firms, baseline monitoring reports (BMRs)[45] for 22 percent of the facilities were either lost or never submitted (258). For those facilities for which some compliance information could be located, only 54 percent were in compliance with categorical standards; 28 percent were clearly not in compliance; and the status of the remaining 18 percent could not be determined. [46]

A 1984 study of electroplates in California also documented widespread noncompliance: 40 percent of the facilities in the San Francisco Bay area were in violation, and 70 percent in the Los Angeles area were classified either as ' 'compliance unknown' (61 percent) or ' 'out of compliance' (9 percent) (97). In response, EPA (which administers the pretreatment program in California) initiated a number of enforcement actions against major violators.

A 1985 study examined compliance for 1,600 major facilities in a broader range of industrial categories (98).[47] One-fourth of the major facilities studied were in noncompliance with Federal standards during 1985. Noncompliance was three times higher in southern California than in the San Francisco Bay area, ranging from 18 percent (L. A. County) to 50 percent (Orange County). Virtually all reported violations in southern California were from electroplates and metal finishers, which accounted for 93 percent of all industrial users in the region.

For the electroplating and metal finishing industries, the noncompliance rate improved considerably in the Bay area, decreasing from 40 percent to 11 percent between 1984 and 1985. In southern California, progress during this period was made primarily in determining the compliance status of industrial users. However, 32 percent of these facilities were still reported to be out of compliance (98).

Several other problems associated with determining or measuring pretreatment compliance also have been identified: the absence of a consistent definition of, or means of quantifying, noncompliance; the use of different and inconsistent data sources for determining noncompliance; and the use of varying methods for monitoring (98,502).

Effectiveness of Enforcement

The final, essential link in the NPDES and National Pretreatment programs is enforcement. EPA's philosophy and policy toward enforcement has undergone major fluctuations over the last decade. The number of enforcement actions initiated by EPA steadily declined from more than 1,500 in 1977 to about 400 in 1982 (576). Part of this decline was caused by explicit changes in EPA's enforcement policy, which placed greater emphasis on pursuing ' 'voluntary compliance and negotiated settlements (238,462,576).

Since that time, EPA and some States have taken several steps to strengthen and codify their enforcement policies. The revision of EPA's Enforcement

[45] BMRs must be submitted by indirect dischargers to the control authority within 6 months of the effective date of a pretreatment standard. They contain Information on the composition of the> facilities' discharges, with respect to those pollutants regulated by categorical standards

[46] The electroplating facilities in this survey were all associated with major corporations, and hence may reflect a greater degree of compliance than the industry as a whole.

[47] Six industries were included: electroplating; metal finishing; semiconductor manufacturing; pulp, paper, and paperboard; steam electric power generation; and textile mills The 1,600 facilities examined were all industrial users of POTWs required to develop pretreatment programs.

Management System, the commitment of new resources to the Agency's enforcement programs, and the increase in the number of formal enforcement actions all point to such changes (462,468). In general, these efforts have been based on the realistic assumption that the resources available to identify and effectively respond to all violations will remain limited, so the development of a consistent way to rank violations is essential. It remains to be seen how effective such actions will be in improving enforcement and compliance under CWA.

Several enforcement problems have been identified during recent years: the nature and timeliness of the response to a violation once it is identified; the effectiveness of the response in eliminating the violation in a timely manner; the ability to impose meaningful penalties; and the adequacy of resources for enforcement activities. Problems in these areas can in turn lead to delays in achieving compliance on the part of industrial firms or municipal plants, or to unfair economic advantages to violators.

Unfortunately, few data systematically evaluate these factors. Available information indicates two phases: an initially very poor record of enforcement, followed by a general trend toward gradual improvement in recent years. These phases illustrate the nature and extent of obstacles (some of which are being overcome) that face enforcement of water pollution control programs.

Extent and Timeliness of Response .—Several studies have examined EPA and State responses to reported violations, with special attention to whether and how quickly action is taken. In one study of enforcement in EPA Region II, over 4,000 violations by 158 major industrial dischargers between 1975 and 1980 were identified (391). Overall, only 13 percent of these violations received any response after they were reported; in contrast, about twice as many violations discovered during onsite inspections received a response. The vast majority of responses taken were informal: phone calls or warning letters. Moreover, almost a year elapsed, on average, before authorities first responded, during which time an average of three additional violations occurred.[48]

A continuing low level of response to permit violations, many of which are instances of SNC, has also been documented in the State of Washington (462). During the second half of 1985, less than half of the reported SNC violations received a formal enforcement response, despite the issuance of a new enforcement policy that required all instances of SNC to be subject to a formal action. During this same 6-month period, no civil penalties were assessed against municipal dischargers, while a substantial number of industrial facilities were fined,

A study of State and POTW enforcement of pretreatment standards in Rhode Island also documented widespread noncompliance by indirect industrial dischargers over the last several years; during this period, only one judicial enforcement action was initiated (497).

Recent national data show some improvement in the extent of response to permit violations, at least at the Federal level. Since 1980, both the number of administrative orders (AOs) issued and the number of judicial actions undertaken (i. e., number of cases referred to the Department of Justice) have been on the rise (figure 31).[49]

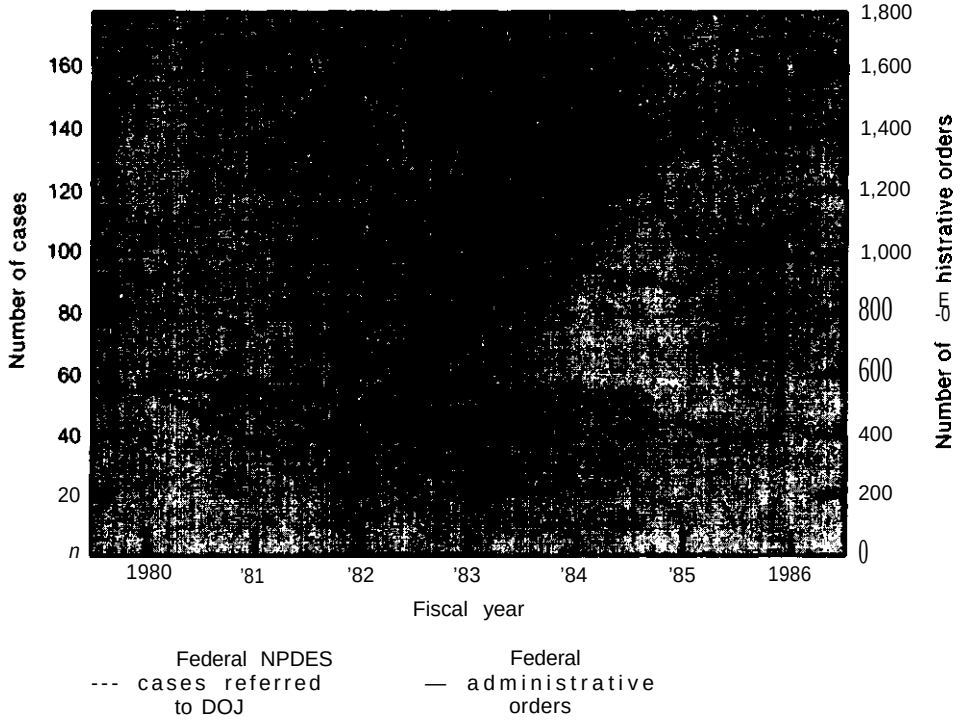
More limited data are available on the level of State activity during this period. For 1985 and 1986, the number of AOs issued by NPDES States was almost three times higher than the number issued at the Federal level; the number of civil actions initiated by these States was 50 percent higher in 1985, and 100 percent higher in 1986, than the number of cases initiated at the Federal level (672).

Effectiveness of Response .—The effectiveness of EPA's response to violations at 33 Louisiana facilities, many of which had "frequently and extensively' violated their permit limits during a 2-year period has been examined (576,689). While EPA initiated numerous informal and formal actions against these facilities, GAO concluded that they were generally ineffective as judged by the continuation of noncompliance. Formal enforcement actions appeared to be no more effective than informal actions: of the 17 facilities that received one

[48] No data were presented on the ultimate effectiveness of these actions in restoring compliance.

[49] Data for AOs was further broken down into actions against major and minor, and municipal and industrial, permitters. Each year, the majority of the AOs were issued to major dischargers; in addition, the largest number of AOs were consistently issued to major municipal permitters.

Figure 31.— Federal Enforcement Activity, Fiscal Years 1980-86



For fiscal years 1980-84, 25 of the cases referred to the Department of Justice (DOJ) were for violations of the Safe Drinking Water Act, not for violations of NPDES permits; the distribution of the 25 cases during these years is not known. Data for 1985 and 1986 are for NPDES violations only (D. Drelich, U.S. Environmental Protection Agency, personal communication, January 1987).

SOURCES U S. Environmental Protection Agency, "Summary of EPA Enforcement Activity for 1980 -1986," draft of press release issuedDec 16, 1966; U.S Environmental Protection Agency, Office of Water, "Water Enforcement Actions Report (Summary)," received by personal communication from EPA on Jan 15, 1987 (data current through Jan 12, 1987)

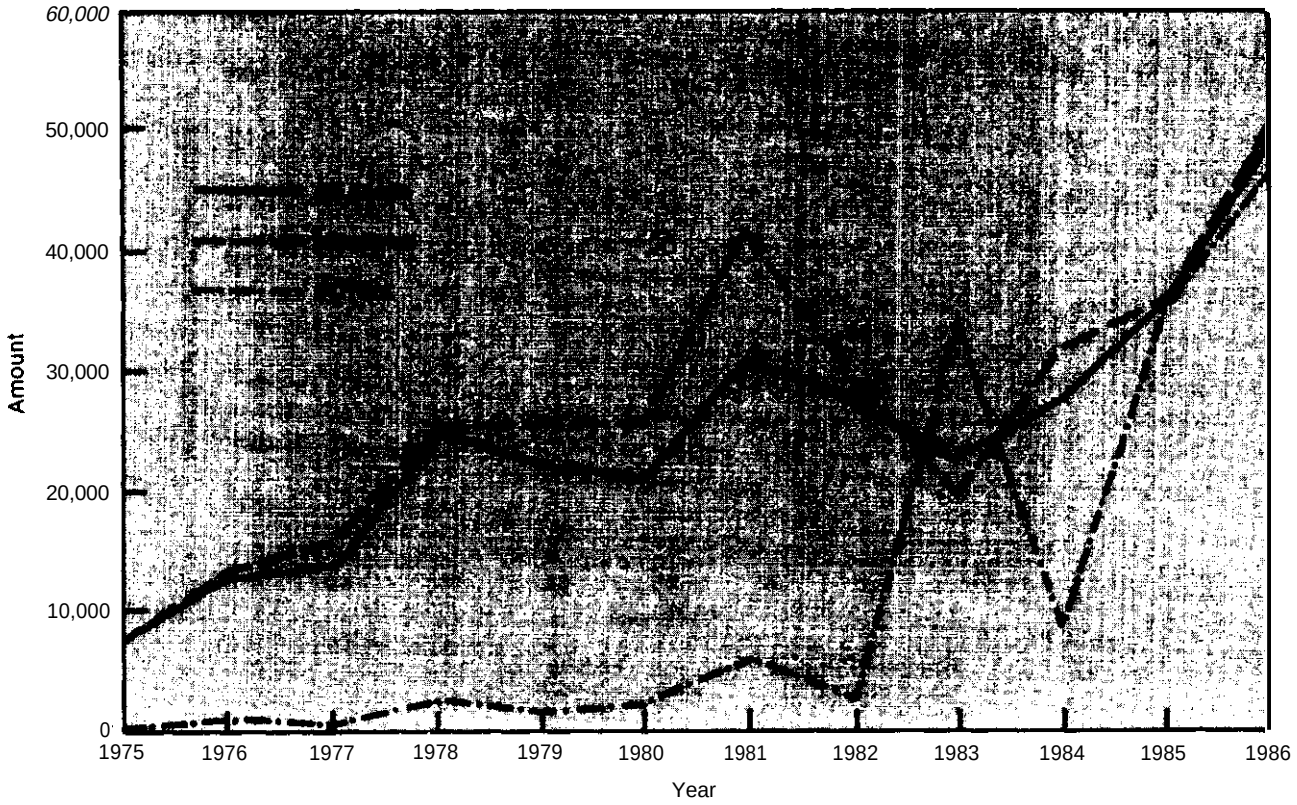
or more AOs, only one came into compliance in the following months. In one extreme case, a discharger was in violation of its permit for 35 consecutive months, despite receiving six AOs. In another, a discharger that had violated its permit limits for 21 consecutive months, often by more than 100 percent, was never subjected to a formal enforcement action by EPA. Out of all 33 facilities, only one case was referred to Federal prosecutors.

EPA has contested a number of GAO's findings, including GAO conclusions about the effectiveness of AOs (65 1). During the period examined by GAO, EPA issued nine AOs, each of which specified a compliance schedule. EPA reports that six facilities returned to compliance within the time frame established in the AO, and that in the other three cases the AOs had a net positive effect, albeit delayed, on ultimately resolving the situations.

Ability to Impose Meaningful Penalties.— Several studies have documented the infrequent imposition, infrequent collection, and low level of penalties for violations of permit limits in various areas of the country (238,462,576,689). These studies emphasize the often time-consuming and frustrating nature of civil actions, especially when measured against the lack of effectiveness of the resulting penalties as deterrents to the original violator or to other permitters.

One common recommendation in such studies is the need for EPA to be given statutory authority to impose *administrative penalties* against vio-

Figure 32.–Amount of Average CWA Civil Penalty,[a] 1975-86



[a]To avoid skewing the analysis by the large penalties assessed in a very small number of cases, only penalties under $200,000 (so-called "routine" cases) are included in calculating the average penalty Only 5 percent of all cases Involved penalties larger than this amount.

SOURCE" Off Ice of Technology Assessment, 1987, based on U.S. Environmental Protection Agency, Office of Enforcement and Compliance Monitoring, 1986 *Update to Clean Water Act Civil Penalties Analysis* (Washington, DC: Dec 12, 1986).

lators without having to resort to judicial action (327).[50] Such authority would greatly enhance EPA's capability to mount appropriate and timely enforcement actions against violators.

The penalty situation has improved considerably in recent years (671), Figure 32 illustrates the trend in the size of the average CWA civil penalty collected in cases brought by the Federal Government between 1975 and 1986. These data show an accelerating increase in the average CWA penalty, from $7,500 in 1975 to $48,400 in 1986. Total penalties collected in 1986 were the highest ever, totaling over $5 million. Figure 32 also shows the individual trends for POTWs and industrial facilities Whereas the average penalty assessed in cases brought against industries showed a gradual increase during this period, the average penalty assessed against POTWs remained very low (less than $5,000) until 1983, but has since risen substantially. In addition, the fraction of cases settled without a penalty has declined over the last several years, especially for cases brought against municipal violators.

Adequacy of Resources for Enforcement Activities. —A consistent theme encountered in this analysis of enforcement, as well as other activities associated with the implementation and administration of water pollution control programs, is the underfunding of such efforts. Resources available to EPA and approved States for administering the NPDES and National Pretreatment programs and ensuring their enforcement are clearly inadequate. For example:

- Although personnel for the National Pretreatment program doubled from 1984 to 1985 to a total of approximately 65 people, EPA's

[50]Language authorizing EPA to impost= administrative penalties under certain conditions was included in the Water Quality Act of 1987.

Pretreatment Implementation Review Task Force (PIRT) estimates that an additional 150 positions in Regional offices would be needed to properly implement the program (653). PIRT also recommended increased Federal funding for State programs.

- The State of Washington estimated that it had resources to conduct only 24 percent of the activities needed to effectively administer its NPDES program. Efforts to supplement its budget through increased use of permit fees have been unsuccessful (462). Five staff positions are currently devoted to the State's pretreatment program, despite a 1985 study indicating an actual need for 14 positions (461).
- Under the proposed fiscal 1987 budget, funding for water quality enforcement and permitting will decrease $4.1 million, and funding for implementing the National Municipal Policy will drop $3.1 million. Overall, the proposed budget for water quality programs represents a 15 percent decrease over the fiscal 1986 budget (149).

Additional Issues Facing the Pretreatment Program

Balancing Needs for National Consistency and Local Flexibility

During the last decade, many indirect industrial dischargers and POTWs argued that POTWs with strong locally developed pretreatment programs should be allowed to retain these programs. These locally controlled programs would not have to meet the programmatic and bureaucratic requirements of the National Pretreatment Program as long as they provide control of toxic pollutants that is as stringent as the national program. Proponents of this perspective argue that imposing National Categorical Standards on these POTWs results in overregulation, and unnecessarily increases costs and administrative burdens for POTWs and industries.

Opponents of this approach maintain that a strong national program is necessary to ensure equitable regulation throughout the Nation and to hold POTWs and industries to a set of minimum standards. From an administrative viewpoint, allowing local control would create an atmosphere of uncertainty and might encourage some POTWs or industries to delay complying with national regulations because of concern about program changes. In addition, EPA would have to devote some of its scarce resources to evaluate local program adequacy and performance.

Most POTWs interested in local control have abandoned the issue for political reasons, and it now appears that the Nation is committed to continued development of a strong national program. At the same time, however, the development of more stringent local limits, where needed, is being strongly encouraged, as is the expansion of water quality-based controls tailored to local needs.

Despite attempts to achieve nationwide consistency, large differences exist in the implementation and oversight of various regulations by different EPA Regions (502,503). Some Regions have allocated resources for both program approvals and oversight and enforcement, while others have only allocated resources for program approvals. In addition, the arrangements among municipalities, States, and EPA Regions are often complex and variable. With more than 95 percent of the required POTW programs approved, the pretreatment program appears to be nearing the end of its development stage. As efforts shift toward implementing these programs, the importance of local limits and water quality-based permitting will grow considerably.

Obstacles to POTW Program Implementation and Enforcement

Local Limits.—Despite the importance of local limits, several obstacles hinder their development and enforcement. POTWs have an incentive to develop local limits on indirect discharges of certain toxic metals or organic chemicals that have the potential to disrupt POTW treatment operations. However, because many pollutants that are harmful to aquatic resources do not disrupt POTW operations, POTWs have had little incentive to develop and impose local limits on these pollutants.

A POTW also might develop local limits to help it meet the specific limitations on its own discharge that are contained in its NPDES permit or to clean up its sludge. However, EPA estimates that only 1 percent of all POTW NPDES permits contain any numerical limits on the discharge of toxic me-

tals or organic chemicals (653). For example, none of Rhode Island's POTWs have any such limits specified in their discharge permits (497). Where they do exist, the limits are typically based on State water quality standards, but those standards have been developed to a much greater extent for metals than for organic chemicals (see last section of this chapter). Moreover, where nationally developed standards for toxic pollutants—in effluent, receiving waters, or sewage sludge—have not been developed, few incentives (and many obstacles) exist for POTWs to develop their own local limits (503,653). The net result of this lack of incentive is that POTWs only rarely impose local limits on their industrial users, especially for priority pollutants.

Monitoring and Enforcement.—These important elements of local pretreatment programs are often inadequate. Even for POTWs with approved pretreatment programs, mechanisms to ensure a program's effectiveness may not exist. Two-thirds of the POTWs examined in one study did not monitor influent for priority metals or organic chemicals, although most large POTWs have generally identified the major sources of toxic pollutants entering their facilities (503). In another study of POTWs with approved programs, only 25 percent had all of the following mechanisms considered essential for controlling industrial wastes: 1) a sewer use ordinance with specific effluent limits, 2) a permitting mechanism, and 3) a monitoring and enforcement program (503). Gradual improvements in these areas have occurred, although for many programs the ability to identify and effectively respond to noncompliance has yet to be demonstrated.

The burden of enforcing pretreatment regulations initially falls on POTWs.[51] Even in the best of situations, it is difficult to determine the extent to which industries have complied with applicable regulations; in part, this stems from heavy reliance on self-monitoring by industries, which commonly is not independently verified by POTWs. Because partial financing for POTW operations comes from the taxes and user fees paid by industrial dischargers, there may be little motivation for a POTW to enforce limits, except where POTW operations or sludge management is impaired (497,503).

Hazardous Waste in Sewers

The current and increasing discharge of hazardous waste to sewers poses a major challenge to the pretreatment program. Hazardous wastes can be legally discharged into POTWs under the Domestic Sewage Exemption of the Resource Conservation and Recovery Act (RCRA). As recent amendments to RCRA come into effect, increasing amounts of hazardous wastes are expected to be discharged into POTWs. New provisions extending RCRA authority to all facilities that generate more than 100 kilograms per month[52] of hazardous waste have increased the total number of generators now subject to RCRA regulations from 14,000 to over 175,000 (50 FR 31285, Aug. 1, 1985). Many of these small quantity generators already discharge into local POTWs and thus could fall under the Domestic Sewage Exemption; it is estimated that as many as 25 percent of all small hazardous waste generators already use this disposal option for their hazardous wastes (568).

EPA recently submitted a major report, known as the Domestic Sewage Study (666), to Congress on the issue of hazardous waste in sewers, and more recently issued an Advanced Notice of Proposed Rulemaking (51 FR 30166, Aug. 22, 1986) that discussed preliminary approaches to implementing the Study's recommendations. For more discussion of this issue and the role of POTWs in treating domestic and industrial wastes, the reader is referred to these sources and to chapter 9.

[51] If appropriate action is not initiated by the POTW, higher authorities can step in. For example, in the last 2 years EPA has initiated more than 50 judicial actions against indirect industrial dischargers (primarily electroplates) for violations of general and categorical pretreatment regulations (J. Moran, Office of Enforcement and Compliance Monitoring, EPA, pers. comm., Dec. 23, 1986).

[52] Previously, only generators producing more than 1,000 kilograms per month were subject to RCRA hazardous waste regulation.

USING WATER QUALITY-BASED STANDARDS FOR FURTHER CONTROL OF TOXICS POLLUTANTS

In 1984, EPA released a national policy statement that described a strategy for achieving additional and more efficient control of toxic pollutants beyond that resulting from BAT and other CWA technology-based requirements (49 FR 9016, Mar. 9, 1984). This strategy focuses on water quality-based permitting of toxic pollutant discharges to be implemented through the NPDES program. Because water quality-based standards are difficult to set, EPA is adopting an integrated strategy that uses both chemical and biological methods to determine appropriate standards (659). States will be expected to devote more effort to develop water quality-based effluent limits for inclusion in NPDES permits.

This new EPA policy reflects a reevaluation of the regulatory efforts to control toxic pollutants during the last 15 years. The 1972 Clean Water Act shifted the focus of pollutant control from the use of water quality-based standards to the use of technology-based standards. Subsequent implementation of technology-based standards has resulted in significant improvements in the control of toxic discharges and in the quality of some receiving waters, and full implementation would achieve even more control.

However, the level of control provided has not always satisfied all the interested parties. For example, the technology-based standards usually do not consider site-specific circumstances such as the quality of receiving waters. In addition, BAT standards are industry-specific; some industries are required to achieve greater removal of a specific pollutant than are other industries, leading to claims of under- or over-regulation.

As a result, some industries have argued for waivers from complying with technology-based standards, in situations where the quality of the receiving water would not be impaired. 53 In contrast, environmentalists have argued that even the achievement of compliance with technology-based standards has not resulted in sufficient improvement in the quality of some receiving waters, and that supplemental controls are needed.

The 1972 CWA did not eliminate the use of water quality-based standards. Section 303 required States to adopt water quality standards to protect inter- and intra-state waters through establishment of water quality goals and designation of water uses; specific standards based on Federal water quality criteria are then to be applied to protect these uses.[54] Section 301(b)(l)(C) of CWA requires that all discharges meet water quality-based standards where they have been developed, These standards can in principle be translated, using wasteload allocation techniques, into effluent limits for the various dischargers to a particular receiving waterbody.

EPA maintains and periodically updates a summary of Federal water quality criteria and State standards. According to the most recent summary, Federal water quality criteria have now been developed for most conventional, non-conventional, and toxic priority pollutants (668).[55] The Federal criteria are for guidance only and are not enforceable. Using these criteria, all States have adopted enforceable water quality standards for fecal coliform bacteria, oil and grease, dissolved oxygen, pH, dissolved solids and salinity, and temperature, and almost all have a standard for suspended solids and turbidity (668).[56] EPA estimates that **40** percent of major municipal permits—and perhaps as high a fraction of major industrial permits—are based in some manner on these water quality standards (J. Hoornbeek, Office of Water Enforcement and Permits, EPA, pers. comm. , Nov. 13, 1986).

[53] These waivers are termed ' 'fundamentally different factor' (FDF) waivers. The conditions (including consideration of water quality) under which EPA can grant an FDF variance were clarified by Congress in the Water Quality Act of 1987,

[54] EPA is authorized to review State standards and may also promulgate standards where State standards have not been developed, although they have not done so,

[55] Federal water quality criteria consist of four criteria based on consideration of aquatic life (acute and chronic criteria specific for fresh or marine waters) and two additional criteria based on consideration of human health (one for both water and fish ingestion, and the other for fish ingestion only). Typically, only a subset of these six parameters is specified for a given pollutant,

[56] Under current policy, the adequacy of State water quality standards is now a consideration in the decision of whether to grant approval to a State to administer the NPDES program. However, the standards developed by States whose programs were approved prior to the development of this policy (or, indeed, prior to the development of most Federal water quality criteria) have not always been subject to a comparable degree of scrutiny by the Federal Government.

In contrast, for most other pollutants—in particular, priority pollutants—none or only a few States have developed standards (668). Specifically:

- Of 85 priority organic chemicals for which Federal water quality criteria exist, no States have developed standards for 37, and only one State has developed standards for another 32. For each of the remaining 16 priority organic pollutants, standards have been developed by an average of 12 States (with a range of 2 to 23 States).
- At least 1 State has developed a standard for each of the 14 priority metals and cyanide for which Federal water quality criteria exist; for each of' these substances, an average of 15 States (with a range of 1 to 24 States) have developed standards.

Thus, for no priority pollutants have even half of the States developed a water quality standard. Fourteen States have no water quality standards for priority pollutants whatsoever.

OTA also reviewed water quality standards for priority pollutants that have been promulgated by the 24 coastal States to determine the number of standards that have been specifically developed for or applied to marine waters. This survey revealed the following:

- Nine of the 24 coastal States have no marine water quality standards for priority pollutants whatsoever, and 16 States have no such standards for priority metals or cyanide.
- For the 8 coastal States that have any marine standards for priority metals or cyanide, standards have been developed for an average of 4.5 of the 14 priority metals and cyanide.
- For the 15 coastal States that have any marine standards for priority organic chemicals, standards have been developed for an average of 6.8 of the 85 priority organic chemicals.

The development of water quality-based standards poses several problems. First, it is questionable whether EPA has sufficient resources to continue to develop and update the Federal water quality criteria, or to evaluate water quality standards that are developed by States. Moreover, a large increase in compliance monitoring and enforcement burdens would also be anticipated.

Even if resources were sufficient, a number of major technical obstacles would need to be overcome. Only limited data are available on ambient pollutant concentrations in receiving waters, variability in these concentrations, and the fate of these pollutants and their impacts on indigenous organisms. In addition, our ability to monitor water quality in relation to potential environmental or human impacts is relatively primitive.

Nevertheless, further promotion of EPA's policy on water quality-based permit limitations for toxic pollutants could help provide an additional level of control beyond technology-based standards. Several approaches to increase the use of water quality-based standards may be useful for Congress and EPA to consider:

- improve technical assistance to States and local management agencies to aid in the development of State water quality-based standards;
- provide state-of-the-art guidelines to States by updating existing national water quality criteria and accelerating the development of new national water and sediment criteria;
- incorporate water quality standards into POTW NPDES permits as a means of providing incentives for POTWs to develop local limits; and
- promote wider application of whole-effluent toxicity testing, for example, through the expanded use of toxicity-based limitations in NPDES permits.