United States
Environmental Protection
Agency

Office Of Water
(EN-336)

21W-4004
July 1991

EPA

National Pretreatment Program

Report To Congress

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 10 1991

THE ADMINISTRATOR

Honorable J. Danforth Quayle
President of the Senate
United States Senate
Washington, D.C. 20510

Dear Mr. President:

I am pleased to present the Environmental Protection Agency's Report to Congress on the National Pretreatment Program. This Report responds to Section 519 of the Water Quality Act of 1987, which required EPA to study certain elements of the National Pretreatment Program. The National Pretreatment Program is a joint regulatory effort by EPA, States, and municipalities to ensure that nondomestic discharges of pollutants to municipal wastewater treatment plants ("publicly owned treatment works," or POTWs) do not interfere with POTW operations, pass through to receiving waters, or contaminate sewage sludge.

Section 519 required EPA to study the following:

(a) STUDY. The Administrator shall study--

(1) the adequacy of data on environmental impacts of toxic industrial pollutants from publicly owned treatment works;

(2) the extent to which secondary treatment at publicly owned treatment works removes toxic pollutants;

(3) the capability of publicly owned treatment works to revise pretreatment requirements under section 307(b)(1) of the Federal Water Pollution Control Act;

(4) possible alternative regulatory strategies for protecting the operations of publicly owned treatment works from industrial discharges, and shall evaluate the extent to which each such strategy identified may be expected to achieve the goals of this Act;

(5) for each such alternative regulatory strategy, the extent to which removal of toxic pollutants by publicly owned treatment works results in contamination of sewage sludge and the extent to which pretreatment

requirements may prevent such contamination or improve the ability of publicly owned treatment works to comply with sewage sludge criteria developed under section 405 of the Federal Water Pollution Control Act; and

(6) the adequacy of Federal, State, and local resources to establish, implement, and enforce multiple pretreatment limits for toxic pollutants for each such alternative strategy.

(b) REPORT. Not later than 4 years after the date of the enactment of this Act, the Administrator shall submit a report on the results of such study along with recommendations for improving the effectiveness of pretreatment requirements to the Committee on Public Works and Transportation of the House of Representatives and the Committee on Environment and Public Works of the Senate.

This Report to Congress accomplishes that mandate. It examines what is known about discharges of toxic pollutants to publicly owned treatment works (POTWs), the extent to which POTWs remove toxic pollutants from wastewaters, and the environmental effects of toxic pollutants released from POTWs to receiving waters, sewage sludge, and air. It also evaluates how well the National Pretreatment Program is being carried out, and examines alternative regulatory strategies for improving the Program. Finally, the Report recommends improvements to the Program that will allow POTWs to better control toxic pollutant discharges and meet the goals of the Clean Water Act (CWA).

The Report reaffirms the Federal, State, and local government partnership that is unique to the National Pretreatment Program. It finds that publicly owned treatment works (POTWs) have made tremendous progress carrying out and enforcing national and local pretreatment standards and requirements. Many POTWs have achieved significant reductions in toxic pollutant loadings to their treatment plants and subsequent reductions of toxic pollutants in their effluents and sewage sludges.

The Report finds that additional work is necessary. States and POTWs have been limited to some extent by the lack of environmental standards and criteria that provide an important basis for the Pretreatment Program and which allow us to thoroughly demonstrate the environmental effectiveness of this truly multi-media program. EPA is making good progress in ensuring that States adopt water quality criteria for toxic pollutants, is considering expansion of its criteria development activities, and, along with States, is issuing water quality-based NPDES permits. The Report also demonstrates that POTWs and industries are using pollution prevention as an important means of reducing toxic pollutants to and from POTWs.

Lastly, the Report affirms the existing regulatory structure of the National Pretreatment Program. It recommends improvements to the Program within that structure that fall within three broad categories:

- Continued development of national technology-based discharge standards for industries and pollutants of concern;
- Strengthening of controls by individual POTWs over toxic discharges; and
- Continued development of criteria and standards for receiving environments, and limits in POTWs' NPDES permits to reflect such development, in order to help POTWs assess their effects on receiving environments and provide appropriate site-specific controls on their industrial dischargers.

I believe that this Report to Congress responds fully to the mandate of Section 519 of the 1987 WQA, that it constitutes an insightful and comprehensive examination of the National Pretreatment Program, and that its findings and recommendations are sound.

Sincerely yours,

William K. Reilly

William K. Reilly

Enclosure

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WASHINGTON, D.C. 20460

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Speaker of the House
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Washington, D.C. 20515

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Enclosure

ACKNOWLEDGMENTS

This Report to Congress is the product of intensive effort, dedication, and team spirit. Many individuals and organizations, beyond those mentioned here, contributed to this product. Their contributions are greatly appreciated.

Two individuals, in particular, are responsible for managing and facilitating the completion of this Report to Congress: Ross Brennan and Debora Clovis, of the Permits Division. Ross and Debora provided the unending energy and enthusiasm that was the trademark of this report. Section Chief Jeffrey Lape and Branch Chiefs Ephraim King and Jim Taft provided guidance, as did other EPA senior managers: Cynthia Dougherty, Director, Permits Division and James Elder, Director, Office of Water Enforcement and Permits. Valuable support also was provided by numerous OWEP staff, including Pat Bradley, Jim Collins, Louis Eby, Cristina Gaines, Marilyn Goode, John Hopkins, Andy Hudock, Lee Okster, Linda Suttora, and George Utting.

Extensive input and advice was provided by the EPA Work Group and the individual representatives:

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Special thanks are also extended to the EPA Regional Pretreatment Coordinators, State Pretreatment Coordinators, and numerous POTWs for providing information for the Report. Particular thanks go to the Hampton Roads Sanitation District, Virginia, City of Pocatello, Idaho, and City of Thomasville, North Carolina, for serving as case studies.

Finally, Science Applications International Corporation (SAIC) of McLean, Virginia, provided assistance to EPA during the preparation of this report under EPA Contract No. 68-C8-0066. Peter Trick and Jack Mozingo were the SAIC Work Assignment Managers. Principal technical contributors were David Hair, Kathleen Harrigan, Robert Kelly, Larry Lai, Robert Linett, Karen McDonald, Maurice Owens, James Parker, Peter Trick, and Mary Waldron. Data management support was provided by Lewis Pfister, Dung Phan, and George Wilkie. Report production was managed by Margaret Siriano with assistance from Abby Johnson, Cindy Marut, and Elisabeth Smeda.

Cover photo: S.C. Delaney/EPA

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EXECUTIVE SUMMARY

This report presents the results of a study on the discharge of toxic pollutants to and from publicly owned treatment works (POTWs) performed by the U.S. Environmental Protection Agency (EPA) in response to Section 519 of the Water Quality Act (WQA) of 1987.

Specifically, Section 519 of the WQA directed EPA to study the following:

- The adequacy of data on environmental impacts of toxic industrial pollutants discharged from POTWs
- The extent to which secondary treatment at POTWs removes toxic pollutants
- The capability of POTWs to revise pretreatment requirements under Section 307(b)(1) of the Federal Water Pollution Control Act (FWPCA)
- Possible alternative regulatory strategies for protecting the operations of POTWs from industrial discharges and the extent to which each strategy is expected to achieve the goals of this Act
- For each alternative regulatory strategy, the extent to which removal of toxic pollutants by POTWs results in contamination of sewage sludge and the extent to which pretreatment requirements may prevent sludge contamination or improve the ability of POTWs to comply with sewage sludge criteria developed under Section 405 of the FWPCA
- For each alternative strategy, the adequacy of Federal, State, and local resources to establish, implement, and enforce multiple pretreatment limits for toxic pollutants.

Section 519 further directed EPA to submit a report on the results of the study along with recommendations for improving the effectiveness of pretreatment requirements. The Office of Wastewater Enforcement and Compliance developed this report, and advice and comments were provided by a work group consisting of EPA Regions and States and representatives of EPA program offices.

PURPOSE OF REPORT TO CONGRESS

This report constitutes a comprehensive evaluation of the National Pretreatment Program, with particular emphasis on the study topics listed in Section 519. The National Pretreatment Program was established by Section 307 of the Clean Water Act (CWA) and is implemented through the General Pretreatment Regulations (40 *CFR* Part 403) and categorical pretreatment standards (40 *CFR* Parts 405-471). It involves municipalities, States, and the Federal Government in efforts to control pollutants from nondomestic (i.e., industrial and commercial) sources and prevent pass through, interference, and sludge contamination at POTWs.

Industrial dischargers are required to pretreat their wastewaters prior to discharge to POTWs in accord with national pretreatment standards (consisting of national prohibited discharge standards, technology-based categorical standards, and locally established discharge limitations). In addition, industrial users must meet other obligations, such as monitoring, reporting, and spill prevention, under the General Pretreatment Regulations. In most cases, the principal developers and enforcers of pretreatment requirements at the local level are POTWs, with assistance and oversight provided by States, EPA Regions, and EPA Headquarters. The National Pretreatment Program extends to more than 200,000 nondomestic sources, of which 30,000 are considered significant industrial users (SIUs), and to nearly 1,500 approved local pretreatment programs. Approved programs cover over 2,000 wastewater treatment plants, which in turn treat nearly 80 percent of the municipal wastewater flow nationally.

The purpose of this evaluation is to determine, after the pretreatment program has been underway for over a decade, how the program can more effectively achieve the goals of the CWA and minimize the adverse environmental impacts of toxics that may be discharged from POTWs.

STUDY APPROACH AND ORGANIZATION

The congressional mandate and characteristics of the National Pretreatment Program influenced the Agency's approach to this study. First, Congress requested a national assessment of the program. Furthermore, Congress requested information on environmental impacts from a program that historically has been largely technology-based. Finally, the National Pretreatment Program has undergone intensive examination several times in its relatively brief history, enabling the Agency to use the results of previous studies.

EPA has, therefore, designed this Report to Congress to:

- Provide as complete an assessment of the pretreatment program as possible
- Present actual rather than projected results of the program (e.g., through the use of actual monitoring and compliance data rather than modeling results)
- Use and combine data from various EPA program offices (e.g., the Toxics Release Inventory System, NEEDS 1988 Survey File, and the Permit Compliance System)

- Build upon existing national studies (e.g., the Domestic Sewage Study and the 40-POTW Study)
- Combine performance of the study with ongoing program implementation activities (e.g., State and local pretreatment program audits)
- Supplement national data with State and local data.

This evaluation of the National Pretreatment Program is organized into nine chapters. Chapter 1 provides background information on the National Pretreatment Program and its relationship to other water pollution control programs under the CWA.

Chapter 2 characterizes the data sources and the methodology used by EPA to complete the report.

Chapter 3 characterizes the sources and discharges of toxic pollutants to POTWs. The chapter also provides information on pollution prevention activities undertaken within various types of industries.

Chapter 4 explores the extent to which secondary wastewater treatment plants remove toxic pollutants. It describes the fate of toxic pollutants within treatment plants, differentiating bona fide removal (biodegradation) from partitioning to air and sludge, and characterizes actual secondary treatment plant performance in removing toxic pollutants from wastewater.

Chapter 5 evaluates the capability of POTWs to revise pretreatment standards through two mechanisms: removal credits and local limits. The chapter describes the statutory and regulatory history of the removal credits and local limits programs and discusses the processes by which POTWs develop, submit, and implement these mechanisms. It also describes existing Federal, State, and local environmental and technical criteria that influence the establishment of removal credits and local limits, in addition to summarizing the current status of POTW development and implementation of removal credits and local limits. Finally, the chapter addresses the capability of POTWs to obtain removal credits and to develop, implement, and enforce local limits.

Chapter 6 examines the adequacy of data on environmental impacts of toxic pollutants discharged from POTWs and the extent of those impacts, where known. It provides information on the nature of POTWs' receiving waters and sludge disposal methods. Chapter

6 also describes potential environmental effects of POTW discharges and analyzes the extent to which POTWs comply with various environmental standards and criteria, and it characterizes the adequacy and limitations of the data with which impacts are assessed.

Chapter 7 evaluates the effectiveness of the existing National Pretreatment Program by examining the following: whether the program covers the appropriate POTWs, pollutants, and industries; whether POTWs are effectively implementing the requirements of the program; and whether the program is effective in preventing or reducing the environmental impacts of toxic pollutants discharged by POTWs. The chapter examines program implementation requirements and identifies areas where POTWs have and have not met specific program requirements.

Chapter 8 explores alternative regulatory strategies for enhancing the National Pretreatment Program. It describes how alternatives were selected and then characterizes 17 supporting regulatory options in terms of their purpose, scope, affected parties, applicability to CWA objectives, and impact on sewage sludge quality. Study findings in support of each alternative are considered. These alternatives are also assessed for their implementation and compliance costs.

Chapter 9 summarizes report findings and recommends ways to enhance attainment of the environmental objectives underlying the pretreatment program.

MAJOR FINDINGS AND RECOMMENDATIONS

Sources and Amounts of Pollutants Discharged to POTWs

- Sources
  - Nationwide, more than 15,000 POTWs receive and treat a total of approximately 34 billion gallons per day of domestic, commercial, and industrial wastewater.
  - A total of 1,542 POTWs (encompassing 2,128 individual municipal wastewater treatment plants) are required to have approved local pretreatment programs. As of March 1990, 1,442 of the 1,542 (94 percent) have approved local programs. Toxic discharges to another 314 POTWs are regulated by State-run pretreatment programs, pursuant to 40 *CFR* 403.10(e), in lieu of local programs. Those POTWs with approved pretreatment programs and those covered by State-run programs receive more than 80 percent of the national wastewater flow discharged to POTWs.
  - EPA estimates that 30,000 significant industrial users (SIUs) discharge to POTWs. This number comprises approximately 11,600 categorical industrial users (CIUs) and 18,400 noncategorical SIUs.

- Several hundred thousand other nondomestic users discharge to wastewater treatment plants across the United States. These facilities include retail and commercial establishments, as well as industries that do not meet EPA's definition of significant industrial user.

- Sources and Types of Industrial Discharges
  - The Domestic Sewage Study, assuming imposition of and compliance with categorical Pretreatment Standards for Existing Sources (PSES), identified the following industrial categories responsible for the highest loadings of 165 metals and toxic organics to POTWs:
    - Metals: Electroplating and metal finishing; industrial and commercial laundries; organic chemicals manufacturing; coal, oil, petroleum products and refining; and pulp and paper mills.
    - Organics: Equipment manufacture and assembly; pharmaceutical manufacture; organic chemicals manufacturing; coal, oil, petroleum products and refining; and industrial and commercial laundries.
  - Data from the Toxics Release Inventory System regarding releases of more than 300 listed toxic chemicals showed that more than 5,700 industrial facilities estimated discharges of more than 680 million pounds of toxic pollutants to more than 1,700 POTWs in 1988. The industrial categories reporting the largest volume released to POTWs were fertilizer manufacturing; organic chemicals manufacturing; dye manufacturing and formulating; pulp and paper mills; food and food by-products processing; and pharmaceutical manufacturing.
  - For the 165 pollutants analyzed in the DSS (plus copper and zinc), annual POTW loadings of toxic pollutants reported in TRIS (159 million pounds) exceed loadings estimated in the DSS (60 million pounds), although the DSS represented more facilities discharging to POTWs.

- Other Potentially Significant Sources
  - Findings for the DSS, TRIS, and EPA's 304(m) plan suggest that commercial and industrial facilities not yet subject to categorical pretreatment standards may discharge considerable quantities of toxic pollutants to POTWs. Such facilities include machinery manufacturing and rebuilding, industrial and commercial laundries, hazardous waste treatment facilities, and waste reclaimers.
  - Domestic wastewaters may contain considerable amounts of toxic pollutants as a result of the disposal of household hazardous wastes. In some cases, pollutants contributed by drinking water supplies and drinking water conveyance systems may also be significant. Inorganic pollutants present in domestic wastewater include metals such as copper, iron, lead, and zinc. Organic compounds may include pesticides, plasticizers, coal tar compounds, and chlorinated solvents.
  - POTWs may also receive significant loadings of toxic pollutants from hauled wastes, landfill leachate, storm water, or cleanup activities associated with RCRA corrective actions, Superfund cleanups, and underground storage tanks.

- Types of Controls
  - Categorical standards and local limits have brought about significant reductions in metals loadings and moderate reductions in toxic organics loadings from regulated industries.

- - <u>Metals</u>: Toxic metal pollutant loadings from regulated industries are estimated to be reduced by 95 percent after implementation of PSES. This reduction results in estimated annual loadings of about 14 million pounds (6,500 metric tons).
- - <u>Organics</u>: Depending on the data source, toxic organic loadings from regulated industries are estimated to be reduced by approximately 40 to 75 percent after PSES, resulting in annual loadings of approximately 65 million pounds (30,000 metric tons).

- Planned development of additional categorical standards for such industries as machinery manufacturing and rebuilding, pharmaceutical manufacturing, industrial laundries, paint formulating, and hazardous waste treatment is expected to further reduce loadings of toxic pollutants to POTWs.
- POTWs and industrial users have demonstrated that they understand pollution prevention and the opportunities it affords to reduce loadings of toxic pollutants. EPA has found that pollution prevention techniques have been used at 36 of the 47 industrial categories evaluated in this report.
- In 1989, over 600 household hazardous waste collection programs were in place, many of which were coordinated by POTWs. Further reductions in toxic pollutants, including commercial and domestic sources, may be necessary to obtain the reductions needed to achieve desired environmental standards.

Extent of Removal of Toxic Pollutants at Secondary Treatment Plants

- Fate of Toxic Pollutants
  - Toxic pollutants present in the raw sewage entering secondary treatment plants have several fates. Toxic organic pollutants can biodegrade, partition to sewage sludge, volatilize, or remain in the discharge to receiving waters. Metals generally partition to the sewage sludge or remain in the discharge from the POTW.
  - The removal of most toxic pollutants from wastewaters is largely incidental to the treatment of conventional pollutants and should be considered in terms of partitioning among alternative pathways; toxic pollutants may be shifted from one medium to another (to the air through volatilization or sludge through adsorption), as well as destroyed through biodegradation.
- Nature of Pollutant Removals
  - Pollutant removal is calculated from the results of sampling the influent and effluent of a POTW treatment plant.
  - EPA's analyses of priority pollutant removals indicate that removal efficiencies for toxic pollutants vary widely from POTW to POTW.
  - Calculation of removals of toxic pollutants at a POTW must consider that removal involves several pathways and is variable because of changing conditions and situations at the POTW (e.g., concentration of the pollutant, POTW operational characteristics, aeration/turbulence, temperature).
  - Removal efficiencies do not appropriately represent POTW variability when expressed as single median values, because of the variability of observed removals.

- The broad range of removal efficiencies observed underscores the need for using POTW-specific data in making decisions that involve toxic pollutant removals applicable to individual POTWs.

POTW Capability to Revise Pretreatment Standards

- Status of Removal Credits
  - Removal credits are adjustments to categorical pretreatment standards that reflect the removal of a pollutant by a POTW. A POTW may elect to lessen the stringency of a categorical standard where it demonstrates it consistently removes a given pollutant and maintains compliance with its NPDES permit and sludge requirements. The removal credits program has been suspended since 1986. Removal credits will remain unavailable until EPA promulgates sludge requirements pursuant to Section 405 of the CWA.
  - When the removal credits program was suspended in 1986, 12 POTWs nationwide had removal credits approved by EPA, and another 15 had removal credit applications pending. The approved removal credits covered 16 pollutants and affected approximately 150 industrial dischargers.
  - Future POTW interest in removal credits, once they are available again, is expected to be low; however, increased regulation of organic pollutants in recently promulgated and forthcoming guidelines may renew interest in removal credits for some organic compounds.
- Assessment of POTW Capability: Removal Credits
  - POTWs possess adequate resources and technical expertise to perform the tasks inherent in revising pretreatment standards through removal credits (e.g., monitoring and calculation of revised standards).
  - Most pollutants for which removal credits were granted (or for which applications were filed) are metals that do not biodegrade in municipal treatment systems and that are partitioned instead to sludge.
- Status of Local Limits
  - Analysis of local limits at 200 POTWs found that 90 percent of POTWs have adopted local limits for one or more toxic pollutants and that more than 70 percent have adopted local limits for the 10 pollutants listed in EPA guidance as being of highest concern. A much smaller percentage, however, has adopted local limits using a headworks loading or other technical basis. POTWs surveyed by the General Accounting Office were found to impose local limits for an average of 14 toxic pollutants.
  - POTWs regulate many more pollutants in their local limits than they are limited for in their National Pollutant Discharge Elimination System (NPDES) permits. According to EPA's Permit Compliance System, 32 percent of the NPDES permits for pretreatment POTWs issued in 1989 contained limits for one or more toxic pollutants.
- Assessment of POTW Capability: Local Limits
  - POTWS are generally capable of developing and implementing local limits. Weaknesses observed include the following:

- - In developing local limits, POTWs generally lack site-specific data necessary to calculate treatment plant removals. The current practice of using literature POTW removal data to develop local limits may not accurately reflect treatment plant performance and may result in exceedances of environmental or technical criteria.
- - POTWs often rely on literature data to predict pollutant concentrations that may result in unit process inhibition. These literature inhibition data are based on a limited sample size and may not accurately characterize site-specific conditions. Additionally, these data are available for only a few pollutants and treatment processes.
- - The application of local limits to categorical industries often involves comparisons with the categorical standards to determine which of the limits (local or categorical) are more stringent. Although EPA has provided guidance to address this issue, POTWs continue to have difficulty applying the most stringent standard.

- POTWs often lack sufficient environmental standards, criteria, or permit conditions to develop technically based limits or judge the appropriateness of existing local limits. The NPDES permits for two-thirds of the pretreatment POTWs nationwide do not contain limits for any toxic pollutants. Of those that do, only a few pollutants are generally limited. In addition, national sludge disposal standards are not yet in place, and most States do not have comprehensive sludge standards. POTWs, therefore, are often without specific environmental criteria and standards upon which local limits are to be based.

Adequacy of Data on the Environmental Effects of Toxic Discharges From POTWs

- Types of Effects and Pathways
  - Discharges of toxic pollutants from POTWs can impair the quality of receiving environments, including surface water, ground water, and air. In addition, the health and safety of workers at POTWs may be adversely affected.
  - Toxic effects vary by pollutant, as well as by receiving medium. Principal effects of concern are lethality, carcinogenicity (causing cancer), teratogenicity (causing developmental abnormalities), or mutagenicity (causing genetic abnormalities). Some compounds discharged from POTWs (PCBs and arsenic) exhibit all of these deleterious effects. Several metals are lethal, teratogenic, and mutagenic but do not cause cancer.
- Extent of Environmental Criteria
  - The lack of comprehensive criteria for all pollutants discharged to and from POTWs inhibits estimation of the environmental effects of POTW discharges.
  - In addition, the POTWs, States, and EPA do not collect or maintain data that are comprehensive enough to characterize municipal wastestreams or their impacts in receiving environments adequately. Data on POTWs' effluents and their impacts are most comprehensive for discharges to surface water.
- Surface-Water Impacts
  - Eighty percent of POTWs covered by pretreatment programs discharge treated effluent to rivers and streams, 4 percent to lakes, 7 percent to oceans, and 9 percent to other environments, including land, estuaries, and reservoirs.

- Under the 304(l) program, 254 POTWs (171 pretreatment POTWs) are among the 888 facilities contributing toxic pollutants to stream segments not attaining water quality standards.

- Ground-Water Impacts
  - The most significant potential cause of ground-water contamination by POTWs is disposal of sewage sludge, although empirically this has rarely been a problem. Forty-two percent of all municipal sewage sludge is beneficially used in land application, 22 percent disposed of in landfills, 14 percent by incineration, 6 percent through distribution and marketing, 5 percent by ocean disposal, and 2 percent by other practices. Roughly three-quarters of sludge is used or disposed of in land-based practices.
  - Pollutants under consideration for regulation in EPA's proposed Part 503 regulations for sludge use and disposal were detected at high frequency in the National Sewage Sludge Survey (NSSS).. Mean concentrations of certain toxic metals (arsenic, cadmium, copper, lead, molybdenum, nickel, and zinc) found in sludge in the NSSS suggest that some POTWs may be precluded from certain beneficial use or disposal practices unless they can reduce loadings through additional pretreatment.

- Air/Worker Health and Safety Impacts
  - Little is known about the extent and effects of air emissions from POTWs. The DSS estimated that 0.1 percent of the mass of national emissions of volatile organic compounds may come from POTWs. Twenty-seven POTWs nationally are each reported to emit over 100 tons per year of Clean Air Act criteria pollutants.

Effectiveness of the National Pretreatment Program

- Program Scope
  - EPA Regions and States have successfully identified those POTWs whose receipt of industrial discharges makes pretreatment a necessity. The POTWs with approved programs, or covered by State-run pretreatment programs, receive more than 80 percent of the national wastewater flow discharged to POTWs.
  - Virtually all the POTWs reported in TRIS to be receiving more than 1 million pounds of toxic chemicals are covered by programs. Evaluation of various data sources (e.g., TRIS, NEEDS, 304[l]) may enable EPA to target additional POTWs for development of local programs.

- Implementation Status
  - Measurements of the level of implementation of local programs indicate that local implementation is well underway. Ninety-four percent (totaling 1,442) of required local pretreatment programs have been approved. Twenty-seven States have approved State pretreatment programs. Specific programmatic implementation issues will require more attention, such as the need for POTWs to develop technically based local limits and to adequately enforce all pretreatment standards and requirements.
  - PCS indicates that 84 percent of SIUs have been issued control mechanisms, and 90 percent of SIUs have been inspected under local programs.

- EPA Regions and States have performed extensive oversight of local pretreatment programs, having performed more than 3,600 audits and inspections at 1,328 POTWs in the last 5 years.
- One of the pretreatment program's key strengths is implementation at the local level, which provides the flexibility necessary to respond to site-specific conditions. In general, locally implemented programs have been found to regulate more noncategorical industries than State-run programs. In contrast to State-run programs, local programs have developed and implemented site-specific local limits to prevent pass through and interference and have conducted more frequent monitoring of industries to assess compliance.
- The decentralized, local approach has, however, resulted in instances of incomplete or inconsistent implementation of local pretreatment programs. As many as 40 percent of the approved local pretreatment programs need to improve at least one key area of implementation (e.g., issuance of industrial user control mechanisms, local limits development, enforcement).

• Environmental Results
  - The lack of comprehensive environmental data makes it difficult to evaluate the program's effectiveness in achieving the goals of the Act. However, evidence from various data sources suggests that the pretreatment program has resulted in significant reductions in the discharge of toxic pollutants to POTWs and from POTWs to the environment.
  - Many POTWs report significant declines in concentrations and loadings of toxic pollutants in influent, effluent, and sludge associated with implementation of pretreatment programs. These decreases have reduced operational problems and improved the quality of receiving waters and sludges.

Alternative Regulatory Strategies for Pretreatment

• The overall regulatory framework for control of toxic discharges to POTWs appears to provide suitable mechanisms to address environmental concerns and achieve the goals of the Act.

RECOMMENDATIONS

From the major findings in this Report to Congress, EPA recommends the following approaches, none of which require statutory change, to further reduce the environmental impacts associated with toxic discharges to and from POTWs:

• Continue to promulgate national categorical pretreatment standards and stress the adoption of cost-effective pollution prevention and domestic wastewater controls wherever feasible.

• Improve local pretreatment standards to further reduce toxic loadings and to ensure the integrity of POTW collection systems.

• Improve the scientific basis of pretreatment controls, and provide better benchmarks for pretreatment program performance, by establishing comprehensive standards and criteria for all media affected by POTW discharges.

Aspects of these broad recommendations are explained more fully below. It should be noted that EPA is currently undertaking many regulatory development and program implementation activities envisioned by these recommendations. These recommendations do not comprise entirely new initiatives, but are intended to complement ongoing water pollution control efforts by municipalities, States, and EPA.

Recommendation One: Enhance National Categorical Pretreatment Standards

- Continue to develop new and revised categorical standards in accordance with EPA's plan developed under 304(m), and continue to review new pollutants, particularly those nonpriority pollutants now known to pose significant environmental risks, for inclusion in categorical standards. Where final standards are not necessary on a national basis, issue guidance to POTWs on problem pollutants and control options.
- Continue to consider cost-effective pollution prevention techniques as the basis for categorical standards where such techniques offer the best available technology economically achievable (BAT).
- Reexamine the removal credit requirements of the General Pretreatment Regulations (Section 403.7) in light of the findings of this report. Further topics for examination might include the definition of consistent removal, monitoring requirements, types of compounds for which removal credits are and are not available, the use of data from similar POTWs, and specific conditions for inclusion in the NPDES permit once removal credits are approved.

Recommendation Two: Improve Local Pretreatment Standards

- Promote opportunities for use of cost-effective pollution prevention tools in industrial user permitting, local limits development, spill control, and inspections to reduce nondomestic loadings of toxic pollutants. Encourage market forces and industrial user input into the process of developing and allocating POTW local limits.
- Promote domestic hazardous waste programs and other opportunities to reduce discharges of pollutants from domestic sources.
- Consider revising the local limits requirements in the General Pretreatment Regulations (Section 403.5) to address methods for determining pollutants of concern, use of actual monitoring data instead of default or literature values, the basis of limits, and other issues.
- Consider developing additional local limits guidance for high-risk nonconservative organic pollutants (e.g., volatile organic compounds).
- Assess the degree to which corrosion control programs and pipe replacement programs completed in response to Safe Drinking Water Act requirements may reduce concentrations of pollutants in municipal wastewaters.

Recommendation Three: Improve Scientific Basis of Pretreatment Controls

- Continue to emphasize with EPA Regions and States the need for water quality-based NPDES permits for pretreatment POTWs.
- Continue to train permit writers in methods for incorporating water quality-based limits and sludge requirements in NPDES permits.
- Target pretreatment POTWs for additional monitoring and reporting, in order to ascertain the need for additional toxics control, based on data showing actual or reasonable potential for problems. Target additional POTWs for development of local pretreatment programs based on these same data sources.
- Establish measures for assessing the environmental effectiveness (e.g., improved water quality and sludge quality) of local pretreatment programs. Incorporate these measures into ongoing implementation activities (such as audits, PCIs, or POTW annual reports).
- Continue to develop water quality and sludge quality standards.
- Issue guidance to States emphasizing the need to develop water quality standards and wasteload allocations for toxics of concern. Provide technical assistance as necessary.
- Continue aggressive enforcement of pretreatment standards and requirements at the local, State, and Federal levels.

1. BACKGROUND AND INTRODUCTION

This Report to Congress responds to Section 519 of the Water Quality Act (WQA) of 1987. The WQA, which amended the Clean Water Act (CWA) of 1977, required the U.S. Environmental Protection Agency (EPA) to evaluate several issues related to the National Pretreatment Program. Specifically, Section 519 directed EPA to study:

- The adequacy of data on environmental impacts of toxic industrial pollutants discharged from publicly owned treatment works (POTWs)
- The extent to which secondary treatment at POTWs removes toxic pollutants
- The capability of POTWs to revise pretreatment requirements under Section 307(b)(1) of the Federal Water Pollution Control Act
- Alternative regulatory strategies for protecting the operations of POTWs from industrial discharges, and the extent to which each strategy is expected to achieve the goals of the WQA
- For each alternative strategy, the extent to which removal of toxic pollutants by POTWs results in contamination of sewage sludge, and the extent to which pretreatment requirements may prevent sludge contamination or improve the ability of POTWs to comply with sewage sludge criteria
- For each alternative strategy, the adequacy of Federal, State, and local resources to establish, implement, and enforce multiple pretreatment limits for toxic pollutants.

Section 519 also directed EPA to submit a Report to Congress on the results of the study and to recommend ways to improve the effectiveness of pretreatment requirements. This report addresses this mandate. The Office of Water Enforcement and Permits (OWEP) prepared the report with the help of EPA Regions, selected States, and other EPA program offices.

1.1 THE NATIONAL PRETREATMENT PROGRAM

This Report to Congress constitutes an assessment of the National Pretreatment Program. The pretreatment program, which is part of EPA's water pollution control program under the CWA, is a joint regulatory effort by Federal, State, and local authorities that requires the control of nondomestic (i.e., industrial and commercial) sources of toxic pollutants discharged to POTWs. Pretreatment minimizes the likelihood of treatment plant upsets and reduces the level of toxic pollutants in wastewater discharges from the POTW and in the sludge resulting from municipal wastewater treatment.

1.1.1 Controls on POTWs Under the Clean Water Act

The National Pollutant Discharge Elimination System (NPDES) permit program under Section 402 of the CWA protects surface waters of the United States from pollution by wastewater discharges, including discharges from POTWs. NPDES permits control more than 64,000 discharges to surface waters. Of these, 49,000 are industrial sources (3,000 major industrial sources and 46,000 minor industrial sources, mainly manufacturing and commercial facilities). The remaining 15,000 sources are POTWs.

Wastewater from POTWs consists of domestic sewage and industrial and commercial wastes that are discharged indirectly to surface waters via sewers by industrial users of the POTWs. There are hundreds of thousands of industrial users in the United States. Approximately 30,000 industrial users meet EPA's definition of "significant industrial user" (defined in Subsection 1.1.6). "Pretreatment" is the removal by industrial users of pollutants from their wastestreams before they discharge the wastestreams to POTWs. Pretreatment ensures the protection of surface waters from the effluent discharged from POTWs and also protects POTWs from interference with plant operations that may be caused by certain discharges from industrial users.

Each POTW that discharges directly to surface waters must apply for and obtain an NPDES permit. These permits are issued either by EPA or a State (where the State is authorized to administer its own NPDES program). EPA or State permit writers examine the volume and quality of municipal effluent and then develop pollutant-specific numeric limits and other requirements for the POTW's permit. The NPDES permit also requires other actions, such as submitting discharge monitoring reports, operating a pretreatment program, or meeting schedules for complying with permit conditions. NPDES permits have a maximum duration of 5 years under current law.

The CWA originally emphasized the control of conventional pollutants discharged by POTWs. Conventional pollutants are biochemical oxygen demand (BOD), total suspended solids, fecal coliform, pH, and oil and grease. Section 301 of the CWA required POTWs to meet numeric limits for such pollutants by 1977. The limits were based on the use of "secondary treatment"—the breakdown of organic matter by microorganisms. Although secondary treatment may remove some toxic pollutants (such as heavy metals or manmade organic compounds) on an incidental basis, the CWA instead provides for control of toxics through POTW pretreatment programs and industrial compliance with numeric pretreatment standards.

In addition to meeting secondary treatment requirements, POTWs may also be required to meet permit limits based on water quality standards that States develop under Section 303 of the CWA. These standards protect the quality of individual water bodies. To establish water quality standards, States designate desired uses for stream segments, such as fishing, swimming, water supply, or industrial use. Ambient Federal or local water quality criteria are applied to the most sensitive use for each stream and become the operative water quality standards. These, in turn, may be translated into effluent limits in NPDES permits to protect water quality and designated uses.

POTWs are also subject to restrictions on how they may dispose of the sewage sludge generated by their treatment operations. POTWs impose pretreatment controls on their industrial users not only to protect receiving waters but also to ensure that sewage sludge is of sufficient quality for the disposal or beneficial use intended. Sewage sludge may be landfilled or incinerated, or, if it contains low enough quantities of toxic pollutants, it may be used as a fertilizer or soil conditioner.

Until recently, control of the disposal of municipal sewage sludge was regulated on a State-by-State basis, and POTW operators rarely had access to comprehensive criteria that would enable them to place appropriate pretreatment controls on their industrial users. Regulations defining acceptable land disposal practices and beneficial use for sludge (40 *CFR* Part 257) have been promulgated under the joint authority of the CWA and Subtitle D of the Resource Conservation and Recovery Act (RCRA). Other laws governing municipal sludge use or disposal depend on the use or disposal method employed or the pollutants present in the sludge. These laws include the Clean Air Act; the Marine Protection, Research, and Sanctuaries Act; RCRA Subtitle C; and the Toxic Substances Control Act.

EPA is now preparing regulations that will control the management of municipal sewage sludge in a much more comprehensive manner. These regulations are under the authority of Section 405 of the CWA, as amended by Section 406 of the WQA of 1987. This provision requires EPA to regulate sludge use and disposal to protect public health and the environment from any reasonably anticipated adverse effects of these practices.

One of the most prevalent sludge disposal methods nationwide is disposal at a municipal landfill. This practice will be covered by regulations that have been proposed at 40 *CFR* Part 258 for operation and maintenance of municipal landfills.

EPA is also developing technical standards for other sludge use and disposal options, including land application, that will be incorporated into NPDES permits or other permits issued to POTWs. These standards will make it easier for POTWs to control the quality of their sludge by setting effluent limits for their industrial users that will allow POTWs to meet whichever standards apply to their own sludge disposal practices.

EPA has proposed an initial round of sludge standards that are expected to be published in early 1992 at 40 *CFR* Part 503. Until the Part 503 standards are promulgated, EPA is regulating sewage sludge use and disposal practices through a congressionally mandated interim permitting program that places case-by-case sludge conditions in NPDES permits.

1.1.2 The Role of the National Pretreatment Program

NPDES permits issued to POTWs protect two media: receiving waters and sewage sludges. To comply with its NPDES permit and meet other environmental criteria, a POTW must limit the pollutants it receives that are not amenable to treatment at its own plant.

Typically, POTWs receive a mixture of two types of waste: domestic sewage from residential and commercial sources, and industrial wastewaters discharged into the sewer. Industrial wastes frequently contain toxic pollutants, such as heavy metals or manmade organic chemicals, that may not be compatible with the physical and biological processes that POTWs typically use to treat wastes. Such toxic pollutants may pass through wastewater treatment plants untreated or interfere with treatment plant operations. Therefore, POTWs may require industrial users to "pretreat" wastewaters discharged to municipal sewers.

Local industrial waste controls have existed in some cities for many years. Milwaukee, Wisconsin, for example, has regulated discharges of industrial wastewaters to sewers since the 1920s. (The success of this program is shown most clearly in the widespread marketing of the fertilizer Milorganite, which is a sewage sludge product.)

The Federal Government's role in pretreatment was first established with the Federal Water Pollution Control Act Amendments of 1972. Section 307(b) of the 1972 Amendments required EPA to promulgate technology-based pretreatment standards for industrial users of POTWs that would prevent pollutant discharges that interfere with POTW operations, pass through treatment works to receiving waters without adequate treatment, hinder proper use or disposal of sewage sludge, or are otherwise incompatible with the POTW.

The Clean Water Act Amendments of 1977 contained a more comprehensive approach to pretreatment that gave greater attention to toxic pollutants. As a result, EPA promulgated the General Pretreatment Regulations in 1978 (40 *CFR* Part 403). The Agency adopted these regulations after considering many alternative strategies concerning the number of industrial users to be regulated, the amount of local flexibility allowed, and the relative roles of Federal, State, and local governments.

The pretreatment program has three objectives:

1. Prevent interference with treatment plant operations. Some nondomestic pollutants are incompatible with POTW treatment systems and can disrupt plant operations and reduce treatment efficiency. Interference is defined in the General Pretreatment Regulations (40 *CFR* 403.3[i]) as:

   > A discharge which, alone or in conjunction with a discharge or discharges from other sources, both: (1) inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and (2) therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with . . . [applicable] statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations). . .

2. Prevent pass through of pollutants to receiving waters. Even if nondomestic pollutants do not interfere with treatment systems, they may pass through POTWs without being treated adequately. The General Pretreatment Regulations (40 *CFR* 403.3[n]) define pass through as:

   > A discharge which exits the POTW into waters of the United States in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation).

3. Improve opportunities to recycle and reclaim municipal and industrial wastewaters and sludges. Certain pollutants are "partitioned" from wastewater to sewage sludge by the POTW's treatment system. Contamination of sludge by toxic pollutants can increase disposal costs or limit disposal options. Pollutants remaining in the municipal wastewater can limit opportunities for water reuse. Additionally, many pretreatment technologies provide for reclamation of lost raw materials by industrial users, or are substituted by pollution prevention practices that eliminate the need for end-of-pipe treatment.

1.1.3 Responsibilities for Implementing the National Pretreatment Program

EPA's General Pretreatment Regulations establish the framework, responsibilities, and requirements for implementing and enforcing pretreatment standards. EPA established the National Pretreatment Program on the premise that the program's goals would best be met through the interaction of Federal, State, and local governments. Local governments bear the primary responsibility for developing, carrying out, and enforcing local pretreatment programs. This is because POTWs:

- Know their own nondomestic users and are best placed to develop effective controls on those users
- Are in the best position to diagnose and correct problems unique to their systems
- Can respond to emergencies and can take quick, effective action to address environmental hazards.

The Federal Government and the States also share responsibility for carrying out the National Pretreatment Program. State and Federal approval authorities review, approve, and oversee local pretreatment programs and regulate discharges to any POTWs that do not have such local programs.

States that are authorized to run the NPDES Program at the State level must apply for authority to administer pretreatment requirements as well. States are designated as "approval authorities" after EPA reviews and approves their State pretreatment programs. Currently, as illustrated in Figure 1-1, 39 States have federally approved NPDES permit programs, and 27 States have approved State pretreatment programs. EPA is the approval authority in States without approved pretreatment programs.

Under 40 *CFR* 403.10(e), approved States may choose to regulate industrial users directly instead of requiring POTWs to do so through local programs. Alabama, Connecticut, Mississippi, Nebraska, and Vermont currently are "403.10(e) States" that run the National Pretreatment Program at the State level in lieu of local programs.

EPA develops industry-specific national categorical pretreatment standards, oversees approved State programs, makes necessary changes to the General Pretreatment Regulations, and exercises its enforcement authority to ensure that industrial users and

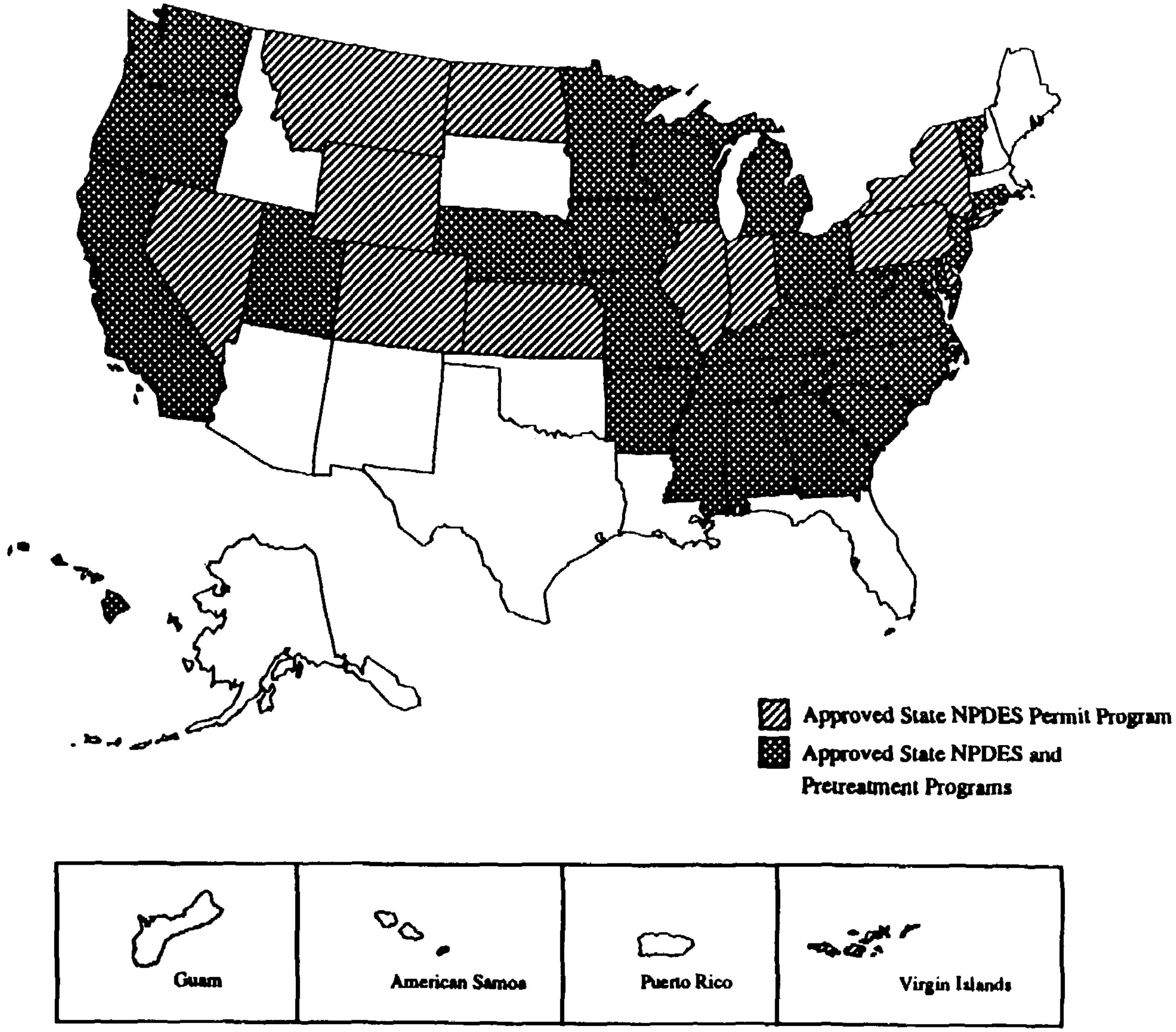


Figure 1-1. Status of State NPDES and Pretreatment Program Approvals, November 1990
Thirty-nine States and territories have federally approved NPDES programs. Twenty-seven States have federally approved pretreatment programs.

POTWs comply with pretreatment standards and requirements. The Agency also provides extensive training and technical assistance to States and POTWs.

1.1.4 POTWs Required to Have Pretreatment Programs

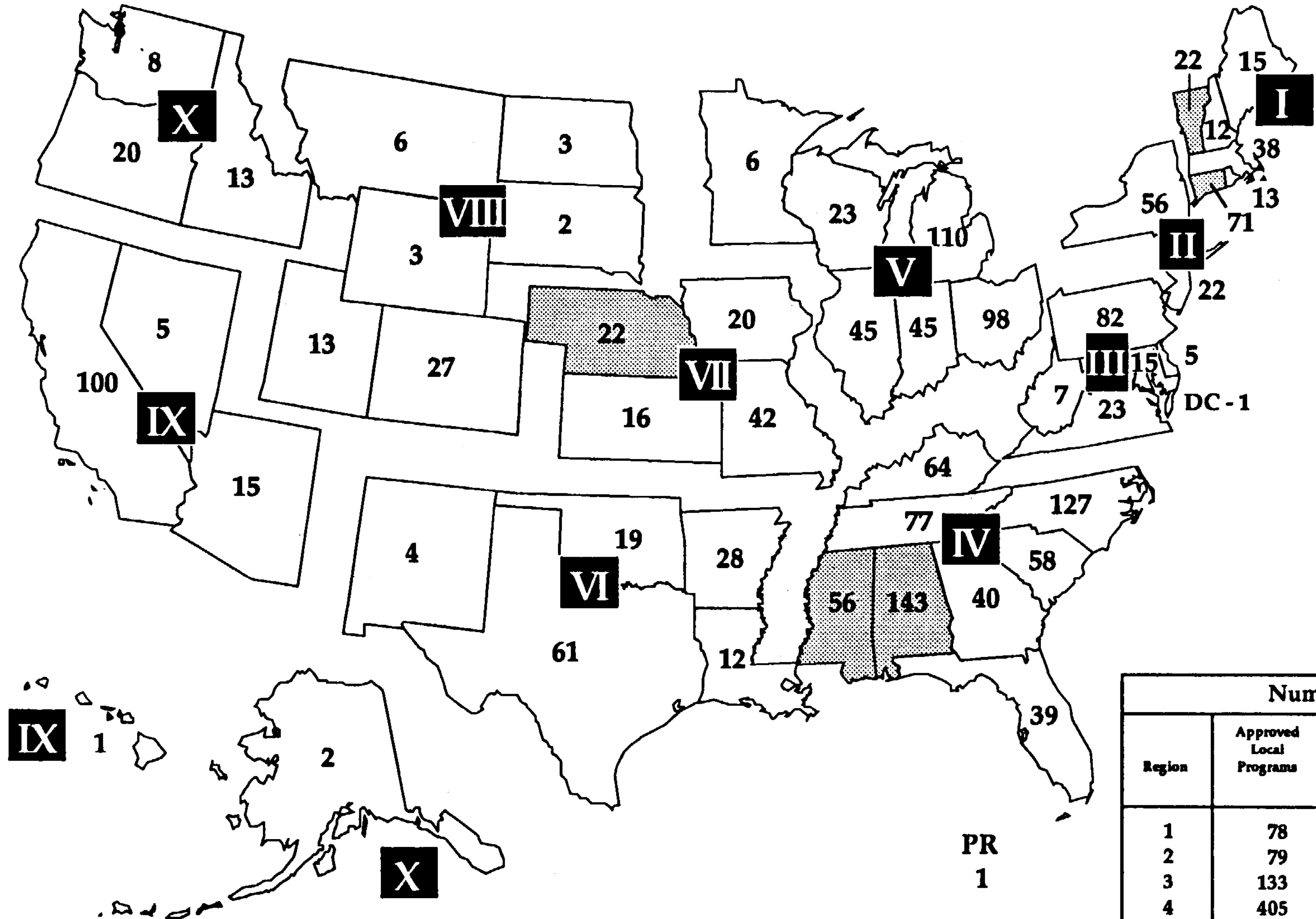
Unless they are located in States that have chosen to assume responsibility for local program functions under 40 *CFR* 403.10(e), the following POTWs must have pretreatment programs pursuant to 40 *CFR* 403.8(a):

- POTWs with design flows exceeding 5 million gallons per day (mgd) are required to have pretreatment programs if the discharges from their industrial users are subject to pretreatment standards (described below) or cause pass through or interference.
- POTWs with 5 mgd design flow or less may also be required to have pretreatment programs depending on the nature or volume of their industrial influent, particularly if a potential exists for upsets of treatment processes, violations of NPDES permit requirements, or contamination of sewage sludge.

POTWs meeting these criteria were required to develop pretreatment programs by July 1, 1983. POTWs identified since that time as requiring programs are required to submit programs for approval within 1 year of identification.

EPA's 1988 NEEDS Survey (described in Chapter 2 and hereafter referred to as NEEDS '88) identified 15,591 wastewater treatment plants nationwide. Among these plants, 1,542 POTWs are required to develop and implement local pretreatment programs. Of these, 1,442 programs have been approved and are being implemented. These approved local pretreatment programs cover 2,015 individual wastewater treatment plants, or 13.6 percent of the total number of plants in the country (note that a pretreatment program may cover more than one plant). One hundred pretreatment programs, covering 113 plants, remain to be approved.

Figure 1-2 illustrates the number of approved local programs in each State. EPA Regions IV and V have the most approved pretreatment programs, representing roughly half of the national total. North Carolina, Michigan, and California are the States with the highest numbers of approved POTW programs. As Figure 1-3 reveals, most local programs were approved before 1986. In addition, the so-called "403.10(e)" States (where States rather than local POTWs implement pretreatment requirements) regulate discharges to about 314 POTWs.

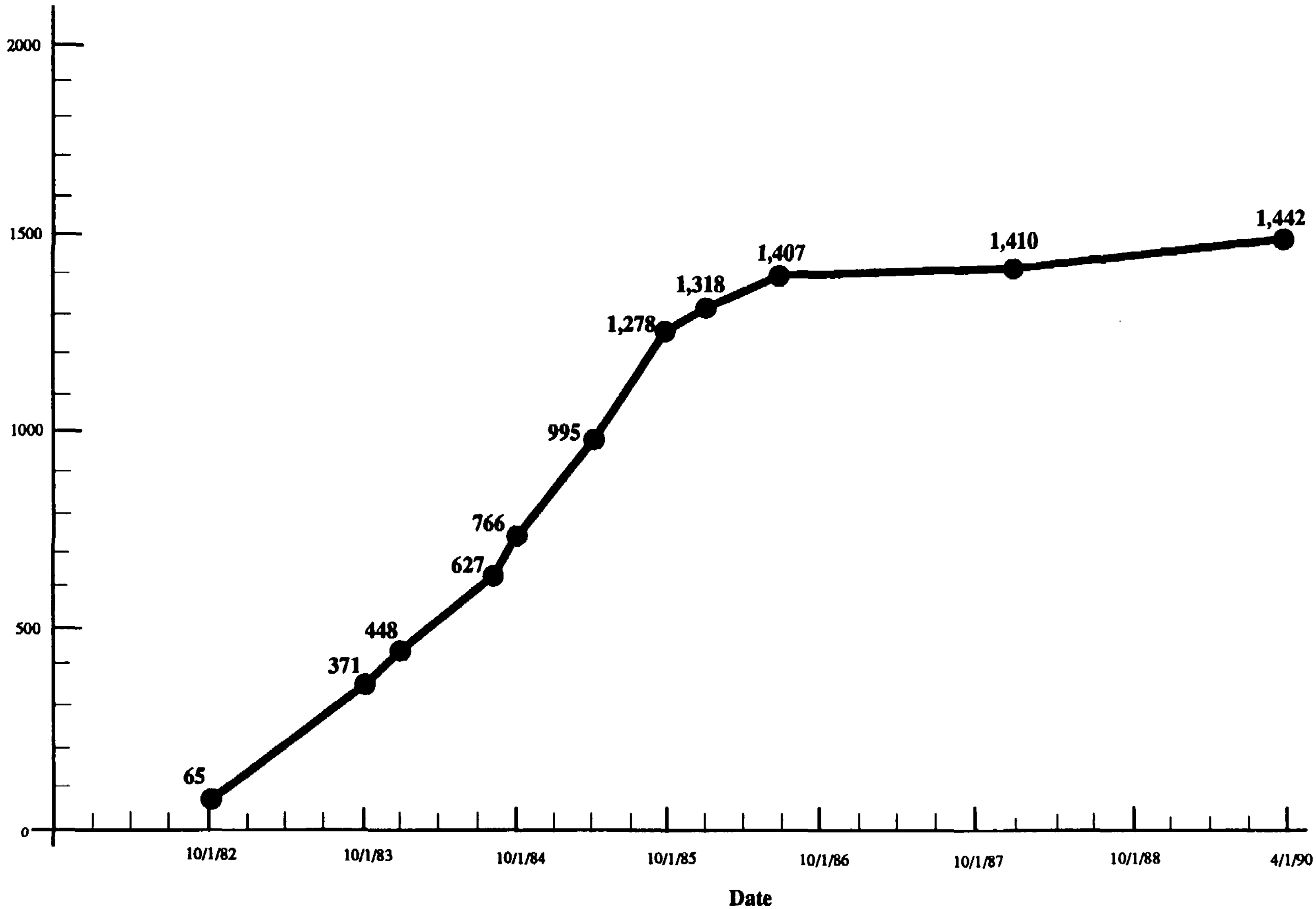


Source: EPA Office of Water Enforcement and Permits.

Region	Approved Local Programs	Plants in Approved Local Programs	Plants in State-Run Programs
Numbers			
1	78	82	93
2	79	178	–
3	133	174	–
4	405	537	199
5	327	382	–
6	124	252	–
7	78	128	22
8	54	57	–
9	121	163	–
10	43	62	–
Total	1,442	2,015	314

State-Run Programs

Figure 1-2. Approved Local Pretreatment Programs April 1990



Source: EPA Office of Water Enforcement and Permits

Figure 1-3. Numbers of POTW Pretreatment Programs Approved by Selected Dates, 1982-1990

To analyze the characteristics of POTWs with and without approved pretreatment programs, EPA merged two of its national data bases: NEEDS '88 and Permit Compliance System (PCS). Chapters 2 and 6 describe these data bases in more detail. This data merge yielded statistics on approximately 12,000 POTWs, or roughly 80 percent of the 15,591 POTWs in the country. (It should be noted that all data were not available for all POTWs. The number of POTWs for which specific data were available varied depending on the specific data need and the data source. Numbers of POTWs may therefore be inconsistent from one table or analysis to another in this report.)

As Table 1-1 indicates, large POTWs are represented heavily in the pretreatment program and contribute a high percentage of the total national wastewater flow, although they represent only a small number of all POTWs in the country.

Table 1-2 shows the levels of treatment provided at POTWs, indicating that the majority of both pretreatment and nonpretreatment POTWs provide secondary treatment. Many provide greater than secondary treatment, while a considerably smaller percentage provides less than secondary treatment. (As discussed in Chapter 4, secondary treatment involves bacterial stabilization of organics. Less than secondary treatment involves only the settling of sewage solids.)

Finally, Table 1-3, which characterizes the receiving waters to which POTWs discharge, shows that at least 80 percent of all POTWs discharge to streams or rivers.

1.1.5 Pretreatment Standards

POTWs required to have local pretreatment programs must develop and implement pretreatment requirements as needed to prevent pass through and interference, identify users subject to pretreatment requirements, issue control mechanisms to those users, monitor compliance, and take timely and appropriate enforcement actions against users who violate pretreatment requirements. One of the most important elements of local programs is the requirement that POTWs impose numerical limitations (local limits) to prevent pass through or interference from the industrial pollutants discharged into their sewer systems. Pretreatment standards consist of national prohibited discharge standards, national categorical standards, and local limits.

Table 1-1. Distribution of POTWs by Design Flow Rates

Design Flow (mgd)	Pretreatment POTWs*		Nonpretreatment POTWs**	
	Number of Plants	Total Flow (mgd)	Number of Plants	Total Flow (mgd)
≤1.0	421	213	8,644	2,175
1.0< - ≤5.0	793	2,258	1,361	3,002
5.0< - ≤10.0	366	2,782	83	584
10.0< - ≤25.0	303	4,915	19	246
25.0< - ≤50.0	128	4,606	3	109
50.0< - ≤100.0	52	3,928	0	—
>100.0	44	9,762	0	—
TOTAL	2,107	28,464	10,110	6,116

* POTWs covered by approved local pretreatment programs, POTWs covered by programs currently under development, and POTWs in Alabama, Connecticut, Mississippi, Nebraska, and Vermont with industrial users regulated by States.

** All other POTWs.

Source: POTWs represented in both PCS and NEEDS '88.

Table 1-2. Types of Treatment Provided by Pretreatment and Other POTWs

	Pretreatment POTWs[2]			Nonpretreatment POTWs[3]		
	POTWs			POTWs		
Level of Treatment[1]	Number	Percentage	Percentage of Total Flow	Number	Percentage	Percentage of Total Flow
Less Than Secondary	179	8.5	15.6	1,354	13.9	N/A
Secondary	1,081	51.8	40.9	6,217	63.8	N/A
Greater Than Secondary	827	39.6	43.5	2,169	22.3	N/A
Total	2,087	100	100	9,740	100	100

1. Categories defined by NEEDS '88:

   - Less than secondary: Primary (BOD>45 mg/l) and Advanced Primary (BOD≥31 and ≤45 mg/l)
   - Secondary (BOD≥24 and ≤30 mg/l or 85% removal)
   - Greater than secondary: Advanced Treatment I (BOD≥10 and ≤23 and/or nutrient removal); Advanced Treatment II (BOD<10 and/or nutrient removal).

2. Includes POTWs covered by approved local pretreatment programs, POTWs with local programs under development, and POTWs in Alabama, Connecticut, Mississippi, Nebraska, and Vermont with industrial users regulated by the States.
3. Includes all other POTWs.

Source: NEEDS '88 for POTWs with appropriate data.

Table 1-3. Types of Receiving Waters to Which POTWs Discharge

	Pretreatment POTWs[1]			Nonpretreatment POTWs[2]		
	POTWs		Average Daily Flow Per POTW (mgd)	POTWs		Average Daily Flow Per POTW (mgd)
Receiving Water Type	Number	Percentage		Number	Percentage	
Rivers and Streams	1,634	80.1	7.8	8,641	89.1	0.4
Great Lakes	33	1.6	25.8	63	0.6	0.5
Other Lakes	53	2.6	4.1	307	3.2	0.3
Ocean	132	6.5	32.16	243	2.5	1.3
Other[3]	174	8.6	18.07	442	4.6	0.9
TOTAL	2,026	100		9,696	100	

1. Includes POTWs covered by approved local pretreatment programs, POTWs with local programs under development, and POTWs in Alabama, Connecticut, Mississippi, Nebraska, and Vermont with industrial users regulated by the States.

2. Includes all other POTWs.

3. Includes discharges to waters not classifiable as to type (discharge to island shorelines, some estuaries, and ocean shorelines, and stream discharge to ocean/lake/ground).

Source: NEEDS '88 for POTWs with appropriate data.

1.1.5.1 Prohibited Discharge Standards

Prohibited discharge standards (40 *CFR* 403.5) forbid certain types of discharges by any nondomestic user to the wastewater collection system of any POTW, including POTWs without local pretreatment programs. The prohibited discharge standards consist of general and specific prohibitions.

General prohibitions are national prohibitions against pollutant discharges to a POTW that cause pass through or interference. As defined in 40 *CFR* 403.3(n), pass through occurs when a pollutant remains in the treatment plant's wastestream without undergoing sufficient treatment or removal, causing a violation of the POTW's NPDES permit. Interference (40 *CFR* 403.3[i]) occurs when a discharge inhibits or disrupts the POTW's treatment processes or operation, thereby either causing a permit violation or precluding permitted sludge beneficial use or disposal practices.

Specific prohibitions are national prohibitions against pollutant discharges that cause problems at the POTW, such as fire or explosion, harm to worker health and safety, corrosion, obstruction of flow, or inhibition of treatment processes due to heat or oil and grease.

1.1.5.2 National Categorical Pretreatment Standards

Whereas the general and specific prohibited discharge standards apply to all nondomestic users, national categorical pretreatment standards (categorical standards) apply to industrial users with specified industrial processes. Each categorical standard covers a different industrial category. Under the CWA, categorical standards are technology-based; they require dischargers to meet end-of-process limits developed according to the Best Available Technology Economically Achievable (BAT) for each category.

Categorical standards are expressed as Pretreatment Standards for Existing Sources (PSES) and Pretreatment Standards for New Sources (PSNS). EPA has promulgated PSES and PSNS for the industrial categories shown in Table 1-4. Industrial dischargers subject to categorical standards are known as categorical industrial users (CIUs).

Categorical standards may limit any pollutant (most include at least some criteria for conventional and nonconventional pollutants), but they emphasize the control of 126 toxic pollutants that have been designated "priority pollutants." These priority pollutants are the result of a 1976 consent decree between EPA and the Natural Resources Defense Council, under which EPA agreed to promulgate technology-based standards for 65 classes of toxic

Table 1-4. Status of Categorical Standards

Industrial Categories With Categorical Standards in Effect

E	N	Aluminum Forming
E	N	Asbestos Manufacturing
E	N	Battery Manufacturing
E	N	Builder's Paper and Board Mills
	N	Carbon Black Manufacturing
E	N	Cement Manufacturing
E	N	Coil Coating
E	N	Copper Forming
E	N	Dairy Products Processing
E		Electroplating
E	N	Electrical and Electronic Components
E	N	Feedlots
	N	Ferroalloy Manufacturing
	N	Fertilizer Manufacturing
E	N	Fruits and Vegetables Processing
	N	Glass Manufacturing
E	N	Grain Mills Manufacturing
	N	Ink Formulating
E	N	Inorganic Chemicals
E	N	Iron and Steel Manufacturing
E	N	Leather Tanning and Finishing
E	N	Meat Products
E	N	Metal Finishing
E	N	Metal Molding and Casting
E	N	Nonferrous Metals Forming and Metal Powders
E	N	Nonferrous Metals Manufacturing
E	N	Organic Chemicals, Plastics, and Synthetic Fibers
E	N	Petroleum Refining
E	N	Pharmaceutical Manufacturing
E	N	Plastics Molding and Forming
E	N	Porcelain Enameling
E	N	Pulp, Paper, and Paperboard
	N	Rubber Manufacturing
E	N	Seafood Processing
E	N	Soap and Detergent Manufacturing
E	N	Steam Electric Power Generating
E	N	Sugar Processing
E	N	Textile Mills
E	N	Timber Products Processing

E = Standards in effect for existing sources.
N = Standards in effect for new sources.

Categories for Which New Categorical Standards Being Developed

Hazardous Waste Treatment, Phase I (facilities treating aqueous wastewaters)
Machinery Manufacturing and Rebuilding
Pesticide Chemicals

Categories for Which Guidelines Are Being Revised

Organic Chemicals, Plastics, and Synthetic Fibers
Pharmaceutical Manufacturing
Pulp, Paper, and Paperboard

Categories for Which Categorical Standards Being Reviewed For Possible Revision

Petroleum Refining
Textile Mills
Timber Products Processing

Categories Being Studied for Possible Development of Categorical Standards

Drum Reconditioning
Hospitals
Industrial Laundries
Oil and Gas Extraction—Stripper Subcategory
Paint Formulating
Solvent Recycling
Transportation Equipment Cleaning
Used Oil Reclamation and Re-Refining

compounds for 34 industrial categories. The 129 priority pollutants were derived from the original 65 classes of compounds, later removing 3 from consideration. Standards for each category are established for the pollutants of concern for that category, so the number of toxic pollutants regulated varies from category to category. For example, the pulp, paper, and paperboard category regulates 3 priority pollutants, while the organic chemicals, plastics, and synthetic fibers category regulates more than 40.

EPA is continuing to evaluate industrial categories to determine whether additional standards are needed. Section 304(m) of the WQA requires EPA to publish a plan every 2 years that schedules annual review and revision of effluent guidelines, including categorical standards. Studies being conducted as part of this mandate are discussed in more detail in Chapter 3. Chapter 5 addresses the pollutants and industries currently covered by categorical standards.

1.1.5.3 Local Limits

National prohibited discharge standards and categorical standards are not always sufficient to protect POTWs from pass through and interference. For this reason, the National Pretreatment Program also provides for local limits, which are discharge standards developed and enforced at the local level. Local limits are also federally enforced pursuant to 40 *CFR* 403.5(d).

Local limits take local circumstances into account; they also translate prohibited discharge standards and other State and local requirements into numeric effluent limits. Local limits are considered "technically based" if they are developed to ensure plant compliance with discharge standards in NPDES permits, sludge disposal requirements, and applicable Federal, State, and local environmental criteria. In certain cases, they should also be developed to protect worker health and safety. When a local limit and a categorical standard both exist for the same discharge, the more stringent of the two limits must be enforced.

All POTWs with approved pretreatment programs are required to develop and enforce local limits and to evaluate, every 5 years, whether their limits need to be revised. Nonpretreatment POTWs must also develop local limits if they have experienced pass through or interference problems that are likely to recur. Local limits developed to prevent pass through or interference are enforceable at the Federal and State level as well as by POTWs. Chapter 5 describes in more detail how POTWs develop local limits.

1.1.6 Significant Industrial Users

Although hundreds of thousands of industrial and commercial sources nationwide discharge wastes to sanitary sewers, not all require the same degree of control and oversight. For this reason, EPA in 1986 recommended through national guidance that POTWs use EPA's definition of significant industrial user (SIU). On July 24, 1990 (55 *FR* 30082), EPA promulgated revisions to the General Pretreatment Regulations that provided a standard definition of SIU. Generally, an SIU is defined at 40 *CFR* 403.3(t) as:

- Any user subject to a categorical pretreatment standard, also known as a CIU
- Any other industrial user that discharges an average of 25,000 gallons per day or more of process wastewater, or that contributes a process wastestream making up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant
- Any other user designated as an SIU by the control authority (generally because of potential for adverse impact).

EPA estimates that POTWs with approved pretreatment programs regulate about 11,600 CIUs and about 18,400 other SIUs—an average of over 10 users per program. Approximately 800 CIUs and SIUs discharge to nonpretreatment POTWs and, thus, are subject to regulation by EPA Regions and States rather than by POTWs.

1.2 PREVIOUS ASSESSMENTS OF THE NATIONAL PRETREATMENT PROGRAM

Several studies have been conducted of various elements of the National Pretreatment Program since its inception. The evaluations performed for this Report to Congress have taken into account these previous studies, the more important of which are discussed in this section.

1.2.1 Pretreatment Regulatory Impact Analysis

EPA promulgated its General Pretreatment Regulations on June 26, 1978, and amended them on January 28, 1981. Pursuant to Executive Order 12291, which requires that Regulatory Impact Analyses (RIAs) be conducted to analyze the costs and benefits of major pending regulations, EPA completed an RIA of the General Pretreatment Regulations on November 20, 1981 (EPA, 1981).

The Pretreatment RIA compared the design of the existing program to several other less stringent options, such as covering fewer industries, employing water quality concerns as "triggers" for program development, and making the pretreatment program a voluntary program with guidance from the Federal Government. It concluded that the benefits of the existing program (such as reduced toxic pollutant loadings to effluent and sludge, reduction in exceedances of water quality criteria, prevention of worker health and safety problems, and improvement in plant operations and integrity) outweighed program costs.

The Pretreatment RIA also demonstrated the importance of effective control of industries by POTWs and the need for pretreatment to reduce loadings of toxic pollutants. EPA, therefore, recommended to Congress that local program implementation remain a cornerstone of the National Pretreatment Program and endorsed national categorical pretreatment standards as a principal way to reduce toxic pollutant loadings to POTWs.

1.2.2 Assessment of Industrial Waste Control Programs in Three Municipalities

The next important study of the National Pretreatment Program was the *Assessment of Industrial Waste Control Programs in Three Municipalities* (EPA, 1983; also known as the Three-City Study), prepared by EPA and submitted to Congress on September 13, 1983.

Although the Pretreatment RIA had demonstrated the potential effectiveness of the General Pretreatment Regulations and categorical standards, a debate arose about the need for federally mandated pretreatment programs in large cities that had independently undertaken their own industrial waste programs. A bill was introduced in Congress to exempt large municipalities with well-operated programs from Federal pretreatment requirements, and Congress directed EPA to study the issue.

The Three-City Study examined whether the independently developed programs of three municipalities (Los Angeles, Chicago, and Passaic Valley) could be shown to accomplish goals substantially equivalent to the National Pretreatment Program, although their programs differed procedurally from the requirements set forth in 40 *CFR* Part 403. The study found that although the three cities had achieved significant industrial waste control, their programs were deficient in legal authorities (especially in the multijurisdictional area), identification of industries, monitoring, permitting, and enforcement; this resulted in NPDES permit violations and documented environmental problems.

The study projected that complete implementation of categorical pretreatment standards at the three cities would reduce toxic organic and metal pollutant loadings in effluent and sludge, eliminate noncompliance problems, and ameliorate environmental problems. EPA, therefore, recommended that Congress not enact a waiver from pretreatment requirements for large cities.

1.2.3 Pretreatment Implementation Review Task Force

In 1984, EPA convened the Pretreatment Implementation Review Task Force (PIRT) consisting of EPA Headquarters and regional personnel, State officials, POTW officials, environmental groups, and industry representatives. The purpose of PIRT was to identify problems in implementing the existing pretreatment program and to recommend measures that would rectify those problems. PIRT relied primarily on the experience of task force members in program implementation and did not collect or evaluate new data as part of the report.

In response to the 1985 PIRT report, *Pretreatment Implementation Review Task Force: Final Report to the Administrator* (EPA, 1985), EPA developed additional guidance and policy documents and promulgated amendments to the General Pretreatment Regulations in 1987 and 1988 that responded to many of PIRT's recommendations.

1.2.4 Domestic Sewage Study

On February 7, 1986, EPA submitted the *Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works* (EPA, 1986), also known as the Domestic Sewage Study (DSS). The DSS was required by Section 3018(a) of the 1984 Hazardous and Solid Waste Amendments to RCRA, in which Congress directed EPA to evaluate the impacts of wastes discharged to POTWs as a result of the Domestic Sewage Exclusion (DSE).

The DSE (RCRA Section 1004[27], codified in 40 *CFR* 261.4[a][1]), provides that solid or dissolved material in domestic sewage is not a solid or a hazardous waste under RCRA. The exclusion allows industries to discharge hazardous wastes to POTW sewers containing domestic sewage without having to comply with many RCRA requirements, such as manifesting and reporting, that otherwise apply to facilities that generate hazardous waste. Moreover, POTWs receiving DSE wastes are not deemed to receive hazardous wastes and, therefore, are not subject to RCRA requirements for hazardous waste treatment, storage, and disposal facilities.

The rationale for the DSE is that exempted wastes are regulated adequately under the National Pretreatment Program and that management of such wastes under RCRA would be redundant. To determine whether DSE wastes were indeed being controlled adequately under the exemption, or whether regulation under RCRA would also be necessary, Congress directed EPA to study:

- The types, sizes, and number of facilities discharging wastes under the DSE
- The types and quantities of wastes disposed of under the DSE
- Significant generators, wastes, and constituents not sufficiently regulated to protect human health and the environment.

The DSS concluded that the DSE should be retained and that the National Pretreatment Program, with changes to strengthen control of hazardous wastes, could control hazardous waste discharges to sewer systems sufficiently to protect public health and the environment. The DSS recommended that EPA consider the following measures to improve controls on hazardous waste discharges to sewers:

- Additional research on the sources, quantities, fates, and effects of hazardous waste discharges to sewers and on additional regulatory controls that might be necessary
- Improvements to categorical standards and local limits to control such discharges
- Strengthened implementation and enforcement of CWA requirements
- Identification and application of pertinent environmental controls under other environmental statutes as necessary.

Section 3018(b) of the 1984 Amendments to RCRA also directed EPA to revise existing regulations and to promulgate additional regulations as necessary to ensure that hazardous wastes discharged to POTWs would be controlled adequately to protect human health and the environment. Pursuant to that mandate, EPA promulgated amendments to the General Pretreatment Regulations on July 24, 1990 (55 *FR* 30082). The regulations, effective August 23, 1990:

- Prohibit the introduction to POTWs of wastestreams with a closed-cup flashpoint of less than 140°F (to prevent fires and explosions at POTWs)
- Prohibit the introduction to POTWs of pollutants that result in gases, vapors, and fumes in quantities that may cause acute worker health and safety problems
- Prohibit discharges of petroleum oil, nonbiodegradable cutting oil, or mineral oil products in amounts that would cause interference or pass through
- Prohibit the discharge of trucked or hauled wastes except at discharge points designated by the POTW

- Provide definitions of significant industrial user and significant noncompliance
- Require each POTW with an approved pretreatment program to determine, at least once every 2 years, which of its SIUs need a plan to control spills and batch discharges
- Require one-time notification by each industrial user of each hazardous waste being discharged to the sewer system and certification that it has a waste minimization program in place
- Require each POTW with an approved pretreatment program to issue permits or equivalent individual control mechanisms to its SIUs
- Require certain POTWs (including all POTWS with local pretreatment programs) to submit the results of whole-effluent toxicity testing with their NPDES permit applications (i.e., at least every 5 years)
- Require all pretreatment POTWs to evaluate the need to revise local limits as part of their NPDES permit applications (i.e., at least every 5 years)
- Require stricter monitoring and reporting requirements for SIUs
- Require POTWs with approved pretreatment programs to develop enforcement response plans detailing how they will respond to industrial user violations.

1.2.5 General Accounting Office Report

In April 1989, the U.S. General Accounting Office (GAO) released a report entitled, *Improved Monitoring and Enforcement Needed for Toxic Pollutants Entering Sewers* (GAO, 1989). The GAO undertook the report to assess enforcement of the National Pretreatment Program, including the extent to which industrial users were in noncompliance with discharge limitations, enforcement by POTWs against noncompliant industrial users, and EPA and State oversight of the efforts by POTWs to implement and enforce the program.

The GAO report recommended the following measures to improve enforcement of the pretreatment program:

- POTWs lacking appropriate enforcement standards should be required to apply EPA standards against noncompliant industrial users.
- EPA standards should be applied against POTWs failing to implement pretreatment programs.
- EPA should direct Federal and State approval authorities to review the adequacy of sampling frequencies, sampling locations, and local limits employed by POTWs and require correction of any deficiences found.

In October 1989, EPA announced a major enforcement initiative against POTWs that had failed to carry out their responsibilities under the National Pretreatment Program. The enforcement initiative involved 413 enforcement actions taken against POTWs; 61 of these POTWs were targeted for administrative penalty orders or judicial enforcement. The DSS regulations promulgated on July 24, 1990, also addressed concerns raised in the GAO report, including the need for increased monitoring and for POTWs to develop enforcement response plans. Chapter 7 discusses current enforcement-related activities.

1.2.6 Report to Congress on Hydrogen Sulfide Corrosion

EPA is finalizing the Report to Congress on Hydrogen Sulfide Corrosion in Wastewater Collection and Treatment Systems (Sulfide Corrosion Study). The Sulfide Corrosion Study was required by Section 522 of the Water Quality Act of 1987. EPA was required to study the corrosive effects of hydrogen sulfide in wastewater collection and treatment systems, the extent to which uniform imposition of categorical pretreatment standards exacerbates this corrosion problem, and the range of available options to deal with such effects.

With respect to the second requirement of Section 522—that EPA investigate the role of pretreatment in hydrogen sulfide corrosion—EPA conducted a case study at the County Sanitation Districts of Los Angeles County (CSDLAC). The executive summary of the Hydrogen Sulfide Study discusses the findings of this case study as follows:

> **2.2 Effects of Industrial Pretreatment**
>
> The national effects of industrial pretreatment on hydrogen sulfide corrosion are very difficult to ascertain since no sanitation districts other than CSDLAC were found to have sufficient data to establish a correlation. Based on theoretical analysis, review of full scale and pilot scale research data from CSDLAC, and a series of site investigations, the following conclusions are presented.
>
> - The reduction in metals and other industrial constituents in CSDLAC wastewater may have caused an acceleration in corrosion rate, possibly due to decreased biological inhibition and/or chemical precipitation.
> - Two pilot studies conducted by CSDLAC demonstrated that sulfide generation was reduced when metals were added to the wastewater at levels approximating those in the early 1970s. (This is consistent with the known toxic effects of metals on other microorganisms.)
> - When compared with data from 50 other wastewater treatment plants in the 1970s, total metals and cyanide levels in the CSDLAC wastewater were higher than levels in wastewater entering 47 of the 50 facilities. While 32 percent of the cities had total metals and cyanide levels higher than CSDLAC levels after pretreatment, it is

difficult to project how many cities could potentially have a corrosion problem affected by industrial pretreatment since it is not known at what levels industrial constituents begin to suppress sulfide generation.

- Data comparing corrosion in residential versus industrial sewers were inconclusive as to whether metals suppressed hydrogen sulfide corrosion.
- Local regulation of certain nontoxic constituents in industrial waste discharges (BOD, sulfide, temperature, pH) has had a beneficial impact in reducing the potential for hydrogen sulfide corrosion.
- Additional research is necessary to establish the constituents and their associated levels at which sulfide generation is suppressed or accelerated.

The complete draft text of Chapter 3 of the Sulfide Corrosion Study is provided as Appendix E of this Report to Congress.

1.3 SUMMARY

The National Pretreatment Program has been the object of intense scrutiny. Several studies have been submitted to Congress and reviewed in committee hearings. Each major study has concluded that the National Pretreatment Program is essentially sound; all have found that controls beyond categorical standards, as well as improved enforcement, may be necessary to meet environmental objectives.

Despite these similarities, the conclusions of each study reflected different concerns about the program. For example, the Pretreatment RIA showed that the benefits of the 1981 program outweighed its costs, the Three-City Study resulted in an EPA recommendation that Congress drop consideration of municipal pretreatment waivers, and the DSS led to modifications to the pretreatment program that strengthened control over hazardous wastes discharged to sewers.

Little beyond the express language of Section 519 indicates congressional intent for this Report to Congress. The only reference to this report in the legislative history is contained in the report from the House Committee that initially developed Section 519 (then referred to as Section 47):

> Section 47 requires the Administrator to study the effectiveness of the National Pretreatment Program. This study is not intended to determine the need for pretreatment or in any way to delay ongoing program implementation. Rather, the study should be used to

> update and expand information available to the Agency on such matters as the impact on publicly owned treatment works of industrial discharges and the pollution removal effectiveness of publicly owned treatment works technology. In addition, the study should be used to evaluate the effectiveness—both in terms of pollutant removal and cost—of industrial pretreatment controls.
>
> Section 47(a)(3) requires the Administrator to study the capability of publicly owned treatment works to revise pretreatment requirements under section 307(b)(1) of the Federal Water Pollution Control Act. The Committee intends that EPA focus particular attention on the extent to which EPA's pretreatment removal credits program is presently effectuating the Congressional intent behind section 307(b)(1). Congress added the credits system to the Act in 1977 because of its concern that EPA's categorical pretreatment standards could result in costly redundant treatment by industry and publicly owned treatment works. The Committee also intends that, in implementing section 47(a)(3), the Administrator shall examine the capability of publicly owned treatment works to establish and enforce requirements more stringent than or different from national categorical standards.
>
> The Committee's reference in section 43(a)(4) to possible alternative regulatory strategies is meant to include, among other things, consideration of sludge quality in evaluating strategy effectiveness. Section 43(a)(5)'s reference to adequacy of . . . resources is meant to include evaluation of technical expertise and availability of analytical methods as well as financial and staffing level evaluations.

The legislative history makes it clear that Congress did not intend for EPA to justify the existence of the pretreatment program or to conduct a regulatory impact analysis. Therefore, for example, EPA is not estimating the costs of the existing program but rather the costs associated with potential alternative regulatory strategies (Chapter 8). Initial costs of the pretreatment program were estimated in the 1981 RIA, and, per Executive Order 12291, subsequent costs to industrial users continue to be evaluated during development of national categorical standards and amendments to 40 *CFR* Part 403. Rather, Congress intended this report to examine alternative means of improving the program, considering the effectiveness of each option in attaining the objectives of the Clean Water Act.

1.4 ORGANIZATION OF THIS REPORT TO CONGRESS

This Report to Congress provides a comprehensive evaluation of the National Pretreatment Program, with particular emphasis on those areas specified in Section 519. The objective of this evaluation is to determine, now that implementation of the National

Pretreatment Program is well underway, whether and how the program can achieve the goals of the CWA more effectively and minimize the adverse environmental impacts of toxic pollutants discharged to and from POTWs.

This report builds on, and broadens the scope of, the studies and evaluations discussed in Section 1.2. As a thorough study of the National Pretreatment Program, it examines every facet of the relationship between POTWs and toxic pollutants: the discharge to POTWs of toxic pollutants by industrial and domestic sources, the fates of those pollutants in POTWs, and the ultimate impacts of those pollutants in the environment to the extent currently known. It also examines the environmental and programmatic effectiveness of the National Pretreatment Program, explores a number of alternatives to the existing program, and recommends several regulatory changes that would enhance program effectiveness.

Chapter 2 describes the data used for the report, describing EPA's use of national data bases and supplemental State and local data sources. The chapter also identifies a number of the major methodological decisions that affected the scope and findings of the report.

Chapter 3 characterizes the discharges of toxic pollutants to POTWs. It identifies the sources of these pollutants and explores whether additional reductions in such discharges are possible and (implicitly) whether controls are needed for sources—such as domestic sources—not currently regulated under the National Pretreatment Program. In addition to evaluating industrial and domestic sources of toxic discharges, Chapter 3 identifies existing and planned controls affecting such discharges, including the prohibited discharge standards, national categorical pretreatment standards, local limits, spill prevention plans, and future initiatives within the water, hazardous and solid waste, Superfund, and air programs. The chapter also provides information on pollution prevention activities undertaken by various industries.

Chapter 4 explores the extent to which secondary treatment removes toxic pollutants from the wastestreams of POTWs. It describes the fate of toxic pollutants within POTWs, differentiating bona fide removal (biodegradation) from volatilization to air and partitioning to sludge, and it characterizes actual secondary treatment plant performance in removing toxic pollutants from wastewater.

Chapter 5 evaluates the capability of POTWs to revise pretreatment standards through two mechanisms: removal credits and local limits. The chapter describes the statutory and regulatory history of the removal credits and local limits programs and discusses the processes by which POTWs develop, submit, and implement these mechanisms. It also describes existing Federal, State, and local environmental and technical criteria that influence the protectiveness of removal credits and local limits, and provides an overview of the current status of POTW development and implementation of removal credits and local limits. Finally, the chapter details the evaluation of the technical capability of POTWs to grant removal credits and to implement and enforce local limits.

Chapter 6 examines the environmental impacts of toxic pollutants discharged from POTWs and assesses the extent to which data limitations affect the assessment of environmental impacts. To characterize the receiving environments of POTWs, this chapter provides information on the geographic location of POTWs, the nature of their receiving waters and sludge disposal methods, and other demographic descriptors. Chapter 6 also analyzes the extent to which POTWs comply with various environmental standards and criteria, and it characterizes the adequacy and limitations of the data with which impacts are assessed.

Chapter 7 evaluates the effectiveness of the existing National Pretreatment Program by examining the following: whether POTWs are implementing the requirements of the program effectively; whether the program covers the appropriate POTWs, pollutants, and industries; and whether the program has been effective in preventing or reducing the environmental impacts of toxic pollutants discharged by POTWs. In addition, the discussion addresses program implementation and identifies areas where POTWs have and have not met specific program requirements. The chapter also analyzes the extent to which environmental improvements can be attributed to implementation of the pretreatment program.

Chapter 8 explores alternative regulatory strategies for enhancing the National Pretreatment Program. It describes how the alternatives were selected and then characterizes the purpose, scope, and affected parties for 17 supporting regulatory options. Each alternative is evaluated for its applicability to CWA objectives and the findings of this study. Finally, each alternative is assessed for its quantitative impacts (e.g., compliance costs, number of regulatory actions) and attendant resource requirements.

Chapter 9 summarizes the findings of each chapter and, based on those findings, presents the report's final recommendations.

REFERENCES

U.S. Environmental Protection Agency. 1986. *Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works*. 530-SW-86-004. Washington, DC: Office of Water Regulations and Standards.

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U.S. General Accounting Office. 1989. *Improved Monitoring and Enforcement Needed for Toxic Pollutants Entering Sewers*. GAO-RCED-89-101.

2. STUDY APPROACH AND DATA SOURCES

This chapter describes the approach taken by the U.S. Environmental Protection Agency (EPA) to evaluate the National Pretreatment Program as required by Section 519 of the Water Quality Act of 1987, and it provides an overview of the major data sources used in the study. Section 2.1 summarizes a number of critical decisions made by EPA in designing the study. This is followed by an overview, Section 2.2, of the data necessary to evaluate the program fully. Section 2.3 identifies the principal data sources used in the study, with specific information on origins and coverage. Lastly, Section 2.4 describes how a number of major data sources were linked to expand the coverage and utility of the data that were used to answer major study questions.

2.1 APPROACH

This Report to Congress provides information on all topics of inquiry set forth in Section 519, specifically (1) the adequacy of data on environmental impacts from the discharge of toxic pollutants to publicly owned treatment works (POTWs), (2) the performance of secondary treatment plants in removing toxic pollutants, (3) POTW capability to revise pretreatment standards, and (4) alternative regulatory strategies for the pretreatment program. This section presents an overview of the key aspects of EPA's approach; other sections discuss the major data sources used in this report. Each subsequent chapter provides greater detail on specific data sources and uses, as well as the adequacy of the information upon which EPA relied.

Several aspects of the congressional mandate, along with fundamental characteristics of the National Pretreatment Program, influenced the Agency's approach. First, Congress clearly intended a national assessment of a program that is inherently decentralized. Furthermore, Congress required information on environmental impacts from a program that relies on environmental standards not yet fully in place and on technology-based standards; this made data acquisition problematic. Finally, as discussed in Chapter 1, the National Pretreatment Program has undergone intensive examination several times in its relatively brief history and EPA was determined to build upon and not simply duplicate previous efforts, even though several topics of concern were similar in scope.

All of these factors led EPA to define the study approach so that it would:

- Provide as comprehensive an assessment of the National Pretreatment Program as possible
- Present actual results of the program rather than projected results (e.g., through the use of actual monitoring and compliance data rather than modeling results)
- Draw upon and integrate data from across EPA program offices (e.g., Office of Water, Office of Solid Waste and Emergency Response, Office of Air and Radiation)
- Make use of previous national studies relevant to this study's topics (e.g., the Domestic Sewage Study [DSS], the 40-POTW Study)
- Integrate performance of the study with ongoing program implementation activities to consolidate resources and make immediate use of findings (e.g., State and local pretreatment program audit results)
- Supplement these data with State and local data to characterize the real world accurately.

Apparent in this approach are two overriding themes: a commitment to a multimedia perspective and reliance on existing and readily available data. The following subsections address these themes and their methodological implications.

2.1.1 Multimedia Perspective

Pollution control programs have focused traditionally on control of discharges from a particular wastestream or to a single component of the environment. For example, EPA's water pollution control activities under the National Pollutant Discharge Elimination System (NPDES) focus on controlling point source discharges to a single medium: the Nation's surface waters. Similarly, Agency programs under the Clean Air Act address emissions that cause or contribute to air pollution.

In recent years, it has become apparent that pollution control activities, including those associated with POTWs, must be viewed from a multimedia perspective, where components are interrelated and program activities directed at one medium are likely to affect others. Discharges of toxic pollutants to and from POTWs affect virtually all environmental media—surface water (and thus fisheries and drinking water), ground water, soils, air—and the health and safety of treatment plant employees. Reduction of a pollutant in a POTW's effluent, for example, might mean a transfer of that pollutant to sewage sludge or to the air.

Therefore, to ensure a comprehensive evaluation of the National Pretreatment Program, EPA adopted a multimedia approach to the study. Chapter 6, for example, discusses the tradeoffs of various sewage sludge beneficial use and disposal practices regarding the ultimate fate of metals in sewage sludge. For instance, land-applied sewage sludge decomposes slowly and may release toxic pollutants to soils, where they may leach to ground water. Sludge incineration, on the other hand, may release toxic pollutants to the atmosphere. These interrelationships made a mulitmedia approach necessary.

2.1.2 Reliance on Existing Data

A comprehensive evaluation of the National Pretreatment Program must cover the toxic pollutants being discharged to POTWs by nondomestic dischargers, the performance of the treatment plants that receive these discharges, and the environments that receive POTW discharges. Given the breadth of the program, the resources and time necessary to collect new data to perform this study would have been tremendous. Fortunately, considerable data have already been collected on many components of the pretreatment program, and ongoing data collection programs currently track such items as compliance with discharge limits and pretreatment program implementation.

EPA decided, therefore, to rely on existing sources of data and information, and to supplement them as appropriate with a limited number of case studies. The Agency decided not to develop a statistical model of the program, engage in monitoring, or perform risk assessments. Modeling was rejected as too theoretical and inappropriate for an unbiased assessment of data adequacy. Monitoring was eliminated because of its expense and the amount of time required. Risk assessment was not directly explored because of limitations in the data necessary to perform such an analysis and preference for actual measures of program effectiveness or environmental impacts. Instead, EPA decided to present as much actual information on as many POTWs as possible.

The decision to rely on existing data provided the opportunity to respond to the statutory mandate to assess "the adequacy of data on environmental impacts of toxic industrial pollutants discharged from publicly owned treatment works." Chapter 6 provides this assessment. Chapters 3, 4, 5, and 7 also address the adequacy of data for their respective topics.

The choice of which pollutants to evaluate in this report reflects EPA's decision to use existing data. EPA decided that each analysis undertaken for the report would address all pollutants for which data were available for that analysis. EPA did not eliminate pollutants from consideration simply because they are not among the 126 Clean Water Act priority pollutants; nor did the Agency select a list of pollutants of concern and carry them through the entire study, as was done for hazardous constituents in the DSS (see Chapter 1).

2.2 Overview of Data Needs

Having made these fundamental decisions concerning the overall approach to the study, EPA established a conceptual framework to identify those data elements necessary to complete the study and guide specific analyses. This framework, presented in Table 2-1, includes the major components of the pretreatment program: industrial, commercial, and domestic users discharging toxic pollutants; POTWs that receive these pollutants; and the environments and humans affected by the discharges.

Within each component, EPA's framework identifies data needs for the technical aspects of the study, such as the amounts of pollutants discharged, removal efficiencies of various treatment processes, and effects on the environment. It also identifies data needs for the programmatic aspects of each component of the pretreatment program, such as the regulatory status of industries, pretreatment program resources, and ambient water quality standards.

The framework was used to identify and organize data sources and analyses for the study. With its broad, multimedia approach, the framework highlighted possible relationships among components and ensured that data were compiled and considered in context with other data. The framework also provided the basis for evaluating data availability and adequacy, as called for by Congress in Section 519.

2.3 Existing Data Sources

In compiling existing data sources in accordance with the framework, EPA focused on national data sources that provided the greatest coverage of study components and POTWs and, thus, ensured the broadest assessment of the pretreatment program. Data from significant studies, such as those described in Chapter 1, also were used in the present study.

Tables 2-2 and 2-3 identify these national data sources and organize them according to continuity and longevity. Table 2-2 focuses on sources with continuous, ongoing data collection, and Table 2-3 addresses sources based on one-time studies and surveys. The

Table 2-1. Data Framework for Section 519 Study

	Industrial and Other Sources of Toxic Pollutants*	POTWs >2,000 Pretreatment; >13,000 Others	Receiving Environments
Technical Data Objectives	For each user: Pollutants discharged Amounts (mass/concentration) discharged at various stages (raw, current, pretreatment standards for existing sources [PSES]) Prevention tools, treatment processes, and removal efficiencies Number of users of each type (categorical, significant, other) and each category	For each POTW: Influents • Pollutants • Amount (mass/concentration) Pollutant releases (wastestreams), fates, and impacts throughout the plant: • Collection system • Headworks • Unit processes Treatment processes and removal efficiencies Effluents • Pollutants • Amounts (mass/concentration) Sewage sludge • Pollutants • Amounts (mass/concentration)	For each POTW: Surface water • Flow rate and pollutant concentration • Effects of POTW discharges Ground water • Pollutant concentration recharge/discharge rates • Effects of POTW Terrestrial • Pollutant and descriptive data on soils and biota • Effects of POTW Air • Ambient air quality • Effects of POTW emissions Workers • Pollutant exposure • Effects of POTW on exposure
Programmatic Data Objectives	Regulatory controls • Categorical standards • Local limits • Monitoring requirements Regulatory status	Program status pretreatment program elements • User control mechanisms • Local limits • Inspection of industrial users (IUs) • Monitoring of IUs • Enforcement Program resources • Information and management • Technical skills • Legal authority/political environment Environmental permit elements (discharge limits, reporting, monitoring, pretreatment, operational and programmatic requirements) • Effluent • Air • Sewage sludge Compliance with permits and standards • Effluent • Air • Sewage sludge	Surface water • Designated use • Standards • Compliance status Ground water • Designated use • Standards • Compliance status Terrestrial • Designated use • Standards • Compliance status Air • Standards • Compliance status Workers • Standards • Compliance status

*Includes industrial, commercial, domestic, and other sources of toxic inputs, including at least 30,000 significant industrial users (SIUs).

Table 2-2. National Data Sources—Ongoing Collection

Data Source	Overview	Criteria for Inclusion and No. of Facilities or Treatment Plants	Data Characteristics	Data Collection, Management, and Access
Toxics Release Inventory System	Inventory of toxic releases from industries. Data are collected pursuant to Section 313 of the 1986 Emergency Planning and Community Right-to-Know Act. The inventory is managed by EPA's Office of Toxic Substances.	Large manufacturing facilities that handle significant quantities of toxic chemicals. Specifically, facilities must (1) be included in Standard Industrial Classification Code groups 20 through 39 (Appendix A); (2) have 10 or more full-time employees; and (3) have manufactured, processed, or otherwise used in the course of a calendar year any chemical listed in quantities greater than the thresholds established in Section 313. The 1988 version of TRIS provides data on >4,000 industries discharging to >1,000 POTWs.	Data elements: type, use, amount, and release/transport of chemicals; waste treatment methods and efficiency; waste minimization practices. Wastestream/media: industry discharges/releases. Pollutants: More than 300 toxic chemicals or categories, as listed in Section 313. Data coverage: beginning in 1987, data are submitted annually.	Data submitted by industries on an annual basis and are based largely on estimates. Data compiled into a separate data base for each year. Available on the EPA mainframe.
Permit Compliance System/ Pretreatment Permits & Enforcement Tracking System	Automated tracking system for the National Pollutant Discharge Elimination System. Supports two main functional areas of the NPDES program: permitting and compliance. A component of PCS, PPETS provides local data to support the National Pretreatment Program. PCS/PPETS are managed by EPA's Office of Wastewater Enforcement and Compliance (OWEC).	Permitted major and significant minor facilities that discharge into the Nation's navigable waters. Used in this report: a total of 2,015 municipal plants covered by pretreatment programs; 13,872 other municipal plants. (Data on industries that discharge directly to surface waters are also maintained in PCS but were not the subject of this study.)	Data elements (many optional): NPDES permit requirements, effluent characteristics, and compliance/ enforcement status and history. Pretreatment status and various measures and assessments in PPETS. Wastestreams/media: most monitoring data are for effluent; limited influent and in-plant process data. Pollutants: as specified in NPDES permits. Data coverage: most recent 3 years maintained online; preceding 3 years archived.	Data submitted by POTWs to EPA Regions or States, then to EPA Headquarters. Available on the EPA mainframe.

Table 2-2. National Data Sources—Ongoing Collection (continued)

Data Source	Overview	Criteria for Inclusion and No. of Facilities or Treatment Plants	Data Characteristics	Data Collection, Management, and Access
Pretreatment Audit Summary System (PASS)	Data management system for selected audits of local pretreatment programs. Audits are conducted in accordance with the *Pretreatment Compliance Inspection and Audit Manual for Approval Authorities* (EPA, 1986a). The data base is managed by the EPA Office of Wastewater Enforcement and Compliance.	Pretreatment control authorities with an emphasis on large POTWs in States that do not have approval authority. Currently contains data on 530 approved programs covering 817 separate treatment plants.	Data elements: pretreatment program background, legal authority and control mechanisms, local limits applications, compliance monitoring and enforcement, resources and data management, and program effectiveness. Wastestreams/media: local limits evaluation data may include influent, effluent, and sludge data. Pollutants: vary according to treatment plant and local limits coverage. Data coverage: data for audits of selected pretreatment programs conducted since 1984.	Data collected by EPA or State auditors. Maintained in microcomputer data base.
NEEDS 1988 Survey File	Data, analytical tools, and reporting utilities for the estimation of funds needed for the construction of municipal wastewater treatment plants (Section 205[a] and Section 516[b][1] of the Clean Water Act) The system is managed by EPA's Office of Municipal Pollution Control.	15,591 wastewater treatment plants. 2,015 pretreatment plants; 13,576 non-pretreatment plants.	Data elements: flow rates, treatment processes, population of community served, summary of financial needs, design and actual flow rates, and receiving water description. Wastestreams/media: influent and effluent. Pollutants: Biological Oxygen Demand (BOD), suspended solids, phosphorus, and ammonia. Data coverage: beginning in 1972, survey has been conducted on a biennial basis.	Data submitted by States. Separate data base for each year collected. Available on EPA mainframe.
Reach File (Reach)	Information on streams, lakes, reservoirs, and estuaries that have been divided into unique segments called "reaches." Reach interrelationships are organized in a manner that allows upstream and downstream analysis of river and open-water conditions. Serves as a major tool in integrating data from other data bases. The file is maintained by EPA's Office of Water Regulations and Standards (OWRS).	68,000 reaches throughout the United States.	Data elements: stream and open-water names, stream and shoreline traces, and mileage information. Wastestreams/media: receiving surface water. Data coverage: Version 1 released in 1982; updated and enhanced thereafter.	Data file available on EPA mainframe.

Table 2-2. National Data Sources—Ongoing Collection (continued)

Data Source	Overview	Criteria for Inclusion and No. of Facilities or Treatment Plants	Data Characteristics	Data Collection, Management, and Access
Stream Gage/ Flow File	Common repository for gage information and support activities, such as water quality studies, waste load allocation, dilution studies, and water treatment assessment. The system is managed by EPA's OWRS.	36,000 gaging stations throughout the United States.	Data elements: location, data collection activities, and mean, annual, and 7Q10 flow at gaging stations. Wastestreams/media: receiving surface water. Data coverage: files from U.S. Geological Survey released in 1984.	Data base available on EPA mainframe.
Pretreatment Facility File (PFF)	File identifies treatment plants covered by approved local pretreatment programs and plants required to develop programs. Maintained by EPA's Office of Wastewater Enforcement and Compliance (OWEC).	2,128 treatment plants covered by 1,542 control authorities (approved, required, and inactive local programs).	Data elements: facility and control authority NPDES numbers, facility name, pretreatment status (e.g., approved, covered, required). Data coverage: pretreatment status as of April 1990.	Data collected by EPA and maintained on a microcomputer.
Office of Water Accountability System	System maintains the accountability measures that Office of Water uses to monitor annual regional performance to meet Office of Water national program objectives.		The system contains qualitative and quantitative information about noncompliance rates, inspections, and audits, as well as information regarding whether EPA Regions have entered data into PCS.	
Water Pollution Control Federation (WPCF) POTW Employee Safety Survey	Survey to assess worker health and safety in U.S. and Canadian POTWs. Conducted by the WPCF.	1988 survey covers 1,082 POTWs.	Emphasis on safety issues; survey conducted annually since 1967.	Results of survey summarized and available in hard copy.

Table 2-3. National Data Sources—One-Time Collection

Data Source or Study Name	Overview	Criteria for Inclusion and No. of Facilities or Treatment Plants	Data Characteristics	Data Collection, Management, and Access
Domestic Sewage Study	Study conducted by EPA's Office of Water in fulfillment of Section 3018 of the 1984 Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act (RCRA). The purpose of the study was to evaluate the impacts of hazardous wastes discharged to POTWs as a result of the Domestic Sewage Exclusion (DSE).	Focused on discharges of users in 47 industrial categories and the residential sector. Thirty of the industrial categories had already been identified as potential candidates for categorical pretreatment standards.	Data elements: types, sizes, and number of generators using the DSE; types and quantities of wastes disposed under the DSE; fate of wastes in POTWs and the environment; and significant generators, wastes, and constituents not sufficiently regulated to protect human health and the environment. Wastestreams/media: air, sewage sludge, surface water, ground water, influent, in-plant, and effluent of POTWs; and worker health and safety. Pollutants: 165 hazardous constituents, including 67 Clean Water Act priority pollutants. Data coverage: study conducted in 1985 using existing data sources.	Data compiled primarily from existing sources and supplemented with regional, State, local, and industrial sources. Results are documented in *Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works* (EPA, 1986b).
304(m)/ITD Studies	Data summaries prepared to support the biennial plan to revise and promulgate effluent guidelines (including categorical standards) for selected industrial categories. Studies conducted and final reports prepared by EPA's Office of Water Regulations and Standards.	Industrial categories covered included Machinery Manufacturing and Rebuilding, Drum Reconditioning, Industrial Laundries, Paint Formulating, Pharmaceutical Manufacturing, Hazardous Waste Treatment, Transportation Equipment Cleaning, Used Oil Reclamation and Re-refining, Hospitals, and Solvent Recycling. Most of these were not considered previously for regulation through national categorical standards.	Data elements: engineering, economic, and environmental data on specific industries being studied/characterized. Wastestreams/media: industry effluent. Pollutants: compounds contained in 1987 Industrial Technology Division List of Analytes. Data coverage: varied according to industry studied (see Chapter 3 for details).	One-time data collection for each industry.

Table 2-3. National Data Sources—One-Time Collection (continued)

Data Source or Study Name	Overview	Criteria for Inclusion and No. of Facilities or Treatment Plants	Data Characteristics	Data Collection, Management, and Access
National Urban Runoff Program (NURP)	A collection of 28 projects, conducted separately at the local level but centrally reviewed, coordinated, and guided. The purpose of the program was to determine the nature, causes, and severity of urban runoff problems, and to identify opportunities for controlling these problems.	Focus was on runoff from residential, commercial, and light industrial land use areas.	Data elements: characteristics of urban runoff, receiving water quality effects of urban runoff, and urban runoff controls and effectiveness. Wastestreams/media: storm-water runoff to surface waters from residential, commercial, and light industrial land use areas. Pollutants: 20 of the 28 studies tested for all priority pollutants. All studies tested for standard storm-water pollutants (total suspended solids [TSS], BOD, COD, total phosphorus, soluble phosphorus, total Kjeldahl nitrogen, nitrite, nitrate, total copper, total lead, and total zinc). Data coverage: 5-year study initiated in 1978.	One-time data collection for each project. A summary data base currently being compiled. Findings available in *Results of the Nationwide Urban Runoff Program* (EPA, 1983).
National Sewage Sludge Survey (NSSS)	Survey conducted by EPA to collect information and data necessary to produce national estimates of (1) concentrations of toxic pollutants in municipal sludge, (2) sludge generation and treatment processes, (3) sludge use and disposal practices and alternative use and disposal practices, and (4) sludge treatment and disposal costs. These data are being used to evaluate standards for the use and disposal of sewage sludge (Section 405[d] of the CWA).	Survey performed on a stratified random sample consisting of 479 sewage treatment plants with at least secondary treatment. 462 of these completed a general survey; sludges were analyzed for pollutants at 180 of these plants. 215 of the 462 plants were covered by pretreatment programs.	Data elements: toxic pollutant concentrations in sewage sludge, sewage sludge generation and treatment processes, current and alternative sludge use and disposal practices, and treatment and disposal costs. Wastestreams/media: sewage sludge. Pollutants: samples analyzed for 419 pollutants, including CWA priority pollutants, toxic compounds highlighted in the DSS; RCRA Appendix VIII constituents; and contaminants of suspected concern in municipal sludge. Data coverage: Collection effort began in August 1988 and ended in September 1989.	One-time data collection with results available as printed documents or computer files. Data files available on EPA mainframe computer.

Table 2-3. National Data Sources—One-Time Collection (continued)

Data Source or Study Name	Overview	Criteria for Inclusion and No. of Facilities or Treatment Plants	Data Characteristics	Data Collection, Management, and Access
40-POTW Study	Project conducted by EPA's Effluent Guidelines Division to systematically study the occurrence and fate of priority pollutants in POTWs.	Study covered geographically distributed POTWs representing a variety of municipal treatment technologies, size ranges, and industrial flow contributions. Also included 10 POTWs characterized by one dominant industrial discharger.	Data elements: occurrence and concentration of toxic pollutants in POTW wastestreams, impact of industrial contribution on influent quality, treatment or removal of priority pollutants in POTWs, and correlation of influent and effluent priority pollutant levels. Wastestreams/media: influent, effluent, and sludge. Pollutants: 129 priority pollutants and selected conventional/nonconventional pollutants. Data coverage: study conducted in 1978 and 1979.	Data collected by EPA. Results reported in *Fate of Priority Pollutants in Publicly Owned Treatment Works - Final Report* (EPA, 1982).
General Accounting Office (GAO) Survey	Data collected by GAO to determine whether (1) industrial discharges are exceeding program discharge limitations, and (2) enforcement is sufficient to ensure that discharge limitations and other program requirements are met.	Survey performed on a stratified random sample of 428 local pretreatment programs.	Data elements: general pretreatment program information, monitoring programs, enforcement actions, impact on receiving water quality, and the impact of resources and local attitudes on program implementation. Wastestreams/media: no monitoring of wastestreams or media performed; nonanalytical questions covered influent, effluent, sewage sludge, plant upset, and worker health and safety. Pollutants: local limits data collected for cadmium, chromium, copper, lead, nickel, zinc, phenol, cyanide, silver, arsenic, mercury, total organics, boron, suspended solids, and BOD. Data coverage: survey work conducted September 1987 through October 1988 with updates through February 1989.	Survey data available on computer tape. Results documented in *Improved Monitoring and Enforcement Needed for Toxic Pollutants Entering Sewers* (GAO, 1989).

Table 2-3. National Data Sources—One-Time Collection (continued)

Data Source or Study Name	Overview	Criteria for Inclusion and No. of Facilities or Treatment Plants	Data Characteristics	Data Collection, Management, and Access
Local Limits Guidance Manuals (LL Guidance)	In the mid-1980s, EPA's Office of Water Enforcement and Permits collected monitoring data from POTWs for development of the *Guidance Manual on the Development and Implementation of Local Discharge Limitations* (EPA, 1987). In addition to summarizing these data to demonstrate possible discharges from residential and commercial sources, EPA also addressed key elements necessary for POTWs to develop local limits. In the late 1980s, EPA collected and analyzed additional data and prepared the *Supplemental Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program* (EPA, 1991).	*Supplemental Manual*—Monitoring data provided by 38 POTWs with local pretreatment programs located in 10 EPA Regions. Commercial sources of pollutants included hospitals, automobile radiator shops, car washes, truck cleaners, photo processors, dry cleaners, and commercial laundries.	Data elements: residential/commercial line monitoring data, specific commercial source monitoring data, septage hauler monitoring data, and landfill leachate monitoring data. Wastestreams/media: residential/commercial users effluent, POTW influent, septage hauler load, and landfill leachates Pollutants: 1990—phosphate, iron, total phosphorous, boron, fluoride, barium, manganese, cyanide, nickel, lithium, cadmium, arsenic, chromium (III), chromium (T), mercury, silver, and 10 organics; 1987—nine metals and cyanide. Data coverage: supplemental manual used post-1986 data.	Data for supplemental manual submitted to EPA by POTWs, which had been obtained through a variety of local sampling programs. Data available in publications noted in "Overview."

tables describe in some detail those characteristics essential for appropriate use and evaluation of data, including how and why data were compiled, the sources of data, and the media and pollutants covered. The paragraphs below briefly describe several of the major data sources listed in the tables and provide examples of how data from these sources were used in this report.

Table 2-2 begins with the Toxics Release Inventory System (TRIS), which is a relatively new source that includes data on chemicals discharged and treatment and minimization practices for manufacturing facilities that handle significant quantities of specific toxic chemicals. It is limited to facilities that have 10 or more full-time employees and that have manufactured, processed, or otherwise used any of more than 300 chemicals in quantities greater than specific threshold levels. Section 313 of the 1986 Emergency Planning and Community Right-to-Know Act describes these chemicals and the threshold levels.

As discussed in Chapter 3, TRIS data supplemented the findings of the DSS in characterizing toxic pollutant discharges from industries to POTWs. TRIS data also were used in Chapter 7 to determine whether POTWs reported as receiving the largest amounts of toxic pollutants were covered by the pretreatment program.

The Permit Compliance System (PCS), including the Pretreatment Permits and Enforcement Tracking System (PPETS), is another data base used extensively in this study. As noted in Table 2-2, PCS is the automated tracking system for the National Pollutant Discharge Elimination System (NPDES) program that provides various data for dischargers with NPDES permits, currently including about 15,747 POTWs. Data elements cover permit requirements, effluent monitoring data, and compliance and enforcement status and history. The PPETS component of PCS contains pretreatment-related data for most local pretreatment programs, based on annual inspections and periodic audits of programs by EPA Regions and States. In some cases, entry of specific data elements into PCS is optional, particularly for pretreatment-related data elements.

PCS and PPETS were used for various analyses in every chapter of this report. In Chapter 3, for example, data on the numbers and types of industries that discharge to POTWs (industrial users) were taken from PCS. Chapter 4 used PCS compliance data to identify well-operated secondary treatment plants. Chapter 5 used a number of PPETS data elements that describe pretreatment program implementation activities. Chapter 6 used POTW effluent monitoring data from PCS to calculate instream pollutant concentrations, and

Chapter 7 used both pretreatment and effluent monitoring data. Finally, Chapter 8 used PCS data to evaluate changes that might occur as the result of adopting alternatives to current strategies.

The NEEDS 1988 Survey File represents the most recent results of a biannual survey of the Nation's municipal wastewater treatment plants. NEEDS '88 includes a variety of data, analytical tools, and reporting utilities for the estimation of funds needed for the construction of these POTWs. For the present study, it was used to characterize industrial flow contributions to POTWs in Chapters 3 and 7, to identify treatment processes in Chapter 4, and to support the environmental impact analysis in Chapter 6.

The Domestic Sewage Study (DSS), as described in Chapter 1 and Table 2-3, was conducted in 1985 to evaluate the impacts of wastes discharged to POTWs as a result of the Domestic Sewage Exclusion (DSE). Similar to the present study's approach, information was compiled from existing sources and supplemented with EPA Region, State, local, and industrial facility data. In contrast to TRIS, described previously, the DSS focused on 165 pollutants, the vast majority of which were RCRA hazardous constituents and 67 of which were Clean Water Act priority pollutants.

DSS data were used in most chapters of this report. In Chapter 3, for example, DSS data on toxic pollutant discharges by specific types of industries are compared to TRIS and other data to characterize industrial discharges to POTWs. Chapter 4 presents the estimates of pollutant removal efficiencies provided in DSS, and Chapter 6 also uses DSS estimates of POTW discharges to various environmental media.

In accordance with the study approach described previously, most of the data sources described in Tables 2-2 and 2-3 provide actual rather than projected data for as many of the study topics as possible. They also include data from EPA program offices and include the results of significant national and regional studies.

Another aspect of EPA's study approach, integrating performance of the study with ongoing program implementation activities, enabled EPA to make immediate use of recent program findings and activities in various analyses. For example, EPA created new data bases by compiling and reorganizing information previously submitted by POTWs that describes the development of local discharge limitations. This information was used in Chapter 4 to characterize pollutant removal efficiencies and in Chapter 5 to evaluate POTW capability to revise pretreatment standards. The 47-POTW data base included extensive influent and effluent monitoring data compiled from POTWs' local limits development documents. This data base was used to characterize secondary treatment removal efficiency in Chapter 4. Table 2-4 further describes these and other data sources that were not national in scope but that supported various analyses in the study.

Table 2-5 describes a number of regional and other data sources that also were used extensively. For example, the North Carolina Department of Natural Resources and Community Development maintains a computerized data base of information for all pretreatment programs. This data base currently includes 121 control authorities and contains compliance monitoring data on nearly 1,000 industrial users.

2.4 Use of Major Data Sources

As noted previously, most of the major data sources were designed for a specific purpose and cover specific data elements and wastestreams, types of facilities, and other issues. For example, the Pretreatment Audit Summary System (see Table 2-2) stores and summarizes the results of selected program audits of local pretreatment control authorities conducted by EPA Regions and States in their oversight capacity. It reports on a wide range of programmatic issues, such as the quality of permits, the types of local limits, adequacy of resources, and data management capabilities.

For some analyses, using data from a single source proved adequate. Chapter 3, for example, focused on the National Urban Runoff Program Study to characterize the pollutant loadings in storm water and, thus, the potential inputs to combined sewer flows and POTWs. In most cases, however, one data source did not provide all of the data elements necessary for an analysis. For example, the analysis in Chapter 6 that determines how often POTWs could cause exceedances of water quality criteria required data on POTW flow rates, pollutant concentrations, and the flow of the receiving waters. The NEEDS '88 Survey includes plant flow data and a receiving stream identifier, but does not track discharge pollutant concentrations or receiving waters flow. PCS, on the other hand, includes pollutant concentrations, but as with NEEDS, does not include receiving stream flow. The Stream Gage/Flow system, in contrast, stores receiving stream flow but none of the other variables.

To take advantage of all available data, EPA established linkages among several of the data sources. The linkages allowed data on specific POTWs in each linked data source to be used in conjunction with data from any or all of the other linked sources. Successful linkages

Table 2-4. Major Data Sources Compiled Specifically for This Study

47-POTW Removal Efficiency Data Base

- Compiled from local limits development documents submitted by POTWs to EPA Regions.
- 47 POTWs located in EPA Regions II, III, V, VI, VII, VIII, IX, all with secondary treatment and implementing approved local pretreatment programs.
- Includes influent and effluent data on 92 pollutants: 67 organics, 23 inorganics, as well as BOD and TSS.

Removal Credits Applications Data Base

- Compiled from removal credits applications submitted by POTWs to approval authorities (States or EPA as appropriate).
- Detailed submissions from 17 POTWs and summary information from 6 other POTWs.
- Data include a discussion of the basic development procedures used, industries and pollutants affected, summaries of the data used in development, and the resultant removals claimed/credited.

Local Limits Data Base

- Compiled from local limits development documents submitted by POTWs to EPA Regions.
- 57 local limits submissions, principally from EPA Regions VI and IX.
- Data include procedures used in the development of the limits, the data and environmental criteria used to calculate the limits, and the resultant limits that were determined from the evaluation.

200 POTW Local Limits Data

- Compiled from reports prepared to document EPA Region and State oversight audits of approved local pretreatment programs.
- Data include pollutant limits applied to industrial users by POTWs.

Table 2-5. Other Data Sources

North Carolina Industrial Users Data Base

- Maintained by North Carolina Department of Natural Resources and Community Development to monitor industrial discharges to POTWs.
- Industrial user monitoring data from 121 local pretreatment programs and nearly 1,000 industrial users.
- Data include industry permit limits, industrial effluent monitoring data, and compliance information.

Ontario Ministry of the Environment's Municipal Industrial Strategy for Abatement Study

- Study performed to provide POTW influent and effluent monitoring data to develop monitoring regulations.
- Study conducted on 37 Canadian POTWs in 1987.
- Data include pollutant concentrations for influent and effluent streams at representative locations in POTWs, including raw and treated sludge.
- Covers 144 organic pollutants, 13 metals, selenium, cyanide, and conventional pollutants.

National Water Quality Inventory—1988 Report to Congress

- Compiled by EPA from State reports on the extent to which their surface waters are meeting the goals of the CWA and to recommend how the goals can be achieved.
- State reports submitted biennially since 1975.
- Report to Congress covers the following issues: total sizes of assessed water bodies that are fully, partially, or not supporting designated beneficial uses, and those that are threatened; major causes of use impairment; sources of pollution in those waters not fully supporting their uses; and number of waters adversely affected by toxic pollutants.

were established between PCS/PPETS, the NEEDS Survey File, Pretreatment Audit Summary System, General Accounting Office data (see Table 2-3), National Sewage Sludge Survey data (see Table 2-3), and the local limits data base (see Table 2-4). For the water quality exceedance analysis in Chapter 6, NEEDS Survey data (flow and reach number), PCS data (pollutant concentration), and the Stream Flow/Gage file (receiving waters flow) were linked. Figure 2-1 illustrates this linkage.

The same approach was used in Chapter 4 to identify well-operated secondary treatment plants. NEEDS data for a particular POTW identified the type of treatment processes (i.e., primary, secondary, and tertiary) used, and PCS data indicated whether the POTW had ever been in significant noncompliance with its NPDES permit limits for conventional pollutants.

Because the linkages among sources were imperfect (i.e., not all POTWs were represented in any one source, and data were sometimes inadequate to allow complete cross-matches) and because of the decision to use as much data as possible for each analysis, the numbers of POTWs represented in any given analysis varied somewhat from analysis to analysis. This accounts, for example, for the slightly different totals of pretreatment (and nonpretreatment) POTWs presented in Figure 1-2 and Tables 1-1 and 1-2; in each case, all data available in the sources cited were used.

Table 2-6 provides an overview of the use of a number of major data sources in this study. It is organized according to data source and chapter and indicates where linked data sources contributed to various analyses.

2.5 CASE STUDIES

EPA's final source of data for this Report to Congress was a set of case studies conducted at three POTWs. By examining three local pretreatment programs in detail, EPA obtained analytical data and descriptive information to complement the national data bases, program studies, and State and local material described previously. The case studies illustrate particular issues raised in each chapter, as well as portray in more general terms the many facets of the National Pretreatment Program; in short, the case studies were intended to impart a "real-world" perspective to the report.

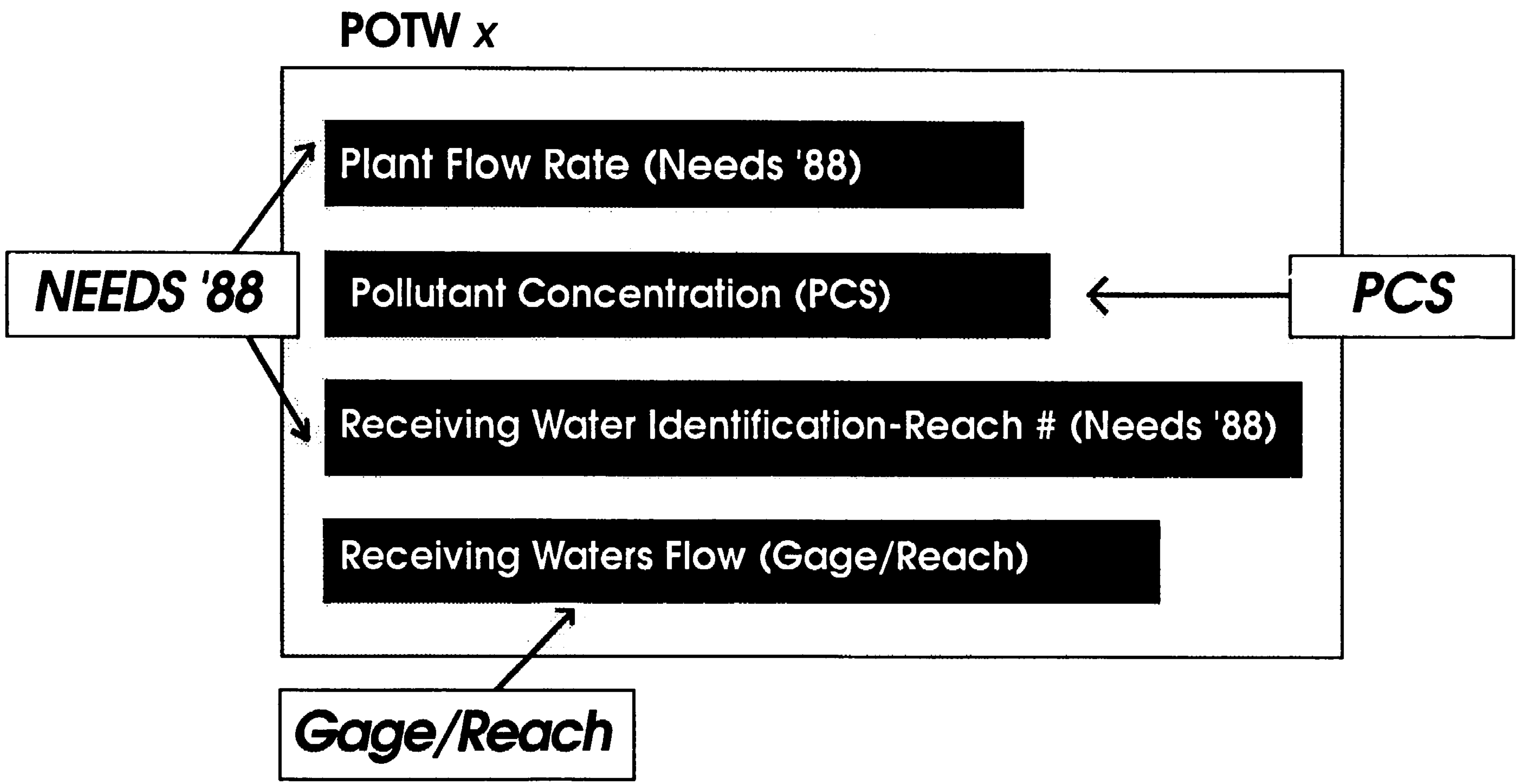

Figure 2-1. Example of Linkage of Data Sources for Chapter 6 Water Quality Exceedance Analysis

Table 2-6. Uses of Data Sources

Data Source or Study	Chapter and Form of Use (S = Singular; L = Linked)									
	3		4		5		6		7	
	S	L	S	L	S	L	S	L	S	L
TRIS	■								■	
PCS/PPETS		■		■	■			■		■■
PASS		■			■				■	■
NEEDS '88		■		■				■	■	■■
Stream Gage/Flow File								■		■
Reach File								■		■
OWAS [1]	■	■								
WPCF Survey							■			
DSS	■		■				■		■	
304(m)/Studies	■								■	
NURP	■									
NSSS		■							■	
40 POTW			■				■			
GAO Survey					■				■	
LL Guidance	■								■	
47 POTW			■							
RC Data Base [2]					■					
LL 200 POTW Data Base					■		■			
NC Industries [3]	■									
MISA [4]			■							
NWQ Inventory [5]							■			

1. OWAS – Office of Water Accountability System
2. RC – Removal Credits
3. NC – North Carolina
4. MISA – Municipal Industrial Strategy for Abatement
5. NWQ – National Water Quality

Note: Pretreatment Facility File, as referenced in Table 2-2, was used primarily to identify pretreatment facilities for the above sources.

In selecting POTWs for case studies, EPA did not seek out and analyze "perfect" programs. Because of the small number of case studies to be performed, EPA selected a group of POTWs that would:

- Exhibit as much diversity as possible in geographical location, size, industrial makeup, and basis of pretreatment standards
- Yield data on industrial users, wastestreams, and receiving media with sufficient quality, breadth, and depth to provide illustrations of the topics of concern in the report
- Meet with the approval of EPA Headquarters, EPA Region and State pretreatment coordinators, and POTW personnel and not compromise any current or planned enforcement initiatives.

EPA selected the following three POTWs as case studies:

- Thomasville, North Carolina—A small (3 million gallons per day [mgd]) POTW serving a population of 16,000. Thomasville's four categorical industrial users (CIUs) and nine other significant industrial users (SIUs [primarily furniture manufacturers and textile mills]) contribute 25 percent of the POTW's average flow.
- Hampton Roads Sanitation District (HRSD), Virginia—A large metropolitan POTW (total 203 mgd) with 10 treatment plants serving the Tidewater area of southeastern Virginia. HRSD accepts wastewaters from about 260 SIUs, 35 of which are CIUs. Industrial wastewaters—mostly from electroplaters, organic chemical manufacturers, and 10 major military installations—constitute 10 percent of the flow to HRSD's treatment plants.
- Pocatello, Idaho—A medium-sized (12 mgd design flow rate, 7 mgd average) POTW that serves a population of 50,000 in the cities of Pocatello and Chubbuck. Two industries subject to categorical standards discharge to the POTW, as do seven other significant industries and 75 additional nonsignificant users (including commercial use, hospitals, and a university). Approximately 20 percent of the POTW's average daily flow is contributed by nondomestic users.

Table 2-7 lists general characteristics of the three case study POTWs.

Table 2-7. General Characteristics of Case Study Cities

City/POTW	Design Flow (mgd)	Total Population Served	Jurisdictions	Economic Base
Thomasville, NC, Hamby Creek	4.0	16,000	City of Thomasville	Manufacturing Service
Hampton Roads Sanitation District, VA (10 plants)	203 (all plants total)	1,255,370 (1988 est.)	Chesapeake Hampton Newport News Norfolk Poquoson Portsmouth Suffolk Virginia Beach Williamsburg Gloucester County Isle of Wight County James City County York County	Military Installations and Related Industries; Service and Resort Sectors
Pocatello, ID	12.0	50,000	City of Pocatello City of Chubbuck	Transportation Chemical Manufacturing and Food Processing

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U.S. EPA. 1983. *Results of the Nationwide Urban Runoff Program. Volume 1–Final Report,* Washington, DC: Water Planning Division. NTIS: PB84-185552.

U.S. EPA. 1982. *Fate of Priority Pollutants in Publicly Owned Treatment Works—Final Report.* Washington, DC: Office of Water Regulations and Standards, Effluent Guidelines Division. EPA 440/1-82/303.

U.S. General Accounting Office. 1989. *Improved Monitoring and Enforcement Needed for Toxic Pollutants Entering Sewers.* GAO/RCED-89-101.

3. DISCHARGE OF TOXIC POLLUTANTS TO POTWS

This chapter identifies the toxic pollutants[1] discharged to publicly owned treatment works (POTWs) and the sources responsible for these discharges. Although not specifically requested by Congress under Section 519 of the 1987 Water Quality Act, the identification of the types and sources of toxic pollutants discharged to POTWs is a necessary step toward evaluating the adequacy of controls on toxic pollutant discharges, their treatability and fate within POTWs, and their environmental impacts.

Virtually all chemicals used by industrial, commercial, and domestic customers may be discharged to POTWs and are subject to varying degrees of regulatory control. This chapter characterizes the sources and types of toxic pollutants discharged to POTWs from industrial/commercial, domestic, and other sources (Sections 3.2 through 3.4, respectively) and the regulatory controls that may affect these discharges. It concludes with an overview of how pollution prevention initiatives may lower the discharge of toxic pollutants to POTWs.

3.1 METHODOLOGY

Over the past several years, the U.S. Environmental Protection Agency (EPA) has conducted several major studies to estimate the types and quantities of toxic pollutants discharged to POTWs, as well as to evaluate the effectiveness of regulatory controls on the discharge of these pollutants. In this Report to Congress, EPA used these previous studies, expanding the coverage of toxic pollutants and the examination of the sources of these pollutants.

3.1.1 Previous EPA Studies

In 1981, the Regulatory Impact Analysis (RIA) for the General Pretreatment Regulations (40 *CFR* Part 403) estimated the quantities of priority pollutants discharged to POTWs from 22 industrial categories subject to national categorical standards. The RIA estimated that categorical industrial dischargers to POTWs are responsible for the generation of about 460 million pounds (approximately 208,000 metric tons) per year of metals and organics in raw (i.e., untreated) wastewater (EPA, 1981). Assuming full compliance with applicable categorical standards, EPA estimated that industrial contributions

1. "Toxic pollutant" is defined to include the CWA "priority" pollutants (Appendix A of 40 *CFR* Part 423 and listed in Figure 3-1 of this report) and other "nonpriority" pollutants as reported by the various data sources used in this chapter.

to POTWs would be reduced by approximately 85 percent to about 70 million pounds (approximately 31,750 metric tons) per year of metal and organic wastes.

In 1985, the EPA *Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works* (EPA, 1986b, referred to as the Domestic Sewage Study and hereafter as the DSS) estimated that approximately 160,000 industrial and commercial facilities discharge 3,200 million gallons per day (mgd) of process wastewater to POTWs (or approximately 12 percent of total POTW flow). This estimate represents actual flows as opposed to NEEDS estimates of POTW design flows discussed in Subsection 1.1.4. Estimates for those industrial categories subject to national categorical standards were 136 million pounds (62,000 metric tons) per year of hazardous metal pollutants and approximately 99 million pounds (45,000 metric tons) per year of hazardous organic pollutants at raw (untreated) discharge levels. Assuming full compliance with categorical standards, EPA estimated that hazardous metal pollutants discharged to POTWs from categorical industries would be reduced by approximately 95 percent to about 7 million pounds (3,300 metric tons) per year, and hazardous organic pollutants discharged to POTWs would be reduced by approximately 55 percent to about 44 million pounds (20,000 metric tons) per year.

3.1.2 Approach to Identifying Sources and Types of Toxic Pollutants

This chapter examines more sources of discharges and pollutants than did the Pretreatment RIA or the DSS. The RIA primarily evaluated discharges of the 126 Clean Water Act (CWA) priority pollutants from 22 categorical industries. The DSS went beyond this to evaluate 165 hazardous constituents (including 67 priority pollutants) from categorical and noncategorical industries (including commercial facilities).

Sources of Discharges. Whereas the emphasis of previous studies was on industries subject to national categorical pretreatment standards, due partly to the availability of data for such industries, data collection and analysis activities for this Report to Congress have also focused on toxic pollutants from noncategorical industrial facilities (including commercial facilities) and from domestic and other sources.

Pollutants. The Pretreatment RIA focused primarily on the priority pollutants, largely because those pollutants were specifically regulated under the CWA. Because the intent of the DSS was to investigate discharges of hazardous wastes to sewers, the DSS concentrated on 165 hazardous pollutants that are indicators of Resource Conservation and Recovery Act (RCRA) hazardous waste; it too, however, stressed the priority pollutants—

again for reasons of data availability. This Report to Congress is not limited to a particular subset of pollutants. Instead, the approach was to identify the broadest possible universe of toxic pollutants, including priority pollutants and the RCRA hazardous constituents, from various sources.

3.1.3 Data Sources

EPA collected and analyzed information from a variety of sources to identify all possible toxic pollutants discharged to POTWs. Figure 3-1 provides a listing of the 126 priority pollutants. The primary information sources were national data bases and studies generated and maintained by EPA. Other sources, such as State data bases, were used to supplement national data as necessary. No sampling or analysis of possible sources of toxic pollutants was performed specifically for this report.

At the national level, the Industrial Technology Division (ITD) of EPA's Office of Water Regulations and Standards recently completed several studies in which data were collected regarding discharges from a variety of industrial categories for which EPA is considering revising or promulgating national categorical pretreatment standards. The EPA Office of Water Enforcement and Permits (OWEP) has also collected State and local data to assist control authorities in regulating commercial sources of toxic pollutants through the development and refinement of local limits.

In addition to the above data collection activities conducted within the Office of Water, EPA's Toxics Release Inventory System (TRIS) was used as a source of information regarding toxic pollutant discharges to POTWs. As discussed in Chapter 2, TRIS contains information collected pursuant to Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986, which requires certain industrial and commercial facilities to submit annual reports regarding releases of particular toxic chemicals to the environment, including POTWs. Although limited in its coverage of facilities, TRIS contains information regarding the quantities of more than 300 toxic chemicals released to POTWs.

Most State agencies responsible for pretreatment program oversight and implementation maintain information regarding the numbers and types of industrial and commercial facilities that discharge to POTWs. Several State agencies maintain data bases that contain readily available information regarding the types of toxic pollutants being discharged to POTWs. One such data base, maintained by the State of North Carolina, contains monitoring data for all indirect discharges regulated by control authorities in the State. This data base, which is useful as a benchmark for data adequacy because it provides

Figure 3-1. Priority Pollutants

Volatile Compounds

Acrolein	Vinyl Chloride
Benzene	Acrylonitrile
Carbon Tetrachloride	Bromoform
Chlorodibromomethane	Chlorobenzene
2-Chloroethylvinyl Ether	Chloroethane
Dichlorobromomethane	Chloroform
1,2-Dichloroethane	1,1-Dichloroethane
1,2-Dichloropropane	1,1-Dichloroethylene
Ethylbenzene	1,3-Dichloropropylene
Methyl Chloride	Methyl Bromide
1,1,2,2-Tetrachloroethane	Methylene Chloride
Toluene	Tetrachloroethylene
1,1,1-Trichloroethane	1,2-Trans-Dichloroethylene
Trichloroethylene	1,1,2-Trichloroethane

Acid Compounds

Chlorophenol	2,4-Dichlorophenol
2,4-Dimethylphenol	4,6-Dinitro-O-Cresol
2,4-Dinitrophenol	2-Nitrophenol
4-Nitrophenol	P-Chloto-M-Cresol
Pentachlorophenol	Phenol
2,4,6-Trichlorophenol	

Base/Neutral Compounds

Acenaphthene	Acenaphthylene
Anthracene	Benzidine
Benzo(a)Anthracene	Benzo(a)Pyrene
Benzo(b)Fluoranthene	Benzo(ghi)Perylene
Benzo(k)Fluoranthene	Bis(2-Chloroethoxy)Methane
Bis(2-Chloroethyl)Ether	Bis(2-Chloroisopropyl)Ether
Bis(2-Ethylhexyl)Phthalate	4-Bromophenyl Phenyl Ether
Butyl Benzyl Phthalate	2-Chloronaphthalene
4-Chlorophenyl Phenyl Ether	Chrysene
Dibenzo(a,h)Anthracene	1,2-Dichlorobenzene
1,3-Dichlorobenzene	1,4-Dichlorobenzene
3,3-Dichlorobenzidine	Diethyl Phthalate
Dimethyl Phthalate	Di-N-Butyl Phthalate
2,4-Dinithrotoluene	2,6-Dinitrotoluene
Di-N-Octyl Phthalate	1,2-Diphenylhydrazine (as Azobenzene)
Fluoranthene	Hexachlorobenzene
Fluorene	Hexachlorocyclopentadien
Hexachlorobutadiene	Indeno(1,2,3-cd)Pyrene
Hexachloroethane	Naphthalene
Isophorone	N-Nitrosodimethylamine
Nitrobenzene	N-Nitrosodiphenylamine
N-Nitrosodi-N-Propylamine	Pyrene
Phenanthrene	1,2,4-Trichlorobenzene

Figure 3-1. Priority Pollutants (continued)

Pesticides and PCBs	
Aldrin	Gamma-BHC
Alpha-BHC	Delta-BHC
Beta-BHC	Chlordane
4,4′ DDT	4,4′-DDE
4,4′-DDD	Dieldrin
Alpha-endosulfan	Beta-Endosulfan
Endosulfan Sulfate	Endrin
Endrin Aldehyde	Heptachlor
Heptachlor Epoxide	PCB-1242
PCB-1254	PCB-1221
PCB-1232	PCB-1248
PCB-1260	PCB-1016
Toxaphene	
Metals and Cyanide	
Antimony	Arsenic
Beryllium	Cadmium
Chromium	Copper
Lead	Mercury
Nickel	Selenium
Silver	Thallium
Zinc	Cyanide
Miscellaneous	
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)	
Asbestos	

Source: 40 *CFR* Part 423 Appendix A.

some of the best State data, was used to provide additional data for this report regarding the types and levels of toxic pollutants being discharged to POTWs.

3.2 Industrial and Commercial Sources of Toxic Pollutants

This section describes toxic pollutants discharged to POTWs from industrial and commercial sources. Subsection 3.2.1 describes the relative extent of industrial/commercial discharges to POTWs in two ways: the number of industrial/commercial users discharging to POTWs and the relative volume of wastewater discharged by industrial/commercial users as compared to total POTW wastewater flow. Subsection 3.2.2 then identifies the toxic pollutants discharged to POTWs from industrial and commercial sources.

3.2.1 Estimates of the Number of and Flow From Industrial and Commercial Dischargers

The types and quantities of toxic pollutants discharged to POTWs depend in part on the number of industrial and commercial users and the total flow from these users relative to the total POTW flow. This subsection estimates the number of industrial and commercial dischargers to POTWs (Subsection 3.2.2.1) and describes what portion of total POTW flow consists of industrial and commercial flow (Subsection 3.2.2.2).

3.2.1.1 Estimates of Industrial and Commercial Users

Under the National Pretreatment Program, industrial and commercial facilities that discharge to POTWs typically are classified in three ways:

- Categorical Industrial User (CIU)—An industrial facility subject to regulation by technology-based categorical pretreatment standards established by EPA.
- Significant Industrial User (SIU)—Defined by EPA as all categorical industrial users, noncategorical industrial users with an average process flow of 25,000 gallons per day or more, noncategorical industrial users contributing 5 percent or more of the POTW's dry weather hydraulic or organic capacity, or any industrial user designated by the control authority to have a reasonable potential to affect POTW operations adversely.

  Other Nonsignificant User—Defined as any other nondomestic source that is not an SIU but may still be regulated by a local pretreatment program. These users are typically surcharged for sewer use, inspected, and/or controlled through a sewer use permit (i.e., regulated by a POTW).

Data Sources

Several data sources estimate the total number of CIUs and SIUs that discharge to POTWs. These data sources, described in Chapter 2, include the EPA Permit Compliance

System (PCS), which includes the Pretreatment Permits and Enforcement Tracking System (PPETS); the EPA Pretreatment Audit Summary System (PASS); the EPA National Sewage Sludge Survey (NSSS); and the Office of Water Accountability System (OWAS).

Analysis of these data sources revealed that PCS/PPETS was the most comprehensive source for estimates of the number of CIUs and SIUs discharging to POTWs.[2] PCS/PPETS contained SIU data for 90 percent of approved local pretreatment programs, many State-operated pretreatment programs, and a number of POTWs regulated outside of State and local pretreatment programs.

To establish comprehensive national estimates of the numbers of CIUs and SIUs, EPA first extracted available information from the PCS/PPETS system. The Agency used PASS and NSSS in the absence of PCS/PPETS data for locally run programs[3] and OWAS in the absence of PCS/PPETS data for industrial users regulated by approval authorities.[4]

As for other nonsignificant regulated users (i.e., non-CIU and non-SIU), no national estimates exist. The only EPA data source containing information regarding other regulated users is PASS. PASS has estimates for other regulated users for just over 400 POTWs with approved pretreatment programs.

Estimates of CIUs and SIUs

Table 3-1 summarizes CIUs and SIUs by State. Appendix A-1 lists by State the number of CIUs and SIUs for each POTW with an approved pretreatment program. Each

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2. Most data were provided by PCS (1,356 POTW control authorities) and supplemented by PASS for 31 control authorities and by NSSS for 9 additional control authorities.

3. No CIU and SIU data were available in any of the data bases for 102 control authorities with approved local programs. It should also be noted that for one of the nine control authorities for which NSSS data were used, the number of CIUs was not available.

4. OWAS was used in the absence of PCS data for industrial users regulated by approval authorities. It should be noted that data regarding numbers of CIUs and SIUs regulated by approval authorities (i.e., in the absence of a local POTW or State-approved program) were not available for 19 of the 50 States or for the District of Columbia and Puerto Rico.

Table 3-1. Numbers of Categorical and Significant Industrial Users

		Regulated by Approved Local Pretreatment Programs				Regulated by Approval Authorities (EPA or approved States) in Absence of Approved Local Pretreatment Programs			Totals		
EPA Region	State	Number of Control Authorities	CIUs	Noncategorical SIUs	Total	CIUs	Noncategorical SIUs	Total	CIUs[1]	Noncategorical SIUs[1]	Total[1]
I	MA	38	421	1,557	1,978	11	31	42	432	1,588	2,020
	NH	12	69	186	255	5	25	30	74	211	285
	ME	15	29	79	108	1	15	16	30	94	124
	RI	13	245	183	428	3	11	14	248	194	442
	CT[3]	NA	NA	NA	NA	ND	ND	534	ND	ND	534
	VT[3]	NA	NA	NA	NA	17	23	40	17	23	40
	Subtotal	78	764	2,005	2,769	37	105	676	801	2,110	3,445
II	NJ	22	434	365	799	48	96	144	482	461	943
	NY	56	671	1,129	1,800	23	0	23	694	1,129	1,823
	PR	1	8	23	31	0	0	0	8	23	31
	Subtotal	79	1,113	1,517	2,630	71	96	167	1,184	1,613	2,797
III	DE	5	25	27	52	0	0	0	25	27	52
	DC	1	27	85	112	0	0	0	27	85	112
	MD	15	96	164	260	6	0	6	102	164	266
	PA	82	352	570	922	16	0	16	368	570	938
	VA	23	106	170	276	18	0	18	124	170	294
	WV	7	10	53	63	10	0	10	20	53	73
	Subtotal	133	616	1,069	1,685	50	0	50	666	1,069	1,735

Table 3-1. Numbers of Categorical and Significant Industrial Users (continued)

		Regulated by Approved Local Pretreatment Programs				Regulated by Approval Authorities (EPA or approved States) in Absence of Approved Local Pretreatment Programs			Totals		
EPA Region	State	Number of Control Authorities	CIUs	Noncategorical SIUs	Total	CIUs	Noncategorical SIUs	Total	CIUs[1]	Noncategorical SIUs[1]	Total[1]
IV	FL	39	210	443	653	8	0	8	218	443	661
	GA	39	184	336	520	42	0	42	226	336	562
	KY	64	165	361	526	0	0	0	165	361	526
	TN	77	276	493	769	ND	ND	ND	276	493	769
	NC	121	238	760	998	0	0	0	238	760	998
	SC	58	178	302	480	0	0	0	178	302	480
	AL[3]	NA	NA	NA	NA	ND	ND	362	0	0	362
	MS[3]	NA	NA	NA	NA	ND	ND	109	0	0	109
	Subtotal	398	1,251	2,695	3,946	50	0	521	1,301	2,695	4,467
V	IL	45	618	310	928	ND[2]	ND[2]	ND[2]	618	310	928
	IN	45	317	439	756	ND[2]	ND[2]	ND[2]	317	439	756
	MI	110	512	1,243	1,755	ND[2]	ND[2]	ND[2]	512	1,243	1,755
	MN	6	254	119	373	ND[2]	ND[2]	ND[2]	254	119	373
	OH	97	731	858	1,589	ND[2]	ND[2]	ND[2]	731	858	1,589
	WI	23	295	169	464	ND[2]	ND[2]	ND[2]	295	169	464
	Subtotal	326	2,727	3,138	5,865	407	0	407	3,134	3,138	6,272
VI	AR	28	87	201	288	27	0	27	114	201	315
	LA	12	31	149	180	ND[4]	ND[4]	ND[4]	31	149	180
	NM	4	42	61	103	ND	ND	ND	42	61	103
	OK	19	113	213	326	ND	ND	ND	113	213	326
	TX	61	588	2,092	2,680	ND	ND	ND	588	2,092	2,680
	Subtotal	124	861	2,716	3,577	97	0	97	958	2,716	3,674

Table 3-1. Numbers of Categorical and Significant Industrial Users (continued)

		Regulated by Approved Local Pretreatment Programs				Regulated by Approval Authorities (EPA or approved States) in Absence of Approved Local Pretreatment Programs			Totals		
EPA Region	State	Number of Control Authorities	CIUs	Noncategorical SIUs	Total	CIUs	Noncategorical SIUs	Total	CIUs[1]	Noncategorical SIUs[1]	Total[1]
VII	IA	20	66	104	170	44	0	44	110	104	214
	KS	15	97	112	209	43	0	43	140	112	252
	MO	43	283	258	541	25	0	25	308	258	566
	NE[3]	NA	NA	NA	NA	54	5	59	54	5	59
	Subtotal	78	446	474	920	166	5	171	612	479	1,091
VIII	CO	27	136	208	344	7	14	21	143	222	365
	MT	6	5	67	72	1	0	1	6	67	73
	ND	3	2	28	30	2	8	10	4	36	40
	SD	2	11	21	32	0	25	25	11	46	57
	UT	13	61	95	156	0	4	4	61	99	160
	WY	3	1	5	6	0	1	1	1	6	7
	Subtotal	54	216	424	640	10	52	62	226	476	702
IX	AZ	15	91	119	210	ND	ND	ND	91	119	210
	CA	100	2,465	2,433	4,898	ND	ND	ND	2,465	2,433	4,898
	HI	1	1	8	9	ND	ND	ND	1	8	9
	NV	5	22	103	125	ND	ND	ND	22	103	125
	Subtotal	121	2,579	2,663	5,242	0	0	0	2,579	2,663	5,242

Table 3-1. Numbers of Categorical and Significant Industrial Users (continued)

		Regulated by Approved Local Pretreatment Programs				Regulated by Approval Authorities (EPA or approved States) in Absence of Approved Local Pretreatment Programs			Totals		
EPA Region	State	Number of Control Authorities	CIUs	Noncategorical SIUs	Total	CIUs	Noncategorical SIUs	Total	CIUs[1]	Noncategorical SIUs[1]	Total[1]
X	AK	2	3	11	14	ND	ND	ND	3	11	14
	ID	13	14	50	64	ND	ND	ND	14	50	64
	OR	20	139	137	276	ND	ND	ND	139	137	276
	WA	8	110	190	300	ND	ND	ND	110	190	300
	Subtotal	**43**	**266**	**388**	**654**	**0**	**0**	**0**	**266**	**388**	**654**
	TOTAL	**1,434[5]**	**10,839**	**17,089**	**27,928**	**888**	**258**	**2,151**	**11,727**	**17,347**	**30,079**

1. Totals based on incomplete data. Data for 102 control authorities not available as well as in several States in absence of approved local program.
2. Data available only from OWAS - Illinois and Indiana = 116 CIUs/SIUs. Ohio + Wisconsin + Michigan + Minnesota = 291 CIUs/SIUs. There is no breakdown for individual States.
3. State-operated pretreatment program as authorized under 40 *CFR* Section 403.10(e) of the General Pretreatment Regulations.
4. Data available only from OWAS - Louisiana + New Mexico + Oklahoma + Texas = 70 CIUs/SIUs. There is no breakdown for individual States.
5. Data on all POTWs with approved programs (a total of 1,442) were not available.

ND = No data available.

NA = Not applicable.

Source: PCS (1990), PASS (1990), NSSS (1990), OWAS (1990).

approved pretreatment program is reflected in the "status" column in Appendix A-1 by "@". As shown, over 30,000 SIUs are either regulated by approved local pretreatment programs or regulated directly by approval authorities (EPA or an approved State). Because over 60 percent of these industrial users are noncategorical SIUs, control authorities are regulating a greater percentage of industrial users not subject to national effluent regulations (i.e., categorical pretreatment standards).

As indicated in Table 3-1, most CIUs and SIUs (over 90 percent) are regulated under approved local pretreatment programs. Table 3-1 indicates that more than 800 CIUs and over 200 SIUs are regulated by approval authorities (approved State or EPA) in the absence of approved POTW pretreatment programs. However, the estimates in Table 3-1 for discharges to nonpretreatment POTWs are probably low because estimates of the number of CIUs and SIUs discharging to nonpretreatment POTWs were not available for several States.

<u>Estimates of Nonsignificant Industrial/Commercial Users</u>

Comprehensive national estimates are not available for nonsignificant industrial users regulated by local pretreatment programs. However, estimates of the number of nonsignificant industrial users were available for 437 out of the 530 POTWs contained in PASS. EPA estimates that more than 35,000 other industrial users are regulated by those 437 approved POTW pretreatment programs alone. This indicates that the total number of nonsignificant industrial users for this subset of POTW pretreatment programs is greater than the estimated total number of SIUs estimated for the universe of State and POTW pretreatment programs. However, characterization data regarding these nonsignificant industrial users are limited. Therefore, it is unclear whether these other industrial users classified as nonsignificant could be sources of toxic pollutants.

The Association of Metropolitan Sewerage Agencies (AMSA) recently provided estimates of the number of nonsignificant industrial users regulated by its members (AMSA, 1990). Based on its survey, 82 POTW control authorities regulated almost 45,000 nonsignificant industrial users. This total represented more than 80 percent of all regulated industrial users estimated by the survey. These two data sources suggest that there may be several hundred thousand nonsignificant industrial users nationally.

3.2.1.2 Estimates of Industrial and Commercial Flow Contributions

Analysis of the total contribution of flow from industrial and commercial users can indicate, in part, the potential quantities of toxic pollutants that could be discharged to

POTWs. If, for example, a large percentage of a POTW's total flow is from industrial and commercial sources, or if a POTW has a large number of industrial and commercial users, it is more likely that significant amounts of toxic pollutants are being received by the POTW. This section describes the contribution of flows to POTWs from industrial and commercial sources.

Data Sources

The primary source used to gather POTW and industrial flow data is the NEEDS '88 data base, which has flow data for over 90 percent of the POTWs. As discussed in Chapter 2, the NEEDS data base contains a variety of information regarding POTW operations. These data are used by EPA to determine construction costs for POTWs and to estimate costs for future municipal wastewater treatment needs. In the absence of flow data for a POTW in NEEDS, EPA used several data sources to estimate POTW flow data, including PASS (for 63 POTWs), PCS (1 POTW), and the NSSS (1 POTW). Flow data for POTWs that are not control authorities (i.e., POTWs whose industrial users are regulated by State control authorities or approval authorities) were derived from the NEEDS data base exclusively.

POTW Flow Estimates

Appendix A-2 presents the total design, total actual, and total industrial flow rates for each of the 1,994 POTWs that are part of local pretreatment programs and for which data were available. Each POTW with an approved pretreatment program is reflected in the "status" column of Appendix A-2 by "@". POTWs with a "c" in the "status" column are covered under the POTW's approved program with the same CANPDES number. Table 3-2 summarizes the distribution of industrial flows over the distribution of flow rates at POTWs with pretreatment programs (i.e., POTWs that are control authorities). Using the data given, it is estimated that over 3.6 billion gallons of industrial wastewater are discharged to these POTWs each day. Overall, this accounts for just over 15 percent of the total actual flow to POTWs; total actual POTW flow is estimated to be approximately 21 billion gallons per day. Industrial flows constitute less than 25 percent of the total flow for almost 70 percent of the POTW control authorities. However, for 108 POTW control authorities, all with total actual POTW flows of less than 50 mgd, industrial flows account for more than 50 percent of the total POTW flow.

Drawing upon information given in the NEEDS data base, EPA estimated that the discharge from POTWs that are not required to have local pretreatment programs (excluding

Table 3-2. Percent Industrial Flow by POTW Average Daily Flow Rate

POTW Average Daily Flow Rate (mgd)*		Percent Industrial Flow			
		0≤ - ≤25	25< - ≤50	50< - ≤75	75< - ≤100
0< - ≤0.5	Total Flow (mgd)	26.62	8.04	2.54	1.23
	Industrial Flow (mgd)	1.13	2.98	1.66	1.08
	Number of Control Authorities	100	27	7	4
0.5< - ≤1.0	Total Flow (mgd)	65.55	21.97	4.29	6.17
	Industrial Flow (mgd)	4.17	7.88	2.73	5.47
	Number of Control Authorities	84	28	6	7
1.0< - ≤5.0	Total Flow (mgd)	1,073.40	261.65	113.22	20.15
	Industrial Flow (mgd)	90.11	93.17	69.18	17.20
	Number of Control Authorities	397	108	40	10
5.0<- ≤10.0	Total Flow (mgd)	1,333.19	279.23	86.84	26.50
	Industrial Flow (mgd)	111.34	103.77	51.75	23.84
	Number of Control Authorities	187	40	12	4
10.0< - ≤25.0	Total Flow (mgd)	1,865.81	749.42	163.29	0.00
	Industrial Flow (mgd)	166.00	268.48	105.35	0.00
	Number of Control Authorities	123	46	10	0
25.0< - ≤50.0	Total Flow (mgd)	1,894.43	407.50	203.05	65.94
	Industrial Flow (mgd)	175.71	142.69	117.05	57.95
	Number of Control Authorities	55	12	6	2
50< - ≤100.0	Total Flow (mgd)	1,381.09	720.92	0.00	0.00
	Industrial Flow (mgd)	173.63	270.56	0.00	0.00
	Number of Control Authorities	19	10	0	0

Table 3-2. Percent Industrial Flow by POTW Average Daily Flow Rate (continued)

POTW Average Daily Flow Rate (mgd)*		Percent Industrial Flow 0≤ - ≤25	25< - ≤50	50< - ≤75	75< - ≤100
>100	Total Flow (mgd)	9,209.57	1,374.03	0.00	0.00
	Industrial Flow (mgd)	1,160.46	434.06	0.00	0.00
	Number of Control Authorities	31	6	0	0
No Data	Total Flow (mgd)	0.00			
	Industrial Flow (mgd)	0.00			
	Number of Control Authorities	53			

Total Flow = 21,365.64 mgd
Total Industrial Flow = 3,659.40 mgd
Total Number of Control Authorities = 1,434

Source: NEEDS '88, PCS, PASS, NSSS.

*A control authority may comprise more than one wastewater treatment plant or POTW. This table covers POTW control authorities and not POTWs where EPA or the State is the control authority.

POTWs in 403.10 [e] States), and for which data exist, is approximately 6 billion gallons per day.[5] The industrial/commercial contributions make up less than 10 percent of the total flow of POTWs that are not control authorities.

Table 3-3 summarizes the number of SIUs according to ranges of total average daily flow rates for POTW control authorities. As indicated, the average number of SIUs per control authority increases with increasing control authority flow rate. Seventy-four percent of all control authorities have total actual flow rates of 10 mgd or less and regulate an average of approximately 10 SIUs, including an average of 3 CIUs, or less.

3.2.2 Industrial and Commercial Sources

This subsection describes the toxic pollutants discharged to POTWs by industrial and commercial sources. The three primary data sources evaluated in this section are the DSS, TRIS, and ITD's 304(m) studies.

3.2.2.1 Industrial Categorization Scheme

The initial step in describing the toxic pollutants discharged by industrial and commercial sources was to organize these sources into specific categories to facilitate comparison among the various data sources. This subsection adopted the industrial categorization scheme used in the DSS (see Table 3-4). The DSS profiled discharge practices and presented data for 47 different industrial categories. The DSS categorization scheme was based on the grouping of industrial/commercial facilities with comparable wastewater characteristics. The benefit of using the DSS categorization scheme is that it allows direct comparison between new data collected for this report and the data given in the DSS.

Consent Decree Industrial Categories

The 47 industrial categories shown in Table 3-4 include the traditional Natural Resources Defense Council (NRDC) Consent Decree (or categorical) industries. Many of these categories correspond well with the industrial categories for which effluent limitations guidelines and standards have been developed or proposed. In some cases, Consent Decree

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5. It should be noted that this number represents data for only a portion of the universe of POTWs that are not required to have local pretreatment programs. The actual total flow from all such POTWs is larger.

Table 3-3. Distribution of POTW Control Authorities, POTWs, and Industrial Users by Average Daily Flow

Average Daily Flow Rate (mgd)	Number of POTW Control Authorities	Number of POTW Treatment Plants	Number of Categorical Industrial Users	Number of Noncategorical Significant Industrial Users	Total Number of Significant Users
0≤ - ≤0.5	138	153	115	182	297
0.5< - ≤1.0	125	132	131	280	411
1.0 <- ≤5.0	555	624	1,374	2,515	3,889
5.0< - ≤10.0	243	316	1,023	1,886	2,909
10.0< - ≤25.0	179	255	1,445	2,778	4,223
25.0< - ≤50.0	75	140	1,108	1,750	2,858
50.0<- ≤100.0	29	69	1,122	1,668	2,790
>100	37	242	4,434	5,963	10,397
No data	53	65	87	120	207
Total	1,434*	1,996*	10,839**	17,142**	27,981**

* Numbers of control authorities and treatment plants in this table are less than national totals because IU information is not available for all POTWs.

** Does not include CIUs/SIUs in State-run pretreatment programs (i.e., CIUs/SIUs in Alabama, Connecticut, Mississippi, Nebraska, and Vermont). Also does not include CIUs/SIUs for which EPA or an approved State is the control authority.

Source: NEEDS '88, PCS, PASS, NSSS.

Table 3-4. Industrial Categories as Profiled in the EPA Domestic Sewage Study

Adhesives and Sealants*
Battery Manufacturing*
Coal, Oil, Petroleum Products, and Refining*
Construction Industry (contract and special trade)
Cosmetics, Fragrances, Flavors, and Food Additives
Dye Manufacture and Formulation*
Electric Generating Power Plants and Electric Distribution Services
Electrical and Electronic Components*
Electroplating/Metal Finishing*
Equipment Manufacture and Assembly*
Explosives Manufacture*
Fertilizer Manufacture
Food and Food By-Products Processing
Gum and Wood Chemicals, Varnishes, Lacquers, and Related Oils*
Hazardous Waste Site Cleanup
Industrial and Commercial Laundries*
Ink Manufacture and Formulation*
Inorganic Chemicals Manufacturing*
Iron and Steel Manufacturing and Forming*
Laboratories and Hospitals
Leather Tanning and Finishing*
Miscellaneous Chemical Formulation
Motor Vehicle Services
Nonferrous Metals Forming*
Nonferrous Metals Manufacturing*
Organic Chemicals Manufacturing*
Paint Manufacture and Formulation*
Pesticides Formulation*
Pesticides Manufacturing*
Pharmaceutical Manufacturing*
Photographic Chemicals and Film Manufacturing*
Plastics Molding and Forming*
Plastics, Resins, and Synthetic Fibers Manufacturing*
Porcelain Enameling*
Printing and Publishing*
Pulp and Paper Mills*
Rubber Manufacture and Processing*
Service Related Industries (other than motor vehicle services)
Soap and Detergents, Cleaning Preparations, and Waxes Manufacture and Formulation
Stone, Clay, Glass, Concrete, and Other Mineral Products
Textile Mills*
Timber Products Processing*
Transportation Services
Waste Reclamation Services
Waste Treatment and Disposal Services
Wholesale and Retail Trade
Wood Furniture Manufacture and Refinishing

*Industrial category that falls within the scope of the NRDC Consent Decree.
Source: EPA (1986).

industrial categories were subdivided or combined for purposes of the DSS. Specifically, the modifications to the consent decree industrial categories include:

- Expanding the petroleum refining category to include production of coal and oil products and renaming the category coal, oil, petroleum products, and refining.
- Combining the coil coating category with the electroplating/metal finishing category because of the similarity of their processes.
- Combining the aluminum, copper, and nonferrous metals forming categories into one category entitled nonferrous metals forming.
- Dividing the metals molding and casting category into its ferrous and nonferrous subcategories. The nonferrous metals subcategories were included in the nonferrous metals forming category and the ferrous metals subcategories were included in the iron and steel manufacturing and forming category.
- Dividing the organic chemicals, plastics, and synthetic fibers category into three categories: dye manufacture and formulation; organic chemicals manufacturing; and plastics, resins, and synthetic fibers manufacturing categories.
- Including the photographic processing category in the service-related industries category.
- Moving the car wash subcategory from the auto and other laundries category to the motor vehicle services category and addressing laundries as a separate category entitled industrial and commercial laundries.
- Expanding the electroplating/metal finishing category to include other metal fabrication and metal products manufacturing processes.
- Expanding the leather tanning and finishing and pulp and paper categories to include processing of the finished product.

<u>Other Industrial Categories</u>

Table 3-4 includes 17 categories of smaller service-oriented industries that do not fall within the scope of the NRDC Consent Decree, either because they have emerged in importance since negotiation of the Consent Decree (e.g., waste reclamation services, waste treatment and disposal services) or because of their smaller size and service-related orientation (e.g., motor vehicle services, service-related industries, and laboratories and hospitals). As a result, most of these industrial categories have never been reviewed extensively for regulatory purposes until recently.

3.2.2.2 Domestic Sewage Study

This subsection summarizes the findings of the DSS as they relate to the types and sources of toxic pollutants discharged to POTWs. Loadings presented in the DSS were derived primarily from data collected by the EPA Office of Water Regulations and Standards, ITD, in support of the development of effluent limitations guidelines and standards. In addition, the EPA Office of Solid Waste Industry Studies Data Base (ISDB) provided discharge estimates for many nonpriority toxic pollutants discharged by the organic chemicals industry (i.e., dye manufacture and formulation, organic chemicals manufacturing, pesticides manufacturing, and plastics, resins, and synthetic fibers manufacturing).

Pollutant loadings were estimated in the DSS under three discharge scenarios:

- Raw Discharge—Represents loadings of pollutants in wastewater assuming no pretreatment is provided.
- Current Discharge—Represents loadings of pollutants in wastewater at "current" treatment levels. For most industrial categories, "current" levels of treatment represent levels present before promulgation of the categorical Pretreatment Standards for Existing Sources (PSES).
- After-PSES—Represents loadings of pollutants in wastewater at treatment levels required to meet proposed and promulgated categorical PSES limitations. This scenario assumed full compliance with categorical pretreatment standards by all industrial facilities. After-PSES loadings for those industrial categories for which PSES limitations have not been promulgated reflect current loadings for those industrial categories (i.e., some degree of treatment of raw loadings is provided).

Limitations of the Domestic Sewage Study

Although the DSS involved the most comprehensive evaluation of industrial and commercial discharges of toxic pollutants to POTWs to date, several limitations were associated with the study:

- The DSS examined 165 hazardous pollutants, of which only 67 were CWA priority pollutants. In part, these 165 hazardous pollutants were selected to represent those hazardous wastes most likely to be discharged to POTWs and those for which discharge data were most likely available. Therefore, not all toxic pollutants discharged to POTWs may have been identified or examined.
- Estimates of national loadings of toxic pollutants to POTWs were available only for Consent Decree industrial categories. This is primarily because most loadings were based on data collected by ITD in support of categorical standards development.
- Except for the organic chemicals industrial categories, discharge data needed to calculate loadings consisted primarily of priority pollutant data. Estimates of industrial loadings for several industrial categories were also based on older (i.e., pre-1980) data. The characteristic operations for industrial categories may have since changed.

Toxic Metal Pollutant Loadings From Consent Decree Industrial Categories

Of the 165 hazardous pollutants used to represent hazardous wastes discharged to POTWs, 13 toxic metal pollutants were identified as being discharged to POTWs by at least one of the DSS industrial categories shown in Table 3-4. Appendix A-3 lists the quantity of each toxic pollutant discharged under the raw loadings, current, and after-PSES scenarios for each DSS industrial category. Table 3-5 summarizes the total loadings of toxic metals and cyanide under the raw and after-PSES scenarios described previously for each Consent Decree industrial category.

Table 3-5 indicates that approximately 204 to 218 million pounds per year of toxic metal pollutants are discharged to POTWs under the raw discharge scenario. Raw loadings of toxic metal pollutants for the Consent Decree industries are estimated to be reduced by approximately 94 percent after implementation of PSES for the applicable industrial categories, assuming full compliance by all industries. This reduction results in annual PSES loadings for toxic metal pollutants of about 13 to 14 million pounds.

The electroplating/metal finishing industrial category is the major source of priority toxic metals under the after-PSES scenario. Other major sources under the after-PSES scenario include the industrial and commercial laundries;[6] coal, oil, and petroleum products and refining; organic chemicals manufacturing; and pulp and paper industrial categories.

Toxic Organic Pollutant Loadings From Consent Decree Industrial Categories

Of the 165 hazardous pollutants representing the hazardous wastes being discharged to POTWs, over 100 toxic organic pollutants were identified as being discharged to POTWs by at least one of the Consent Decree industrial categories. Table 3-5 identifies the total loadings of toxic organics under the raw and after-PSES discharge scenarios described above for each of the Consent Decree industrial categories. Between 82 and 254 million pounds per year are estimated to be discharged to POTWs under the raw discharge scenario from all the Consent Decree industrial categories.[7] It was estimated that these toxic organic pollutant raw loadings are reduced overall by approximately 47 to 80 percent after the implementation

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6. Note that PSES has not yet been promulgated for this category.
7. The range in estimates is attributable to differences in estimates between the Office of Water ITD and the Office of Solid Waste ISDB data bases, which are due to the difference in methodologies used to derive national estimates in each data base.

Table 3-5. Summary of Total Metals/Cyanide and Organics Discharged to POTWs From Consent Decree Industrial Categories

Industrial Category	Metals/Cyanide* Raw Loading (lbs/yr)	Metals/Cyanide* After PSES Loading (lbs/yr)	Organics Raw Loading (lbs/yr)	Organics After PSES Loading (lbs/yr)	Total Raw Loading (lbs/yr)	Total After PSES Loading (lbs/yr)
Adhesives & Sealants***	837,860	451,704	214,048	154,103	1,051,908	605,807
Battery Manufacturing	3,425,757	2,011	846	45	3,426,603	2,056
Coal, Oil, Petroleum Products & Refining	1,120,788	1,120,788	3,717,478	3,717,478	4,838,266	4,838,266
Dye Manufacturing & Formulation	(1,502,956)** 2,457,490	(1,441) 1,100	(26,088,943) 454,308	(299,624) 185	(27,591,899) 2,911,798	(301,065) 1,285
Electrical & Electronic Components	557,163	237,388	695,481	69,546	1,252,644	306,934
Electroplating & Metal Finishing	137,017,458	3,769,343	8,004,876	384,936	145,022,334	4,154,279
Equipment Manufacture & Assembly***	N/A	N/A	17,008,482	17,008,482	17,008,482	17,008,482
Explosives Manufacturing***	123	123	3	3	126	126
Gum & Wood Chemicals***	93,664	93,664	112,399	112,399	206,063	206,063
Industrial & Commercial Laundries***	2,895,075	2,606,575	2,168,700	2,168,700	5,063,775	4,775,275
Ink Manufacture & Formulation***	8,081	8,081	436	436	8,517	8,517
Inorganic Chemical Manufacturing	2,974,754	322,111	0	0	2,974,754	322,111
Iron & Steel Manufacturing & Forming	21,748,859	241,377	6,210,457	559,000	27,959,316	800,377
Leather Tanning & Finishing	11,288,088	867,241	462,644	362,044	11,750,732	1,229,285
Nonferrous Metals Forming	703,060	11,753	N/A	N/A	703,060	11,753
Nonferrous Metals Manufacturing	1,817,547	4,466	20,731	2,654	1,838,278	7,120
Organic Chemicals Manufacturing	(16,628,294) 2,843,790	(1,285,221) 15,557	(65,804,984) 13,376,441	(4,060,431) 13,978	(82,433,278) 16,220,231	(5,345,652) 29,535
Paint Manufacture & Formulation***	178,179	147,107	107,293	91,753	285,472	238,860
Pesticides Formulation	N/A	0	N/A	0	N/A	0

Table 3-5. Summary of Total Metals/Cyanide and Organics Discharged to POTWs From Consent Decree Industrial Categories (continued)

Industrial Category	Metals/Cyanide* Raw Loading (lbs/yr)	Metals/Cyanide* After PSES Loading (lbs/yr)	Organics Raw Loading (lbs/yr)	Organics After PSES Loading (lbs/yr)	Total Raw Loading (lbs/yr)	Total After PSES Loading (lbs/yr)
Pesticides Manufacture	(628,205) 126,982	(4,951) 143	(63,030,602) 6,288,012	(1,176,340) 1,008	(63,658,807) 6,414,994	(1,181,291) 1,151
Pharmaceutical Manufacturing	10,152,861	171,132	16,244,875	16,244,875	26,397,736	16,416,007
Photographic Chemicals & Film Manufacturing***	479,430	207,263	10,408	9,783	489,838	217,046
Plastics Molding & Forming	23,813	23,813	41,464	41,464	65,277	65,277
Plastics, Resins & Synthetic Fibers Manufacturing	(301,888) 217,768	(21,643) 6,503	(41,230,845) 4,849,688	(1,928,560) 2,086	(41,532,733) 5,067,456	(1,950,203) 8,589
Porcelain Enameling	575,951	63,803	1,236	1,037	577,187	64,840
Printing & Publishing***	797,488	760,445	37,944	35,526	835,432	795,971
Pulp & Paper Mills	921,919	919,743	1,776,312	1,652,067	2,698,231	2,571,810
Rubber Manufacturing***	458,375	458,375	33,275	33,275	491,650	491,650
Textile Mills***	551,373	551,373	816,553	816,553	1,367,926	1,367,926
Timber Products Processing***	36,486	15,920	74,501	23,528	110,987	39,448
	(217,725,495) 204,310,182	(14,368,855) 13,078,902	(253,915,816) 82,728,891	(50,954,642) 43,506,944	(471,641,311) 287,039,073	(65,323,497) 56,585,846

* Metals/cyanide totals include DSS estimates for copper and zinc, which were not of the 165 hazardous constituents evaluated for the DSS. Loading estimates were provided, however, in the report appendices.

** Numbers in parentheses represent DSS estimates using the Office of Solid Waste ISDB data base; numbers without parentheses represent DSS estimates using the Office of Water ITD estimates.

*** The after PSES loadings for this industrial category for which PSES limitations have not been promulgated actually reflect current loadings (i.e., some degree of treatment of raw loading is provided).

Source: EPA (1986b).

of categorical pretreatment standards by applicable industrial categories. The total toxic organic pollutant loadings after PSES were estimated between 43 and 51 million pounds per year (19,000-23,000 metric tons per year).

As shown in Table 3-5, several industrial categories contribute significant quantities of toxic organics to POTWs under the raw discharge scenario. Data from ITD indicate that these categories include equipment manufacture and assembly; organic chemicals manufacture; pharmaceutical manufacture; electroplating/metal finishing; pesticides; and plastics, resins, and synthetic fibers manufacturing. The source profile for loadings of toxic organic pollutants changes significantly after PSES implementation to exclude those industrial categories regulated under categorical standards for priority organics. After PSES implementation, major sources of toxic organic pollutants include equipment manufacture; pharmaceutical manufacture; coal, oil, petroleum products and refining; and industrial and commercial laundries.

Types of Toxic Pollutants Discharged From Consent Decree Industrial Categories

Of the 67 CWA priority pollutants for which data were available in the DSS (as well as copper and zinc, which were not included among the 165 DSS hazardous pollutants),[8] Table 3-6 presents loadings under the raw loading, current, and after-PSES scenarios for the most prevalent pollutants discharged to POTWs by Consent Decree industries. As shown, toxic metals and volatile organics tend to dominate total loadings under the raw discharge scenario. However, the loadings of metals under the current and after-PSES scenarios drop in ranking, probably because most metals are regulated by categorical standards. On the other hand, the loadings for most of the volatile organics remain high because categorical standards for organics are not yet fully in place.

As for the nonpriority toxic pollutants, the DSS estimated loadings for only the four organic chemicals-related industries. The major nonpriority toxic pollutants identified include methanol, xylene, formaldehyde, acetone, furfural, aniline, tetrahydrofuran, methyl isobutyl ketone, formic acid, and cyclohexanone.

8. Although copper and zinc were not defined as hazardous pollutants in the DSS, and therefore not evaluated as part of the DSS, loading estimates were provided in the DSS report appendices.

Table 3-6. Top 20 Toxic Priority Pollutants With the Highest Loadings for the Consent Decree Industrial Categories Within the Scope of the NRDC Consent Decree

Pollutant	Raw Loading (lbs/yr)	Percent of Total
Chromium & Compounds	66,426,800	22
Zinc & Compounds	40,669,200	13
Nickel & Compounds	31,946,200	10
Cyanide	31,732,800	10
Phenol	28,604,400	9
Copper & Compounds	27,392,200	9
Methylene Chloride	12,498,200	4
1,1,1 - Trichloroethane	11,162,800	4
Lead & Compounds	11,004,400	4
Toluene	9,035,400	3
Benzene	5,104,000	2
Ethyl Benzene	4,925,800	2
Trichloroethylene	4,864,200	2
Tetrachloroethylene	4,393,400	1
Chloroform	4,283,400	1
Bis(2-ethylhexyl) Phthalate	2,888,600	1
2,4-Dimethyl Phenol	2,547,600	1
Naphthalene	2,523,400	1
Silver & Compounds	1,982,200	1
Arsenic & Compounds	1,766,600	1
Total	**305,751,600**	**100**

Pollutant	Current (prior to PSES) Loading (lbs/yr)	Percent of Total
Phenol	23,625,800	22
Methylene Chloride	12,056,000	11
1,1,1-Trichloroethane	8,635,000	8
Toluene	7,959,600	7
Zinc & Compounds	5,570,400	5
Ethyl Benzene	4,793,800	5
Chromium & Compounds	4,527,600	4
Copper & Compounds	4,149,200	4
Chloroform	4,180,000	4
Benzene	4,089,800	4
Trichloroethylene	3,795,000	4
Lead & Compounds	3,438,600	3
Tetrachloroethylene	3,313,200	3
Nickel & Compounds	3,194,400	3
Cyanide	3,159,200	3
Bis (2-ethyhexyl) Phthalate	2,655,400	3
Naphthalene	2,017,400	2
2,4-Dimethyl Phenol	1,735,800	2
Silver & Compounds	1,647,800	2
Acrolein	1,645,600	2
Total	**106,189,600**	**100**

Table 3-6. Top 20 Toxic Priority Pollutants With the Highest Loadings for the Consent Decree Industrial Categories Within the Scope of the NRDC Consent Decree (continued)

Pollutant	After PSES Loading (lbs/yr)	Percent of Total
Methylene Chloride	11,877,800	20
1,1,1-Trichloroethane	8,632,800	15
Toluene	4,426,400	7
Copper & Compounds	4,015,000	7
Trichloroethylene	3,784,000	6
Tetrachloroethylene	3,102,000	5
Ethyl Benzene	2,615,800	4
Chromium & Compounds	2,512,400	4
Chloroform	2,512,400	4
Antimony & Compounds	2,169,200	4
Phenol	2,043,800	3
Zinc & Compounds	1,900,800	3
Nickel & Compounds	1,738,000	3
Butyl Benzene Phthalate	1,474,000	2
Cyanide	1,388,200	2
Benzene	1,240,800	2
Bis (2-ethyhexyl) Phthalate	1,170,400	2
Lead & Compounds	1,141,800	2
Silver & Compounds	792,000	1
2,4-Dimethyl Phenol	514,800	1
Total	**59,052,400**	**100**

Source: EPA (1986b).

Other Industrial Categories

The DSS relied on a variety of data sources to estimate the potential for discharge of toxic pollutants by 17 non-Consent Decree industries. Appendix A-4 lists the toxic pollutants identified in the DSS as being discharged to POTWs by these other industrial categories. Table 3-7 estimates the number of facilities in each category and a summary of the types of toxic pollutants identified for each category. Unfortunately, the data do not differentiate facilities that discharge to POTWs (indirect dischargers) from those that discharge to surface waters (direct discharges), and the table therefore includes both direct and indirect dischargers.

At least 50 toxic pollutants were identified in the DSS as being discharged from the following industrial categories: cosmetics, fragrances, flavors, and food additives (57 toxic pollutants); food and food by-products (53 toxic pollutants); transportation services (56 toxic pollutants); and waste treatment and disposal (50 toxic pollutants). The priority pollutant toluene was identified in discharges from each of the 17 industrial categories. Other toxic pollutants identified in at least 10 of the 17 industrial categories include:

- 1,1,1-Trichloroethane*
- 1,2-Dichloroethane*
- Acetone
- Arsenic*
- Benzene*
- Carbon Tetrachloride*
- Chloroform*
- Chromium*
- Cyanide*
- Formaldehyde
- Lead*
- Mercury*
- Methanol
- Methyl Ethyl Ketone
- Methylene Chloride*
- Phenol*
- Xylene.

* CWA Priority Pollutant

3.2.2.3 Toxic Release Inventory System

As mentioned previously, TRIS was established under Section 313 of the 1986 Emergency Planning and Community Right-to-Know Act. Starting in 1987, the Act has required certain industrial facilities to submit annually to the State and EPA a report regarding releases to the environment of more than 300 listed toxic chemicals and chemical categories. The specific information that pertains to this Report to Congress includes the amounts and types of toxic pollutants discharged from industries to POTWs. There are

Table 3-7. Summary of the Number of Toxic Pollutants Associated With Direct and Indirect Discharges From Non-Consent Decree Industrial Categories

Category	Estimated Number of Facilities*	Organic Pollutants		Metals/Inorganics		Total
		Priority	Nonpriority	Priority	Nonpriority	
Construction	1,076	1	4	1	0	6
Cosmetics, Fragrances, Flavors	53	14	32	11	0	57
Electrical Plants and Services	3,150	3	0	5	0	8
Fertilizer Manufacture	1,600	11	28	10	0	49
Food and Food By-Products	26,000	11	35	7	0	53
Hazardous Waste Cleanup	200	8	1	6	0	15
Laboratories and Hospitals	2,926	8	10	11	0	29
Miscellaneous Chemical Formulation	80	6	17	2	0	25
Motor Vehicle Services	3,587	1	3	9	0	13
Service Related Industry	23,395	4	5	11	0	20
Soaps and Detergents	209	11	24	4	0	39
Stone and Mineral Products	7	6	17	4	0	27
Transportation Services	582	17	38	1	0	56
Waste Reclamation	9,450	6	10	8	0	24
Waste Treatment and Disposal	207,523	13	34	3	0	50
Wholesale and Retail Trade	366	3	1	11	0	15
Wood Furniture Manufacturing and Refinishing	366	11	30	1	0	42

*Data provided no distinction between indirect or direct dischargers.

Source: EPA (1986b).

several limitations to using the TRIS data base to describe toxic pollutant discharges to POTWs:

- The data set is limited to <u>manufacturing</u> facilities only. Therefore, many non-manufacturing industries (e.g., industrial laundries) that may also release significant quantities of pollutants to POTWs are not addressed.
- Only <u>manufacturing facilities that handle large quantities</u> of chemicals (i.e., manufactured more than 50,000 pounds in 1988 or 25,000 pounds in 1989 and subsequent years or use more than 10,000 pounds) are required to report. Therefore, facilities handling small quantities of toxic pollutants, such as many electroplaters and metal finishers, are not addressed.
- Facilities are only required to report <u>estimates</u> of the quantities of toxic pollutants released, and for small releases need only report in ranges. Therefore, the <u>actual</u> quantities discharged to POTWs may differ from the quantities reported.
- Only facilities with 10 or more full-time employees are required to report. Again, this may not include many small, industrial/commercial establishments (e.g., printing and publishing, industrial laundries, and electroplaters/metal finishers).

TRIS data reported for 1988 were extracted for use in this report. Release data were organized by facility into the 47 industrial categories discussed in Subsection 3.2.2.1. The basis for placing a facility into 1 of the 47 categories was the facility's primary Standard Industrial Classification (SIC) code. Of the 5,748 facilities that reported releases to POTWs in TRIS, 473 could not be categorized because of the absence of any SIC code for the facility. According to the 1988 TRIS data, 5,748 facilities discharged over 680 million pounds of toxic pollutants to over 1,700 POTWs in 1988 (see Table 3-8). Table 3-8 provides a summary of data reported in TRIS for 38 industrial categories. TRIS did not contain data for all 47 of the industrial categories that were discussed in Subsection 3.2.2.1. Appendix A-3 presents the quantities of each toxic pollutant identified for each industrial category.

According to Table 3-8, TRIS reported the largest volumes of wastes being released to POTWs from fertilizer manufacturers (143 million pounds), organic chemicals manufacturers (92 million pounds), dye manufacture and formulation (68 million pounds), pulp and paper mills (46 million pounds), food and food by-product processing (38 million pounds), and pharmaceutical manufacturing (28 million pounds). Generally, the Consent Decree industrial

Table 3-8. Summary of Data Reported in TRIS by Industrial Category for 1988

Industrial Category	Number of Facilities Reporting	Number of POTWs Receiving*	Number of Pounds Discharged to POTWs**
Adhesives and Sealants	73	74	196,138
Battery Manufacturing	83	76	884,195
Coal, Oil, Petroleum Products and Refining	69	60	11,097,249
Cosmetics, Flavors, and Food Additives	34	30	1,184,756
Dye Manufacturing and Formulation	72	51	68,278,270
Electrical and Electronic Components	339	296	14,294,031
Electroplating/Metal Finishing	859	684	20,133,640
Equipment Manufacturing and Assembly	1,145	969	27,063,119
Explosives Manufacturing	4	4	75,654
Fertilizer Manufacturing	101	98	143,490,850
Food and Food By-Product Processing	506	473	38,254,618
Gum, Wood Chemicals, Varnishes and Lacquer	3	3	333,351
Ink Manufacturing and Formulation	15	15	353,961
Inorganic Chemicals Manufacturing	21	20	4,791,581
Iron and Steel Manufacturing and Forming	146	151	17,455,097
Laboratories and Hospitals	2	2	114,532
Leather Tanning and Finishing	40	37	12,505,998
Miscellaneous Chemical Formulation	132	122	10,172,642
Motor Vehicle Services	1	1	21,000
Nonferrous Metals Forming	127	125	3,212,220
Nonferrous Metals Manufacturing	86	83	1,587,918
Organic Chemicals Manufacturing	173	149	92,815,513
Paint Manufacturing	118	114	4,221,248
Pesticide Manufacturing and Formulation***	21	22	663,684
Pharmaceutical Manufacturing	108	95	28,419,701
Plastics, Resins, and Synthetic Fibers	165	153	9,132,905
Plastics Molding and Forming	64	62	971,842
Printing and Publishing	62	57	508,144
Pulp and Paper	52	52	46,675,179
Rubber Manufacturing	92	88	630,015
Service Related Industry (Non-Motor Vehicle)	2	2	7,968
Soap and Detergents Manufacturing	226	210	4,231,307

Table 3-8. Summary of Data Reported in TRIS by Industrial Category for 1988 (continued)

Industrial Category	Number of Facilities Reporting	Number of POTWs Receiving*	Number of Pounds Discharged to POTWs**
Stone, Clay, Glass, and Concrete	118	120	2,754,495
Textile Mills	125	107	10,783,040
Timber Products Processing	51	49	72,748
Transportation Services	1	1	410
Wholesale and Retail Trade	6	7	27,220
Wood Furniture Manufacturing and Refinishing	33	31	227,473
Miscellaneous****	473	444	103,143,000
Totals	**5,748**	**NA**	**680,786,712**

NA - Not applicable.

* Due to the fact that a POTW may receive wastes from facilities in more than one industrial category, a total number for this column would result in double counting. The actual number of POTWs identified in TRIS is 1,717. Also note that for certain industrial categories (e.g., adhesives and sealants), the number of POTWs receiving wastes is greater than the number of facilities reporting. This occurs because several facilities reported discharges to more than one POTW.

** All discharges are reported in pounds per year.

*** This includes both Pesticides Manufacturing and Pesticide Formulating Categories.

**** This category includes all facilities reported in TRIS that could not be categorized because of the absence of an SIC code.

Source: TRIS (1988).

categories report greater quantities of pollutants being released to POTWs than do the non-Consent Decree industries.[9]

More than 200 toxic pollutants were reported to be discharged to POTWs in quantities ranging from 187 billion pounds per year (ammonium sulfate) to 2 pounds per year (tetrachlorvinphos). In an effort to determine which of the toxic pollutants being reported in TRIS could be considered significant from a national perspective, the toxic pollutants released by 10 or more facilities were ranked according to the total amount discharged (see Table 3-9).[10]

Because pollutants differ in the potential severity of their effects (for example, a pound of zinc discharged to a POTW will have a lesser effect than a pound of benzene), EPA took a further step to assess the relative importance of the loadings of each pollutant listed in Table 3-9. EPA normalized or standardized the total numbers of pounds of each priority pollutant reported in TRIS in terms of its toxicity to aquatic life and human health. To do this, EPA computed toxic weighting factors by multiplying the inverse of applicable EPA water quality criteria (i.e., chronic freshwater aquatic and human health criteria) for each pollutant by a standard.[11] Copper was selected as the standard pollutant for developing weighting factors since it is a toxic metal pollutant and is commonly detected and removed from industrial effluents.[12] The resultant toxic weights were then multiplied by the number of pounds reported in TRIS, resulting in the number of toxic pound equivalents for the pollutant.

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9. The larger quantities being reported by Consent Decree industrial categories are expected because the Consent Decree industrial categories cover most of the manufacturing facilities required to report.

10. It should be noted that even a small quantity of a toxic pollutant may be significant for the particular POTW that receives the pollutant. However, for purposes of this report, nationally significant toxic pollutants include those pollutants discharged in large quantities and by many facilities. Toxic pollutants were not considered nationally significant if they were discharged by fewer than 10 facilities. There were 113 toxic pollutants for which fewer than 10 facilities reported discharges to POTWs.

11. Since the development of toxic weights is dependent on the use of EPA water quality criteria, this analysis is limited to only those priority pollutants reported in TRIS for which chemical-specific water quality criteria are available.

12. This same procedure is used by the EPA Office of Water Regulations and Standards as part of its cost-effectiveness analyses of proposed regulatory options for effluent guidelines and categorical pretreatment standards.

Table 3-9. Summary of Toxic Pollutants Reported as Being Released by 10 or More Facilities to POTWs in TRIS for 1988

Pollutant	Pounds to POTWs	Total Facilities Reporting Release	Minimum Discharge (lbs/yr)	Maximum Discharge (lbs/yr)
Ammonium Sulfate (solution)	187,006,695	155	11	52,345,936
Methanol	111,590,690	490	1	7,922,060
Barium and Compounds	100,943,818	183	1	100,000,000
Sulfuric Acid	61,481,639	951	1	9,440,000
Hydrochloric Acid	36,213,709	561	1	14,000,000
Nitric Acid	23,552,392	415	1	15,000,000
Ammonia	22,319,809	518	2	1,411,600
Ethylene Glycol	16,322,723	472	1	2,828,400
Acetone	14,170,522	330	1	2,400,000
Phosphoric Acid	13,875,279	649	1	455,130
Glycol Ethers	8,532,603	518	1	1,410,000
Ammonium Nitrate (solution)	7,595,942	23	250	1,713,000
Phenol*	5,723,727	167	1	1,412,000
Aluminum Oxide	5,601,977	224	1	2,500,000
Formaldehyde	4,632,348	239	1	1,291,582
N-Butyl Alcohol	4,511,588	133	5	1,300,000
Xylene (mixed isomers)	4,158,305	370	1	720,000
Toluene*	3,545,408	464	1	560,931
Chlorine	3,125,880	216	1	332,000
Dichloromethane	2,585,199	257	1	1,100,000
Zinc (fume or dust)*	2,426,892	419	1	685,000
Vinyl Acetate	2,319,733	45	1	2,146,712
Chromium and Compounds	2,102,584	658	1	520,000
Aniline	2,098,710	24	3	563,292
Manganese and Compounds	2,010,573	278	1	1,646,000
Diethanolamine	1,899,977	116	2	630,000
Methyl Isobutyl Ketone	1,508,780	95	1	400,000
1,2-Dichloroethane*	1,477,242	21	1	1,300,000
Biphenyl	1,428,510	57	2	165,971
Chloroform*	1,226,573	36	1	358,530
Cyanide Compounds*	1,148,625	216	1	845,000
Benzene*	1,103,015	80	1	440,000

Table 3-9. Summary of Toxic Pollutants Reported as Being Released by 10 or More Facilities to POTWs in TRIS for 1988 (continued)

Pollutant	Pounds to POTWs	Total Facilities Reporting Release	Minimum Discharge (lbs/yr)	Maximum Discharge (lbs/yr)
Acrylonitrile*	955,741	29	2	488,139
Methyl Ethyl Ketone	932,817	172	1	296,000
Nickel and Compounds	885,281	587	1	417,000
Naphthalene*	772,468	81	1	610,000
Hydrogen Fluoride	711,889	75	1	187,200
2-Methoxyethanol	662,102	17	1	483,000
Acetonitrile	594,769	21	3	180,000
Tetrachloroethylene*	586,638	87	1	103,574
Chlorobenzene*	578,774	15	1	200,000
Maleic Anhydride	556,373	18	2	550,000
Hydroquinone	510,560	24	3	366,000
Dimethyl Phthalate	508,571	10	250	490,000
Ethylbenzene*	507,325	115	1	150,000
1,2,4-Trimethylbenzene	496,817	27	2	390,000
Styrene	471,291	85	1	180,204
Copper Compounds*	707,495	330	1	96,243
Propylene Oxide	407,276	26	18	197,138
Cresol (mixed isomers)*	357,992	21	1	250,000
Ethylene Oxide	343,298	44	2	78,204
1,1,1-Trichloroethane*	295,719	408	1	27,170
Pyridine	275,083	11	44	129,648
1,2,4-Trichlorobenzene*	261,676	28	4	59,922
Catechol	245,399	10	1,000	71,000
Lead and Compounds*	209,468	454	1	58,178
Acetaldehyde	206,050	12	71	82,830
Cumene	203,279	16	1	150,000
2-Ethoxyethanol	196,286	25	1	72,100
Methyl Methacrylate	191,578	53	7	35,000
Di(2-Ethylhexyl) Phthalate	168,491	31	1	140,000
Carbon Disulfide	159,369	15	57	70,000
Cyclohexane	140,917	30	1	12,000
Antimony and Compounds*	107,567	91	1	15,701

Table 3-9. Summary of Toxic Pollutants Reported as Being Released by 10 or More Facilities to POTWs in TRIS for 1988 (continued)

Pollutant	Pounds to POTWs	Total Facilities Reporting Release	Minimum Discharge (lbs/yr)	Maximum Discharge (lbs/yr)
Freon 113	104,913	76	1	35,061
Trichloroethylene*	79,258	114	1	39,797
Epichlorohydrin	73,385	20	4	65,000
1,2-Dichlorobenzene*	64,118	14	13	28,404
Chloromethane*	53,973	18	1	37,975
Phthalic Anhydride	53,441	23	4	19,000
Dibenzofuran	47,726	26	1	44,273
Butyl Benzyl Phthalate*	44,235	29	2	13,000
O-Xylene	44,023	11	1	33,689
Bis(2-Ethylhexyl) Adipate	42,569	11	2	17,000
Benzyl Chloride	41,553	17	19	28,700
Sec-Butyl Alcohol	41,108	12	250	13,300
Diethyl Phthalate*	37,350	12	1	16,812
Cobalt and Compounds	36,784	74	8	7,573
Dibutyl Phthalate*	36,770	36	1	6,886
Butyl Acrylate	34,615	52	1	10,000
4,4'-Isopropylidenediphenol	31,135	11	35	18,000
Ethyl Acrylate	27,657	33	1	6,500
Acrylic Acid	23,187	34	1	5,800
Aluminum (Fume or Dust)	18,324	45	3	3,900
Anthracene*	20,432	34	1	14,736
Cadmium and Compounds*	20,635	82	1	1,800
Decabromodiphenyl Oxide	19,090	10	5	8,590
Methyl Acrylate	14,886	16	1	11,000
Acrylamide	13,493	23	4	6,300
Methyl Tert Butyl Ether	7,713	10	38	4,035
Silver and Compounds*	8,906	44	1	770
Pentachlorophenol*	4,728	17	2	2,100
Arsenic Compounds*	3,126	16	1	750

*Clean Water Act Priority Pollutant

Source: TRIS (1988)

The results of the toxic weighting analysis for the priority pollutants reported in TRIS are shown in Table 3-10. As shown in Table 3-10, acrylonitrile has the highest toxic pound equivalents of all the priority pollutants reported in TRIS. Other priority pollutants with high toxic pound equivalents are chloroform, benzene, 1, 2-dichloroethane, and arsenic.

Although a pollutant may be discharged in large quantities, it may not be significant nationally if only several facilities discharge the pollutant. Further analysis of the TRIS data reveals that the total amounts of several pollutants discharged to POTWs were skewed by the discharge from a single facility. Specifically, there are 79 toxic pollutants for which 75 percent or more of the total amount reported as discharged is due to the discharge from one facility.[13] In an attempt to account for skewed data, the amount attributed to facilities that discharged 75 percent or more of the total for a pollutant was subtracted from the total. The associated total number of facilities discharging each pollutant was also adjusted to account for the loss of one facility. The resulting adjusted total pounds discharged and number of facilities discharging were then used to rank the toxic pollutants to account for both the amount of pollutant discharged and the number of facilities reporting its discharge to POTWs. Specifically, each pollutant was ranked based on its relative proportion to the maximum adjusted total pounds discharged for a pollutant and its relative proportion to the maximum adjusted total number of facilities for a pollutant. These relative proportions were then added together to arrive at an overall ranking for each pollutant in TRIS. Appendix A-5 displays the results of these rankings.

Using the ranking and adjustment discussed above, Table 3-11 presents the top 40 pollutants being discharged to POTWs as reported in TRIS. As noted, sulfuric acid was reported to be the pollutant discharged in the highest amount and by the most facilities.

The most significant nonpriority toxic organic pollutants reported in Table 3-11 include methanol, ethylene glycol, acetone, formaldehyde, methyl ethyl ketone, butanol, diethanolamine, methyl isobutyl ketone, and styrene. Two nonpriority metals, manganese and barium, were also ranked in the top 40 pollutants reported. The remainder of the top 40 toxic pollutants reported in TRIS consisted primarily of nonconventional pollutants (e.g.,

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13. For purposes of this analysis, if a single facility reported 75 percent or more of the total amount for a given pollutant, that pollutant loading was not considered nationally significant.

Table 3-10. Summary of Toxic Pound Equivalents for the Priority Pollutants Reported As Being Released to POTWs in TRIS for 1988*

CWA Priority Pollutant	Pounds Released to POTWs as Reported in TRIS**	Aquatic Chronic Water Quality Criteria*** (µg/l)	Human Health Water Quality Criteria*** (µg/l)	Toxic Weighing Factor	Toxic Pound Equivalent
1,1,1-Trichloroethane	295,719	--	18,400	0.00065	192
1,2,4-Trichlorobenzene	261,676	50	488	0.26459	69,237
1,2-Dichlorobenzene	64,118	763	400	0.04573	2,932
1,2-Dichloroethane	1,477,242	20,000	0.94	12.76656	18,859,299
Acrylonitrile	955,741	2,600	0.058	206.90117	197,743,931
Antimony and Compounds	107,567	1,600	146	0.08969	9,648
Arsenic and Compounds	5,051		0.0022	5,454.54545	27,550,909
Benzene	1,103,015	--	0.66	18.18182	20,054,820
Cadmium and Compounds	20,365	1.1	10	12.10909	246,602
Chlorobenzene	578,774	50	488	0.26459	153,138
Chloroform	1,226,573	1,240	0.19	63.16757	77,479,636
Chromium and Compounds	2,102,584	11	50	1.33091	2,798,350
Copper and Compounds	707,495	12	--	1.00000	707,495
Cyanide Compounds	1,148,625	5.2	200	2.36769	2,719,588
Dibutyl Phthalate	36,770	--	3,500	0.00343	126
Diethyl Phthalate	37,350	--	350,000	0.00003	1
Ethylbenzene	507,325	--	1,400	0.00857	4,348
Lead and Compounds	209,468	3.2	50	3.99000	835,777
Naphthalene	772,468	620	--	0.01935	14,947
Nickel and Compounds	885,281	160	13.4	0.97052	859,183
Pentachlorophenol	4,728	13	1,010	0.93496	4,420
Phenol	5,723,727	2,560	3,500	0.00812	46,477
Silver and Compounds	8,906	0.12	50	100.24000	892,737
Tetrachloroethylene	586,638	840	0.8	15.01429	8,807,953
Toluene	3,545,408	--	14,300	0.00084	2,978
Trichloroethylene	79,258	21,900	2.7	4.44499	352,301
Zinc (Fume or Dust)	2,426,902	110	--	0.10909	264,751

N/A - Not Applicable; water quality criteria not available for this specific pollutant.

* This analysis is limited to priority pollutants reported in TRIS for which chemical-specific water quality criteria are available.

** Source: EPA Toxics Release Inventory System (1988)

*** Source: EPA Water Quality Critria (EPA 1986)

Table 3-11. Relative Ranking of Pollutants Reported as Directed to POTWs in TRIS

Rank	Pollutants Ranked by Number of Facilities Discharging and by Total Discharged	Rank	Pollutants Ranked by Number of Facilities Discharging and by Total Discharged
1	Sulfuric Acid	21	Formaldehyde
2	Ammonium Sulfate (solution)	22	Aluminum Oxide
3	Methanol	23	Chlorine
4	Copper and Compounds*	24	Cyanide Compounds*
5	Zinc and Compounds*	25	Barium and Compounds
6	Hydrochloric Acid	26	Phenol*
7	Phosphoric Acid	27	Methyl Ethyl Ketone
8	Chromium and Compounds*	28	N-Butyl Alcohol
9	Ammonia	29	Diethanolamine
10	Nickel and Compounds*	30	Ethylbenzene*
11	Glycol Ethers	31	Trichloroethylene*
12	Ethylene Glycol	32	Methyl Isobutyl Ketone
13	Nitric Acid	33	Antimony and Compounds*
14	Toluene*	34	Tetrachloroethylene*
15	Lead and Compounds*	35	Styrene
16	1,1,1-Trichloroethane*	36	Benzene*
17	Acetone	37	Cadmium and Compounds*
18	Xylene (mixed isomers)	38	Naphthalene*
19	Manganese and Compounds	39	Hydrogen Fluoride
20	Dichloromethane*	40	Freon 13

* CWA priority pollutant.

Source: TRIS (1988).

sulfuric acid, hydrochloric acid, nitric acid) that were reported to be released to POTWs in significant quantities and that could pose more of a collection system problem (e.g., corrosion) than a toxic effect in a POTW treatment plant. Still others (e.g., ammonium sulfate, ammonium nitrate) are commonly used as water treatment chemicals.

Generally, loadings for many toxic pollutants reported in TRIS as being discharged to POTWs were higher than the loadings estimated in the DSS. Table 3-12 compares, by industrial category, TRIS data to DSS data for the Consent Decree industrial categories[14] and only for the 165 pollutants examined by the DSS (as well as copper and zinc). Appendix A-3 presents a detailed comparison by pollutant and industrial category. As shown in the table, reported TRIS estimates for eight of the industrial categories under the raw loadings scenarios are higher than those provided in the DSS. However, for almost all industrial categories, the TRIS estimates exceed the after-PSES DSS estimates. Although this would be expected since most of the DSS estimates were based primarily on priority pollutants, TRIS estimates also exceed those DSS estimates for the organic chemicals manufacturing industrial categories, where estimates of nonpriority pollutants were available.

The discrepancy between the TRIS and DSS loadings is most likely due to the differences in the methods used to derive the loadings. The TRIS loadings represent the number of pounds of pollutants discharged to POTWs as reported to EPA for releases to POTWs in 1988. The DSS loadings represent the number of pounds of pollutants discharged to POTWs as estimated by EPA based on representative industrial category pre-1986 data scaled up to derive national estimates. It should also be noted that most of the TRIS estimates were based on a smaller number of facilities than the number of facilities used to estimate the pollutant loadings in DSS. This is partially because only the larger manufacturing facilities were required to report under TRIS. Therefore, precise comparison of TRIS and DSS is impossible. Examination of the average total pounds per year discharged to POTWs by a facility also shows that TRIS estimates almost always exceed the after-PSES estimates given by DSS; TRIS average per facility estimates exceed DSS raw loadings for almost 50 percent of the industrial categories.

14. DSS did not provide quantitative estimates for non-Consent Decree industrial categories.

Table 3-12. Comparison of Quantities of DSS Toxic Pollutants Released to POTWs as Reported in TRIS and DSS

Industrial Category	TRIS Estimates*			DSS Estimates				
	Total Reported As Discharged (lbs/yr)	Number of Facilities	Average Per Facility (lbs/yr)	Raw Loadings (lbs/yr)	After PSES Loadings (lbs/yr)	Number of Facilities	Average Per Facility (Raw) (lbs/yr)	Average Per Facility (After PSES) (lbs/yr)
Adhesives and Sealants	128,768	73	1,764	1,051,908	605,807	298	3,530	2,033
Battery Manufacturing	24,262	83	292	3,426,603	2,056	149	22,997	14
Coal, Oil, and Petroleum Refining	4,686,811	69	67,925	4,838,266	4,838,266	45	107,517	107,517
Dye Manufacture and Formulation	21,678,727	72	301,093	(27,591,899)** 2,911,798	(301,065) 1,285	(47) 47	587,062 61,953	(6,406) 27
Electrical and Electronic Components	1,070,085	339	3,157	1,252,644	306,934	270	4,639	1,137
Electroplating/Metal Finishing	893,236	859	1,040	145,022,334	4,154,279	10,561	13,732	393
Equipment Manufacture and Assembly	5,307,168	1,145	4,635	17,008,482	17,008,482	ND		
Explosives Manufacture	311	4	78	126	126	4	32	32
Gum and Wood Chemicals and Related Oils	196,305	3	65,435	206,063	206,063	10	20,606	20,606
Industrial and Commercial Laundries	ND	ND		5,063,775	4,775,275	68,635	74	70
Ink Manufacture and Formulation	21,116	15	1,408	8,517	8,517	223	38	38
Inorganic Chemicals Manufacturing	76,015	21	3,620	2,974,754	322,111	31	95,960	10,391
Iron and Steel Manufacturing and Forming	1,670,871	146	11,444	27,959,316	801,277	162	172,588	4,946
Leather Tanning and Finishing	656,416	40	16,410	11,750,732	1,229,285	141	83,339	8,718
Nonferrous Metals Forming	522,029	127	4,110	703,060	11,753	228	3,084	52
Nonferrous Metals Manufacturing	90,673	86	1,054	1,838,278	7,120	123	14,945	58
Organic Chemicals Manufacturing	45,327,493	173	262,008	(82,433,278) 16,220,231	(5,345,652) 29,535	(230) 230	(358,406) 70,523	(23,242) 128
Paint Manufacture and Formulation	3,972,783	118	33,668	285,645	238,860	751	380	318
Pesticide Mfg. and Formulating***	66,829	21	3,182	(63,658,807) 6,414,994	(1,181,291) 1,151	(207) 207	(307,530) 30,990	(5,707)
Pharmaceutical Manufacturing	20,035,111	108	185,510	26,397,736	16,416,007	279	94,616	58,839
Photographic Chemicals and Film Manufacturing	ND	ND		489,838	217,046	ND		
Plastics Molding and Forming	433,999	64	6,781	65,277	65,277	1,145	57	57
Plastics, Resins, and Synthetic Fibers Mfg.	9,133,623	165	55,355	(41,532,733) 5,067,456	(1,950,203) 8,589	(153) 153	(271,456) 33,121	(12,746) 56

Table 3-12. Comparison of Quantities of DSS Toxic Pollutants Released to POTWs as Reported in TRIS and DSS (continued)

Industrial Category	TRIS Estimates*			DSS Estimates				
	Total Reported As Discharged (lbs/yr)	Number of Facilities	Average Per Facility (lbs/yr)	Raw Loadings (lbs/yr)	After PSES Loadings (lbs/yr)	Number of Facilities	Average Per Facility (Raw) (lbs/yr)	Average Per Facility (After PSES) (lbs/yr)
Porcelain Enameling	ND	ND		577,187	64,840	88	6,560	737
Printing and Publishing	165,067	62	2,662	835,432	795,971	38,679	22	21
Pulp and Paper Mills	40,846,842	52	785,516	2,698,231	2,571,810	261	10,338	9,854
Rubber Manufacture and Processing	345,797	92	3,759	491,650	491,650	512	960	960
Textile Mills	1,520,069	125	12,161	1,367,926	1,367,926	974	1,404	1,404
Timber Products Processing	45,116	51	885	110,987	39,448	7,000	16	6
Total	158,915,522			471,641,484	(65,324,397)			
				287,039,246	56,586,746			

* TRIS estimates shown are for the 165 DSS hazardous pollutants only (as well as copper and zinc).
** Numbers in parentheses represent DSS estimates using the Office of Solid Waste ISDB data base; numbers without parentheses represent DSS estimates using the Office of Water ITD estimates.
*** This includes two industrial categories: Pesticides Manufacturing and Pesticides Formulating.
ND = No Data.
Sources: TRIS (1988); EPA (1986b).

Comparison across the Consent Decree industrial categories shows that according to TRIS, the larger loadings of toxic pollutants are discharged from the organic chemicals (i.e., organic chemicals manufacturing; dye manufacture and formulation; and plastics, resins, and synthetic fibers), pharmaceutical manufacturing, and pulp and paper industrial categories. This contrasts slightly with the DSS estimates, which identified several metals-related industrial categories as significant contributors of toxic pollutants (e.g., electroplating/metal finishing, equipment manufacture). This difference appeared particularly with the electroplating/metal finishing and equipment manufacture industrial categories, where a significant portion of the total number of facilities is expected to be relatively small in size and, therefore, exempt from TRIS reporting requirements.

Many of the same toxic pollutants identified in the DSS were also reported in the TRIS data base as being discharged to POTWs by industries. However, several other pollutants were also identified by TRIS for many of the industrial categories. For example, the organic chemicals manufacturing industry had 96 toxic pollutants identified by TRIS that were not identified in the DSS. The most common pollutants in TRIS for which estimates were not provided in the DSS were nonpriority toxic pollutants, including acetone, methyl ethyl ketone, and methanol.

3.2.2.4 304(m) Studies

Section 304(m) of the CWA directs EPA to publish a plan every 2 years for the review and revision of effluent limitations guidelines (including categorical standards) and the promulgation of new guidelines covering industrial categories that discharge toxic and nonconventional pollutants. Specifically, the biennial plans must establish a schedule for annual review and revision of previously promulgated effluent guidelines, identify categories for which guidelines have not been published previously, and establish a schedule for promulgation of guidelines for the new categories. EPA's Office of Water Regulations and Standards ITD prepared a series of preliminary data summaries in its first biennial 304(m) plan. The summaries contain engineering, economic, and environmental data used in determining the categories that merited priority in the preparation of new and revised regulations. Of the industrial categories for which preliminary data summaries were prepared, 10 included indirect dischargers to POTWs.

This subsection summarizes the findings of the 10 preliminary data summaries that addressed indirect dischargers. The findings are of particular interest, because they highlight the types and quantities of toxic pollutants that are potentially discharged by facilities that have not generally been subject to regulation at the national level. In the absence of local control, particularly for those pollutants not typically monitored (e.g., toxic organics), these industries can contribute large quantities of toxic pollutants to POTWs.

The following summaries, extracted from EPA's studies, generally characterize the wastewaters generated by each 304(m) category. This review focuses on all pollutants, except conventional pollutants, identified by EPA during the studies. Appendix A-6 summarizes the analytical results for each of the industrial categories. Table 3-13 summarizes the numbers and types of pollutants detected during analyses of wastewaters from these industrial categories.

- Machinery Manufacturing and Rebuilding (MM&R)—One hundred and thirty-five toxic pollutants (73 of which were priority pollutants) were found above detection levels in MM&R wastewaters (EPA, 1989f). Based on these data, EPA estimates that the MM&R industry generates raw (i.e., untreated) wastewater containing 150 million pounds of toxic metals per year and 36 million pounds of toxic organics per year. The presence of toxic metals would be expected because most machinery parts are constructed of metals and the processing of these metals results in their presence in wastewaters. The toxic organics found in MM&R wastewaters can be associated with their use as solvents, cleaners, processing aids, and strippers in machinery manufacturing processes.
- Drum Reconditioning—Drums are used to hold a vast array of substances, including oil and petroleum, industrial chemicals, paints and inks, solvents, resins, adhesives, pesticides, and food products. As a result, the composition of drum reconditioning wastewaters varies (EPA, 1989b). The toxic organics detected in raw wastewaters at certain plants are 1,1,1-trichloroethane, 2-butanone, 2-chloronapthalene, benzoic acid, benzyl alcohol, biphenyl, ethylbenzene, hexanoic acid, methylene chloride, naphthalene, n-hexadecane, nitrobenzene, p-cymene, styrene, toluene, and trichloroethylene. Acetone had the highest average concentration (858 mg/l) of those toxic organic pollutants detected at greater than 10 mg/l. The predominant metals/inorganics detected in the raw wastewaters were aluminum, iron, lead, magnesium, sodium, calcium, and zinc.
- Industrial Laundries—Thirty-nine toxic pollutants (38 of which were priority pollutants) were identified in raw wastewater from industrial laundries (EPA, 1989e). Although many volatile organic compounds were detected in at least one of the nine samples analyzed, most of the toxic metals (i.e., antimony, cadmium, chromium, copper, lead, nickel, and zinc) were detected in all raw wastewater

Table 3-13. Summary of the Number of Pollutants Found Above Detection Limits by EPA for Industrial Categories Studied Under Section 304(m) of the Clean Water Act

Category	Estimated Number of Facilities	Number of Organic Pollutants Detected		Number of Metals/Inorganics Detected		Total Number of Pollutants Detected
		Priority	Nonpriority	Priority	Nonpriority	
Machinery Manufacturing and Rebuilding	679,000*	75	35	14	11	135
Drum Reconditioning	200	15	27	14	11	71
Industrial Laundries	1,300	23	3	13	0	39
Paint Formulating	700	10	9	11	10	40
Pharmaceutical Manufacturing	285	27	22	10	10	69
Hazardous Waste Treatment	897	38	23	11	10	82
Transportation Equipment Cleaning	690**	35	29	13	11	88
Used Oil Reclamation and Re-Refining	68**	16	22	9	10	57
Hospitals	6,800	7	6	7	7	27
Solvent Recycling	137	25	18	12	12	67

* This category includes all facilities that perform any 1 of 45 major wastewater-generating metal processes on machinery. This includes industries related to transportation, office machines, electronic and electrical equipment and machinery, laboratory and medical instruments, household appliances, industrial tools, and other miscellaneous manufacturing and repair.

** Data provided no distinction between indirect or direct dischargers. For these categories, the number of facilities includes both direct and indirect dischargers.

Source: EPA (1989b,c,d,e,f,g,h,i,j,k).

samples analyzed. Using these sampling results and assuming a population of 1,000 industrial laundries, EPA projected the following estimates of the annual raw waste loadings of toxic pollutants from the industrial laundry industry:

– Nonpriority Pollutants	(lbs/year)
Volatile Organics	24,000,000
Semivolatile Organics	3,000,000
Pesticides and Herbicides	200,000
Metals/Inorganics	1,500,000

– Priority Pollutants	(lbs/year)
Volatile Organics	1,500,000
Semivolatile Organics	2,000,000
Pesticides and Herbicides	30,000
Metals/Inorganics	1,600,000
Cyanide	300,000.

- Paint Formulating—Twenty organic compounds were detected in the raw wastewater samples, with acetone found at the highest concentration (greater than 1,000 mg/l) (EPA, 1989g). Twenty-two metals were also detected in the raw wastewater samples, with aluminum, calcium, iron, magnesium, sodium, and zinc found at the highest concentrations.
- Pharmaceutical Manufacturing—Sixty-nine toxic pollutants were detected in pharmaceutical manufacturing wastewaters (EPA, 1989h). The most prevalent toxic pollutants found by EPA in these wastewaters included volatile organics and metals. Using the data collected for the study, EPA estimated the following quantities of toxic pollutants in raw wastewaters from indirect discharging pharmaceutical manufacturing facilities:

– Nonpriority Pollutants	(lbs/year)
Volatile Organics	9,900,000
Semivolatile Organics	112,000
Pesticides and Herbicides	118,000

– Priority Pollutants	(lbs/year)
Volatile Organics	2,418,000
Semivolatile Organics	406,000
Pesticides and Herbicides	20
Metal	53,000
Cyanide	4,600

- Hazardous Waste Treatment—Eighty-two toxic pollutants were detected in raw wastewaters generated by hazardous waste treaters (EPA, 1989c). The most prevalent types of toxic pollutants found in raw wastewater from hazardous waste treaters included volatile organics (e.g., acetone, benzene, toluene, methylene chloride, and methyl ethyl ketone) and metals. Using the data collected, EPA estimated that 36 million pounds of toxic organics and 305 million pounds of metals are present each year in the raw wastewater of hazardous waste treaters.
- Transportation Equipment Cleaning—Eighty-eight toxic pollutants were detected in raw wastewaters generated by facilities in this industrial category (EPA, 1989j). The predominant toxic pollutants detected included acrylonitrile, acrolein, benzene, arsenic, and cyanide. The total discharge of priority pollutants from this industry is estimated at approximately 22 million pounds per year.
- Used Oil Reclamation and Re-Refining—Fifty-seven toxic pollutants were detected in wastewaters from used oil facilities (EPA, 1989k). The most prevalent pollutants found in the raw wastewaters from these facilities included lead, tetrachloroethylene, toluene, 1,1,1-trichloroethane, trichloroethylene, and napthalene.
- Hospitals—A total of 27 toxic pollutants were detected in raw wastewaters from hospitals (EPA, 1989d). EPA projected the following annual loadings of toxic pollutants in raw wastewaters:

– Nonpriority Pollutants	(lbs/year)
Volatile Organics	545,675
Metals	314,995
– Priority Pollutants	(lbs/year)
Volatile Organics	37,960
Semivolatile Organics	56,210
Metals	255,135.

  The primary sources of wastewater in hospitals are sanitary wastewater and discharges from surgical rooms, laboratories, laundries, x-ray departments, cafeterias, and glassware washing. The types of waste generated by hospitals generally include (1) chemical waste, such as spent solvents, acids, caustics, and metals, (2) radioactive waste, including radioisotopes with low radioactive levels and generally short half-lives, and (3) infectious waste, consisting primarily of contaminated synthetic materials, such as plastic tubing and paper products.

- Solvent Recycling—Sixty-six toxic pollutants were detected in the raw wastewaters from solvent recyclers (EPA, 1989i). The predominant toxics found in these raw wastewaters were extractable/volatile organics (e.g., acetone, methylene chloride, 1,1,1-trichloroethane); some of these organics were detected at concentrations exceeding 100 mg/l.

As shown above, a variety of toxic pollutants have been found in the raw wastewaters generated by facilities in a number of industrial categories. Initial estimates by EPA show that significant quantities of toxic pollutants could be discharged to POTWs if the waste is untreated or improperly treated. The most significant type of toxic pollutant generated by the 10 industrial categories studied by EPA are the nonpriority volatile organic pollutants. For those industries where estimates were provided, the loadings of nonpriority toxic organics ranged from 545,000 pounds per year for hospitals, to 24 million pounds per year for industrial laundries.

3.2.2.5 State Monitoring Data

Examination of actual POTW and industrial user monitoring data can provide additional insights into the types and quantities of toxic pollutants discharged to POTWs that may not be gained using national studies and data bases. Most POTW and IU monitoring data are maintained at the POTW level; collection, organization, and summary of all industrial user monitoring data collected at the POTW level were not possible for this report. The State of North Carolina maintains perhaps the most comprehensive data base of industrial user monitoring data at the approval authority (State) level. This subsection presents industrial user monitoring data collected and compiled by the North Carolina Department of Natural Resources and Community Development.

<u>Summary of Industrial Types</u>

Monitoring data exist for one or more pollutant parameters for 929 industrial users in the North Carolina Industrial Users Data Base (described in Chapter 2). These industrial users were placed into the 46 industrial categories described in Subsection 3.2.2.1 in accordance with the primary SIC code(s) assigned to each industrial category.[15] Table 3-14 lists the number of North Carolina industrial users in each of the 46 industrial categories. It should be noted that 213 industrial users covered in the North Carolina data base could not be placed into the 46 industrial categories, because SIC codes were not reported for these facilities. Table 3-14 categorizes these 213 users as "Miscellaneous."

In North Carolina, industrial users represent at least 36 of the 46 industrial categories examined in this study. The four industrial categories having the most industrial users are

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15. The North Carolina Industrial Users Data Base contained two categories—pesticide manufacturing and pesticide formulating—which were combined in this analysis, lowering the number of categories from 47 to 46.

Table 3-14. Summary of North Carolina Industrial Dischargers That Report Effluent Monitoring Results to the State

Industrial Category	Total Number of Facilities Reporting
Adhesives and Sealants	1
Battery Manufacturing	5
Coal, Oil, and Petroleum Products and Refining	4
Construction Industry (contract and special trade)	1
Cosmetics, Fragrances, Flavors, and Food Additives	4
Dye Manufacture and Formulation	2
Electric Generating Power Plants and Electric Distribution Services	ND
Electrical and Electronic Components	12
Electroplating/Metal Finishing	86
Equipment Manufacture and Assembly	117
Explosives Manufacture	ND
Fertilizer Manufacture	1
Food and Food By-Products Processing	89
Gum and Wood Chemicals, Varnishes, Lacquers, and Related Oils	ND
Hazardous Waste Site Cleanup	ND
Industrial and Commercial Laundries	22
Ink Manufacture and Formulation	1
Inorganic Chemicals Manufacturing	ND
Iron and Steel Manufacturing and Forming	4
Laboratories and Hospitals	27
Leather Tanning and Finishing	ND
Miscellaneous Chemical Formulation	1
Motor Vehicle Services	6
Nonferrous Metals Forming	8
Nonferrous Metals Manufacturing	1
Organic Chemicals Manufacturing	5
Paint Manufacture and Formulation	5
Pesticide Manufacturing and Formulating*	1
Pharmaceutical Manufacturing	8
Photographic Chemicals and Film Manufacturing	ND
Plastics Molding and Forming	6
Plastics, Resins, and Synthetic Fibers Manufacturing	5
Porcelain Enameling	ND
Printing and Publishing	7
Pulp and Paper Mills	1
Rubber Manufacture and Processing	10
Service Related Industries (other than vehicle services)	6
Soap and Detergents, Cleaning Preparations, and Waxes Manufacture and Formulation	9
Stone, Clay, Glass, Concrete, and Other Mineral Products	15
Textile Mills	206
Timber Products Processing	4

Table 3-14. Summary of North Carolina Industrial Dischargers That Report Effluent Monitoring Results to the State (continued)

Industrial Category	Total Number of Facilities Reporting
Transportation Services	14
Waste Reclamation Services	ND
Waste Treatment and Disposal Services	ND
Wholesale and Retail Trade	2
Wood Furniture Manufacture and Refinishing	20
Miscellaneous**	213
Total	**929**

* This includes two industrial categories: Pesticides Manufacturing and Pesticides Formulating.

** This category includes facilities that could not be categorized because of the absence of SIC codes for these facilities in the data base.

ND = No data.

Source: North Carolina Department of Natural Resources and Community Development (1990).

textile mills (206 industrial users), equipment manufacture and assembly (117), food and food by-products processing (89), and electroplating/metal finishing (86).

Summary of Monitoring Data

For this study, all monitoring data associated with the 929 North Carolina industrial users were extracted and summarized by industrial category. Presented in Appendix A-7, this summary identifies several industries that are not regulated at the national level through categorical standards and that discharge a number of toxic pollutants. For example:

- Total metals concentrations averaged 15 mg/l for discharges from a fertilizer manufacturer; total copper levels for this discharge averaged 3.49 mg/l.
- Significant concentrations of total chromium (4.4 mg/l), copper (17.0 mg/l), lead (17.7 mg/l), and zinc (2.3 mg/l) were reported for an ink manufacturer.
- An average of 33.71 mg/l of phenol was reported for the 27 facilities in the laboratories and hospitals category.
- Mercury concentrations ranging from 0.0007 mg/l to 18.0 mg/l were reported for wood furniture manufacturing and refinishing category. Copper concentrations for this category ranged from 0.01 mg/l to 72.64 mg/l.
- Industrial users in the transportation services category were reported to discharge significant concentrations (6.42 mg/l) of total metals.

The toxic pollutants for which monitoring is required of industrial users in North Carolina are primarily metals/inorganics (e.g., silver, aluminum, arsenic, cadmium, cyanide (total), cyanide (amenable), copper, chromium, iron, fluoride). Few facilities are required to monitor for toxic organic pollutants. Specifically, out of the 716 facilities for which an industrial category could be identified, only 95 are required to monitor for phenols; 28 are required to monitor for the aggregate parameter total toxic organics (TTO). Further, all of the TTO monitoring is associated with those metals industries subject to TTO limitations contained in categorical standards (e.g., electroplating). Therefore, many of the industries where toxic organics would be expected to be present (e.g., industrial laundries, pharmaceutical manufacturers, and organic chemical manufacturers) are not required to monitor for these pollutants.

3.3 Domestic Sources of Toxic Pollutants

Traditionally, domestic discharges to POTWs have been considered simply a source of suspended solids and degradable organic materials, as compared to industrial and commercial sources, which are often associated with toxic pollutants. For many POTWs, however, domestic flows make up a large part of the total flow received (see Table 3-2). This, coupled with the fact that toxic pollutants have been found in domestic wastewater, indicates that discharges of domestic wastewater can be a significant source of toxic pollutant loadings to POTWs. This section examines the types and extent of toxic pollutant discharges associated with domestic sources.

3.3.1 Characterization of Domestic Wastewater

To characterize wastewater from domestic sources, EPA used monitoring data presented in the Supplemental Manual (EPA, 1991). The manual presents data reported by 15 municipalities located in seven EPA regions, all of which monitored sewer trunk lines receiving wastewaters exclusively from residences and small commercial sources.

Table 3-15 identifies overall average inorganic pollutant levels for domestic contributions, while Table 3-16 shows overall average organic pollutant levels. Single point values for the maximum and minimum for each pollutant were provided to define the range of values considered. Note that these tables reflect only pollutants monitored and reported by the 15 municipalities; the fact that other pollutants (such as chlorine) are not reported does not mean they are not present in domestic wastewaters.

Table 3-15 indicates the high levels of ammonia and phosphate normally associated with sanitary wastewater, as well as an elevated level of fluoride, which is commonly associated with the fluoridation of drinking water. A variety of metals occur, with relatively high levels of copper, iron, lead, and zinc, which are probably associated with corrosion of the water and wastewater conveyance system. Furthermore, zinc may also be introduced into the system by the addition of zinc orthophosphate, which is often added at the treatment plant to control corrosion in the distribution system. It is not possible to determine whether the other pollutants originate in source water or the extent to which they reflect domestic sources.

Table 3-16 shows measurable levels of three pesticides (BHC, 4,4-DDD, and endosulfan); a plasticizer (bis[2-ethylhexyl]phthalate) commonly associated with plastic packaging and films; three coal tar components (fluoranthene, pyrene, and phenol) commonly associated with asphalt, tar, and other high molecular weight petroleum derivatives; and five chlorinated solvents (1,1-dichloroethane, 1,1-dichloroethylene, tetrachloroethylene, trans-1,2-dichloroethylene, and 1,2,4-trichlorobenzene), commonly used for cleaning fabrics and metal surfaces. Another chlorinated solvent detected is methylene chloride. Chloroform is

Table 3-15. Overall Average Inorganic Domestic Pollutant Levels

Pollutant	Domestic Weighted Average (mg/l)[1]	Minimum	Maximum[2]
Ammonia	43.111	7	114
Arsenic	0.007	.0004	.088
Barium	0.115	.04	.216
Boron	0.300	.1	.42
Cadmium	0.008	.0006	.11
Chromium(T)	0.034	.001	1.2
Chromium(III)	0.006	<0.005	.007
Copper	0.109	<0.005	.61
Cyanide	0.082	.01	.37
Fluoride	0.255	.24	.27
Iron	0.989	.0002	3.4
Lead	0.116	<.001	2.04
Lithium	0.031	.03	.031
Manganese	0.087	.04	.16
Mercury	0.002	.0001	.054
Nickel	0.047	<.001	1.6
Phosphate	28.8	27.4	30.2
Phosphorus	0.7	.7	.7
Selenium	0.004	.002	.005
Silver	0.019	.0002	1.052
Zinc	0.212	<.01	1.28

Source: EPA (1991).

Table 3-16. Overall Average Organic Domestic Pollutant Levels

Pollutant	Domestic Weighted Average (mg/l)[1]	Minimum	Maximum[2]
BHC	0.001	.001	.001
Bis(2-ethylhexyl) Phthalate	0.006	.00002	.022
Chloroform	0.009	.00001	.069
4,4-DDD	0.0003	.00026	.0004
1,1-Dichloroethane	0.026	.026	.026
1,1-Dichloroethene	0.007	.005	.008
Endosulfan	0.002	.002	.002
Fluoranthene	0.001	.00001	0.001
Methylene Chloride	0.027	.000008	.055
Phenols	0.010	.00002	.029
Pyrene	0.0002	.00001	<.0005
Tetrachloroethylene	0.014	.00001	.037
Trans-1,2-Dichloroethylene	0.013	.013	.013
1,2,4-Trichlorobenzene	0.013	<.002	.035

[1]Averages were weighted based upon the number of observations identified in each municipality.
[2]Minimum and maximum values are single point values that define the range of data used.
Source: EPA (1991).

another chlorinated solvent present; however, it is a common by-product of drinking water disinfection (see Subsection 3.3.3).

3.3.2 Potential Sources of Toxic Pollutants in Domestic Wastewater

This subsection examines the potential sources of toxic pollutants present in domestic wastewater. The discussion focuses on the disposal of household hazardous wastes and on drinking water, which, although not regulated under the pretreatment program, may constitute significant sources of toxic loadings to POTWs.

3.3.2.1 Household Hazardous Waste

Hazardous wastes are defined and regulated by EPA under the Resource Conservation and Recovery Act (RCRA). However, RCRA's implementing regulations for the management of hazardous wastes do not apply to hazardous wastes derived from households. It has been shown, nevertheless, that even the small quantities of hazardous waste discarded or discharged from households can collectively be of sufficient toxicity and volume in municipal landfills and sewers to pose serious hazards to human health and the environment (EPA, 1987b). Further, since household hazardous wastes may exhibit the properties of regulated hazardous wastes, including toxicity, corrosivity, reactivity, or ignitability, their discharge to POTWs can be a source of toxic pollutants.

The total quantity of household hazardous wastes discharged to POTWs is not known. However, the specific types of toxic pollutants that are present in household hazardous wastes and discharged to POTWs can be estimated based on an evaluation of the general types of household products that may be disposed of via toilets and household drains. Table 3-17 lists products normally considered household wastes when discarded and the toxic pollutants associated with these products. As indicated, a variety of common household commodities contain toxic pollutants, including acids, bases, metals, and complex organic compounds, including aliphatic and aromatic hydrocarbons, and chlorinated organic solvents.

The actual impacts on POTWs of the toxic pollutants associated with household hazardous wastes is expected to be highly variable and dependent on a number of factors, including proximity of households to the POTW treatment plant, type of treatment technology in use, and the extent of local regulation and oversight of domestic discharges of hazardous

Table 3-17. Hazardous Constituents of Common Household Commodities

Item	Examples of Potentially Hazardous Ingredients
HOUSEHOLD CLEANERS	
Toilet bowl cleaner	Trichloro-s-trianzinetrione Sodium acid sulfate or oxalate or hydrochloric acid Chlorinated phenols
Drain opener	Sodium hypochlorite Sodium hydroxide Trichlorobenzene Potassium hydroxide Hydrochloric acid Trichloroethane
Laundry soap, bleach, dish-washing detergent, bathroom cleaners, upholstery cleaners, floor cleaners, other general purpose cleaners	Surfactants (LAS and other) Ethoxylated alcohol Methylene chloride Tetrachloroethylene Sodium hypochlorite Tetrachloroethane Xylenols Sodium hypochlorite Phenols Ammonia Diethylene glycol
Polish (e.g., furniture, wood, metal, vinyl)	1,1,1-Trichloroethane Petroleum distillates Mineral spirits Petroleum distillates Oxalic acid Denatured ethanol or isopropanol Phosphoric acid
Floor finish	Diethylene glycol Petroleum solvents Ammonia
Air freshener	Alkyl phenoxy polyethoxy ethanol Isobutane Propane

Table 3-17. Hazardous Constituents of Common Household Commodities (continued)

Item	Examples of Potentially Hazardous Ingredients
HOUSEHOLD CLEANERS (continued)	
Other household (e.g., oven cleaner)	Sodium or potassium hydroxide
AUTOMOTIVE MAINTENANCE	
Oil and transmission fluid (e.g., grease, hydraulic fluid, motor oil, all purpose oil)	Petroleum distillates (petroleum hydrocarbons) Lead
Engine treatment (e.g., transmission and motor oil additives, fuel additives, carburetor cleaner)	Petroleum distillates Mineral spirits 1,1,2-Trichloroethylene Methylene chloride Xylenes Toluene
Antifreeze/coolant	Ethylene glycol Methanol
Auto wax	Petroleum distillates
Other auto (e.g., grease, solvents, rust solvents, refrigerants)	Toluene Chlorinated aliphatic hydrocarbons Potassium dichromate
HOUSEHOLD MAINTENANCE	
Paint (e.g., latex, oil base, art and model paints)	Toluene Xylene Methylene chloride Halogenated aromatic hydrocarbons Mineral spirits
Paint thinner and stripper (remover)	Toluene Chlorinated aliphatic hydrocarbons Esters Alcohols Chlorinated aromatic hydrocarbons Ketones

Table 3-17. Hazardous Constituents of Common Household Commodities (continued)

Item	Examples of Potentially Hazardous Ingredients
HOUSEHOLD MAINTENANCE (continued)	
Stain/varnish/sealant	Pentachlorophenols Methylene chloride Mineral spirits Petroleum Methyl and ethyl alcohol Benzene Lead
Glue (e.g., model, epoxy, general purpose)	Toluene Methyl ethyl ketone Acetone Hexane Methylene chloride Asbestos fiber (asbestos cement)
Other maintenance (e.g., asphalt caulking, tar paper)	Methylene chloride Toluene Trichloroethylene Benzene Asbestos Ketones
PESTICIDE AND YARD MAINTENANCE	
Fertilizers	Concentrated potassium, ammonia, nitrogen, phosphorus
Pesticides	Aromatic petroleum hydrocarbons Petroleum distillates Naphthalene Xylene Carbamates Chlorinated hydrocarbons Organophosphorus Urea Uracil Triazine base Coumarin
Herbicides	Chlorinated phenoxys Dipyridyl Nitrophenols

Table 3-17. Hazardous Constituents of Common Household Commodities (continued)

Item	Examples of Potentially Hazardous Ingredients
PESTICIDE AND YARD MAINTENANCE (continued)	
Pet maintenance (e.g., flea and tick treatment powders and liquids, flea and tick collars)	Carbaryl Dichlorophene Chlordane Other chlorinated hydrocarbons
BATTERIES AND ELECTRICAL	
Auto and flashlight batteries, solder, etc.	Mercuric oxide Sulfuric acid
PRESCRIPTION DRUGS	Diverse ingredients
SELECTED COSMETICS	
Nail polish remover, hair spray, makeup remover, dyes, etc.	Aromatic hydrocarbon solvents Acetone Ethyl and butyl acetate Toluene Alcohols Dibutyl phthalate
OTHER	
Pool chemicals, (acid, chlorine) hobby-related activities, etc.	Sodium dichloro-s-trianzinetrione

Source: EPA (1987b).

wastes.[16] Several local authorities have instituted programs to discourage the improper disposal of household hazardous wastes, including disposal to POTWs. Many communities have instituted separate collection programs for household hazardous waste. These programs, coupled with public education awareness programs, have the potential to reduce significantly the quantity of household hazardous waste disposed to POTWs and to municipal landfills. Under these programs, a central collection point may be established for used oil, automobile batteries, and other wastes.

Table 3-18 shows the total number of household hazardous waste collection programs by State in 1989. As indicated, 35 States have instituted over 600 household hazardous waste programs. The following examples are from several local programs:

- The Massachusetts Water Resources Authority has initiated a public education program to reduce the disposal of household hazardous wastes into sewer systems (Spencer, 1990).
- The town of Lexington, Massachusetts, has been holding 1-day collection programs since 1981. Participation has increased every year since 1986. In 1989, a record 35 55-gallon drums of waste were collected.
- The State of Minnesota holds annual 1-day collections and maintains five permanent collection facilities. Minnesota also operates a household hazardous waste hotline.
- The Seattle-King County area recently established an innovative mobile collection unit, which travels to a different neighborhood in the metropolitan area every 2 weeks.

3.3.2.2 Drinking Water

Another potential source of toxic pollutants in domestic wastewater is the community drinking-water supply. It is estimated that domestic and public water use across the country ranges from 100 to 150 gallons per capita per day, with a national average of 120 gallons per capita per day (Maddaus, 1987). Frequently, all of this water is discharged as wastewater, less what is used for such purposes as lawn sprinkling and car washing. It is estimated that the volume of wastewater from domestic and public sources ranges from 50 to 100 gallons per capita per day (Hammer, 1975). Therefore, although drinking water might contain toxic pollutants at levels below human health criteria, it still may represent a significant source of toxic pollutant loadings to POTWs. This is a particular concern where the effluent limits in a

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16. It should be noted that the regulation of the disposal of hazardous household wastes is outside the scope of the National Pretreatment Program.

Table 3-18. Number of Household Hazardous Waste Collection Programs in 1989

State	Number of Household Hazardous Waste Collection Programs
Alabama	1
Alaska	10
Arizona	2
California	107
Colorado	3
Connecticut	34
Florida	61
Hawaii	9
Idaho	2
Illinois	1
Indiana	4
Iowa	11
Louisiana	2
Maine	2
Maryland	5
Massachusetts	91
Michigan	25
Minnesota	55
Missouri	1
Nebraska	3
New Hampshire	19
New Jersey	31
New Mexico	3
New York	56
North Carolina	4
Ohio	1
Oregon	3
Pennsylvania	5
Rhode Island	5
Texas	2
Vermont	5
Virginia	9
Washington	41
Wisconsin	14
Wyoming	1
Total	628

Source: EPA (1990b).

POTW's NPDES permit are based on water quality criteria or sludge criteria that may well be more restrictive than the human health criteria on which the drinking water standards are based. Such would be the case when water quality or sludge criteria are based on protection of other species (e.g., ingestion by fish of pollutants that bioaccumulate).

The Safe Drinking Water Act (SDWA) Amendments of 1986 require EPA to establish regulations to protect human health from contaminants in drinking water. Under the SDWA, EPA must establish maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) for 83 specified contaminants considered to be of significant risk to human health. MCLs are established as close as possible to MCLGs after consideration of available water treatment technologies and cost.

In addition, the SDWA mandates that MCLs and MCLGs be established for 25 additional contaminants every 3 years. To date, 32 contaminants have been regulated (see Table 3-19). MCLs or appropriate treatment technologies for the other contaminants are being developed.

Although toxic pollutants found in source waters will be treated as mandated by the SDWA Amendments, the collective loadings of these pollutants in drinking water may be significant for the POTWs that ultimately receive this water. Furthermore, under certain circumstances, treated drinking water may contain pollutants that are not regulated under the SWDA and thus not removed. When discharged, these pollutants may result in increased loadings of toxics to POTWs.

For example, treated waters that meet existing standards at the point of entry into the distribution system may be corrosive and cause leaching of toxic pollutants, such as lead, copper, and zinc, into the water during transmission and distribution. (Ironically, zinc orthophosphate, a popular lead corrosion inhibitor that is added to drinking water systems, has the potential to raise zinc levels in POTW influents.) If the drinking water purveyor reduces the corrosivity of the water supply, the improvement in effluent and sludge quality may be dramatic. In New Jersey, for example, the Cumberland County Utilities Authority achieved a copper reduction in sludge from 7,000 mg/kg to 1,200 mg/kg as a result of corrosivity reduction in the water supply (New Jersey DEP, 1990).

3.3.3 Evaluation of Domestic Loadings of Toxic Pollutants

This subsection demonstrates the potential significance of toxic pollutant loadings to POTWs that are due to domestic discharges. To estimate the potential impact of domestic

Table 3-19. Contaminants Required to be Regulated Under the 1986 SDWA Amendments and Existing MCLs*

Contaminant	MCL	Contaminant	MCL
Volatile Organic Chemicals		**Inorganics**	
Benzene	0.005 mg/l	Aluminum	**
Carbon Tetrachloride	0.005 mg/l	Antimony	**
Chlorobenzene	**	Arsenic	.05 mg/l
Dichlorobenzene	**	Asbestos	**
Ethylbenzene	**	Barium	1.0 mg/l
1,2-Dichlorethane	0.005 mg/l	Beryllium	**
1,1-Dichloroethylene	0.007 mg/l	Cadmium	0.010 mg/l
Cis-1,2-Dichloroethylene	**	Chromium	0.05
Trans-1,2-Dichloroethylene	**	Copper	**
Methylene Chloride	**	Cyanide	**
Tetrachloroethylene	**	Fluoride	1.4-2.4 mg/l + (ambient temp.)
Trichlorobenzene	**		
1,1,1-Trichloroethane	0.20 mg/l	Lead	.05 mg/l
Trichloroethylene	0.005 mg/l	Mercury	0.002 mg/l
Vinyl chloride	0.002 mg/l	Molybdenum	**
		Nickel	**
Microbiology and Turbidity			
Giardia lamblia	Treatment to <99.9% removal	Nitrate (as N)	10 mg/l
		Selenium	0.01 mg/l
Legionella	Treatment to <99.9% removal	Silver	0.05 mg/l
Total Coliforms	<1/100 ml	Sodium (no MLC monitoring, reporting only)	**
Turbidity	1 ntu*** (up to 5 ntu)	Sulfate	**
		Thallium	**
Viruses	Treatment to <99.9% removal	Vanadium	**
		Zinc	**

* Some MCLs were in the process of being revised as the analysis was being performed.
** Not yet promulgated
*** ntu = nephelometric turbidity unit

Source: Pontius (1990)

Table 3-19. Contaminants Required to be Regulated Under the 1986 SDWA Amendments and Existing MCLs* (continued)

Contaminant	MCL	Contaminant	MCL
Organics		**Organics, continued**	
2,4-D	0.1 mg/l	Polynuclear Aromatic Hydrocarbons (PAHs)	**
Adipates	**	Simazine	**
Alachlor	**	Styrene	**
Aldicarb	**	2,3,7,8-Tetrachlorodibenzodioxin (dioxin)	**
Aldicarb Sulfone	**	Trihalomethanes	0.10 mg/l
Aldicarb Sulfoxide	**	Toxaphene	0.005 mg/l
Atrazine	**	2,4,5-TP (Silvex)	0.01 mg/l
Carbofuran	**	1,1,2-Trichloroethane	**
Chlordane	**	Vydate	**
Dalapon	**	Xylene	**
Dibromochloropropane (DBCP)	**		
Dibromomethane	**	**Radionuclides**	
1,2-Dichloropropane	**	Beta Particle and Photo Radioactivity	4 mrem (annual dose equivalent)
Dinoseb	**	Gross Alpha Particle activity	15 pCi/l
Diquat	**	Radium-226 and -228	5 pCi/l
Endothall	**	Radon	**
Endrin	0.0002 mg/l	Uranium	**
Epichlorohydrin	**		
Ethylene Dibromide (EDB)	**		
Glyphosate	**		
Heptachlor	**		
Heptachlor epoxide	**		
Hexachlorocyclopentadiene	**		
Lindane	0.0004 mg/l		
Methoxychlor	0.1 mg/l		
Pentachlorophenol	**		
Phthalates	**		
Pichloram	**		
Polychlorinated Biphenyls (PCBs)	**		

* Some MCLs were in the process of being revised as the analysis was being performed.
** Not yet promulgated
*** ntu = nephelometric turbidity unit

loadings of toxic pollutants, EPA postulated the existence of a POTW receiving only domestic wastewater. This situation is based on a conservative assumption, since in most cases even those industrial discharges treated to remove toxics will have higher toxic pollutant concentrations than domestic sewage. Thus, if a POTW receiving only domestic wastewater is affected by the concentration of toxics in domestic sewage, a POTW receiving mixed industrial and domestic waste would be affected at least as much.

The hypothetical POTW is assumed to receive domestic sewage with the toxic pollutant concentrations listed in Tables 3-15 and 3-16 (i.e., trunk line monitoring data from 15 municipalities). The assumed effluent limits in hypothetical POTWs National Pollutant Discharge Elimination System (NPDES) permit were based on compliance with EPA water quality criteria. The standards applied were chronic criteria for the protection of aquatic life, with the exception of arsenic, for which human health protection criteria (assuming water and fish consumption) were used. Two sets of NPDES effluent limits were used: one that assumes no dilution of the POTW effluent is allowed in the receiving water, and another that assumes that up to 50-percent dilution of the effluent is allowed.

Given the influent concentrations in Tables 3-15 and 3-16 and the two sets of NPDES effluent limits, EPA calculated the necessary POTW removal efficiencies for each pollutant (see Table 3-20). In those cases where effluent limits were greater than domestic (or assumed influent) concentrations, POTW removal efficiencies are immaterial, and the necessary removal efficiency is listed as N/A.

As Table 3-20 indicates, water quality criteria can be met for the five organic compounds, nickel, chromium, and selenium under both effluent limit scenarios. For zinc, 48-percent removal would be necessary for a POTW to comply with water quality criteria; domestic concentrations are less than the effluent limits for zinc, assuming 50-percent dilution was available. For the rest of the metals except zinc, significant and likely unachievable removal efficiencies would be required for the hypothetical POTW to meet water quality criteria, even with 50-percent dilution of the effluent. Because POTW removal

Table 3-20. Estimates of POTW Removal Efficiencies Needed to Remove Toxic Pollutants Discharged at Typical Domestic Concentrations

Pollutant	Chronic Water Quality Criteria (WQC)* (mg/l)	Domestic Influent Concentration** (mg/l)	Allowable Effluent Concentration Assuming 0% Dilution (mg/l)	Required Removal Efficiency To Achieve WQC Assuming 0% Dilution (%)	Allowable Effluent Concentration Assuming 50 Percent Dilution*** (mg/l)	Required Removal Efficiency To Achieve WQC Assuming 50 Percent Dilution*** (%)
Arsenic****	0.0000022	0.007	0.0000022	99.97	0.0000044	99.94
Cadmium	0.0011	0.008	0.0011	86.25	0.0022	72.50
Chromium(III)	0.21	0.006	0.21	N/A	0.42	N/A
Copper	0.012	0.109	0.012	88.99	0.024	77.98
Lead	0.0032	0.116	0.0032	97.24	0.0064	94.48
Mercury	0.000012	0.002	0.000012	99.40	0.000024	98.80
Nickel	0.16	0.047	0.16	N/A	0.32	N/A
Selenium	0.036	0.004	0.036	N/A	0.072	N/A
Silver	0.00012	0.019	0.00012	99.37	0.00024	98.74
Zinc	0.11	0.212	0.11	48.11	0.22	N/A
Cyanide	0.0052	0.082	0.0052	93.66	0.0104	87.32
Chloroform	1.24	0.009	1.24	N/A	2.48	N/A
Methylene Chloride	1.24	0.027	1.24	N/A	2.48	N/A
Endosulfan	0.056	0.002	0.056	N/A	0.112	N/A
Phenols	2.56	0.01	2.56	N/A	5.12	N/A
Tetrachloroethene	0.84	0.014	0.84	N/A	1.68	N/A

N/A - Not applicable.

* EPA Water Quality Criteria (EPA, 1986a).

** Domestic concentrations taken from the EPA "Supplemental Manual" (EPA, 1990d).

*** Assumes 50 percent dilution of POTW effluent in receiving water is allowed.

**** WQC represents human health protection criteria (water and fish consumption).

efficiencies are highly variable (see Chapter 4), the presence of toxics, particularly metals, in domestic wastewaters could be significant.[17]

In order to evaluate the proportion of total allowable toxic pollutant loadings to POTWs that could be attributed to domestic sources, EPA evaluated local limits submissions for 25 POTWs in EPA Region VI. As shown in Table 3-21, domestic loadings of several pollutants accounted for more than 50 percent of allowable loadings at certain POTWs. Some of these POTWs experienced loadings of certain pollutants (copper, silver, cyanide, phenols, and zinc) at more than 75 percent of total allowable loadings.

3.4 OTHER SOURCES OF TOXIC POLLUTANTS

Toxic pollutants may also be discharged to POTWs from sources other than industrial, commercial, or domestic discharges. This section discusses the potential types and quantities of toxic pollutants associated with these sources, including storm water, collection system infiltration/inflow, and RCRA and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sources.

3.4.1 Storm-Water Sources

POTW collection systems are classified either as combined or separate, based on whether they receive storm water. In separate systems, two distinct collection systems are provided, one for wastewater (both industrial/commercial and domestic), which discharges to the POTW, and the other exclusively for storm water, which is discharged directly to receiving waters. Although more costly to construct, separate POTW collection systems minimize hydraulic loads to treatment facilities and avoid mixing storm water with domestic and industrial wastewater. Control authorities in areas with separate systems usually have ordinance requirements that prohibit the discharge of storm water to the sanitary system. Some storm water will, however, find its way to the sanitary system through illegal discharges (such as downspout connections and sump pump discharges). The extent of

17. It should be noted that the necessary removal efficiencies for the toxic metals may be understated because the domestic sewage average concentrations most likely represent total metals concentrations, and the EPA water quality criteria represent only the acid-soluble portion of the metal.

Table 3-21. Summary of Local Limit Submissions for 25 POTWs in Region VI

Pollutant	Number of POTWs Developing Local Limits	Number of POTWs Where Domestic Load Accounted for >50% of the Allowable Load	Number of POTWs Where Domestic Load Accounted for >75% of the Allowable Load
Arsenic	25	0	0
Cadmium	25	1	0
Chromium	25	2	0
Copper	25	2	1
Lead	25	2	0
Mercury	25	1	0
Nickel	25	3	0
Selenium	15	0	0
Silver	25	4	2
Zinc	25	14	6
Cyanide	23	1	1
Chromium (hex)	2	0	0
Chromium (tri)	1	0	0
Phenols	20	1	1
1,4-Dichlorobenzene	2	0	0
Trichloroethylene	2	0	0
Bis(2-ethylhexyl) phthalate	2	0	0
Tetrachloroethylene	1	0	0
Thallium	1	0	0
Beryllium	4	0	0
NH_3	5	0	0
Tin	1	0	0

Source: EPA (1990a)

these contributions will depend on the surveillance, monitoring, and enforcement actions of the control authority.[18]

Combined collection systems use a single conveyance system to transport wastewater and storm water. To avoid hydraulic overloading of the treatment facility, or the collection system itself, combined systems are usually equipped with regulators. These regulators, dispersed throughout the collection system, release water from the collection system when a predetermined flow rate in that part of the system is exceeded. Discharges from regulators, commonly referred to as combined sewer overflows (CSOs), are usually directed to a receiving stream.

The loadings of toxic pollutants from storm-water runoff to a combined collection system and its receiving POTW may be significant. This would be particularly true if storm-water runoff representing the "first flush" is not discharged through a combined sewer overflow but instead is received at the POTW treatment plant.[19]

3.4.1.1 Combined Sewer System Estimate

EPA OWEP estimates that there are about 1,200 combined sewer systems in the United States.[20] It is estimated that at least 240 control authorities implementing approved pretreatment programs maintain combined sewer collection systems that collect storm-water runoff from areas within their service areas (EPA, 1990c; NEWPCA, 1989). As shown in Table 3-22, the total number of control authorities with CSOs is relatively small compared to the total number of control authorities nationwide.

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18. In November 1990, EPA promulgated regulations to control storm-water discharges from industrial activities and separate storm sewer systems serving municipalities with populations of 100,000 or more (55 *FR* 47989; Nov. 16, 1990). These regulations establish NPDES permit application requirements that require in part a description of a proposed management program to reduce, to the maximum extent practicable, pollutants from storm-water discharges to municipal systems.

19. In September 1989, EPA issued a CSO Control Strategy (54 *FR* 37370; September 8, 1989). The objective of the CSO Strategy is to ensure regulation of CSO discharges to receiving waters. Part of this strategy encourages the use of the POTW pretreatment program as an additional control measure to reduce the amounts of pollutants present in combined sewers during storm events.

20. National CSO Control Strategy memorandum, August 10, 1989.

Table 3-22. Pretreatment Programs With Combined Sewer Overflows (CSOs)*

EPA Region	State	Number of Control Authorities	Number of Control Authorities With CSOs
I	MA	38	15
	NH	12	5
	ME	15	9
	RI	13	3
	CT	NA	NA
	VT	NA	NA
II	NJ	22	9
	NY	56	28
	PR	1	0
III	DE	5	1
	DC	1	1
	MD	15	2
	PA	82	16
	VA	23	3
	WV	7	7
IV	FL	39	0
	GA	39	5
	KY	64	8
	TN	77	5
	NC	121	0
	SC	58	0
	AL	NA	NA
	MS	NA	NA
V	IL	45	16
	IN	45	39
	MI	110	29
	MN	6	1
	OH	97	34
	WI	23	1
VI	AR	28	1
	LA	12	0
	NM	4	ND
	OK	19	0
	TX	61	0
VII	IA	20	ND
	KS	15	ND
	MO	43	ND
	NE	NA	NA

Table 3-22. Pretreatment Programs With Combined Sewer Overflows (CSOs)* (continued)

EPA Region	State	Number of Control Authorities	Number of Control Authorities With CSOs
VIII	CO	27	1
	MT	6	ND
	ND	3	0
	SD	2	ND
	UT	13	0
	WY	3	0
IX	AZ	15	0
	CA	100	1
	HI	1	0
	NV	5	0
X	AK	2	0
	ID	13	ND
	OR	20	ND
	WA	8	ND
	Total	1,434	240

NA = Not applicable; State-implemented pretreatment program.

ND = No data available.

*Limited data are available; estimates based on information submitted to EPA in response to the National CSO Control Strategy.

Source: EPA (1990c) and NEWPCA (1989).

3.4.1.2 Characterization of Storm Water

Storm-water runoff collected by combined sewer systems may contain toxic pollutants that may ultimately be discharged into POTWs. Toxic pollutants in storm-water runoff come primarily from urban roadways and parking lots, runoff from industrial facilities, agricultural runoff of pesticides, and air pollutants washed to the ground by precipitation.

The most complete study to determine types of pollutants found in storm-water runoff was conducted by EPA during the Nationwide Urban Runoff Program (NURP). In 1978, EPA initiated NURP to determine the nature, cause, and severity of urban runoff problems and to identify opportunities for controlling these problems. The program, conducted by Woodward and Clyde, provided information and methodologies for water quality planning efforts. It consisted of 28 separate projects sampling and analyzing storm water runoff in specific types of watersheds. Data from the NURP study provide insight on what can be considered background levels of pollutants in storm-water runoff from residential, commercial, and light industrial land use areas. NURP data were used as the basis of proposed storm-water regulations published by EPA on November 16, 1990 (55 *FR* 47990).

To assess the pollutant loadings of storm-water discharges exclusively, NURP avoided any sites where combined sewers existed. No national studies have been conducted to measure how much storm water is actually discharged into combined sewers, so pollutant loadings from storm water that reach POTWs cannot be estimated on a national level. It can be assumed, however, that the types of toxic pollutants identified in storm-water runoff in the NURP study would be present in combined sewer flows and, thus, discharged to POTWs.

Table 3-23 summarizes the results of the NURP priority pollutant sampling program. Seventy-six priority pollutants, comprising 15 inorganic and 61 organic compounds, were detected in the runoff samples. Toxic metals were, by far, the most prevalent priority pollutants found in urban runoff. All 15 priority pollutant inorganics (12 metals plus cyanide, fluorine, and selenium) were detected. All but mercury, silver, thallium, and fluorine were detected in at least 10 percent of the samples. Copper, lead, and zinc were the most prevalent, being detected in over 90 percent of the samples. Other inorganics frequently detected included arsenic, chromium, cadmium, nickel, and cyanide.

Organic pollutants were generally detected less often in urban runoff samples and were generally found at lower concentrations than inorganic pollutants. Sixty-one (of 106 organic priority pollutants) were detected in at least one urban runoff sample. The plasticizer bis(2-

Table 3-23. Frequency of Detection of Priority Pollutants in Urban Runoff During the Nationwide Urban Runoff Program

Constituent	Frequency of Detection (percentage of samples)
Lead	94
Zinc	94
Copper	91
Chromium	58
Arsenic	52
Cadmium	48
Nickel	43
Cyanide	23
Phthalate, Bis (2-ethylhexyl)	22
Alpha-Hexachlorocyclohexane	20
Alpha-Endosulfan	19
Phenol, Pentachloro	19
Chlordane	17
Fluoranthene	16
Gamma-Hexachlorocyclohexane	15
Pyrene	15
Phenol	14
Antimony	13
Phenanthrene	12
Beryllium	12
Methane, Dichloro	11
Selenium	11
Phenol, 4-Nitro	10
Chrysene	10
Mercury	9
Methane, Trichloro	9
Naphthalene	9
p-Chloro-m-Cresol	8
Silver	7
Anthracene	7
Aldrin	6
Dieldrin	6
Heptachlor	6
Thallium	6
1,1,1-Trichloroethane	6
Trichloroethylene	6
Ethyl Benzene	6
Phthalate, Diethyl	6
Phthlate, Di-N-Butyl	6
Phthlate, Di-N-Octyl	6
Phthlate, Butyl Benzyl	6

Table 3-23. Frequency of Detection of Priority Pollutants in Urban Runoff During the Nationwide Urban Runoff Program (continued)

Constituent	Frequency of Detection (percentage of samples)
Benzo (a) Pyrene	6
Beta-Hexachlorocyclohexane	5
Methane, Trichlorofluoro	5
Ethylene, Tetrachloro	5
Benzene	5
Benzene, Chloro	5
Benzo (b) Fluoranthene	5
Ethene, 1,2-Trans-Dichloro	4
Benzo(a)anthracene	4
Isophorone	3
Methane, Tetrachloro	3
Ethane, 1,1-Dichloro	3
Toluene	3
Benzo(k)fluoranthene	3
Heptachlor Epoxide	2
Ethane, 1,1,2-Trichloro	2
Ethane, 1,1,2,2-Tetrachloro	2
Ethene, 1,1-Dichloro	2
Propene, 1,3-Dichloro	2
DDT	1
PCB-1260	1
Methane, Chlorodibromo	1
Methane, Dichlorobromo	1
Methane, Tribromo	1
Ethane, 1,2-Dichloro	1
Propane, 1,2-Dichloro	1
Phenol, 2-Chloro	1
Phenol, 2-Nitro	1
m-Cresol, p-Chloro	1
Phthalate, Dimethyl	1
Benzo (g,h,i) Perylene	1
Dibenzo (a,h) Anthracene	1
Fluorene	1
Ideno(1,2,3-c,d)Pyrene	1

Source: EPA (1983).

ethylhexyl) phthalate, found in 22 percent of the urban runoff samples, was detected most frequently, followed by the pesticide alpha-hexachlorocyclohexane (alpha-BHC), detected in 20 percent of the samples.

In summary, toxic pollutants reach POTWs via storm-water runoff collected by combined sewers, although the quantities of toxic pollutants cannot be estimated with currently available data. The most common storm-water runoff pollutants found in the NURP study were toxic metals, such as lead, zinc, copper, chromium, arsenic, cadmium, nickel, and cyanide.

3.4.2 Infiltration/Inflow Sources

Infiltration and inflow may also contribute a diverse load of toxics to POTWs. Infiltration is the passage of ground water into a collection system through breaks and leaks in the system. Inflow, the uncontrolled entrance of water into the system from surface sources, typically occurs when surface water passes over unsealed manhole access points.

Pollutant loadings resulting from inflow reflect the characteristics of the storm water entering the system (see Subsection 3.4.1). Pollutant loadings resulting from infiltration reflect any contamination of the ground water in the area where the infiltration is occurring. In areas where the ground water is uncontaminated, the problem will simply be one of additional hydraulic load. In the vicinity of hazardous waste sites or other ground-water contamination, infiltration may also constitute a source of toxic pollutants. Because infiltration is difficult to detect and is rarely analyzed for the presence of pollutants, the extent of infiltration as a source of toxics is generally unknown. However, there have been some instances in which the infiltration of toxics has been found to be a significant source of toxic pollutants. These instances are discussed below.

The Niagara Falls, New York, area provides an example of how ground water contaminated by hazardous waste can affect the sanitary sewer system through inflow and infiltration. Disposal of hazardous wastes in the Love Canal area has caused extensive contamination of ground water in the area, which is served by a separate sanitary and storm-water collection system. As a result, there is continuous infiltration of pollutants into the sanitary sewer system. In addition, sufficient contamination occurs in the storm water so that a portion of the dry weather flow in the storm-water sewer system is required to be sent to the POTW for treatment.

Another example of toxics entering a collection system through infiltration can be found in Largo and Hollywood, Florida (Hazen and Sawyer, 1990). Diazinon, apparently from agricultural use, has been detected consistently throughout the collection systems. There are no known point source discharges, but it is possible for inflow to occur through unsealed manholes or other such methods. Although the measured concentrations are low (~1 part per billion [ppb]), the LD_{50} for *Cerodaphnia duba* is 0.35 ppb. As a result, both cities are currently unable to comply with their effluent bioassay limitations. Both cities are conducting tests to verify that contaminated ground water is the cause of the contamination, as well as exploring several treatment options.

The City of Blackwell, Oklahoma, also has found that infiltration of ground water into the sewer system causes POTW effluent toxicity (City of Blackwell, 1990). Specifically, monitoring by the City of Blackwell showed that cadmium and zinc were entering a specific section of the sewer collection system via ground water. Remediation of the sewer collection system to stop infiltration has reduced toxicity of the POTW effluent.

3.4.3 Waste Haulers

A common method for the disposal of liquid wastes from domestic, commercial, or industrial sources not connected to a POTW collection system is to have them hauled to a POTW. The types of wastes that can be hauled to POTWs range from septic tank pumpings to industrial process wastewater. The control over the discharge of hauled wastes varies among POTWs.[21]

The only data available that estimate the prevalence of the discharge of hauled wastes are contained in PASS. According to PASS, 47 percent of the POTWs accept hauled septage (material removed from residential septic tanks during periodic maintenance), 3.4 percent accept hauled landfill leachate, less than 1 percent accept hauled RCRA/CERCLA site wastes/leachate, and 1.5 percent accept hauled hazardous waste.[22]

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21. Recent revisions to the General Pretreatment Regulations (55 *FR* 30082; July 24, 1990) require increased control over waste haulers. Specifically, the regulations forbid the discharge of trucked or hauled wastes to sanitary sewers except at points designated by the Control Authority (40 *CFR* 403.5[b][8]).

22. The percentages from PASS are based on the results of audits of 530 POTW pretreatment programs.

Limited data are available at the national level that characterize the types and quantities of toxic pollutants contained in hauled wastes. However, EPA recently collected data from several POTWs and provided the results in the report entitled, *Supplemental Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program: Domestic/Commercial Loadings Removal Efficiency Estimation* (EPA, 1991). Overall average pollutant levels in septage hauler loads, obtained from nine municipalities in seven Regions, are presented in Table 3-24.

Table 3-24. Summary of Pollutants Detected in Septage Hauler Wastes

Pollutant	Septage Average (mg/l)	Pollutant	Septage Average (mg/l)
Acetone	10.588	Methyl Ethyl Ketone	3.650
Benzene	0.062	Methylene Chloride	0.101
Ethyl Benzene	0.067	Toluene	0.170
Isopropyl Alcohol	14.055	Xylene	0.051
Methyl Alcohol	15.84		
Arsenic	0.141	Lead	1.210
Barium	5.758	Manganese	6.088
Cadmium	0.097	Mercury	0.005
Chromium (T)	0.490	Nickel	0.526
Cobalt	0.406	Silver	0.099
Copper	4.835	Tin	0.076
Cyanide	0.469	Zinc	9.971
Iron	39.287		

Source: EPA (1991).

Metals identified at the highest average levels were iron (39.287 mg/l), zinc (9.971 mg/l), manganese (6.088 mg/l), barium (5.758 mg/l), and copper (4.835 mg/l). As indicated, organics identified at the highest average levels are methyl alcohol (15.84 mg/l), isopropyl alcohol (14.055 mg/l), and acetone (10.588 mg/l). Pollutant concentrations in septage (Table 3-24) are higher than their corresponding concentrations in residential/commercial wastewater (Tables 3-15 and 3-16) because septic systems accumulate, and therefore concentrate, wastes before the wastes are hauled to a POTW. POTWs whose influents comprise a relatively large proportion of hauled septage may find that these wastes contribute significant loadings of certain pollutants.

It should be noted that POTWs that accept hazardous wastes by truck, rail, or dedicated pipe are considered to be hazardous waste treatment, storage, and disposal facilities (TSDFs) and are subject to regulation under RCRA. Under RCRA, mixtures of domestic sewage and other wastes, including those considered hazardous, that commingle in the POTW's collection system prior to reaching the property boundary of the POTW are excluded from RCRA regulation. Hazardous wastes delivered directly to the POTW by truck, rail, or dedicated pipeline do not fall within the exclusion and may only be accepted by POTWs that comply with the applicable RCRA requirements for TSDFs.

Hazardous wastes delivered to POTWs by truck, rail, or dedicated pipe may vary in quantity and characteristics from load to load. EPA did not analyze the constituents of hauled hazardous wastes or the extent to which they contribute to toxic pollutant loadings at POTWs for purposes of this report. The Rock Creek Waste Treatment Facility in Independence, Missouri, is an example of a facility that accepts hauled hazardous waste. In 1989, the facility received wastes totaling more than 81 million gallons from nine firms. An example of the leachate from a secure hazardous waste landfill received by the Rock Creek WTF from the Peoria Disposal Company is shown below.

Parameter	Concentration (mg/l)
Total Phenols	2.5
Benzene	0.065
1,1-Dichloroethane	0.098
1,2-Dichloropropane	0.17
Ethylbenzene	3.5
Toluene	21.0
Trans-1,2-Dichloroethylene	0.18
1,1,2-Trichloroethane	0.024
2,4-Dimethylphenol	0.59
Manganese	2.7
Nickel	2.3
Trichloroethylene	0.52
2-Methylphenol	4.4

3.4.4 RCRA and CERCLA Activities

This section addresses the potential impacts that wastewaters from RCRA corrective actions, CERCLA remediations, underground storage tank (UST) cleanups, and municipal landfills may have on discharges of toxic pollutants to POTWs.

3.4.4.1 Background

Congress and EPA have attempted to minimize the potential degree of overlap between RCRA and CWA statutes and in subsequent rulemakings—hence, the domestic sewage exclusion and the wastewater treatment tank exemption. The exclusion and exemption were designed to limit overlap while providing that wastewaters would be treated sufficiently to protect our Nation's waters. The practical impact of the exclusion and exemption was to place the responsibility for wastewater effluent quality on EPA, State, and local water quality managers. Thus, for example, of the 8.9 million tons of hazardous waste managed in the State of New Jersey, approximately 7 million tons (or 78.7 percent) are wastewaters managed through RCRA-exempt processes (EPA, 1985).

Over the last 6 years, since the passage of the Hazardous and Solid Waste Amendments (HSWA) of 1984, increasingly more attention has been placed on the perceived increases in intermedia transfer of wastes from the land to the water media. Prior to HSWA, concerns centered on intermedia transfers from water to land, most significantly the growing quantities of hazardous sludges generated as a result of CWA wastewater treatment requirements. HSWA included several provisions that, taken together, were designed to limit the Nation's reliance on land disposal. These provisions included:

- <u>The Loss of Interim Status Provision</u>—Required compliance with ground-water monitoring, closure, post-closure, and financial responsibility guidelines by a certain date, thereby resulting in the closure of many interim status land disposal facilities.
- <u>The Land Disposal Restrictions Program</u>—Prohibited land disposal of hazardous wastes unless certain treatment levels were achieved.
- <u>Enhanced Treatment Design Requirements for Surface Impoundments and Landfills</u>—Required new and old landfills and surface impoundments to meet certain liner and leachate collection requirements.
- <u>The Corrective Action Program</u>—Enhanced the coverage of corrective action requirements for ground-water, soil, surface water, and air release remediation at interim status and permitted facilities for all solid waste management units. Subtitle I of the HSWA authorized an UST program, including corrective action requirements for UST releases.

These provisions were designed to decrease industry's reliance on surface impoundments, landfills, and other land-based units for hazardous waste treatment, storage, and disposal, thereby decreasing the likelihood of future ground-water contamination. Their effect could be the possible diversion of greater amounts of waste to POTWs, which would create a greater regulatory burden for the local pretreatment programs.

Another source of discharges to POTWs comes from cleanup sites regulated under CERCLA, also known as Superfund. The Superfund remedial action program, like the RCRA corrective action program, could potentially result in increased discharges to POTWs.

As noted previously, many activities conducted as a result of RCRA and CERCLA initiatives can affect the methods by which wastewaters are managed. These actions may have an impact on the volumes or quality of wastewaters discharged to POTWs. Those RCRA and CERCLA programs that may result in appreciable increases in the quantity or quality of wastewaters are summarized below.

3.4.4.2 RCRA Corrective Actions and CERCLA Remedial Actions

Both the RCRA Subtitle C corrective action program and CERCLA remedial action program could result in increased discharges to POTWs as a result of cleanup activities. While no firm estimates are available of the quantity of wastewaters that is or may be discharged as a result of these programs, the use of a POTW is a potential treatment alternative for such wastewaters. EPA's Pretreatment Audit Summary System, for example, lists five pretreatment authorities that acknowledged the receipt of RCRA/CERCLA corrective/remedial action wastes by truck, rail, or dedicated pipeline. In all likelihood, a still larger number of POTWs received wastewaters from RCRA/CERCLA cleanup actions discharged directly to their collection systems.

EPA estimates that 5,700 hazardous waste treatment, storage, or disposal facilities are currently subject to RCRA Subtitle C and are potentially subject to the corrective action requirements. Together, these facilities are likely to have as many as 80,000 solid waste management units. EPA also estimates that up to 1,700 facilities will require ground-water remediation (55 *FR* 30862).

Currently, 1,189 facilities are on the Superfund National Priorities List (NPL). EPA estimates that 37 percent of Fund-lead sites will involve either ground-water or surface-water restoration (EPA, 1988b). Restoration activities include pumping and treating ground waters from contaminated aquifers. The Seymour Recycling Corporation (SRC) site, to cite one example, is a 14-acre area 2 miles southwest of Seymour, Indiana. From about 1970 through 1980, SRC operated a processing center for waste chemicals in a predominantly agricultural area. Ground water in the vicinity of the site is contaminated. The primary contaminants of concern in the ground water include volatile organic chemicals (i.e., trichloroethylene, benzene, and toluene), other organics, and heavy metals. The selected remedial alternative for the site is the implementation of a plume stabilization system that will extract and treat a total of approximately 102 million gallons of contaminated ground water. The treated ground water is sent to the Seymour Wastewater Treatment Plant, a POTW with an actual flow of 3.4 mgd (EPA, 1987a). It is estimated that 0.4 mgd of treated ground water will be discharged to the POTW over a 12-year period.

3.4.4.3 UST Cleanups

EPA estimates that nearly 850,000 facilities and approximately 1.7 million tanks are subject to the Agency's UST program (EPA, 1988c). Of these, the Agency estimates that about 21 percent are leaking from either the tank, the fill system, or the discharge system. Leaking USTs can have a direct and indirect impact on POTWs. As discussed in Subsection 3.4.2, sanitary and storm sewer collection systems can become contaminated through infiltration of contaminated ground water (EPA, 1987c). Perhaps of greater significance, however, is the impact of the volumes of waters that may be discharged to POTWs as a result of UST cleanup actions. These contaminated waters can come from the following sources: contaminated ground water, contaminated storm water, wastewaters generated from tank-cleaning operations, and contaminated water resulting from product recovery operations.

While the total median release volume from USTs reaching ground water is 4,500 gallons per incident, the volume of ground water eventually contaminated, and needing remediation, is far greater (EPA, 1988c). The volume of discharges generated from cleanups varies as a result of site-specific factors, such as the size of the release and the depth to ground water. However, EPA estimates that the typical flow of wastewater discharge as a result of UST cleanups is in the range of 3 to 20 gallons per minute, or about 4,000 to 30,000 gallons per day (EPA, 1989a).

The major constituents present in discharges from UST cleanups depend upon the materials stored in the tanks. The primary pollutants found in cleanups of gasoline USTs, for example, include benzene, toluene, xylene, and ethylbenzene.

The U.S. Coast Guard Air Station in Traverse City, Michigan, was in the process of installing a new fuel farm system in 1979 when soil contamination was discovered in a jet fuel storage area. Subsequent investigations found that the ground water was contaminated. The Coast Guard found that the apparent source of the contamination was a high-octane aviation fueling station failure 11 years earlier, which resulted in a 2,000 gallon release of product over a 12-hour period (EPA, 1987c). Contaminated soil was removed and a containment system consisting of seven extraction wells was constructed to block further plume migration. Water pumped from the extraction well system was piped to a carbon treatment system, where carbon reactors were specified to reduce the levels of benzene and toluene in the water to less than 1 microgram per liter. The treated UST wastewater is then discharged at a rate of 200 gpm to the Traverse City POTW, a pretreatment POTW with an actual flow of 3.27 mgd (and a design flow of 8.5 mgd).

3.4.4.4 Municipal Solid Waste Landfills

This subsection analyzes the potential effects of discharges from municipal solid waste landfills (MSWLFs) to POTWs. Two concerns are addressed: (1) treatment of generated leachates, and (2) contaminated ground waters discharged upon treatment.

EPA's proposed criteria for MSWLFs, which should be finalized in 1991, would require new and existing MSWLFs to institute practices to control leachate collection and surface water runoff. Most new landfills and lateral expansions of existing landfills would be required to install liners and leachate collection systems. (Existing units would not be required to retrofit with liners and leachate collection systems, however). All landfills would be required to construct run-on/runoff controls for surface water. EPA expects that with the imposition of these controls, more leachate will be collected and need to be treated. EPA's Report to Congress on solid waste disposal noted that trucking leachate to POTWs was the most common leachate management method (EPA, 1988d).

Historically, many MSWLFs have not had leachate collection and run-on/runoff controls. A survey conducted by EPA in 1986 and 1987 identified approximately 6,000 MSWLFs nationwide (EPA, 1988d). Sixty-one percent of these landfills, or 4,016 facilities, had run-on/runoff controls. Approximately 11 percent (746 landfills) had leachate collection systems, and roughly 3.5 percent (228 landfills) recirculated leachate. Since only 746 existing landfills out of 6,000 currently have leachate collection systems, it is possible that more than 5,200 will be required to install such systems, assuming the proposed rule is finalized without changes. (It is more likely, however, that only 3,000 to 4,000 will continue to operate and expand and, thus, be required to install leachate collection). Roughly 2,000 will be required to install run-on/runoff controls.

It is difficult to estimate the volume of leachate that will be generated by these landfills. Leachate generation depends on many site-specific variables, including the amount of annual precipitation, surface water conditions, underlying soil conditions, waste characteristics, and the landfill design specifications. It is reasonable to assume, however, that generated leachate will be considered for disposal at POTWs, particularily since 86 percent of MSWLFs are owned by government entities, often the same public entity that operates the POTW (EPA, 1988d).

Leachate composition also varies among landfills because of such variables as waste characteristics and landfill age. EPA has compiled a data base of leachate data from 70 MSWLFs (EPA, 1988d). Leachate from 53 of the landfills was analyzed for organic pollutants, and leachate from 62 landfills was analyzed for inorganic pollutants. The following table identifies the most commonly detected organic pollutants.

Organic Constituent	Concentration Range (parts per million)
1,1-Dichloroethane	0.004 - 44
Trans-1,2-Dichloroethylene	0.002 - 4.8
Ethylbenzene	0.006 - 4.9
Methylene Chloride	0.002 - 220
Phenol	0.007 - 28.8
Toluene	0.006 - 18

The next table lists the most commonly detected inorganic pollutants.

Pollutants	Concentration Range (parts per million)
Arsenic	0.0002 - 0.982
Barium	0.11 - 5
Cadmium	0.007 - 0.15
Chloride	31 - 5,475
Chromium (total)	0.0005 - 1.9
Copper	0.003 - 2.8
Iron	0.22 - 2,280
Lead	0.005 - 1.6
Manganese	0.03 - 79
Nickel	0.02 - 2.2
Nitrate	0.01 - 51
Sodium	12 - 2,574
Sulfate	8 - 1,400

Source: EPA (1988d).

Data on MSWLF leachate were not compiled for such factors as sampling and handling procedures, analytical methods, pollutants for which samples were analyzed, and landfill conditions. The data do, however, highlight the wide variability in both the pollutants identified and their concentrations. It should be kept in mind that MSWLFs may accept hazardous waste from household or small quantity generators, nonhazardous industrial process waste, demolition waste, and municipal incinerator ash. In the past, MSWLFs also accepted pre-RCRA regulated hazardous waste. These wastestreams indicate the potential for leachate to contain a wide variety of organic and inorganic toxic pollutants.

In addition to the requirements for leachate collection and run-on/runoff controls, the revised criteria (if finalized as proposed) will require MSWLFs to undertake corrective action for releases to ground water. The most common form of treatment for contaminated ground water is removal and treatment (EPA, 1988d). As with estimating the volume of leachate generated, it is difficult to estimate the volume of contaminated ground water potentially requiring treatment. The volume of contaminated ground water depends upon the age of the landfill, the flow rate of ground water in the vicinity of the landfill, and the dispersion characteristics of the contaminants.

The number of MSWLFs requiring corrective action could be significant. For example, of the 1,189 sites on EPA's February 1991 revision of the NPL, approximately 20 percent were municipal landfills. An additional 116 landfills not on the NPL have been identified as requiring cleanup under State hazardous waste programs in eight States (GAO, 1989). The Regulatory Impact Analysis for the proposed municipal solid waste landfill rule estimated that the percentage of landfills requiring corrective action could range from 5 to 40 percent (300-2,400 landfills), depending on the location of the point of compliance (EPA, 1988d).[23]

3.4.4.5 Used Oil Recycling

An estimated 1,350 million gallons of used oil are generated each year from utilities, metal working plants, railroad yards, service stations, and other transportation-related facilities. Of this volume, EPA estimates that over 193 million gallons of used oil are

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23. The point of compliance can be considered a boundary; ground water beyond this point must meet cleanup standards.

generated annually by people in the United States who change their oil in their automobiles and that an estimated 2 percent of do-it-yourselfers empty 4 million gallons of oil into sanitary sewers. Another 132 million gallons are dumped by "other automotive generators," but the proportion of that discharged to sewers is unknown (Voorhees, 1989).

EPA and various States are now undertaking serious efforts to recycle used oil. A reduction in improperly disposed oil (i.e., dumped to sanitary sewers) would be expected. However, discharges to sanitary sewers from centralized used oil recyclers will still need to be controlled by POTWs.[24]

The recycling of waste oils normally requires pretreatment (through heating, screening, gravity separation, filtering, chemical flocculation, and dehydration) to remove bottoms, sediments, and water prior to re-refining. The resulting wastewaters contain organics and toxic metals (e.g., lead, chromium, arsenic). The discharge of such wastewaters to POTWs can cause problems at the wastewater treatment plant.

For example, the city of St. Petersburg, Florida, experienced over 30 major interferences in a 6-month period in 1988 from an "unknown substance." After an investigation was initiated, involving extensive sewer line testing, the source was identified as a used oil recycler. Samples taken from the sewer line in the vicinity of the oil recycler were described as containing a "complex hydrocarbon mixture" with hydrocarbons n-nonane through n-dodecane, toluene, and other benzene compounds. POTW personnel identified that, in addition to the effect of the discharge on the plant's dissolved oxygen levels in the aerators and the deleterious impact on the biological treatment process, the discharge also affected the health of plant employees and resulted in NPDES permit violations. An administrative order was issued, and the used oil recycler installed an air stripper to remove volatile pollutants from recycling wastewaters prior to discharge (telephone conversation between R. Linett and J. Parnell, 1990).

3.5 CASE STUDIES

The three case studies for this report examined the number and types of industries regulated by three local pretreatment programs. Table 3-25 summarizes the industrial

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24. As discussed in Subsection 3.2.2.4, EPA is currently examining the used oil reclamation and re-refining industry for possible regulation under national categorical standards. Management standards for recycled used oil under RCRA are also being examined, as is the listing of used oil as a hazardous waste.

Table 3-25. Overview of Industries Discharging to Case Study POTWs

City/ POTW	No. of Regulated IUs	Categorical Industries		Other Significant Industries		Other	
		No.	Category	No.	Type/ Category	No.	Type
Thomasville, NC	13	4	Metal Finishing	5	Textiles	0	N/A
				1	Chemical Blender		
				1	Bakery		
				1	Drum Reconditioning		
				1	Furniture Manufacturing		
Hampton Roads Sanitation District, VA	312	1	Coil Coating	1	Glass Manufacturing	approximately 2,700	Car Dealers
		2	Electroplating	1	Paint Formulating		Small Medical Facilities
		20	Metal Finishing	3	Dairy Products		Other Medical Facilities
		3	Organic Chemical	7	Centralized Waste-Treating		
				12	Industrial Laundry		
				1	Barrel Reclaiming		
				1	Transportation/Services Cleaning		
				260	Other		
Pocatello, ID	9	1	Electrical and Electronic Components	1	Railroad Maintenance	1	Electroplating (no discharge)
				1	Frozen Foods	206	Minor and Insignificant
		1	Electroplating	1	Barley-Malt Plant		
				1	Dairy Products		
				1	Fish Hatchery		
				1	Food Processor		
				1	Industrial Complex		

contributors to each of the programs. The case studies also investigated the relative contributions of flow from domestic and industrial sources. As can be seen in Table 3-26, all three programs received between 18 and 25 percent of the total flow from significant industrial users.

All three POTWs have noted reductions in loadings of pollutants from industrial users. However, pollutants discharged from domestic and commercial sources have stayed constant and in some cases have increased. Figure 3-2 summarizes the sources of several pollutants discharged to the Thomasville POTW. As shown, domestic and commercial loadings constitute less than 50 percent of the total POTW loading for all pollutants except silver, for which domestic and commercial loadings account for more than 90 percent of the total POTW loading. Hampton Roads Sanitation District (HRSD) has experienced substantial decreases in metals loading since it began implementing its pretreatment program; however, loadings of copper and zinc have remained constant, a result the POTW attributes to domestic sources. Pocatello, like HRSD, routinely detects only copper and zinc in its effluent. Pocatello sampled its industrial sources and domestic areas and determined that domestic sources are the primary contributors of copper and zinc. Pocatello also has sampled raw water sources and has further identified the source of copper and zinc to probably be corrosion of piping and related appurtenances.

3.6 Pollution Prevention Initiatives

In October 1988, Congress passed the Pollution Prevention Act of 1990, which states as national policy that pollution should be prevented or reduced at its source wherever possible. The Act requires direct EPA involvement in the advocacy, measurement, and regulation of source reduction techniques, and it provides a State grant program to encourage source reduction by businesses. To date, EPA has published pollution prevention guidance manuals for seven industrial categories; manuals for another 11 categories are scheduled for publication in 1991.

Some industrial facilities have implemented pollution prevention technologies as a cost-efficient means of managing their wastestreams. For example, it may be more environmentally productive and less costly to reformulate products, modify processes, redesign equipment, or reuse waste materials than to implement traditional end-of-pipe controls. The implementation of pollution prevention measures at industrial facilities has been shown to reduce the amounts of pollutants in air, water, sludge, solid waste, and wastewater. As more industries recognize the environmental and economic benefits of

Table 3-26. Sources of Toxic Pollutants Discharged to Case Study POTWs

City/POTW	Average Daily Flow Rate (mgd)	Domestic		Categorical IUs		Other Significant IUs	
		Percent of Total Flow	Major Pollutants Contributed	Percent of Total Flow	Major Pollutants Contributed	Percent of Total Flow	Major Pollutants Contributed
Thomasville, NC	4	75	None	4	Cu, Ni, others	21	Cu, Zn, others
Hampton Roads Sanitation District, VA	154 (1989)	81.3	Copper	1.0	Cd, Cr, Cu, Pb, Ni, As	17.7	Cd, Cr, Cu, Pb, Ni, As, Ag
Pocatello, ID	7	80	Copper Zinc	5	Fl, Ni, Others	15	Metals, Organics, Conventionals

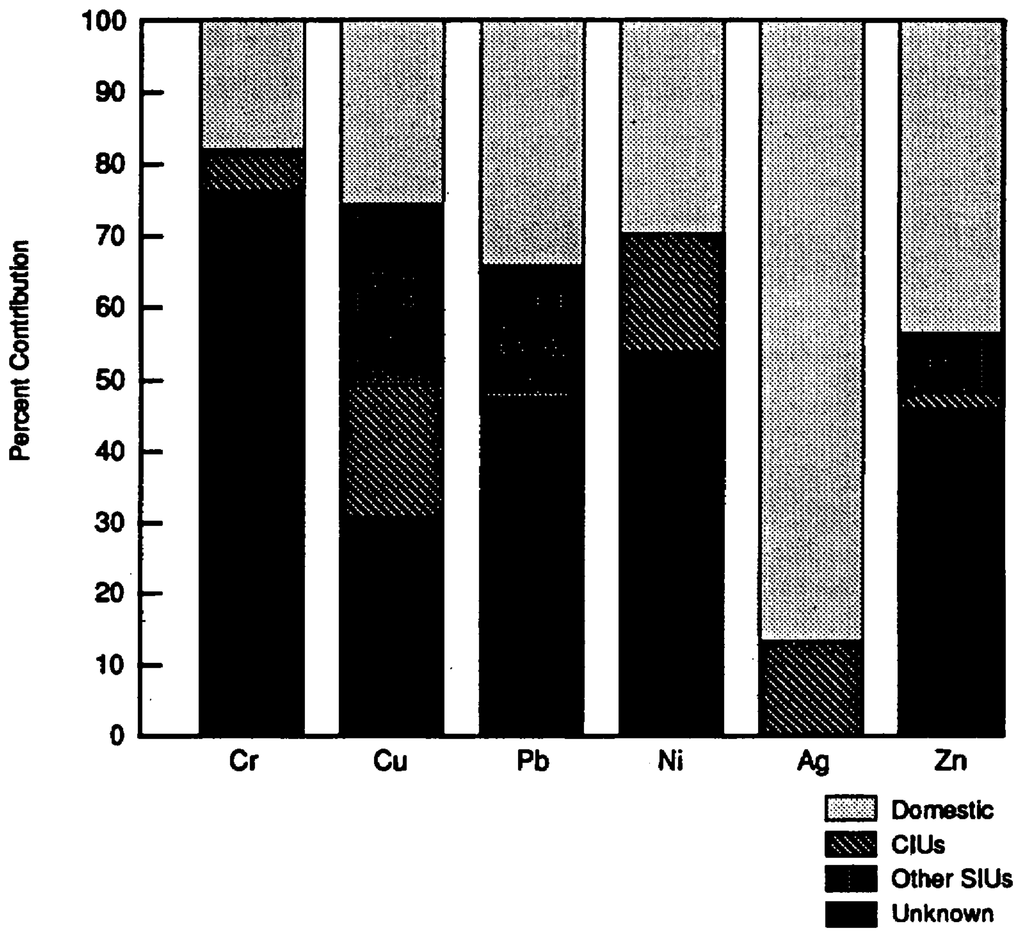

Figure 3-2. Sources of Toxic Pollutants Discharged to the Thomasville, North Carolina, POTW

pollution prevention technologies over pollution control technologies, it is likely that more industries will be discharging fewer toxic pollutants into POTWs. The pretreatment program is well suited to the use of pollution prevention as a means of protecting POTWs and their sludge.

Through the EPA Pollution Prevention Information Clearinghouse (PPIC), EPA collects, studies, develops, and distributes information concerning pollution prevention. Table 3-27 summarizes the types of pollution prevention techniques for various industrial categories presented in the PPIC. The general techniques include:

- Source Reduction—Reduces the volume (and toxicity) of waste generated or transferred to the environment. Reduction techniques include waste segregation, materials handling and housekeeping, process modifications, equipment replacement, employee training, and development of corporate strategies.
- Waste Recycle/Recovery—Reduces the amount of waste that must ultimately be disposed of, such as:
  - Closed-Loop Recycling: Alteration of production line to include reuse of materials as part of the manufacturing process.
  - Reuse of Original Product: Reuse of waste materials in their original form. For example, bottles that are sterilized and reused require less energy and virgin material.
  - Primary Recycling: Where material reuse is not possible, the materials in the waste are reclaimed for future use in a similar product. For example, waste bottles are converted to glass.
  - Secondary Recycling: When reuse and primary recycling are not possible, waste materials are converted directly into a new product. For example, paper is made into compost.
- Energy Recovery—Recovers energy or heat from wastes through combustion, incineration, or thermal transfer.

Table 3-27 shows that pollution prevention case studies exist for 36 of the 47 industrial categories examined for this report. Therefore, it has been shown that reductions in toxic pollutants can be achieved through pollution prevention techniques. Many of these pollutants have been identified as being discharged to POTWs in large quantities. One of the more prevalent pollution prevention techniques used is the recycling of solvents, many of which were identified in Section 3.2 of this report as being discharged by most industries.

Several POTWs have begun to integrate the concept of pollution prevention into their local pretreatment programs as a means of controlling toxic discharges. For example, the Massachusetts Water Resources Authority (MWRA) Sewerage Division (Boston) has

Table 3-27. Summary of Case Study Information in the EPA Pollution Prevention Information Clearinghouse

Industrial Category	Number of Case Study Citations	Type of Prevention Technique(s) Presented in Case Studies (and number of cases describing technique)
Battery Manufacturing	1	Source Reduction (1)
Coal, Oil, Petroleum Products, and Refining	7	Source Reduction (1) Waste Recycle/Recovery (6)
Cosmetics, Fragrances, Flavors, and Food Additives	1	Energy Recovery (1)
Electric Generating Power Plants and Electric Distribution Services	7	Source Reduction (2) Waste Recycle/Recovery (2) Energy Recovery (3)
Electrical and Electronic Components	29	Source Reduction (12) Waste Recycle/Recovery (17)
Electroplating/Metal Finishing	43	Source Reduction (20) Waste Recycle/Recovery (23)
Equipment Manufacture and Assembly	35	Source Reduction (16) Waste Recycle/Recovery (18) Energy Recovery (1)
Fertilizer Manufacture	7	Source Reduction (5) Waste Recycle/Recovery (2)
Food and Food By-products Processing	19	Source Reduction (9) Waste Recycle/Recovery (6) Energy Recovery (3)
Industrial and Commercial Laundries	1	Source Reduction (1)

Table 3-27. Summary of Case Study Information in the EPA Pollution Prevention Information Clearinghouse (continued)

Industrial Category	Number of Case Study Citations	Type of Prevention Technique(s) Presented in Case Studies (and number of cases describing technique)
Inorganic Chemicals Manufacturing	26	Source Reduction (8) Waste Recycle/Recovery (17) Energy Recovery (1)
Iron and Steel Manufacturing	18	Source Reduction (5) Waste Recycle/Recovery (12) Energy Recovery (1)
Laboratories and Hospitals	2	Source Reduction (2)
Leather Tanning and Finishing	7	Source Reduction (1) Waste Recycle/Recovery (6)
Miscellaneous Chemical Formulation	2	Source Reduction (1) Waste Recycle/Recovery (1)
Motor Vehicle Services	3	Source Reduction (2) Waste Recycle/Recovery (1)
Nonferrous Metals Forming	6	Source Reduction (2) Waste Recycle/Recovery (4)
Nonferrous Metal Manufacturing	5	Source Reduction (1) Waste Recycle/Recovery (4)
Organic Chemical Manufacturing	8	Source Reduction (5) Waste Recycle/Recovery (3)
Paint Manufacture and Formulation	3	Source Reduction (3)
Pesticides Formulation	1	Source Reduction (1)

Table 3-27. Summary of Case Study Information in the EPA Pollution Prevention Information Clearinghouse (continued)

Industrial Category	Number of Case Study Citations	Type of Prevention Technique(s) Presented in Case Studies (and number of cases describing technique)
Pesticides Manufacturing	1	Source Reduction (1)
Pharmaceutical Manufacturing	2	Source Reduction (1) Waste Recycle/Recovery (1)
Photographic Chemicals and Film Manufacturing	7	Waste Recycle/Recovery (7)
Plastics, Resins, and Synthetic Fibers Manufacturing	25	Source Reduction (8) Waste Recycle/Recovery (15) Energy Recovery (2)
Printing and Publishing	14	Source Reduction (6) Waste Recycle/Recovery (7) Energy Recovery (1)
Pulp and Paper Mills	15	Source Reduction (9) Waste Recycle/Recovery (5) Energy Recovery (1)
Rubber Manufacturing and Processing	4	Source Reduction (1) Waste Recycle/Recovery (2) Energy Recovery (1)
Service Related Industries	10	Source Reduction (7) Waste Recycle/Recovery (3)
Stone, Clay, Glass, Concrete, and Other Mineral Processing	14	Source Reduction (5) Waste Recycle/Recovery (9)
xtile Mills	10	Source Reduction (6) Waste Recycle/Recovery (4)

Table 3-27. Summary of Case Study Information in the EPA Pollution Prevention Information Clearinghouse (continued)

Industrial Category	Number of Case Study Citations	Type of Prevention Technique(s) Presented in Case Studies (and number of cases describing technique)
Timber Products Processing	8	Source Reduction (2) Waste Recycle/Recovery (3) Energy Recovery (3)
Transportation Services	6	Source Reduction (2) Waste Recycle/Recovery (4)
Waste Reclamation Services	3	Waste Recycle/Recovery (2) Energy Recovery (1)
Waste Treatment and Disposal Services	15	Source Reduction (4) Waste Recycle/Recovery (9) Energy Recovery (2)
Wood Furniture Manufacture and Refinishing	13	Source Reduction (7) Waste Recycle/Recovery (5) Energy Recovery (1)

initiated an industrial source reduction demonstration/pilot project to examine pollution prevention as a means of controlling toxic pollutants. In December 1990, the MWRA announced a new permit fee system intended to create economic incentives for reducing industry's use of toxics, under which industrial dischargers of toxics would be assessed higher annual fees than industrial dischargers of nontoxic wastewaters.

In another example, the Milwaukee Metropolitan Sewerage District (MMSD), in response to new NPDES limits for toxics and the upcoming sewage sludge regulations, has initiated an area-wide toxic waste minimization initiative. The initiative includes a task force made up of local interests working with MMSD to develop a comprehensive pollution prevention program.

As shown in Table 3-18, over 600 household hazardous waste programs were in place in 1989. Many of these are operated in conjunction with POTW pretreatment programs.

POTWs discharging into marine waters may be required to implement pollution prevention initiatives under Section 403(c) of the Clean Water Act. Ocean Discharge Criteria regulations (45 *FR* 65457) contain provisions for determining "No Irreparable Harm" that require that reasonable alternatives to disposal (including process modifications) be explored. Section 403(c) may provide a valuable tool in furthering pollution prevention practices at POTWs discharging to marine waters.

3.7 FINDINGS

As described throughout this chapter, a variety of toxic pollutants are discharged or have the potential to be discharged to POTWs from a variety of sources. Although no one data base contains data describing all of these sources, several data bases at least indicate the numbers and types of toxic pollutants being discharged to POTWs.

3.7.1 Industrial and Commercial Sources

This subsection presents the findings regarding industrial and commercial sources of toxic pollutants being discharged to POTWs:

- Local POTW and State pretreatment programs currently regulate an estimated 30,000 SIUs, 40 percent of which are subject to national categorical standards. Local pretreatment programs regulate an average of about 10 SIUs each. In addition, approximately 800 SIUs are regulated by approval authorities (approved States or

EPA Regions), although current estimates are considered low because data for many States were not available at the national level.

- Nationally, the estimated flow from industrial sources accounts for just over 15 percent of total POTW flow (approximately 21 billion gallons per day) for POTWs with local pretreatment programs.

- Assuming that no pretreatment standards were in place, the DSS reported that between 204 million and 218 million pounds per year of hazardous metal pollutants and between 82 million and 254 million pounds per year of hazardous organic pollutants would be discharged to POTWs at raw (untreated) discharge levels. Assuming full compliance with categorical Pretreatment Standards for Existing Sources (PSES), EPA estimated that hazardous metal pollutants discharged to POTWs from categorical industries would be reduced to less than 14 million pounds per year, and hazardous organic pollutants discharged to POTWs would be reduced to less than 51 million pounds per year. After implementation of PSES and assuming full compliance, loadings of toxic metals to POTWs are highest for the following five DSS industrial categories: electroplating and metal finishing; industrial and commercial laundries; organic chemicals manufacturing; coal, oil, petroleum products and refining; and pulp and paper. Likewise, after-PSES loadings of toxic organics are highest for the following five DSS industrial categories: equipment manufacture and assembly; pharmaceutical manufacture; organic chemicals manufacturing; coal, oil, petroleum products and refining; and industrial and commercial laundries.

- TRIS reported that more than 680 million pounds of toxic pollutants were discharged by over 5,700 facilities to more than 1,700 POTWs in 1988. The industrial categories reporting the largest discharges to POTWs were fertilizer manufacturing (143 million pounds), organic chemicals manufacturing (93 million pounds), dye manufacturing and formulation (68 million pounds), pulp and paper mills (47 million pounds), and food and food byproducts processing (38 million pounds).

- TRIS reported discharges of more than 200 toxic pollutants to POTWs: ammonium sulfate discharged in the highest amount and sulfuric acid by the most facilities. Seventeen of the top 40 toxic pollutants being released to POTWs (with respect to quantity and number of facilities releasing) were priority pollutants, the most common of which were copper, zinc, chromium, nickel, toluene, lead, 1,1,1-trichloroethane, and dichloromethane. The most common nonpriority toxic pollutants reported were sulfuric acid, ammonium sulfate, methanol, hydrochloric acid, and phsophoric acid.

- For the 167 pollutants analyzed in the DSS (including copper and zinc, which were not part of the original DSS estimates), the loadings of toxic pollutants to POTWs reported in TRIS (159 million pounds) exceed those in the DSS (60 million pounds), even though the DSS captured more facilities discharging to POTWs. This is likely due to differences in the methods used to calculate and report loadings—TRIS is based on releases reported by individual facilities for 1988; DSS loadings represent EPA estimates based on representative pre-1986 industrial category data.

- Generally, TRIS supported many findings of the DSS, the most significant of which is that higher quantities of nonpriority pollutants than priority pollutants are being discharged to POTWs.

- EPA's 304(m) studies of 10 industrial categories show that several commercial and industrial categories discharge significant quantities of toxic pollutants to POTWs.

The machinery manufacturing and rebuilding category was estimated to generate the largest number of toxic pollutants (134, including 73 priority pollutants). For those industries where estimates were provided, loadings of priority volatile organics ranged from 37,960 pounds per year for hospitals to just over 2 million pounds per year for pharmaceutical manufacturing. Loadings of nonpriority volatile organics ranged from 545,000 pounds per year (hospitals) to 24 million pounds per year (industrial laundries). These findings support those of the DSS, which also estimated that significant quantities of nonpriority pollutants are being discharged to POTWs.

- Local POTW data collected by the State of North Carolina indicate that several industries not regulated by national categorical standards, such as fertilizer manufacturing, ink manufacturing, wood furniture manufacturing, and transportation services, may discharge significant numbers and quantities of toxic pollutants.

3.7.2 Domestic Sources

Although toxic pollutants discharged to POTWs are most commonly associated with industrial and commercial discharges, domestic wastewaters can contain toxic pollutants at concentrations that pose a threat to the environment. The findings regarding domestic sources of toxic pollutants can be summarized as follows:

- Thirty-five toxic pollutants were identified by 15 municipalities in domestic wastewater. A variety of metals were present, with relatively high concentrations of copper, iron, lead, and zinc. The toxic organic pollutants detected include pesticides, polynuclear aromatic hydrocarbons, and chlorinated solvents.
- Many household hazardous wastes, which can contain a variety of toxic pollutants, can be discharged by homeowners to POTWs. Many States and POTWs have begun to control the disposal of household hazardous wastes by implementing voluntary hazardous waste collection programs. In 1989, over 600 collection programs in 35 States were underway.
- Although toxic pollutants found in source waters will be treated as mandated by the Safe Drinking Water Act to levels that will protect human health, the collective loadings of these pollutants in drinking water may be significant for the POTWs that ultimately receive this water.
- Evaluation of 25 local limits submissions in EPA Region VI indicated that domestic contributions for several toxic pollutants account for a significant portion of the allowable headworks loadings calculated for these pollutants. This was particularly true for zinc, which accounted for more than 50 percent of the allowable headworks loadings for 14 of the 25 local limits submissions reviewed.

3.7.3 Other Sources

Other sources of wastewater to POTWs can also be significant contributors of toxic pollutants:

- The EPA Nationwide Urban Runoff Program found 76 priority pollutants detected in storm water discharges. Preliminary estimates show that fewer than 20 percent of pretreatment POTWs have combined sewer overflows.
- Inflow/infiltration of contaminated ground water has been shown in isolated instances to be the source of toxic pollutant discharges to POTWs. National estimates of the types and quantities of toxic pollutants entering POTWs through inflow/infiltration are not available.
- Although limited data exist, discharges from waste haulers have been found to be a source of toxic pollutants to POTWs. The types and quantities of toxic pollutants are highly variable, as the toxics present generally depend upon the origin of the wastes hauled. Data collected by EPA concerning septage hauler discharges show that significant concentrations of both priority and nonpriority pollutants are present, including iron, zinc, manganese, barium, copper, methyl alcohol, isopropyl alcohol, and acetone.
- The implementation of the RCRA and CERCLA programs may result in appreciable increases in the types and quantities of toxic pollutants discharged to POTWs. There are several cases in which RCRA corrective actions and CERCLA remedial actions have involved POTWs for the ultimate disposal of treated liquid wastes. EPA estimates that 1,700 RCRA facilities and 440 Superfund sites will require remediation of ground water that can contain a variety of toxic pollutants.
- POTWs are also an option for wastewaters resulting from cleanups of ground water and soil as required under the UST program. EPA estimates that almost 340,000 USTs are leaking and will require remediation.
- Soon to be promulgated requirements for municipal solid waste landfills will probably result in increased volumes of wastewaters as a result of run-on/runoff controls, leachate collection, and ground-water remediation. One alternative method for leachate management is hauling to POTWs; the types of toxic pollutants present in leachates vary according to the wastes accepted by the landfill. More than 5,000 MSWLFs will be installing leachate collection systems that may be discharging to POTWs.

3.7.4 Pollution Prevention

POTWs and their industrial users have demonstrated an understanding of pollution prevention and the opportunities it affords to reduce loadings of toxic pollutants. Reductions in toxic pollutant discharges to POTWs can be achieved through the pollution prevention techniques involving source reduction, waste recycle/recovery, and energy recovery. EPA has found that pollution prevention techniques have been used at 36 of the 47 industrial categories evaluated in this report.

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4. Removal of Toxic Pollutants By Secondary Treatment

Section 519(a)(2) of the Water Quality Act of 1987 required the U.S. Environmental Protection Agency (EPA) to study "the extent to which secondary treatment at publicly owned treatment works (POTWs) removes toxic pollutants." The purpose of wastewater treatment is to remove pollutants that may have a deleterious effect on human health or aquatic organisms. Municipal wastewater treatment plants are principally designed to remove conventional pollutants: biochemical oxygen demand (BOD), total suspended solids (TSS), oil and grease, pH, and fecal coliform. The design of wastewater treatment plants is based on plant flow, raw wastewater loadings of BOD and TSS, and the target efficiencies with which these pollutants are to be removed by physical treatment units and biological processes. Removal of metals and toxic organic pollutants generally is not considered in the design of municipal wastewater treatment plants.

The removal of most toxic pollutants from wastewaters by municipal treatment plants (i.e., POTWs) is incidental to the treatment of conventional pollutants and should be considered in terms of partitioning among alternative pathways. Some toxic organic pollutants biodegrade to varying extents. Those that are not biodegraded either sorb to particulates and are removed with sewage sludges, volatilize at various stages in treatment trains, or pass through the POTWs and are discharged to the receiving waters. Metals and some organic pollutants are conservative pollutants; they are not biodegraded in POTWs. Metals and other conservative pollutants either enter wastewater sludges by settling or sorption to solids, or they pass through POTWs and are discharged in effluent of POTWs.

An understanding of the ability of municipal treatment plants to remove toxic pollutants from wastewaters is central to the administration of pretreatment controls at the Federal, State, and local levels, particularly with respect to the development of categorical standards, the administration of removal credits, and the calculation of local discharge limitations (local limits).

Categorical Standards – Before promulgating a categorical standard for a pollutant, EPA must make a threshold determination that the pollutant may pass through POTWs or interfere with their treatment processes. EPA addresses the potential for pass through by comparing the average removal capability of POTWs with the average removal rate achieved by industries that use the best available technology economically achievable (BAT) for their designated industrial categories and that discharge wastes directly to receiving waters rather than to POTWs. If the average POTW removal rate for a particular pollutant is equal to or better than the average BAT removal rate, a judgment is made that treatment at the POTW is sufficient to address pass through, and no categorical standard is promulgated for that pollutant. If the average POTW removal rate is lower than the average BAT rate, however, a standard is promulgated at a level that reflects use of BAT.

It is clear that EPA's ability to set categorical standards is predicated on a sound understanding of the ability of POTWs to remove pollutants.

Removal Credits – Congress recognized that treatment of wastewater by an indirect discharger (i.e., by an industry that discharges its wastewater to a POTW rather than directly to receiving waters) to meet categorical discharge standards and the subsequent treatment by the receiving POTW creates the potential for duplicative treatment (i.e., the industry may install processes to remove pollutants that would otherwise be removed by the municipal wastewater treatment plant). Section 307(b) of the Clean Water Act (CWA) reflects this concern and provides for adjustment of categorical standards through removal credits. EPA's removal credit regulations are at 40 *CFR* 403.7. Effective implementation of removal credits requires both a clear definition of what constitutes removal and a means for demonstrating consistency of POTW performance in achieving such removals. (See Chapter 5 for a detailed description of the removal credits program.)

Local Limits – In accordance with 40 *CFR* 403.5, POTWs required to develop local pretreatment programs must periodically evaluate the need for local discharge limitations. (POTWs without pretreatment programs must also develop local limits in certain cases.) EPA's *Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program* (EPA, 1987) provides step-by-step instruction on the local limits development process. Chapter 5 describes the local limits development process in detail.

An understanding of removals is critical to developing effective local limits. If POTWs overestimate treatment plant removal efficiencies, the potential exists for the plant to experience inhibition or upset of its biological processes and/or to violate the conditions of its National Pollutant Discharge Elimination System (NPDES) permit. Where removal efficiencies are underestimated, the POTW may establish overly stringent standards.

Finally, an understanding of the pollutant removals achieved at POTWs is important in the evaluation of alternative remediation technologies for use at Superfund sites. In many cases, the discharge of ground water to POTWs has been selected based on an assumption that the POTW would be capable of providing a consistent level of treatment and protection of receiving waters. Should this assumption be invalid, the Agency may wish to reconsider current policy that views the discharge of wastewater to POTWs as an acceptable option.

Section 4.1 briefly discusses the types of treatment units and process operations that make up a wastewater treatment plant. Sections 4.2 and 4.3 present and analyze data from the DSS and other data bases relating to pollutant removals at secondary wastewater treatment plants.

4.1 SECONDARY WASTEWATER TREATMENT PLANTS

The purpose of wastewater treatment is to remove pollutants that may have a deleterious effect on human health or aquatic organisms. Traditionally, municipal wastewater treatment plants have been designed for the treatment of conventional pollutants: BOD, TSS, oil and grease, pH, and fecal coliform.

The methods used to treat municipal wastewaters usually combine physical treatment units (e.g., screening, degritting, comminution, and sedimentation) and biological treatment processes (e.g., activated sludge). Figure 4-1 provides a simplified flow diagram of a secondary treatment plant. The treatment process, comprising five stages (preliminary treatment, primary treatment, secondary treatment, disinfection, sludge conditioning), is described in the following paragraphs.

Preliminary treatment may include a variety of treatment units, such as screening, grit removal, and comminution. The main purpose of these units, identified below, is to remove large debris, sand, gravel, and nonputrescible organic matter, thereby protecting downstream pumps, valves, and piping from wear, abrasion, and clogging.

- Screening generally involves the use of parallel bars or gratings with uniform spacing, designed to remove larger debris and solids from the wastewater. Some treatment plants use mechanical cleaning racks for this function.

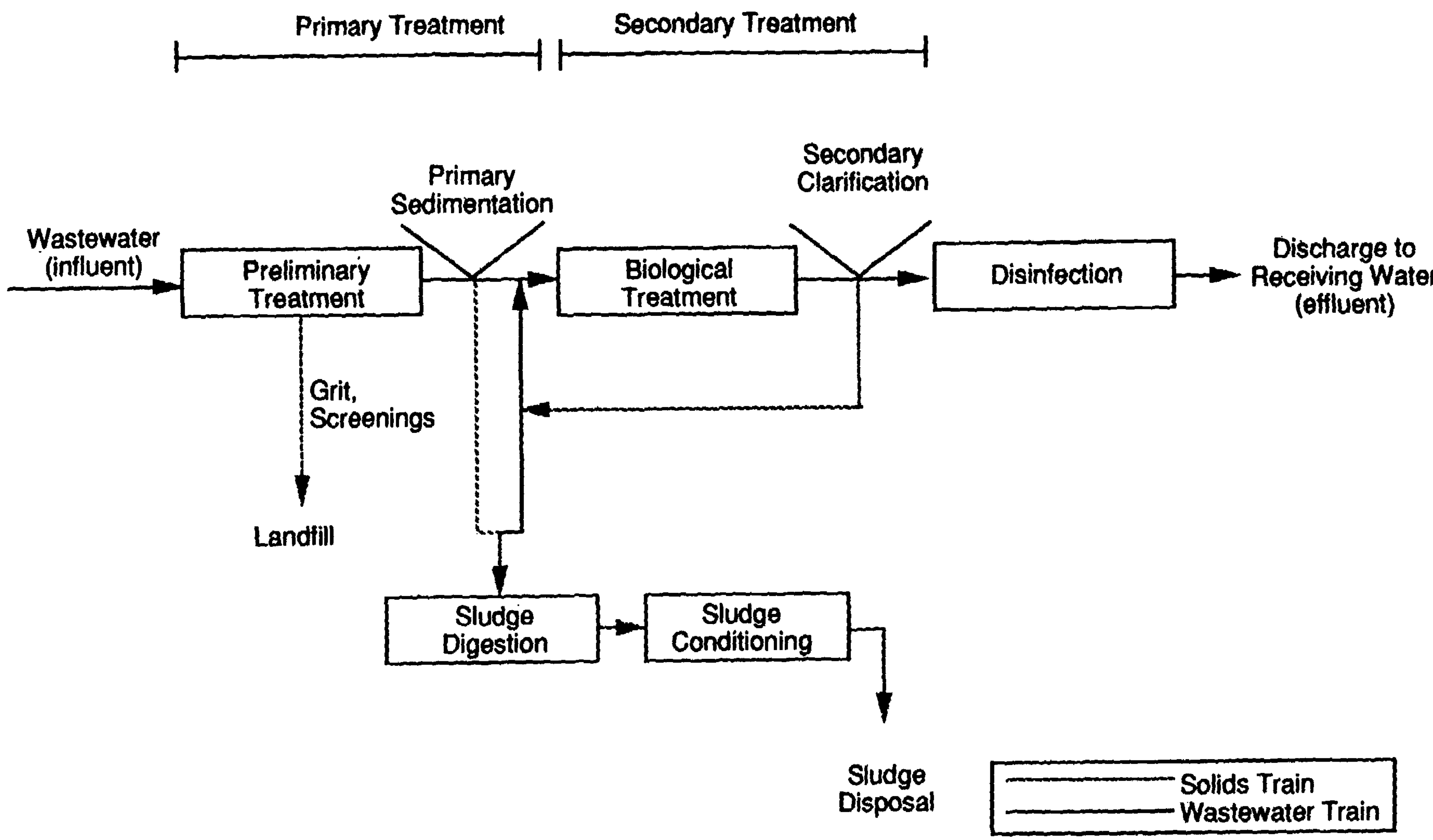

Figure 4-1. Simplified Flow Diagram of a Secondary Wastewater Treatment Plant

- Grit chambers are designed to remove inert solids from the wastewater, based on differential settling rates of the wastewater solids and the flow and velocity of the wastewater. Some grit chambers are aerated, which provides better control of the size of particles to be removed.
- Comminutors cut large wastewater solids into a uniform size of less than one-quarter inch.

The residuals generated from preliminary treatment are largely inert and are generally disposed of in landfills.

Primary treatment is the removal of settlable solids from the wastewater through sedimentation in clarifiers (settling tanks). In addition, floatable materials (e.g., oil and grease) are removed by skimming the surface of the clarifier. At some wastewater treatment plants, wastewater from sludge digestors (described below) is returned to the primary clarifiers.

Residuals generated from primary treatment consist of the sludges that settle out and the skimmings from the surface of the clarifier. Primary solids may be mixed with secondary sludges (wasted from the secondary clarifiers) prior to subsequent conditioning and disposal. Sludge conditioning and disposal are detailed below.

Secondary treatment processes are designed to break down pollutants from wastewater through biological processes. These processes include a wide array of technologies but most involve variations of activated sludge processes, attached growth systems (e.g., trickling filters and rotating biological contactors), and ponds and other natural systems (e.g., stabilization ponds, land treatment). Examples of the more common processes are discussed below.

- Activated sludge processes consist of aeration tanks followed by secondary clarifiers. The aeration tanks contain a microbial population that degrades organic pollutants through catabolic processes. The tanks are aerated to ensure proper mixing and to maintain dissolved oxygen levels necessary to support microbial activity. Secondary clarifiers settle out the biomass and allow for either recycling of solids to the aeration tank or conditioning and disposal as sludge.
- The recycling of solids to the aeration tanks may allow organics that have sorbed to the sludge to be retained within the treatment system for periods in excess of the hydraulic detention time. Thus, volatilization may occur long after the contaminant is reduced in the treated effluent.

- Trickling filters are beds of coarse materials (natural or synthetic) over which the effluent from primary processes is distributed uniformly. Microorganisms that biodegrade organics in the wastewater form a slimy covering on the filter media. Wastewater may be recycled through the filter to allow for a consistent flow across the filter media. Air forced upward through the filter media enhances oxygen transfer.
- Lagoons or stabilization ponds generally are simple basins surrounded by earthen dikes that provide for the biological stabilization of organic pollutants. Depending on their depth and specific design, lagoons may be aerobic, anaerobic, facultative, or aerated systems.

Disinfection, most commonly through chlorination, destroys bacteria, pathogens, and viruses in the wastewater. Excessive free chlorine in the wastewater discharge can, however, cause aquatic toxicity in the receiving stream.

Sludge conditioning may include thickening, aerobic or anaerobic digestion, and dewatering. Sludge digestion processes reduce sludge volume and stabilize solids through biodegradation of organic matter. Dewatering and drying operations further reduce sludge volume. Sidestreams generated from sludge conditioning operations are generally returned to the treatment plant, upstream of secondary treatment units.

Congress directed EPA to evaluate pollutant removals achieved by secondary treatment plants. This involves assessment of the quantities of pollutants that are removed from the wastewater, as well as the fates of those pollutants.

The percent removal of a pollutant in a POTW is the percent reduction of the POTW influent concentration achieved by POTW treatment processes. The percent removal of a pollutant in a POTW is defined as:

$$R = [(C_{in} - C_{out})/C_{in}] \times 100\%$$

where: R = Removal efficiency (presented as a percent)

C_{out} = Effluent concentration

C_{in} = Influent concentration.

Thus, if POTW influent concentration is 50 micrograms per liter (µg/l) and effluent concentration is 20 µg/l, the percent removal is [(50-20)/50] X 100 or 60 percent.

4.2 DSS Pollutant Removals Data

To estimate the removability and fate of pollutants, the DSS used the results of research conducted by EPA's Wastewater Environmental Research Laboratory (WERL) in Cincinnati, Ohio.

Members of the EPA-WERL group based their estimates of probable fate on their best professional judgments (BPJs), summarized literature data, their collective knowledge of biodegradation literature, their "hands-on" pilot-plant experience with pertinent pollutant removability, and their experience with ongoing treatability studies. They used Henry's Law Constants, octanol/water partition coefficients, and qualitative biodegradation data in making the estimates.

EPA-WERL generated removal efficiency estimates based on data obtained from three EPA-WERL research projects and their BPJ. Estimated pollutant removals were projected for both acclimated and unacclimated treatment plants. The estimates provided for acclimated treatment plants were based on a conventional activated sludge wastewater treatment system meeting secondary treatment requirements and having pollutants influent to the treatment plant at 500 parts per billion. It was also assumed that the pollutant being evaluated was discharged to the POTW with a group of typical toxic pollutants at low background concentrations. Unacclimated removals data were projected using experimental data from WERL research studies and knowledge of the available literature.

A limited amount of removal data on unacclimated treatment plant operations supported the development of the estimates both on overall removal and on volatilization fractions. It is important to note that because EPA-WERL calculated removal based on the difference between influent and effluent pollutant concentrations, "removal" for purposes of the DSS included volatilization.

To determine which EPA-WERL estimates approximate actual, full-scale POTW removal efficiencies, EPA compared the EPA-WERL estimates in the DSS to removals obtained from data on 40 POTWs in *Fate of Priority Pollutants in Publicly Owned Treatment Works* (EPA, 1982b) (the "40-POTW Study"). For selected DSS pollutants, Table 4-1 compares the acclimated and unacclimated percent removal estimates made by EPA-WERL in the DSS with the percent removals derived from the 40-POTW Study data. No clear correspondence is seen between the EPA-WERL and the 40-POTW removal estimates.

(Table 4-1 provides acclimated and unacclimated removals estimates for organic compounds but only a single set of estimates for metals. This is because removal of metals in biological systems does not depend on biological activity (although metals may sorb to the biomass and be removed with sludge) and is not influenced by the extent to which the treatment system is acclimated.)

Table 4-2 presents pollutant fates for those DSS pollutants for which individual sludge partition rates could be calculated. This table provides a rough mass balance; it employs data from two different sources—EPA-WERL (September 26, 1988, memo from D. F. Bishop to T. P. O'Farrell, "Estimation of Removability and Impact on RCRA Toxics") estimates for fractions removed and stripped (volatilized) and EPA's 40-POTW Study for partitioning to sludge—estimating the fraction biodegraded by difference. Of the 80 to 90 percent total removal estimated for chloroform, for example, Table 4-2 indicates that 70 to 90 percent is volatilized, 2 percent partitions to sludge, and 8 to 28 percent is believed to be actually biodegraded.

4.3 EVALUATION OF POLLUTANT REMOVAL EFFICIENCY DATA

The pollutant removals and loadings estimates in the DSS provided an important benchmark for evaluating the impacts of pollutants discharged to wastewater treatment plants. Since completion of the DSS in 1986, new data bases have been created, providing additional information on pollutant removal efficiencies at wastewater treatment plants. These data provide an opportunity to revisit the DSS removal estimates and evaluate the appropriateness of their use in estimating pollutant removals on a national and a plant-specific basis.

To be consistent with the congressional mandate to examine removals at secondary wastewater treatment plants (and since the DSS estimates assumed an activated sludge plant meeting secondary discharge standards), the data bases were screened carefully to ensure that they only contained data consistent with a project definition of secondary treatment (presented in Subsection 4.3.1).

Subsection 4.3.2 discusses the two major data bases evaluated: a 47-POTW data base created for this study and a data base that resulted from a study by the Ontario Ministry of the Environment in support of its Municipal Industrial Strategy for Abatement (MISA)

Table 4-1. Comparison of Estimated DSS Percent Removals With Those Obtained Using 40-POTW Study Data

Pollutant	Percent Removals			
	DSS Acclimated	DSS Unacclimated		40-POTW
		Median	Low	
Arsenic	50	—	—	* (93.9)
Cadmium	27	—	—	86.6
Chlorobenzene	90	90	90	* (99.5)
Chromium	70	—	—	78.9
1,2-Dichlorobenzene	90	87	85	91.6
Dichlorodifluoromethane	95	95	95	* (80.3)
Ethylbenzene	95	90	90	96.0
Lead	90	—	—	88.5
Mercury	50	—	—	82.0
Methylene Chloride	95	87	85	**
Nitrobenzene	90	25	20	—
Selenium	50	—	—	—
Silver	90	—	—	91.3
Tetrachloroethylene	90	85	80	80.1
Toluene	95	90	90	97.6
1,1,1-Trichloroethane	95	90	85	87.6
Trichloroethylene	95	87	85	92.0
Trichlorofluoromethane	95	90	85	* (97.9)
Acrolein	95	95	95	—
Antimony	—	—	—	* (71.5)
Benzene	95	90	90	94.1
Bis(2-Chloroethyl) Ether	90	50	30	—
Bis(2-Chloroethoxy) Methane	10	10	10	—
Bis(2-Ethylhexyl) Phthalate	90	90	90	73.5
Bromomethane	95	95	95	* (100)
Butyl Benzyl Phthalate	95	90	90	98.7
Para-Chloro-Meta-Cresol	95	50	40	* (96.7)

Table 4-1. Comparison of Estimated DSS Percent Removals With Those Obtained Using 40-POTW Study Data (continued)

Pollutant	Percent Removals			
	DSS Acclimated	DSS Unacclimated		40-POTW
		Median	Low	
Chloroethane	95	90	90	—
Chloroform	90	80	80	67.6
Chloromethane	95	90	90	97.4
2-Chloronaphthalene	95	80	80	—
Cyanide	90	—	—	**
Di-n-butyl Phthalate	90	90	90	88.2
1,3-Dichlorobenzene	90	87	85	* (100)
1,4-Dichlorobenzene	90	87	85	* (94.9)
1,1-Dichloroethane	90	80	80	* (100)
1,2-Dichloroethane	90	50	30	* (55.4)
1,1-Dichloroethylene	95	90	90	* (81.1)
1,2-Trans-Dichloroethylene	90	80	80	92.8
2,4-Dichlorophenol	95	55	50	—
1,2-Dichloropropane	90	70	70	* (100)
Diethyl Phthalate	90	75	70	* (99.2)
2,4-Dimethylphenol	95	85	80	—
Dimethyl Phthalate	95	65	60	* (100)
Di-N-Octyl Phthalate	90	90	90	* (100)
Hexachloro-1,3-Butadiene	95	90	90	—
Hexachloroethane	95	90	90	—
Naphthalene	95	75	70	98.1
Nickel	35	—	—	47.5
N-Nitrosodimethyl Amine	90	75	70	—
Pentachlorophenol	95	25	20	60.6
Phenol	95	85	80	96.7
1,1,2,2-Tetrachloroethane	90	25	20	* (93.8)
Tribromomethane	65	35	30	* (90.5)

Table 4-1. Comparison of Estimated DSS Percent Removals With Those Obtained Using 40-POTW Study Data (continued)

	Percent Removals			
		DSS Unacclimated		
Pollutant	DSS Acclimated	Median	Low	40-POTW
1,2,4-Trichlorobenzene	85	85	85	* (96.6)
1,1,2-Trichloroethane	80	25	20	* (98.6)
2,4,6-Trichlorophenol	95	55	50	—
Vinyl Chloride	95	95	95	99.8
Acenaphthylene	95	90	90	—
Acrylonitrile	—	75	70	—
Anthracene	95	90	90	* (83.1)
2-Chlorophenol	95	65	60	—
2,4-Dinitrophenol	90	75	70	—
Aldrin	90	90	90	* (91.2)
Chlordane	90	90	90	—
Endrin	95	90	90	—
Toxaphene	95	90	90	—

* Fewer than five of the POTWs had a percent removal for this pollutant. Percent removal based on fewer than five POTWs is indicated in parentheses.

** Percent removals were deleted because of analytical difficulties.

Source: Adapted from the Domestic Sewage Study (EPA, 1986).

Table 4-2. Summary Table of Estimated Fraction Removed: Stripped, Partitioned, and Biodegraded for Pollutants With Partitioning Rates Available

Pollutant	Acclimated[1] Fraction Removed	Unacclimated[1] Fraction Removed Median	Unacclimated[1] Fraction Removed Low	Acclimated[1] Fraction Stripped	Unacclimated[1] Fraction Stripped	Fraction[2] Partitioned to Sludge	Acclimated[3] Fraction Biodegraded	Unacclimated[3] Fraction Biodegraded	Relative[1] Acclimated Biodegradability
1,2-Dichloroethane	0.90	0.50	0.30	0.50	0.90	0.05	0.45	0.05	Moderate
Phenol	0.95	0.85	0.80	0	0	0.15	0.85	0.85	Rapid
Naphthalene	0.95	0.75	0.70	0.30	0.30	0.28	0.42	0.42	Moderate
1,1,2,2-Tetrachloroethane	0.90	0.25	0.20	0.40	0.60	0.04	0.56	0.36	Slow
1,1,2-Trichloroethane	0.80	0.25	0.20	0.50	0.80	0	0.50	0.20	Slow
Diethyl Phthalate	0.90	0.75	0.70	0	0	0.01	0.99	0.99	Rapid
Dimethyl Phthalate	0.95	0.65	0.60	0	0	0	1.00	1.00	Rapid
Pentachlorophenol	0.95	0.25	0.20	0	0	0.18	0.82	0.82	Moderate
Bis(2-Ethylhexyl) Phthalate	0.90	0.90	0.90	0	0	0.73	0.27	0.27	Moderate
Butyl Benzyl Phthalate	0.95	0.90	0.90	0	0	0.45	0.55	0.55	Rapid
Di-n-Butyl Phthalate	0.90	0.90	0.90	0	0	0.22	0.78	0.78	Rapid
Di-n-Octyl Phthalate	0.90	0.90	0.90	0	0	0.08	0.92	0.92	Moderate
Anthracene	0.95	0.90	0.90	0	0	0.55	0.45	0.45	Moderate
1,1-Dichloroethane	0.90	0.90	0.80	0.70	0.90	0	0.30	0.10	Moderate
Chloroform	0.90	0.80	0.80	0.70	0.90	0.02	0.28	0.08	Moderate
Trans-1,2-Dichloroethylene	0.90	0.80	0.80	0.70	0.90	0.54	0	0	Moderate
1,2-Dichloropropane	0.90	0.70	0.70	0.50	0.90	0	0.50	0.10	Slow
Chlorobenzene	0.90	0.90	0.90	0.30	0.50	0.15	0.55	0.35	Moderate

Table 4-2. Summary Table of Estimated Fraction Removed: Stripped, Partitioned, and Biodegraded for Pollutants With Partitioning Rates Available (continued)

Pollutant	Acclimated[1] Fraction Removed	Unacclimated[1] Fraction Removed Median	Unacclimated[1] Fraction Removed Low	Acclimated[1] Fraction Stripped	Unacclimated[1] Fraction Stripped	Fraction[2] Partitioned to Sludge	Acclimated[3] Fraction Biodegraded	Unacclimated[3] Fraction Biodegraded	Relative[1] Acclimated Biodegradability
1,2-Dichlorobenzene	0.90	0.87	0.85	0.50	0.90	0.35	0.15	0	Slow
1,3-Dichlorobenzene	0.90	0.87	0.85	0.50	0.90	0.03	0.47	0.07	Slow
1,4-Dichlorobenzene	0.90	0.87	0.85	0.50	0.90	0.25	0.25	0	Slow
Ethylbenzene	0.95	0.90	0.90	0.25	0.80	0.06	0.69	0.14	Rapid
Toluene	0.95	0.90	0.90	0.25	0.80	0.28	0.47	0	Rapid
Trichloroethylene	0.95	0.87	0.85	0.70	0.80	0.06	0.24	0.14	Moderate
Benzene	0.95	0.90	0.90	0.25	0.80	0.02	0.74	0.18	Moderate
1,2,4-Trichlorobenzene	0.85	0.85	0.85	0.50	0.60	0.09	0.41	0.31	Slow
Vinyl Chloride	0.95	0.95	0.95	0.90	0.95	0.02	0.08	0.03	Moderate
Bromoethane	0.95	0.95	0.95	0.90	0.95	0	0.10	0.05	Moderate
Carbon Tetrachloride	0.90	0.85	0.80	0.80	0.90	0.13	0.07	0	Moderate
Dichlorodifluoromethane	0.95	0.95	0.95	0.95	0.95	0	0.05	0.05	Moderate
Tetrachloroethylene	0.90	0.85	0.80	0.50	0.80	0.03	0.47	0.17	Moderate
1,1,1-Trichloroethane	0.95	0.90	0.85	0.80	0.90	0.01	0.19	0.09	Rapid
1,1-Dichloroethylene	0.95	0.90	0.90	0.80	0.90	0	0.20	0.10	Moderate
Trichlorofluoromethane	0.95	0.90	0.85	0.80	0.90	0	0.20	0.10	Moderate

1. From September 26, 1985, memo from D.F. Bishop to T.P. O'Farrell, "Estimation of Removability and Impact of RCRA Toxics."
2. Calculated using *Fate of Priority Pollutants in Publicly Owned Treatment Works*, Volume 1 (EPA, 1982b).
3. Calculated by difference.

(Environment Ontario, 1988). Finally, Subsection 4.3.3 presents an analysis of the data bases, initially examining trends in pollutant removal efficiencies across wastewater treatment plants and then briefly discussing the variability of removals within wastewater treatment plants.

4.3.1 Derivation of a Project Definition for Secondary Treatment

As mentioned previously, Congress directed EPA to study "the extent to which secondary treatment at publicly owned treatment works removes toxic pollutants." However, the term "secondary treatment" is subject to numerous interpretations. Engineering definitions of secondary treatment have traditionally been based solely on the type of treatment technology employed. Such definitions generally encompass the settling of solids and the biological treatment processes that biodegrade organic pollutants in wastewater. This type of definition has proven adequate for purposes of treatment plant design and construction. However, even well-designed plants may vary in performance, depending on the proficiency of plant operators, the adequacy of operation and maintenance, and the continued validity of the design considerations. EPA thus determined that a strict engineering definition of secondary treatment would not be adequate for the purposes of this study, since such a definition would not screen out poorly designed, operated, or maintained plants. Only pollutant removals data from properly operated POTWs can provide a consistent baseline for comparison of pollutant removals; otherwise, removals data could be an artifact of poor design and/or operation.

EPA regulations also provide a definition of secondary treatment, based in part on the performance capabilities of the treatment processes employed. Part 133 of 40 *CFR* mandates the minimum level of effluent quality that secondary treatment facilities must achieve. The regulations (40 *CFR* 133.102) state that for BOD and TSS, "the 30-day average shall not exceed 30 milligrams/liter (mg/l), the 7-day average shall not exceed 45 mg/l, and the 30-day average percent removal shall not be less than 85 percent." In addition, the pH must be between 6 and 9 standard units.

Concerned that such a regulatory definition might omit the use of existing treatment plants that are not as effective in reducing BOD and TSS, EPA defined facilities eligible for consideration as "equivalent to secondary treatment" (49 *FR* 37006). Equivalent secondary treatment facilities provide significant biological treatment but are not designed to consistently meet the numerical standards noted above. According to current regulations

(40 *CFR* 133.105), a facility is eligible for equivalent-to-secondary treatment status if it meets the following conditions:

- The BOD and TSS effluent concentrations consistently achievable through proper operation and maintenance of the treatment works exceed the minimum levels for secondary treatment as specified in 40 *CFR* 133.102(a) and (c).
- A trickling filter or waste stabilization pond is used as the principal process.
- The treatment works provide significant biological treatment of municipal wastewater.

BOD and TSS limits for such POTWs are a 30-day average of 45 mg/l and a 7-day average of 65 mg/l; the 30-day average percent removal must not be less than 65 percent.

EPA used a project definition of secondary treatment that draws from both the technology- and regulatory-based definitions. This definition includes all wastewater treatment plants that employ one or more biological treatment processes (i.e., activated sludge, oxidation ditches, trickling filters, rotating biological contactors, or stabilization ponds/lagoons) that do not provide tertiary treatment and that are in compliance with secondary discharge standards for BOD and TSS. Rather than using a strict definition of compliance as the standard for screening plant performance, EPA used significant non-compliance (SNC). The definition of SNC recognizes that even well-operated plants may on occasion experience minor exceedances of their permit limits, which may not reflect overall operational performance. Moreover, the long-standing administrative use of SNC within EPA provided for an easily understood benchmark. (The definition of SNC for violations of effluent limitations for conventional pollutants is any exceedance that is 1.4 times greater than the permit discharge limit—the multiplier is 1.2 for toxic pollutants—and that occurs for 2 or more months during a 2-quarter review period; or an exceedance of any parameter limit by any amount that occurs for any 4 or more months during a 2-quarter period). Canadian plants included in this study had to meet the same biological treatment technology screen and achieve 85-percent removal of BOD and TSS.

4.3.2 Pollutant Removals Efficiency Data Bases

EPA based its analysis on full-scale POTW data and did not consider data from pilot-plant or bench-scale research projects. Pilot-plant and bench-scale biological treatment systems are, by definition, maintained under carefully controlled conditions for such factors as temperature, flow rates, influent loadings of BOD and possibly toxic pollutants, sludge wasting rates, and aeration rates. Consistency of conditions is necessary for process optimization, whether for design or modeling purposes. In contrast, full-scale POTWs are subject to many uncontrollable conditions, including daily and seasonal variations in flows, temperature, and pollutant loadings. There are significant differences in treatment train configurations and operational characteristics among POTWs. All these variables influence the rates of physical and chemical changes (adsorption, volatilization, biodegradation) that affect pollutant removals across biological treatment systems and determine pollutant fates within individual POTWs.

This study examines full-scale treatment plant pollutant removals data from a 47-POTW data base created by EPA, a study prepared for the Ontario Ministry of the Environment, and EPA's 40-POTW Study. Each of these data bases contains data collected during a specific period and analyzed using different editing rules; they differ in design and methodology. Each data base was analyzed separately as part of this study of treatment plant pollutant removals, the differences described above precluding compilation into a single data set.

The pollutant removals data presented in the three data bases are largely limited to priority pollutants. EPA is aware that research has been undertaken on pollutant removals for pollutants beyond those evaluated here. However, these are generally bench-scale research projects, often addressing site-specific concerns; for the reasons discussed previously, EPA chose to include only full-scale treatment plant data in this evaluation.

<u>The 47-POTW Data Base</u> – As part of the present study, EPA compiled a data base from readily available information on pollutant removals at 47 POTWs located in EPA Regions II, III, V, VI, VII, VIII, and IX, with the greatest number of plants in Region VI. All 47 POTWs met the definition of secondary treatment described in Subsection 4.3.1 and all are implementing approved pretreatment programs. Of the 47 POTWs, 39 had flows of less than 15 mgd, 5 had flows of between 15 and 45 mgd, and 3 had flows of greater than 45 mgd. The data represented in this data base were collected by POTWs as part of their National Pollutant Discharge Elimination System (NPDES) permit requirements. These requirements included the use of sample collection and analytical methodologies conforming to 40 *CFR* Part 136.

To facilitate comparison of the 47-POTW data with other data collected for this study, average removal efficiencies were calculated for each pollutant for each facility. (Sampling regimes generally involved composite sampling of treatment plant influent and effluent for between 2 and 5 days.) Average removal efficiencies were calculated based on analysis of average influent and effluent data. Subsection 4.3.3 of this report summarizes POTW removal efficiency data from the 47-POTW data base and compares them with removal efficiency data from DSS and the MISA study. Appendix B-1 provides the complete data sets.

The Ontario Ministry of the Environment's Municipal Industrial Strategy for Abatement (MISA) Data Base – The purpose of the MISA study was to provide POTW influent and effluent monitoring data to support the development of monitoring regulations. The study examined monitoring data for 37 Canadian POTWs. (Sampling involved the collection of composite samples at locations in the plants representative of the plant influent and effluent streams, including raw and treated sludges. Composite samples were taken over periods of 2 to 5 consecutive days.) Of the 37 POTWs in the MISA study, 30 met the project definition of secondary treatment (i.e., they employed biological wastewater treatment processes and achieved at least 85-percent removals of influent BOD and TSS). The present study used data from only these 30 POTWs.

Monitoring conducted in the MISA study covered 144 organic contaminants, 13 metals, selenium, cyanide, and conventional pollutants. The influent and effluent concentrations were measured for each contaminant detected during the sampling period. This project made use of all analytical data sets collected during the study in calculating removal efficiencies. In the MISA study, pollutant concentrations were reported as geometric means over the sampling period. For purposes of this report, EPA calculated pollutant removals from the geometric mean influent and effluent data provided in the MISA report.

Of the 159 toxic pollutants addressed in the MISA study, 95 were detected in either the influent or effluent wastestreams of the 30 POTWs that met the project definition of secondary treatment. Of these 95 pollutants, 43 are common to the DSS list of 165 pollutants. Subsection 4.3.3 discusses these data and compares them with DSS and the 47-POTW data base. Appendix B-2 provides the complete MISA data sets for the 30 POTWs included in this analysis.

The actual list of pollutants included in the performance comparisons was selected for each data base based on commonality with the DSS pollutant list and on the number of treatment plants reporting pollutant removals data. The comparison included only those parameters for which at least five data sets (representing five POTWs) were obtained. Table 4-3 lists the DSS pollutants common to either the 47-POTW data base, the MISA study, or both used in the comparisons. Copper was added to the analysis even though it is not a DSS pollutant because of its occurrence in all sewage.

The pollutant removals data available for analysis and discussion in this chapter reflect only a limited number of pollutants. Historically, there has been little incentive for POTWs to conduct treatment plant monitoring for pollutants other than metals. This is because cost for conducting analysis for organic contaminants is far greater than that for metals (it is not uncommon for POTWs to perform metals analysis inhouse). In addition, for many POTWs, regulatory requirements (NPDES permits, sludge management requirements) do not currently include limitations or monitoring requirements for organics.

4.3.3 Analysis of Secondary Treatment Plant Pollutant Removals Data

This subsection summarizes the removal efficiency data from the 47-POTW data base and the MISA study and compares the results to DSS removal efficiency estimates. After obtaining pollutant removals data and creating a list of pollutants for which removals could be evaluated, EPA conducted a trend analysis to characterize pollutant removals. Pollutant removal efficiency distributions were examined to determine whether any trends exist in the frequency of occurrence.

Subsection 4.3.3.1 analyzes pollutant removal efficiencies achieved across a large number of secondary treatment plants. The analysis includes an evaluation of frequency distributions of removals obtained from the 47-POTW and MISA data bases. The variability in pollutant removals among treatment plants is also characterized in terms of the median and inter-quartile ranges obtained from removal frequency distributions by pollutant. These ranges are then compared to estimated unacclimated removals in DSS. Subsection 4.3.3.2 delineates an approach for characterizing pollutant removals that could be used where wide fluctuations in pollutant removals are observed.

In establishing and interpreting POTW-specific removal efficiencies, it was necessary to adopt a number of data interpretation conventions. These conventions are described briefly in the following discussion.

Comparisons of removal efficiencies with DSS estimates were made against unacclimated, rather than acclimated, DSS values. In establishing acclimated removal

Table 4-3. Pollutants Considered in DSS, the MISA Study, and the 47-POTW Data Base

Pollutants	DSS	MISA	47-POTW
Antimony	X		X
Barium	X		X
Cadmium	X	X	X
Chromium	X	X	X
Nickel	X	X	X
Silver	X	X	X
Zinc		X	X
Copper		X	X
Lead	X	X	X
Cyanide	X	X	X
Mercury	X	X	X
Arsenic	X		X
Selenium	X		X
Butylbenzyl Phthalate	X	X	
M-Cresol	X	X	
Phenol	X	X	
Naphthalene	X	X	
Chloroform	X	X	
Ethyl Benzene	X	X	
M & P Xylenes	X	X	
O Xylenes	X	X	
1,1,1-Trichloroethane	X	X	
Trichloroethylene	X	X	
Tetrachloroethylene	X	X	X
Methoxychlor	X	X	
PCB—Total	X	X	
1,2,4-Trichlorobenzene	X	X	
2,4-D	X	X	
2,4,5-T	X	X	
1,2-Trans Dichloroethylene	X		X
Diethyl Phthalate	X		X
DI-N-Octyl Phthalate	X		X
Bis-2(Ethyl Hexyl) Phthalate	X		X
Di-N-Butyl-Phthalate	X		X
Toluene	X		X
1,4-Dichlorobenzene	X		X

estimates in DSS, EPA assumed an activated sludge treatment plant meeting secondary discharge standards, receiving a steady feed of each pollutant at 500 ppb. Pollutant loadings reported in both the 47-POTW and MISA data bases, however, vary across a range of concentrations that does not approximate the conditions DSS assumed for acclimation. The fact that the 47-POTW and MISA data did not approximate the 500 ppb influent wastewater concentration used by EPA-WERL should not be surprising. EPA performed statistical analysis of influent concentrations of seven metals in *Determining National Removal Credits for Selected Pollutants for Publicly Owned Treatment Works* (EPA, 1982a), based on data from the 40-POTW Study. That document presents average influent concentrations for seven metals at 39 POTWs. Of the 273 averages—one for each of the 7 metals at 39 plants—only 15 metal concentrations were at least as large as 500 ppb, with 9 of these being for zinc. Furthermore, the majority of the 273 concentrations are less than 100 ppb, as shown below:

Metal	Number With Avg. Infl. <100 ppb	Number With Avg. Infl. >500 ppb
Cadmium	37	1
Chromium	16	1
Copper	13	1
Lead	29	1
Nickel	30	2
Silver	39	0
Zinc	1	9

Comparisons were made to the estimated median removal values in DSS, which provide a central representation of pollutant removals. Where analytical data in the 47-POTW or MISA data bases indicated influent or effluent pollutant concentrations to be below detection limits, removals were calculated using one-half the analytical detection limit as the surrogate pollutant concentration in order to prevent surrogate values of zero for pollutant levels cited as below detection.

All calculated negative removals (i.e., pollutant concentrations that were higher in effluent than influent) were included in all data sets and analyses. (In general, negative removal occurs when effluent concentrations indicate that more of a given pollutant is present in effluent than is present in influent.) Although some pollutants may be formed through catabolic processes during secondary treatment, this could not account for negative removals for metals, and it is unlikely that this phenomenon alone is sufficient to explain the observed negative removals for the wide range of organics being evaluated.

Two hypotheses could explain negative removals: (1) sampling procedures may not account for the hydraulic detention time of the POTW and, hence, may not be representative, and (2) nonsteady state conditions may prevail at the POTW. The following paragraphs provide more detail on each of these hypotheses.

Hydraulic Detention Times – In most cases, POTWs conduct simultaneous composite sampling of plant influent and effluent and grab sampling of sludge. Even when samples are composited over a period of 1 or more days, the sampling may fail to account for hydraulic detention times and the impact of any internal recycle streams within the treatment plant. The extent to which monitoring data included in the 47-POTW data base and the MISA study address hydraulic detention times and recycle streams and the extent to which these factors may account for the calculated negative removals, could not be determined.

Nonsteady State Conditions – Nonsteady state conditions usually prevail at wastewater treatment plants. Steady state is a condition in which the input loading of a particular pollutant (the influent loading) equals the combined output loading of that pollutant (equal to the sum of the effluent loading, the sludge loading, and biodegradation and volatilization losses). Nonsteady state conditions, the inevitable result of variable influent loadings, are induced by (1) changing flows to the treatment plant, (2) perturbation of physical process equilibria, such as sludge sorption/desorption, and (3) alteration of biodegradation kinetics. Nonsteady state conditions may also be brought about by variations in such plant operating characteristics as aeration rates, sludge recirculation, and wasting rates. As with hydraulic detention time, the extent to which nonsteady state conditions existed at the POTWs being examined could not be evaluated based on available data.

4.3.3.1 Analysis of Secondary Wastewater Treatment Plant Pollutant Data

The removal efficiencies calculated from the 47-POTW data base are given in Table 4-4 (calculations were performed only for pollutants for which there were at least five observations). This table presents the number of observations (influent and effluent data sets), the calculated average influent and effluent pollutant concentration, and the calculated

Table 4-4. Pollutant Removal Efficiencies Reported in the 47-POTW Data Base

Facility	Pollutant	Number of Observations	Average Influent (mg/l)	Average Effluent (mg/l)	"Average" Removal Efficiencies
39	Barium	7	0.224286	0.061429	72.6
23	Bis (2-Ethylhexyl)phthalate	10	0.114000	0.116500	-2.2
24	Bis (2-Ethylhexyl)phthalate	11	0.145273	0.083636	42.4
26	Bis (2-Ethylhexyl)phthalate	10	0.169000	0.124500	26.3
27	Bis (2-Ethylhexyl)phthalate	6	0.114000	0.034000	70.2
28	Bis (2-Ethylhexyl)phthalate	6	0.029500	0.059000	-100.0
36	Bis (2-Ethylhexyl)phthalate	6	0.016750	0.004750	71.6
40	Bis (2-Ethylhexyl)phthalate	6	0.016167	0.017167	-6.2
8	Cadmium	5	0.007200	0.005200	27.8
13	Cadmium	5	0.003800	0.006000	-57.9
24	Cadmium	5	0.005200	0.001600	69.2
27	Cadmium	5	0.005600	0.005100	8.9
30	Cadmium	5	0.000480	0.007020	-1362.5
39	Cadmium	10	0.048000	0.012500	74.0
46	Cadmium	11	0.101364	0.035818	64.7
6	Chromium	34	0.032735	0.011118	66.0
13	Chromium	5	0.012600	0.009000	28.6
17	Chromium	5	0.048000	0.016000	66.7
23	Chromium	11	0.037636	0.030182	19.8
24	Chromium	11	0.122091	0.037182	69.5
26	Chromium	10	0.016200	0.025700	-58.6
31	Chromium	6	0.035167	0.005417	84.6
32	Chromium	8	0.151125	0.008625	94.3
39	Chromium	9	0.087778	0.018889	78.5
46	Chromium	11	1.771818	0.204545	88.5
5	Copper	18	0.196278	0.027722	85.9
6	Copper	34	0.087118	0.013000	85.1
8	Copper	6	0.051833	0.019500	62.4

Table 4-4. Pollutant Removal Efficiencies Reported in the 47-POTW Data Base (continued)

Facility	Pollutant	Number of Observations	Average Influent (mg/l)	Average Effluent (mg/l)	"Average" Removal Efficiencies
13	Copper	6	0.068167	0.035000	48.7
14	Copper	6	0.022167	0.010167	54.1
15	Copper	6	0.021500	0.045167	-110.1
16	Copper	5	0.045400	0.008400	81.5
17	Copper	5	0.136000	0.021000	84.6
22	Copper	6	0.125000	0.057500	54.0
23	Copper	9	0.055556	0.017944	67.7
24	Copper	9	0.064000	0.009889	84.5
26	Copper	9	0.026556	0.002000	92.5
27	Copper	5	0.054000	0.039000	27.8
28	Copper	6	0.065000	0.025000	61.5
30	Copper	8	0.149500	0.058687	60.7
31	Copper	8	0.107125	0.037812	64.7
32	Copper	8	0.109375	0.028875	73.6
33	Copper	8	0.114000	0.031812	72.1
36	Copper	7	0.034286	0.005714	83.3
38	Copper	8	0.047500	0.011250	76.3
39	Copper	15	0.119333	0.063667	46.6
40	Copper	6	0.093333	0.025000	73.2
42	Copper	6	0.038333	0.013417	65.0
43	Copper	7	0.029429	0.017357	41.0
46	Copper	11	0.170000	0.059091	65.2
6	Cyanide	23	0.012217	0.010000	18.1
36	Cyanide	5	0.026000	0.056000	-115.4
46	Cyanide	11	0.522000	0.052545	89.9
11	Di-N-Butyl Phthalate	5	0.036800	0.017800	51.6
11	Di-N-Octyl Phthalate	5	0.194200	0.042800	78.0
12	Di-N-Octyl Phthalate	5	0.194800	0.042600	78.1

Table 4-4. Pollutant Removal Efficiencies Reported in the 47-POTW Data Base (continued)

Facility	Pollutant	Number of Observations	Average Influent (mg/l)	Average Effluent (mg/l)	"Average" Removal Efficiencies
11	Diethyl Phthalate	5	0.016600	0.005000	69.9
12	Diethyl Phthalate	5	0.022200	0.005000	77.5
28	Diethyl Phthalate	6	0.016500	0.018667	-13.1
6	Lead	34	0.032029	0.018118	43.4
13	Lead	5	0.018000	0.011000	38.9
14	Lead	5	0.016000	0.006000	62.5
15	Lead	5	0.018600	0.012400	33.3
23	Lead	8	0.032625	0.017312	46.9
24	Lead	8	0.034875	0.012500	64.2
30	Lead	5	0.033000	0.042000	-27.3
31	Lead	6	0.108000	0.005167	95.2
32	Lead	8	0.080625	0.038500	52.2
39	Lead	9	0.093333	0.013333	85.7
40	Lead	5	0.069000	0.050000	27.5
46	Lead	11	0.320000	0.188182	41.2
11	Mercury	5	0.000730	0.001340	-83.6
38	Mercury	5	0.006600	0.001500	77.3
5	Nickel	5	0.062600	0.017000	72.8
6	Nickel	34	0.061912	0.027912	54.9
14	Nickel	5	0.016000	0.004400	72.5
15	Nickel	5	0.005000	0.005000	0.0
23	Nickel	11	0.028727	0.032636	-13.6
24	Nickel	6	0.012000	0.012500	-4.2
26	Nickel	6	0.010333	0.012833	-24.2
27	Nickel	5	0.048000	0.039000	18.8
39	Nickel	9	0.087889	0.019000	78.4
46	Nickel	11	0.884545	0.450000	49.1
8	Phenols	6	0.046833	0.010667	77.2

Table 4-4. Pollutant Removal Efficiencies Reported in the 47-POTW Data Base (continued)

Facility	Pollutant	Number of Observations	Average Influent (mg/l)	Average Effluent (mg/l)	"Average" Removal Efficiencies
15	Phenols	6	0.096667	0.080000	17.2
23	Phenols	10	0.103000	0.039000	62.1
24	Phenols	6	0.141667	0.040833	71.2
26	Phenols	10	0.159000	0.041500	73.9
29	Phenols	6	0.061178	0.023233	62.0
36	Phenols	6	4.006667	0.103333	97.4
42	Phenols	6	0.359000	0.128345	64.2
43	Phenols	6	0.161667	0.123345	23.7
6	Silver	30	0.015900	0.010667	32.9
13	Silver	6	0.009500	0.006500	31.6
14	Silver	6	0.006500	0.003333	48.7
39	Silver	8	0.034375	0.008570	74.5
36	Trichloroethylene	7	0.080257	0.002500	96.9
5	Zinc	20	0.224825	0.145800	35.2
6	Zinc	34	0.130088	0.028500	78.1
8	Zinc	6	0.126500	0.050833	59.8
11	Zinc	5	0.138600	0.134600	2.9
13	Zinc	6	0.223333	0.161667	27.6
14	Zinc	6	0.118333	0.063333	46.5
15	Zinc	6	0.148333	0.121667	18.0
16	Zinc	7	0.197571	0.063714	67.8
17	Zinc	5	0.110000	0.026000	76.4
22	Zinc	6	0.270000	0.073333	72.8
23	Zinc	11	0.160091	0.072727	54.6
24	Zinc	11	0.222364	0.039273	82.3
26	Zinc	10	0.082700	0.031400	62.0
27	Zinc	6	0.100000	0.050833	49.2
28	Zinc	6	0.220000	0.029167	86.7

Table 4-4. Pollutant Removal Efficiencies Reported in the 47-POTW Data Base (continued)

Facility	Pollutant	Number of Observations	Average Influent (mg/l)	Average Effluent (mg/l)	"Average" Removal Efficiencies
29	Zinc	6	0.172000	0.038917	77.4
30	Zinc	8	0.198125	0.081125	59.1
31	Zinc	8	0.192500	0.054000	71.9
32	Zinc	8	0.208375	0.086625	58.4
33	Zinc	8	0.177000	0.116937	33.9
36	Zinc	7	0.310000	0.032857	89.4
38	Zinc	6	0.178333	0.035000	80.4
39	Zinc	17	0.244706	0.050294	79.4
40	Zinc	6	0.215000	0.025000	88.4
42	Zinc	7	0.098429	0.054429	44.7
43	Zinc	6	0.073333	0.061667	15.9
46	Zinc	11	0.347364	0.087091	74.9
36	1,2-Trans-Dichloroethylene	5	0.017580	0.002500	85.8
12	1,4-Dichlorobenzene	5	0.022000	0.042600	-93.6

average removal efficiency for each plant. Table 4-5 allows for more ready comparison of calculated removal efficiencies across plants for each pollutant.

Table 4-5 shows that where data were provided for more than one treatment plant, the range of average removals was quite large. For example, average mercury removals ranged from -85.6 percent to 77.3 percent, and average cadmium removal efficiencies ranged from -1,362.5 percent to 73.9 percent. These data clearly suggest that pollutant removal at secondary wastewater treatment plants is highly plant specific. Figure 4-2 represents these data graphically.

While Tables 4-4 and 4-5 provide interesting information into the variability of removals from POTW to POTW, they provide little insight regarding removals within individual plants. Figures 4-3 through 4-7 present the distribution of removal efficiencies at the individual POTW within the 47-POTW data base that was represented by the greatest amount of sampling data. These figures illustrate the frequency with which removal efficiencies were achieved across all reported sampling events (for copper, zinc, chromium, nickel, and lead). While data for copper and zinc suggest that some centralized tendencies might exist among the reported removal efficiencies, this is not the case for chromium, lead, or nickel. These data suggest that any calculations or decisions made regarding specific POTW removal efficiencies should be conservative in nature and based on a comprehensive data set of POTW-specific data.

To provide a broad measure of the comparability of removals data from the 47-POTW, MISA, and DSS data bases, the median unacclimated removal estimates from the DSS were plotted against the first and third quartiles of POTW average removal efficiencies calculated from the 47-POTW data base and the MISA study. (Quartiles divide a data set into four equal parts. Data points lying between the first and fourth quartiles represent the middle 50 percent of the data set, with the second quartile representing the median.) Appendices B-3 and B-4 present the complete set of pollutant removal frequency distribution and cumulative frequency plots for the 47-POTW data base and the MISA study, respectively. Examination of these distributions yields the following observations:

- Frequency distribution plots of organics and metals data from the 47-POTW Study revealed a wide dispersion of the data, with no trends being readily discernable. These wide dispersions suggest that single removal values, such as the median or mean, would not appropriately reflect actual pollutant removals.

Table 4-5. Descriptive Statistics for Average POTW Removal Efficiencies in the 47-POTW Data Base

Pollutant*	Minimum	Maximum	Median	Mean	Number of POTWs	Number of Observations
Barium	72.6115	72.6115	72.6115	72.6115	1	7
Bis (2-Ethylhexyl) Phthalate	-100	71.6418	26.3314	14.5997	7	55
Cadmium	-1362.5	73.9583	27.7778	-167.977	7	46
Chromium	-58.6420	94.2928	68.1062	53.7813	10	110
Cyanide	-115.385	89.9338	18.1495	-2.4338	3	39
Di-N-Butyl Phthalate	51.6304	51.6304	51.6304	51.6304	1	5
Di-N-Octyl Phthalate	77.9609	78.1314	78.0461	78.0461	2	10
Diethyl Phthalate	-13.1313	77.4775	69.8795	44.7419	3	16
Lead	-27.2727	95.2160	45.1846	46.9904	12	109
Mercury	-83.5616	77.2727	-3.1445	-3.1445	2	10
Nickel	-24.1935	78.3818	33.9382	30.4551	10	97
Phenols	17.2414	97.4210	64.2493	61.0084	9	62
Silver	31.5789	74.5455	40.8160	46.9391	4	50
Trichloroethylene	96.8850	96.8850	96.8850	96.8850	1	7
Zinc	2.8860	89.4009	62.0314	59.0255	27	243
1,2-Trans-Dichloroethylene	85.7793	85.7793	85.7793	85.7793	1	5
1,4-Dichlorobenzene	-93.6364	-93.6364	-93.6364	-93.6364	1	5

*With the exception of barium, all pollutants are priority pollutants.

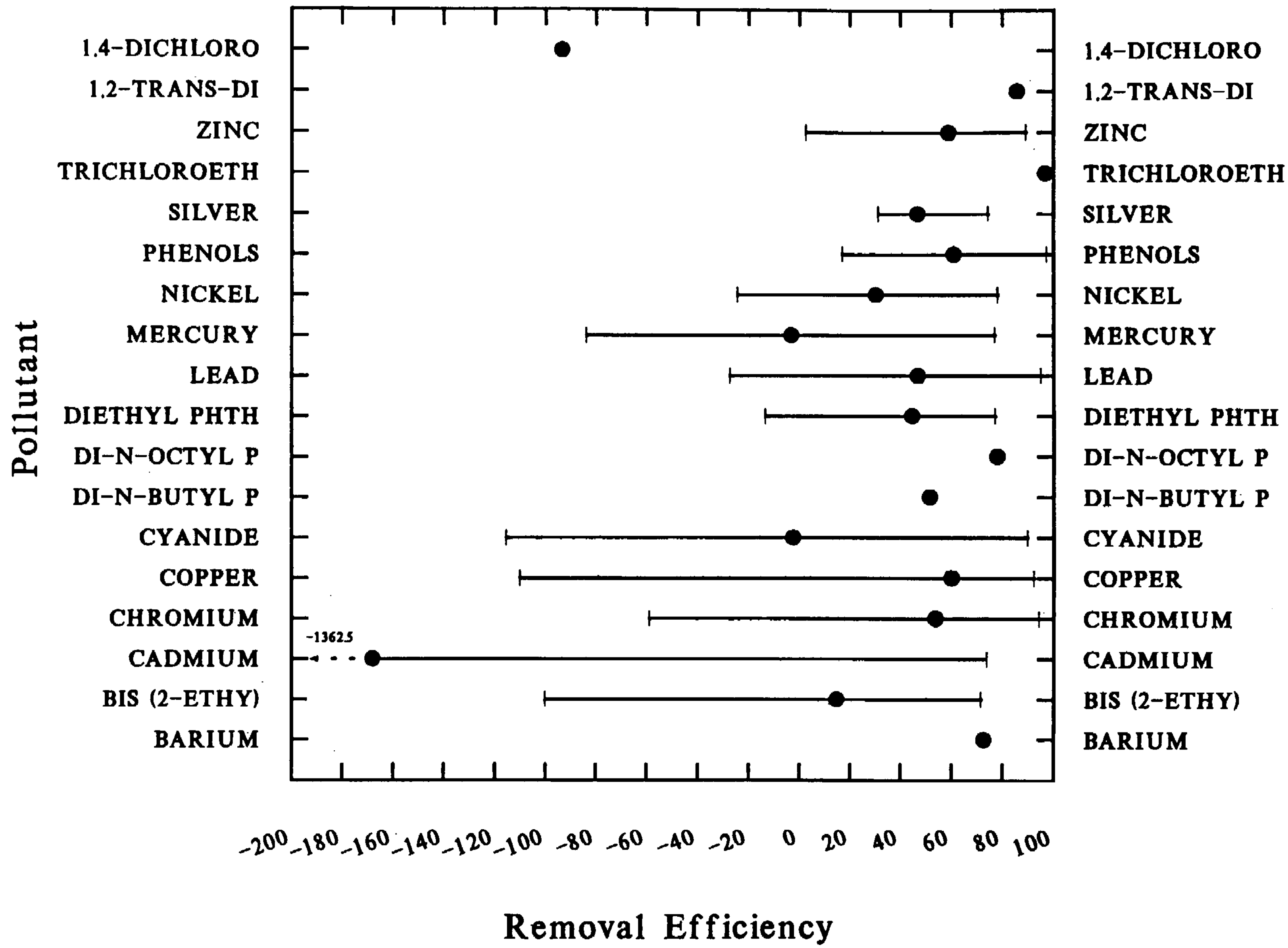

Figure 4-2. Minimum, Average, and Maximum Daily Removal Efficiencies from 47-POTW Data Base (across all POTWs)

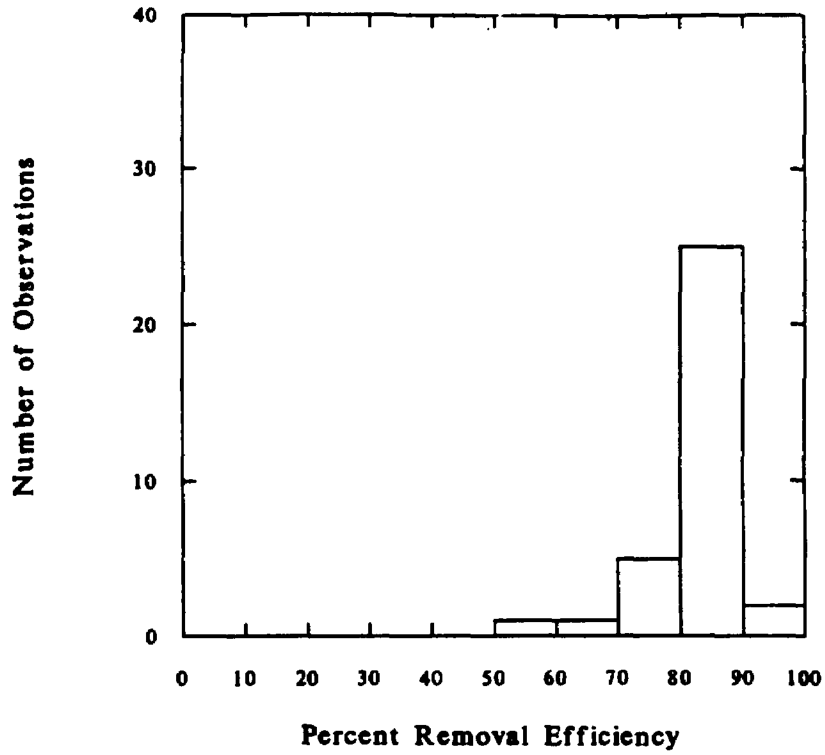

Figure 4-3. In-plant Removal Efficiency Distribution for Copper from One POTW in the 47-POTW Data Base

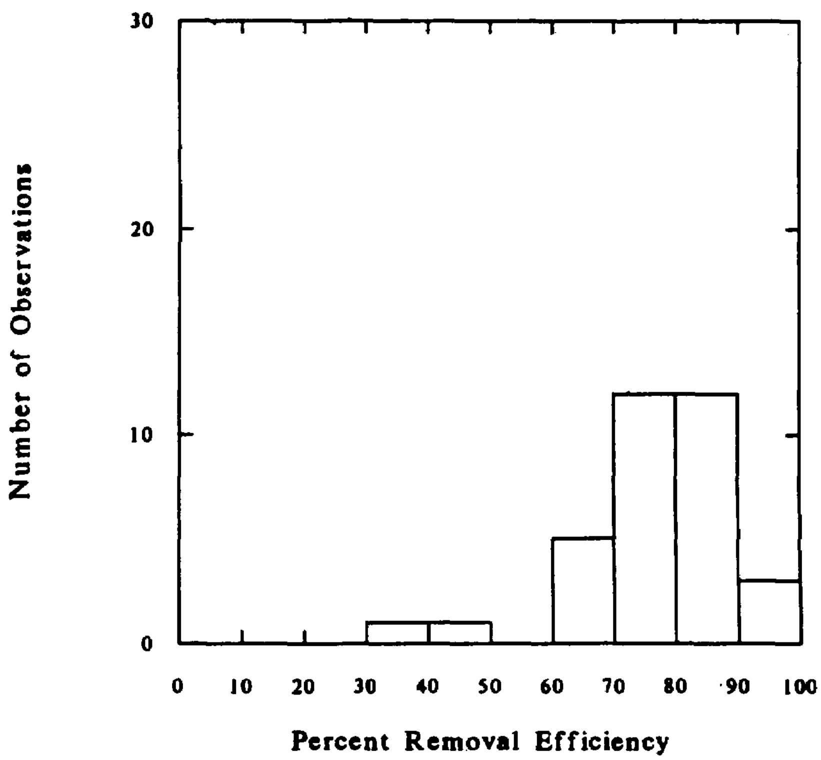

Figure 4-4. In-plant Removal Efficiency Distribution for Zinc from One POTW in the 47-POTW Data Base

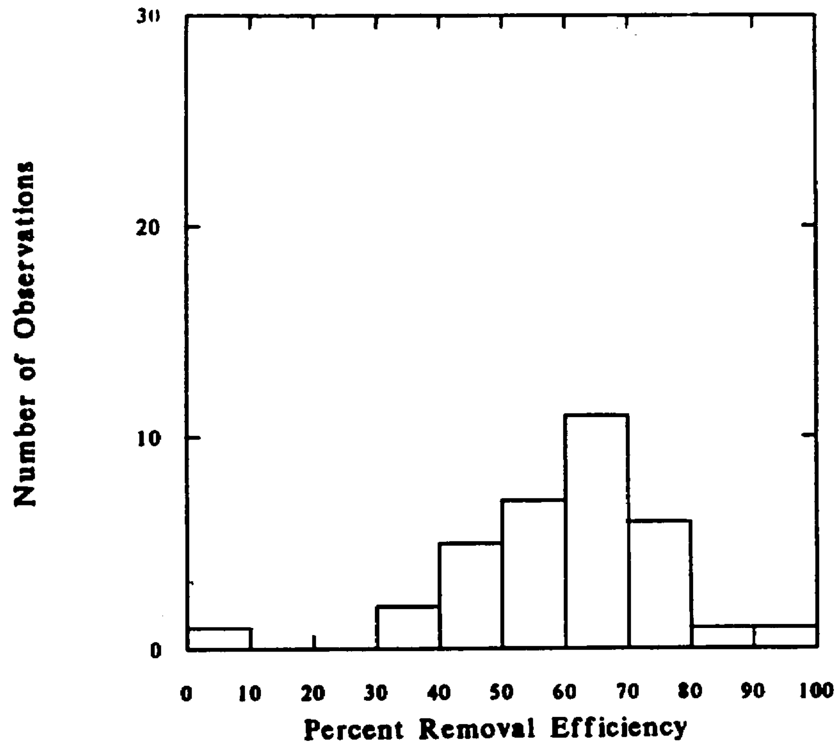

Figure 4-5. In-plant Removal Efficiency Distribution for Chromium from One POTW in the 47-POTW Data Base

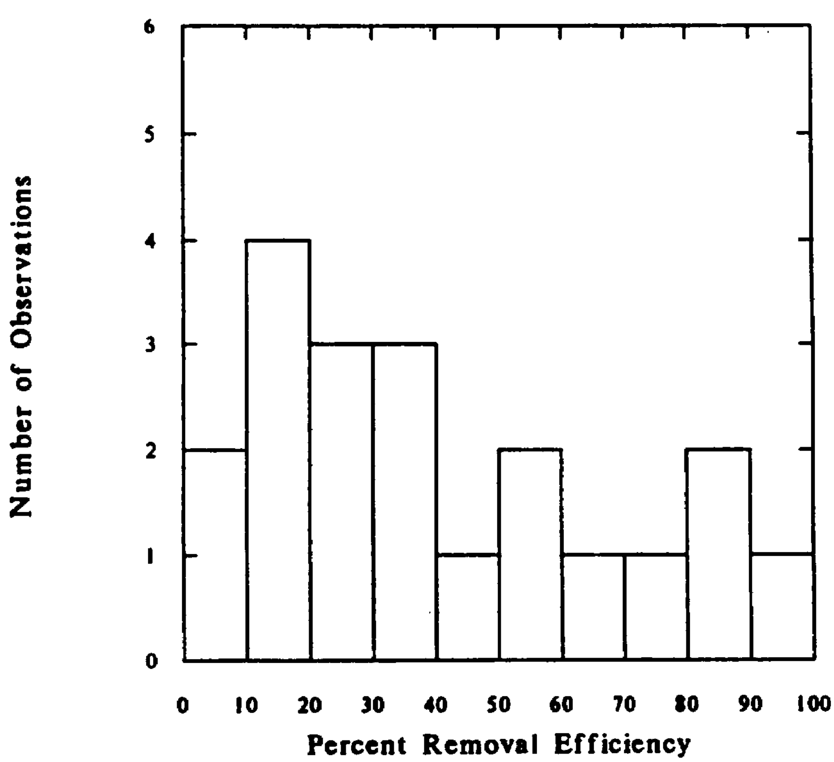

Figure 4-6. In-plant Removal Efficiency Distribution for Nickel from One POTW in the 47-POTW Data Base

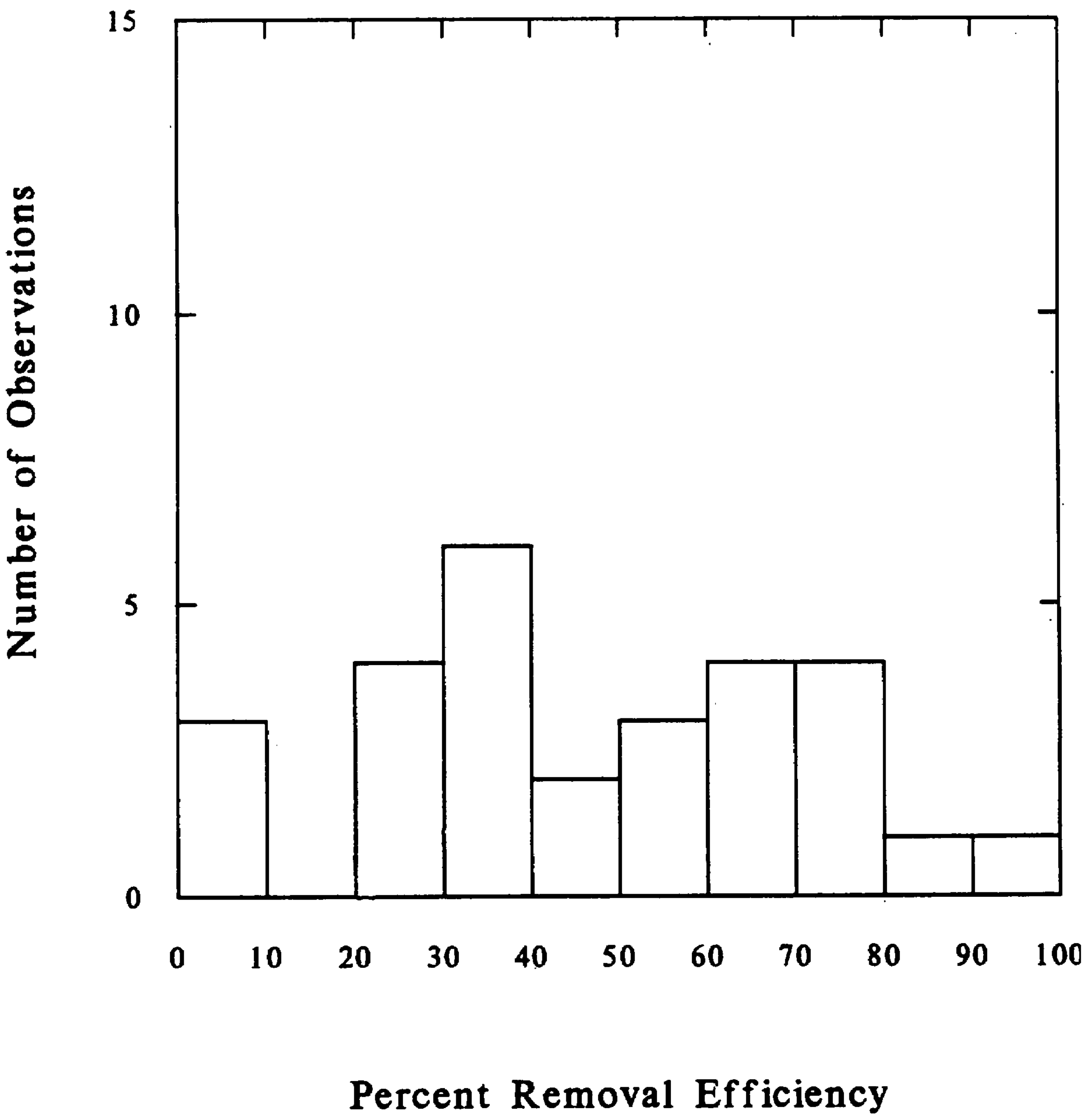

Figure 4-7. In-plant Removal Efficiency Distribution for Lead from One POTW in the 47-POTW Data Base

- Frequency distribution plots for inorganics and metals data from the MISA data base also show wide dispersions. As was the case with the 47-POTW data, these MISA data suggest that such removals should not be represented by single values. However, for 11 of the 16 organic pollutants plotted, over 75 percent removals were indicated. These organics represented both volatile and semi-volatile compounds.
- The 47-POTW and MISA data bases have 11 pollutants in common. Examination of the frequency distribution plots showed that 8 of the 11 plots have overlapping interquartile ranges. Of these eight, only three pollutants have median values that fall reciprocally into the corresponding interquartile ranges. These observations do not indicate clear similarities between the two data bases.
- The DSS estimates of median unacclimated pollutant removals cannot be considered representative of the removals observed in either the 47-POTW or the MISA data bases. In comparing DSS pollutant removals with the cummulative plots of the 47-POTW and MISA data bases, only 7 of 18 pollutant parameters in the 47-POTW data base and only 12 of 23 pollutant parameters in the MISA study fall within the interquartile ranges. Only three DSS estimates fall within the interquartile ranges of both data bases.

A previous study conducted by EPA, *Determining National Removal Credits for Selected Pollutants for Publicly Owned Treatment Works* (EPA, 1982a), includes statistical analyses of pollutant removals data and provides an appropriate point of comparison for these observations. This study analyzed treatment plant removals data for cadmium, chromium, copper, lead, nickel, silver, zinc, and cyanide, as reported in the 40-POTW Study (EPA, 1982b).

The purpose of the 40-POTW Study was to determine the fate and occurrence of priority pollutants at POTWs. The study, conducted in 1978, included extensive sampling at 40 geographically distributed treatment plants representing a variety of technologies, size ranges, and industrial flow contributions.

The 40-POTW Study plants were selected if they operated at or near the efficiency required to meet secondary treatment regulations, although not all of the plants always met 30/30 BOD/TSS discharge limitations. The study population included both secondary and some advanced wastewater treatment facilities.

Since the 40-POTW Study population was different from that evaluated in this chapter and different data editing rules were employed (e.g., in the way that concentrations below detection limits were treated), direct comparison of the removal efficiency distribution histograms is not appropriate. However, the results of the analyses can be compared. The results of the statistical analysis in the removal credits study indicated wide dispersions in observed removal efficiencies, with no readily observable trends. These observations are consistent with the examination of metals removals for the 47-POTW and MISA data bases.

4.3.3.2 Approach for Characterizing Dispersed Pollutant Removals Data

The analyses provided in Subsection 4.3.3.1 suggest that removals can be quite variable from POTW to POTW and from sampling event to sampling event at individual POTWs. POTWs frequently take 8- or 24-hour composite samples of POTW influent and effluent streams and grab samples of sludge to characterize pollutant content. This method of sampling may not account for POTW hydraulic detention times and recycle streams within the treatment plant. In addition, POTWs are likely to be nonsteady state systems. As a result of these complicating factors, the use of a single central value, such as the median, may not characterize the observed dispersed removals adequately.

Rather than relying on the median or other measure of central tendency, it may be more appropriate to characterize dispersions of removal efficiencies at POTWs by deciles. (A decile is similar in concept to a median. Whereas a median divides an ordered data set into 2 equal parts, with half of the values less than the median and half greater, deciles divide an ordered data set into 10 equal parts. Ten percent of the data set values are less than the first decile, 20 percent of the data set values are less than the second decile, and so on. The fifth decile is equivalent to the median.) Although using deciles to estimate removal efficiencies at a POTW would be no more likely to represent actual removal efficiencies than using medians, selecting appropriate deciles would increase the probability that actual removals were at least as efficient as the decile value used. This conservative approach would increase confidence that actual efficiencies were not being overestimated (and, thus, that greater pollutant loadings were passing through the plant) or in the case of sludge, underestimated (in which case greater loadings than predicted would enter the sludge). As described in Chapter 5, the use of deciles to characterize removals has previously been recommended in developing local limits (see, for example, EPA's *Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program* [EPA, 1987]).

An approach using deciles rather than measures of central tendency could be equally appropriate in national decisionmaking related to removal efficiency. Once deciles are calculated for individual treatment plant data, estimates for use in national policymaking purposes might be derived from median values of selected decile removals from the subject universe of treatment plants.

A decile approach is generally more data-intensive than approaches that use measures of central tendency. To calculate deciles, the number of data points (i.e., the number of sampling events at an individual POTW) must be sufficient to allow the division of individual data sets into 10 equal parts; measures of central tendency, such as the mean or median, require as few as one or two data points. This approach would greatly enhance the confidence with which programmatic and policy decisions related to treatment plant performance can be made at both the local and national levels.

4.4 FINDINGS

Toxic pollutants present in the raw sewage entering secondary treatment plants may have several fates. Some toxic organic pollutants may biodegrade to varying extents. Those that are not biodegraded are either partitioned to sewage sludge, volatilized at various stages in the treatment train, or discharged to receiving waters. Metals are not biodegraded; they either enter sewage sludges or remain in the POTW's wastestream and are discharged in the effluent.

The removal of most toxic pollutants from wastewaters by POTWs is largely incidental to the treatment of conventional pollutants and should be considered in terms of partitioning among alternative pathways; pollutants may be shifted from one medium to another (to the air through volatilization or adsorbed to sludge), as well as removed through biodegradation.

The DSS estimated percent removals of selected priority pollutants by municipal wastewater treatment plants. These estimates, based on the research and BPJ of experts, served in part as the starting point for additional calculations estimating national pollutant loadings to air, sludge, and receiving waters. Values were presented for both "acclimated" and "unacclimated" treatment systems.

The examination of removal efficiencies is important for two reasons: because the loadings calculated in the DSS are based in part on estimated treatment plant removal efficiencies (and subsequent loadings estimates) and because of the significance of treatment plant removal efficiencies in various programmatic aspects of the pretreatment program.

Removal efficiencies may vary widely among and within POTWs.

- Examination of the individual data sets representing POTW removal efficiencies in the 47-POTW data base indicated that very wide ranges of removals occurred for the pollutants examined.
- Examination of POTW average pollutant removal efficiencies in both the 47-POTW data base and the MISA data base indicated that POTW average removal efficiencies are dispersed widely from POTW to POTW. For these two data sets, the average POTW pollutant removal efficiencies could not be appropriately represented by any single value.
- MISA study data suggest that removals for a subset of organic pollutants (both volatile and semi-volatile) occur within a narrow range in excess of 75-percent removal. These pollutants were not representative of any single group of compounds (volatile or otherwise) in the data base that might otherwise have explained the trend. In contrast to the MISA results, analysis of the 47-POTW data suggests that organics removals occur over a wide range, with no discernable trends.
- Analysis of data from one POTW within the 47-POTW data base (the plant having the most extensive data) suggested that removals of copper and zinc might be fairly consistent for that plant. However, no such consistency was observed for chromium, lead, and nickel.

While the data contained in the data bases evaluated in this study sometimes extended beyond the list of priority pollutants, the study methodology focused on pollutants having the most extensive (and presumably more reliable) data sets; these pollutants were priority pollutants.

The analysis of the MISA and 47-POTW data bases suggests that single-value, national estimates of pollutant removal efficiencies provided in the DSS cannot be appropriately applied to specific POTWs for either priority or non-priority pollutants. This finding is underscored by the variability in the sampling results within individual POTWs from one event to the next. When these results are viewed in conjunction with the wide dispersion of removals among different POTWs, the need for using POTW-specific data in making decisions applicable to individual POTWs is emphasized.

Given the dispersed distributions of pollutant removals observed at secondary treatment plants, EPA recognizes the need for more sampling data to be used in calculating removal efficiencies. In addition, selection of representative pollutant removal levels based on a statistical confidence level would be more appropriate than the use of averages. This approach is consistent with current removal credits regulations which specify the use of a 75 percent confidence level, and EPA guidance on local limits.

Current EPA guidance allows POTWs to use literature values or other default values to represent POTW conditions, including pollutant removals, for which POTW-specific data are not available. The variability in observed pollutant removals, both across plants and from one sampling event to the next at individual plants, suggests that the use of literature values or other default values in the calculation of local limits should be reevaluated. The observed variability in pollutant removals suggests the need for more extensive POTW-specific monitoring data as the basis for local limits calculations.

Finally, the finding that pollutant removals are widely variant among treatment plants suggests that no single reference level for removals should be accepted at face value and that the acceptability of Superfund remediation wastes discharged to POTWs must be evaluated on a case-by-case basis. Such an evaluation would examine the overall acceptability of using a given POTW as part of remediation activities and the level of protection afforded the POTW and receiving environments with the appropriate environmental standards.

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5. CAPABILITY OF POTWS TO REVISE PRETREATMENT STANDARDS

Section 519(a)(3) of the Water Quality Act of 1987 directed the U.S. Environmental Protection Agency (EPA) to study "the capability of publicly owned treatment works [POTWS] to revise pretreatment requirements under Section 307(b)(1) of the Federal Water Pollution Control Act" (FWPCA). Section 307(b)(1) required EPA to establish national pretreatment standards to control the discharge to POTWs of pollutants not susceptible to treatment by such works. This section also states that if the owner or operator of a POTW can demonstrate that toxic pollutants are removed by the POTW and that such removal will not prevent proper sludge management, then allowances reflecting these pollutant removals can be applied to the industry-specific categorical standards established by EPA (i.e., the POTW can grant removal credits).

The House of Representatives Committee on Public Works and Transportation, which initially developed Section 519 of the Water Quality Act of 1987 (then referred to as Section 47 of HR 8), stated in the report transmitting this section that:

> The Committee intends that EPA focus particular attention on the extent to which EPA's pretreatment Removal Credits program is presently effectuating the Congressional intent behind Section 307(b)(1). Congress added the credits system to the Act in 1977 because of its concern that EPA's categorical pretreatment standards could result in costly redundant treatment by industry and publicly owned treatment works. The Committee also intends that, in implementing Section (519[a][3]), the Administrator shall examine the capability of publicly owned treatment works to establish and enforce requirements more stringent than or different from national categorical standards (House Report No. 189, 99th Congress, 51 [1985]).

Allowing an industrial facility to discharge more of a pollutant than is permissible under a national categorical pretreatment standard based on the percentage removal of that pollutant by the POTW is referred to as granting the facility a removal credit. Limits developed by a POTW based on a consideration of local environmental factors and characteristics of the treatment plant are called "local limits."

EPA established a two-tiered study definition for the term "capability." In assessing POTW capability to revise pretreatment requirements through the removal credits and local limits processes, EPA is providing Congress with information on the availability of technical objectives inherent to removal credits and local limits. EPA also has evaluated POTW capability to perform technical tasks critical to establishing and enforcing local limits and removal credits. The first component of "capability" ensures consideration of POTW capability to achieve the statutory and regulatory objectives intended for removal credits and local limits, namely, eliminating treatment redundancy in an environmentally protective manner and imposing more stringent local controls to meet site-specific plant and environmental objectives, respectively. Thus, in evaluating capability to achieve technical objectives, EPA is measuring how well these program components are fulfilling their original objectives and is considering the availability of environmental criteria that are prerequisites.

By contrast, the second "capability" component, capability to perform required tasks, focuses on the abilities of POTWs to complete significant steps in developing and implementing local limits and removal credits. Evaluation of this aspect of POTW capability involves assessment of POTW aptitude and technical ability to perform more mechanical functions, such as monitoring and limits calculations.

This two-tiered definition ensures consideration of POTW capability to achieve both the ends and the means associated with local limits and removal credits. Section 5.4 fully develops the methodology for this two-tiered approach.

Section 5.1 provides an overview of pretreatment standards (national, State, and local), how each type of standard works, and what industries and pollutants are covered by each type of standard. Section 5.2 describes how removal credits and local limits are developed. Section 5.3 summarizes and evaluates the extent of technical and environmental criteria and standards, including water quality criteria, toxic effluent limits, sludge quality criteria, sludge permit limits, and air quality criteria and emissions limits applicable to POTW wastestreams. Characterization of these criteria and limits is necessary because their adequacy and existence influences the effectiveness and extent of the environmental objectives that guide POTW development or revision of pretreatment standards. Section 5.4 describes the data sources and methods used to evaluate POTW capability to revise pretreatment standards. Section 5.5 presents the assessment of POTW capability to revise pretreatment standards through the granting of removal credits. Section 5.6 evaluates POTW capability to develop and implement local limits. Section 5.7 summarizes overall findings.

5.1 Overview of Pretreatment Standards

The General Pretreatment Regulations establish three types of pretreatment standards: prohibited discharge standards (40 *CFR* 403.5[a] and [b]), local limits (40 *CFR* 403.5[c]), and categorical standards (40 *CFR* Parts 405-471). The following subsections describe these standards briefly.

5.1.1 Prohibited Discharge Standards

Sections 403.5(a) and (b) of the General Pretreatment Regulations establish the general and specific prohibitions, respectively, that apply to all nondomestic users of POTWs. The general prohibitions state that a "user may not introduce into a POTW any pollutant(s) which cause Pass Through or Interference" (see Chapter 1). The specific prohibitions forbid pollutant discharges that meet specific conditions, including the following:

(1) Pollutants that create a fire or explosion hazard in the POTW, including, but not limited to, wastestreams with a closed cup flashpoint of less than 60°C (140°F) using the test methods specified in 40 *CFR* 261.21

(2) Pollutants that will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, unless the works is designed specifically to accommodate such discharges

(3) Solid or viscous pollutants in amounts that will cause obstruction to the flow in the POTW resulting in interference

(4) Any pollutant, including oxygen demanding pollutants (i.e., biochemical oxygen demand [BOD]) released in a discharge at a flow rate and/or pollutant concentration that will cause interference with the POTW

(5) Heat in amounts that will inhibit biological activity in the POTW resulting in interference, but in no case heat in such quantities that the temperature at the POTW treatment plant exceeds 40°C (104°F) unless the approval authority, upon request of the POTW, approves alternate temperature limits

(6) Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through

(7) Pollutants that result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity that may cause acute worker health and safety problems

(8) Any trucked or hauled pollutants, except at discharge points designated by the POTW.

5.1.2 Local Limits

Local limits are developed to implement the prohibited discharge standards at a particular POTW. They are developed by the POTW based on site-specific data and may apply to both the categorical and noncategorical industrial users of the POTW.

5.1.3 Categorical Standards

Effluent limitations guidelines are national, uniform, technology-based effluent standards promulgated by EPA that apply to all industrial facilities in selected industrial categories. Effluent guidelines that restrict pollutants that pass through or interfere with POTWs are referred to as categorical pretreatment standards. Effluent guidelines, including categorical standards, are developed by EPA's Industrial Technology Division (ITD) and are based on the capability of available treatment technology. Categorical standards are expressed as Pretreatment Standards for Existing Sources (PSES) or Pretreatment Standards for New Sources (PSNS); they are published, along with effluent guidelines for direct dischargers, in 40 *CFR* Parts 405 through 471.

Categorical standards may not be sufficient in themselves to protect a specific POTW from pass through and interference; therefore, they are supplemented by prohibited discharge standards and local limits. The following subsections report on the status of categorical standards, summarizing some of the information introduced in Chapters 1 and 3.

5.1.3.1 Current Standards

The list of industries subject to categorical standards has changed as a result of court decrees, settlement agreements resulting from litigation, and EPA's development activities.

Table 5-1 lists all industrial categories currently subject to categorical standards, either for new or existing sources or both. Tables 5-2 and 5-3 identify the pollutants regulated by each category. The number of toxic pollutants regulated for any industry category is variable, as the tables show. For example, the Builders' Paper and Board Mills category regulates only two of the 126 priority pollutants, while the Organic Chemicals, Plastics, and Synthetic Fibers category regulates more than 40. It should be noted, however, that not all industrial categories discharge all toxic pollutants; standards are established only for those identified as pollutants of concern. In addition, the treatment technology upon which the standards are based often achieve treatment of other pollutants in the wastewater. Rather than establishing standards and requiring monitoring for all pollutants potentially present, EPA often has established standards only for indicator pollutants.

Chromium and zinc are the most frequently regulated toxic pollutants; they are regulated for 16 of the 34 categories with toxic standards. Phenol, tetrachloroethylene, toluene, and naphthalene are the four most frequently regulated toxic organic pollutants; phenol is

Table 5-1. Industrial Categories with Pretreatment Standards for Existing Sources (PSES) and Pretreatment Standards for New Sources (PSNS)

40 CFR Part	PSES	PSNS	Industrial Category
467	x	x	Aluminum forming
427		x	Asbestos manufacturing
461	x	x	Battery manufacturing
431	x	x	Builders' paper and board mills
458		x	Carbon black manufacturing
465	x	x	Coil coating
468	x	x	Copper forming
469	x	x	Electrical and electronic components
413	x		Electroplating
412		x	Feedlots
424		x	Ferroalloy manufacturing
418		x	Fertilizer manufacturing
426		x	Glass manufacturing
406		x	Grain mills manufacturing
447		x	Ink formulating
415	x	x	Inorganic chemicals
420	x	x	Iron and steel manufacturing
425	x	x	Leather tanning and finishing
433	x	x	Metal finishing
464	x	x	Metal molding and casting
471	x	x	Nonferrous metals forming and metal powders
421	x	x	Nonferrous metals manufacturing
414	x	x	Organic chemicals, plastics, synthetic fibers
446		x	Paint formulating
443		x	Paving and roofing materials
419	x	x	Petroleum refining
439	x	x	Pharmaceutical manufacturing
466	x	x	Porcelain enameling
430	x	x	Pulp, paper, and paperboard
428		x	Rubber manufacturing
417		x	Soap and detergent manufacturing
423	x	x	Steam electric power generating
409		x	Sugar processing
429	x	x	Timber products processing

Table 5-2. Consent Decree Industrial Categories With Categorical Pretreatment Standards

	Industrial Category (40 CFR Part)																				
Priority Pollutants	467	461	465	468	469	413	415	420	425	433	464	471	421	414	419	439	466	430	431	423	42
Acenaphthene	T					T				T				R						P	
Acrolein						T				T										P	
Acrylonitrile						T				T										P	
Benzene				T		T				T				X						P	
Benzidine						T				T										P	
Carbon Tetrachloride (Tetrachloromethane)					T	T				T				X						P	
Chlorobenzene						T				T				X						P	
1,2,4-Trichlorobenzene					T	T				T				X						P	
Hexachlorobenzene						T				T			X	X						P	
1,2-Dichloroethane					T	T				T				X						P	
1,1,1-Trichloroethane			T	T	T	T				T				X						P	
Hexachloroethane						T				T				X						P	
1,1-Dichloroethane			T			T				T				X						P	
1,1,2-Trichloroethane					T	T				T				X						P	
1,1,2,2-Tetrachloroethane			T			T				T										P	
Chloroethane						T				T				X						P	
Bis(2-chloroethyl) Ether			T			T				T										P	
2-Chloroethyl Vinyl Ether (mixed)						T				T										P	
2-Chloronaphthalene						T				T										P	
2,4,6-Trichlorophenol					T	T				T								X	X	P	
Parachlorometa Cresol	T					T				T										P	
Chloroform (Trichloromethane)			T	T	T	T				T				X						P	
2-Chlorophenol	T				T	T				T										P	
1,2-Dichlorobenzene					T	T				T				X						P	
1,3-Dichlorobenzene					T	T				T				X						P	
1,4-Dichlorobenzene					T	T				T				X						P	
3,3-Dichlorobenzidine						T				T										P	
1,1-Dichloroethylene			T		T	T				T				X						P	
1,2-Trans-dichloroethylene						T				T				X						P	
2,4-Dichlorophenol					T	T				T										P	
1,2-Dichloropropane						T				T				X						P	
1,3-Dichloropropylene (1,3-Dichloropropene)						T				T				X						P	
2,4-Dimethylphenol						T				T				R						P	
2,4-Dinitrotoluene	T					T				T										P	
2,6-Dinitrotoluene				T		T				T										P	
1,2-Diphenylhydrazine	T				T	T				T										P	
Ethylbenzene	T			T	T	T				T				X						P	
Fluoranthene	T					T				T				R						P	
4-Chlorophenyl Phenyl Ether						T				T										P	
4-Bromophenyl Phenyl Ether						T				T										P	
Bis (2-Chloroisopropyl) Ether						T				T										P	
Bis (2-Chloroethoxy) Methane						T				T										P	
Methylene Chloride (Dichloromethane)			T	T	T	T				T				X						P	
Methyl Chloride (Chloromethane)					T	T				T				X						P	
Methyl Bromide (Bromomethane)						T				T										P	
Bromoform (Tribromomethane)						T				T										P	
Dichlorobromomethane					T	T				T										P	
Chlorodibromomethane						T				T										P	
Hexachlorobutadiene						T				T				X						P	
Hexachlorocyclopentadiene						T				T										P	
Isophorone	T				T	T				T										P	
Naphthalene	T			T	T	T		X		T				R						P	
Nitrobenzene						T				T				X						P	
2-Nitrophenol					T	T				T				X						P	
4-Nitrophenol					T	T				T				X						P	

"X"-Numerical standard, "T"-Regulated as part of total toxic organics (TTO), "P"-No discharge in detectable amounts, "R"-Standard has been remanded.

Table 5-2. Consent Decree Industrial Categories With Categorical Pretreatment Standards

	Industrial Category (40 CFR Part)																				
Priority Pollutants	467	461	465	468	469	413	415	420	425	433	464	471	421	414	419	439	466	430	431	423	429
2,4-Dinitrophenol						T				T										P	
4,6-Dinitro-o-cresol						T				T				X						P	
N-Nitrosodimethylamine						T				T										P	
N-Nitrosodiphenylamine	T			T		T				T										P	
N-nitrosodi-n-propylamine						T				T										P	
Pentachlorophenol			T		T	T				T								X	X	P	
Phenol	T				T	T		X		T	X			R						P	
Bis (2-Ethylhexyl) Phthalate	T		T		T	T				T				R						P	
Butyl Benzyl Phthalate			T		T	T				T										P	
Di-n-butyl Phthalate	T		T		T	T				T				R						P	
Di-n-octyl Phthalate						T				T										P	
Diethyl Phthalate	T					T				T				R						P	
Dimethyl Phthalate						T				T				R						P	
Benzo(a)anthracene (1,2-Benzanthracene)						T				T										P	
Benzo(a)pyrene (3,4-Benzopyrene)	T					T				T			X							P	
Benzo(b)fluoranthene 3,4-Benzofluoranthene	T					T				T										P	
Benzo(k)fluoranthane (11,12-Benzofluoranthene)	T					T				T										P	
Chrysene	T					T				T										P	
Acenaphthylene	T					T				T										P	
Anthracene	T			T	T	T				T				R						P	
Benzo(ghi)perylene (1,12-Benzoperylene)	T					T				T										P	
Fluorene	T					T				T				R						P	
Phenanthrene	T		T	T		T				T				R						P	
Dibenzo(a,h)anthracene (1,2,5,6-Dibenzanthracene)	T					T				T										P	
Indeno (1,2,3-cd) Pyrene (2,3-o-Phenylenepyrene)	T					T				T										P	
Pyrene	T					T				T				R						P	
Tetrachloroethylene	T		T		T	T		X		T				X						P	
Toluene	T		T	T	T	T				T				X						P	
Trichloroethylene	T			T	T	T				T				X						P	
Vinyl Chloride (chloroethylene)						T				T				X						P	
Aldrin						T				T										P	
Dieldrin						T				T										P	
Chlordane (technical mixture & metabolites)						T				T										P	
4,4-DDT						T				T										P	
4,4-DDE (p,p-DDX)						T				T										P	
4,4-DDD (p,p-TDE)						T				T										P	
Alpha Endosulfan						T				T										P	
Beta Endosulfan						T				T										P	
Endosulfan Sulfate	T					T				T										P	
Endrin	T					T				T										P	
Endrin Aldehyde	T					T				T										P	
Heptachlor						T				T										P	
Heptachlor Epoxide						T				T										P	
Alpha-BHC (Hexachlorocyclohexane)						T				T										P	
Beta-BHC						T				T										P	
Gamma-BHC (Lindane)						T				T										P	
Delta-BHC						T				T										P	
PCB-1242 (Arochlor 1242)	T					T				T										P	
PCB-1254 (Arochlor 1254)	T					T				T										P	
PCB-1221 (Arochlor 1221)	T					T				T										P	
PCB-1232 (Arochlor 1232)	T					T				T										P	
PCB-1248 (Arochlor 1248)	T					T				T										P	
PCB-1260 (Arochlor 1260)	T					T				T										P	
PCB-1016 (Arochlor 1016)	T					T				T										P	
Toxaphene						T				T										P	

"X"-Numerical standard, "T"-Regulated as part of total toxic organics (TTO), "P"-No discharge in detectable amounts, "R"-Standard has been remanded.

Table 5-2. Consent Decree Industrial Categories With Categorical Pretreatment Standards

	Industrial Category (40 CFR Part)																				
Priority Pollutants	467	461	465	468	469	413	415	420	425	433	464	471	421	414	419	439	466	430	431	423	429
Antimony (Total)					X		X					X	X							P	
Arsenic (Total)					X		X						X							P	X
Asbestos (Fibrous)																				P	
Beryllium (Total)													X							P	
Cadmium (Total)		X			X	X	X			X		X	X							P	
Chromium (Total)	X	X	X	X	X	X	X	X	X	X		X			X		X			P	X
Copper (Total)		X	X	X		X	X			X	X	X	X							P	X
Cyanide (Total)	X	X	X			X	X	X		X		X	X	X		X				P	
Lead (Total)		X		X	X	X	X	X		X	X	X	X	X			X			P	
Mercury (Total)		X					X						X							P	
Nickel (Total)		X		X		X	X	X		X		X	X				X			P	
Selenium (Total)							X						X							P	
Silver (Total)		X				X	X			X		X	X							P	
Thallium (Total)																				P	
Zinc (Total)	X	X	X	X	X	X	X	X		X	X	X	X	X			X	X		P	
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)						T				T										P	
OTHER REGULATED POLLUTANTS																					
Ammonia, (as N)								X				X	X		X						
Chromium, Hexavalent							X	X													
Cobalt		X					X						X								
Cyanide, Amenable						X	X			X											
Fluoride			X		X		X					X	X								
Gold													X								
Indium													X								
Iron							X						X								
Manganese		X	X																		
Molybdenum												X	X								
Oil and Grease	X		X	X							X				X						X
Other Pesticides																					
Palladium													X								
Phosphorous			X																		
Phthalate			X																		
Platinum													X								
Sulfide									X												
Tantalum													X								
Tin													X								
Titanium													X								
Total Metals						X															
Tungsten													X								

"X"-Numerical standard, "T"-Regulated as part of total toxic organics (TTO), "P"-No discharge in detectable amounts, "R"-Standard has been remanded.

Table 5-3. Nonconsent Decree Industrial Categories With Categorical Pretreatment Standards

	Category										
	406	409	412	417	418	424	426	427	428	447	458
Priority Pollutants											
Chromium (total)						X			X		
Cyanide											
Lead									X		
Phenols						X					
Zinc									X		
Other Regulated Pollutants											
Ammonia (as N)					X						
Chromium (hexavalent)						X					
COD				X							
COD/BOD_7				X							
Fluoride							X				
Manganese						X					
Nitrate (as N)					X						
Oil & Grease									X		X
Oil (mineral)							X				
Organic Nitrogen					X						
Phosphorus					X		X				
No Discharge of Process Wastewater Pollutants	X	X	X		X		X	X		X	

regulated for nine categories while the other three are regulated for eight categories. Six of the 14 categories with standards for organic pollutants address total toxic organics.[1]

In addition, 12 categories have a "no discharge" standard (effectively, a standard of zero for all pollutants) for specific manufacturing processes. Another 12 categories have standards for toxic pollutants only for new facilities.

5.1.3.2 Categorical Standards Under the 304(m) Process

On January 2, 1990, EPA responded to Section 304(m) of the Clean Water Act (CWA) by publishing its agenda for revision and review of existing effluent guidelines for direct dischargers and promulgation of new effluent guidelines (55 *FR* 80). At the same time, EPA described its plans for reviewing, revising, and promulgating categorical pretreatment standards. EPA has decided to revise categorical pretreatment standards for existing and new sources in the Organic Chemicals, Plastics, and Synthetic Fibers category (1993), the Pharmaceutical Manufacturing category (1994), and the Pulp, Paper, and Paperboard category (1995) because some toxic pollutants discharged from these industries are not regulated by current pretreatment standards. In addition, EPA is assessing the need to revise categorical pretreatment standards for the Petroleum Refining category, the Timber Products Processing category, and the Textile Mills category.

Furthermore, EPA intends to promulgate pretreatment standards for existing sources (PSES) and pretreatment standards for new sources (PSNS) for the Pesticide Chemicals category (1992), the Hazardous Waste Treatment—Phase 1 category (1995), and the Machinery Manufacturing and Rebuilding category (1995). Processes in these categories generate large quantities of toxic pollutant loadings to POTWs that often exceed loadings from industrial categories already subject to pretreatment standards and effluent limitations.

Finally, EPA plans to study the following industrial categories to determine the merit of

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1. Total toxic organics is defined as the sum of the masses or concentrations of specific toxic organic compounds in the industrial user's process wastewater at a concentration greater than 0.01 milligram per liter (mg/l).

developing effluent guidelines (including categorical standards), which could affect thousands of facilities that discharge toxic pollutants to POTWs:

- Drum Reconditioning
- Hospitals
- Industrial Laundries
- Paint Formulating
- Solvent Recycling
- Stripper Oil and Gas Extraction
- Transportation Equipment Cleaning
- Used Oil Reclamation and Refining.

5.2 POTW REVISIONS TO PRETREATMENT STANDARDS

Congress has requested an evaluation of POTWs' capability to revise or establish pretreatment standards. This chapter reviews the steps involved in developing and implementing removal credits and local limits.

5.2.1 Removal Credits Development and Implementation

Removal credits are mechanisms by which POTWs may adjust federally established categorical pretreatment standards to reflect pollutant removals demonstrated at a POTW, assuming the POTW meets other environmental criteria, such as the POTW's National Pollutant Discharge Elimination System (NPDES) permit limits, sewage sludge use/disposal criteria, and local limits. The purpose of removal credits is to eliminate the need for costly, redundant industrial pretreatment in cases where the local POTW provides some measure of treatment for the regulated pollutants.

Currently, the removal credits provisions of the General Pretreatment Regulations (at 40 *CFR* 403.7) are suspended until the comprehensive sludge disposal regulations of 40 *CFR* Part 503 are promulgated. For the purposes of describing the removal credits development process in this subsection, the approach defined in the regulations at 40 *CFR* 403.7 (although currently suspended) will be used.

The current removal credit provisions of 40 *CFR* 403.7 specify that a POTW must do the following before it can be authorized to grant removal credits to categorical industrial users:

- Apply for authorization to grant removal credits from the approval authority
- Demonstrate consistent removal of the pollutant for which a removal credit is being sought
- Have an approved pretreatment program or qualify for the exception to this requirement
- Maintain compliance with applicable Federal, State, and local sludge disposal requirements
- Maintain compliance with its NPDES permit limits and conditions.

An eligible POTW may apply to the approval authority at any time for authorization to give or modify such credits. The approval authority must review the application in accordance with the procedures listed in 40 *CFR* 403.11, which are the same procedures used to review pretreatment program submissions. The approval authority must complete the review and respond to the POTW within 90 days from the date of public notice of the submission of a request for removal credit authorization or 180 days if the public comment period is extended or if a public hearing is held. After the approval authority has reviewed the application, it can approve or deny the application, or it can authorize a lower removal credit than the POTW sought.

Once the approval authority has approved a POTW's removal credit application, the consistent removal rate documented in the application will be included in the POTW's NPDES permit upon the earliest reissuance or modification (at or following pretreatment program approval) and become an enforceable requirement of the POTW's permit. The approved removal rate will remain in effect for the term of the POTW's NPDES permit, provided the POTW continues to meet the conditions for removal credit approval, including maintaining consistent removal.

After removal credit authority has been granted for a particular pollutant regulated in a categorical pretreatment standard, the POTW may automatically extend that removal credit to other categorical standards where the same pollutant is regulated. Application of the removal credit to other categories is conditioned upon continued compliance with both sludge requirements and NPDES permit limits and conditions.

Once the POTW has been granted authorization to give removal credits, it must continue to monitor and report on its removal capabilities at least once per year. The approval authority may require more frequent reporting. The report must include analytical results for those pollutants for which removal credits were granted. A minimum of one representative sample per month for the period covered is required for the report. Sampling and analytical methods must conform to the requirements specified in the final removal credit rule.

The following subsections discuss the application requirements in the order specified in the removal credit provision. Appendix C-1 provides an example removal credit calculation.

5.2.1.1 List of Pollutants

The application must list the pollutant(s) for which removal credits are proposed. These pollutants may include any toxic or other regulated pollutant for which discharge limits are specified in a categorical pretreatment standard. Some categorical pretreatment standards use conventional or nonconventional pollutants as indicators or surrogates for toxic pollutants. Removal credits may only be given for indicator or surrogate pollutants regulated in a categorical standard if the standard specifically allows removal credits.

5.2.1.2 Consistent Removal Data

The POTW's application must demonstrate consistent removal for each pollutant for which a removal credit is being sought. With certain exceptions, discussed in the following paragraphs, this demonstration must include analytical data from influent and effluent samples and a calculation of consistent removal. Analytical data are required from at least 12 representative samples of influent and effluent taken at approximately equal intervals throughout 1 full year.

"Consistent removal" is currently defined as the arithmetic mean of the lowest 50 percent of the removals calculated by the POTW. In other words, if 12 samples of influent and effluent are collected, the removals for each of the 12 are calculated, and the average of the lowest 6 is deemed "consistent removal." This means that removal at approximately a 75 percent confidence level is required.

When pollutants are not measurable in some influent and effluent samples, the provision provides for several alternatives to numerical averaging of results, including the following:

- Use of historical data to calculate the consistent removal rate
- Use of data from treatability studies, demonstrated removal at similar treatment facilities, or some other alternative means to demonstrate consistent removal.

These alternative procedures are available with the concurrence of the approval authority. A pollutant is deemed not "measurable" if the analytical method either cannot detect it or is unable to yield a concentration value. At a minimum, these options must provide data representative of the yearly and seasonal variations to which the treatment system is subjected.

If the demonstrated removal rate for a pollutant drops substantially and consistently, the approved removal credit will be reduced or withdrawn according to the procedures and criteria described in the regulations. The effect of reducing or withdrawing removal rates for categorical industrial users is that pretreatment standards will be made more stringent, potentially requiring installation of additional treatment by affected industrial users. Where the POTW was initially deemed to have a high consistent removal rate, the effect of a reduced removal credit upon industrial users could be substantial. The POTW should also be aware that the demonstrated removal rate becomes an enforceable part of the POTW's NPDES permit. Therefore, the POTW may elect to demonstrate removal at one level, apply for authority to grant a lesser level, and perhaps actually grant an even lesser amount of credit.

5.2.1.3 Calculation of Revised Discharge Limits

The removal credit application must contain the revised discharge limits for each pollutant and for each industrial category (or subcategory where appropriate) for which removal credits are proposed. The revised limits are derived by using the following formula:

$$y = \frac{x}{1-r}$$

where:

y = revised discharge limit for the pollutant

x = pollutant discharge limit specified in the applicable categorical pretreatment standard

r = POTW's consistent removal rate for the pollutant.

Many POTWs have more than one treatment plant receiving wastewater from industrial users (IUs) regulated by categorical pretreatment standards. Removal rates must be determined separately for each treatment plant. The POTW may then revise and regulate separate limits for categorical IUs discharging to different treatment plants, or it may take the most stringent limit (i.e., the limit that has been revised using the lowest removal rate of all the plants) and use that as the limit for all IUs discharging to all plants. It is important to note that the POTW must demonstrate a consistent removal rate for each pollutant at each treatment plant that receives wastewater from IUs for which removal credits will apply.

5.2.1.4 Local Pretreatment Program Certification

The removal credit application must include a certification from the POTW stating that it has an approved pretreatment program or qualifies for exemption from this requirement as discussed below. The certification must be signed by an authorized POTW representative.

5.2.1.5 Sewage Sludge Management Certification

The POTW's application must specifically describe its current method to use or dispose of its sludge and certify that granting removal credits will not cause the POTW to violate any of the following Federal statutory provisions and regulations or permits issued to implement them (or more stringent State or local regulations):

- Section 405 of the Clean Water Act
- Solid Waste Disposal Act (SWDA), including Title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and State regulations contained in any State sludge management plan prepared pursuant to Subtitle D of RCRA
- Clean Air Act
- Toxic Substances Control Act
- Marine Protection, Research, and Sanctuaries Act.

To meet the requirements of this section, the POTW should demonstrate that it will continue to comply with applicable sludge disposal regulations after the categorical standards are revised. This demonstration involves determining the increase of the pollutant in the sludge that will result from the standard's revision.

5.2.1.6 NPDES Permit Limit Certification

The final application requirement is a certification that granting removal credits will not cause a violation of the POTW's NPDES permit limits and conditions. Alternatively, the POTW can demonstrate that even though it is not currently in compliance with its NPDES permit, it will be in compliance when its industrial user(s) are required to meet the categorical pretreatment standards (as modified by the removal credit provision). Either demonstration involves calculation of the anticipated increase of the pollutant concentrations in the influent to the treatment plant and the resulting effect on treatment processes and effluent.

Where the POTW's NPDES permit does not have toxic pollutant limits, the POTW should check that water quality criteria or standards (if applicable) will continue to be met after the categorical standards are revised.

5.2.1.7 Removal Credits Implementation

Once consistent removal is established, and the industrial users' revised standards have been calculated, the POTW must implement the revised standards through its system of individual control mechanisms. This is usually done by revising existing industrial user permits to incorporate all revised limits. The POTW then performs its routine monitoring and inspections, and reviews self-monitoring reports, to ensure continued compliance with these revised standards.

5.2.2 Local Limits Development and Implementation

Under the National Pretreatment Program, local limits are POTW-specific discharge standards that are based on site-specific information and typically are applied to both categorical and noncategorical industrial users of POTWs. The purpose of local limits is to prevent pass through and interference, to protect POTW operations and chosen sewage sludge use and disposal practices, and to ensure worker health and safety. More specifically, local limits are developed at a particular POTW to implement the prohibited discharge standards described in Subsection 5.1.1, regardless of whether any of its industrial dischargers are subject to categorical pretreatment standards. EPA's July 24, 1990, revisions to the General Pretreatment Regulations (55 *FR* 30082) require each POTW with an approved pretreatment program to submit with its NPDES permit application a formal evaluation of the need to revise local limits.

There are many ways in which a POTW may generate its local limits. For example, it may choose to adopt limits developed by another POTW of similar design; it may use modified drinking water standards; it may adopt categorical standards, such as metal finishing limits; or it may adopt limits based on literature findings. None of these methods, however, specifically addresses the fundamental purposes of local limits defined previously, which are to prevent adverse effects to the POTW, to the environment, and to public health. To address these concerns, which are highly site-specific, the POTW must conduct a comprehensive evaluation of its operational and environmental characteristics and develop protective local limits based on this evaluation.

The predominant approach used by POTWs and advocated in EPA's *Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program* (EPA, 1987a) (hereafter called "EPA's Local Limits Guidance") is a pollutant-specific approach known as the maximum allowable headworks loading (MAHL) method. This method involves back-calculating from environmental and plant protection criteria to develop MAHLs. This is accomplished, pollutant by pollutant, for each environmental criterion or POTW requirement. The lowest or most limiting value for each pollutant serves as the basis for allocation to industry and ultimately setting local limits. The following subsection describes the use of MAHLs in developing local limits.

5.2.2.1 Maximum Allowable Headworks Loading Method

<u>Determining Pollutants of Concern</u>

EPA's August 1985 policy memorandum identified six pollutants of potential concern to all POTWs—cadmium, chromium, copper, lead, nickel, and zinc—because of their occurrence in POTW influents and effluents in concentrations that warrant concern. EPA's Local Limits Guidance identifies four additional pollutants—arsenic, cyanide, silver, and mercury—that all POTWs should consider, unless an analysis of their wastewater and sludge shows that they are not present in significant amounts. The policy memorandum also states that POTWs should collect data on priority, conventional, and nonconventional pollutants reasonably expected to be discharged to the POTW in quantities that could pass through or interfere with the POTW treatment process, contaminate the sludge, or jeopardize worker health and safety or the collection system.

Generally, the POTW should perform at least one priority pollutant scan and possibly a scan for RCRA ground-water monitoring parameters (in Appendix IX of 40 *CFR* Part 264) to identify potential pollutants of concern in the influent, effluent, and sludge. Once the POTW has identified such pollutants, it should evaluate the need for a local limit for each.

Characterizing Existing Loadings

During the local limits development process, the POTW must characterize existing loadings to the treatment plant. Local limits should be based on site-specific monitoring data wherever possible. This can be accomplished by monitoring all industrial users. POTW monitoring or industrial user self-monitoring data are both acceptable. The POTW may also use information from its industrial waste survey, a prerequisite to local program approval, in which the POTW identifies all industrial users that might be subject to its pretreatment program.

If hauled wastes are accepted at the POTW, they may be a significant source of pollutant loadings or flows. In such a case, the POTW should consider the wastes in the determination of local limits.

The POTW also should characterize domestic and other background loadings by monitoring a representative portion of its collection system. Use of literature values is generally discouraged. If used, these values should be justified in the POTW's submission.

The POTW must conduct sufficient monitoring at the treatment plant to characterize influent, effluent, and sludge loadings for its pollutants of concern. Initial monitoring of the treatment plant influent, effluent, and sludge should, at a minimum, represent 5 consecutive days. Ongoing monitoring should include data for at least 1 day a month over at least a year for metals and other inorganic pollutants, and 1 day of sampling a year for toxic organic pollutants.

Determining Applicable Environmental Criteria

Environmental criteria generally include NPDES permit limits, water quality standards or criteria, sludge disposal requirements, and unit process inhibition values. The POTW should use all applicable environmental criteria when developing local limits. Section 5.3 summarizes applicable environmental and technical standards and criteria. Additional appropriate requirements may include worker health and safety criteria, collection system effects, incineration emissions requirements, or other applicable Federal, State, or local environmental protection requirements.

Another less frequently used environmental criterion is biological toxicity. The July 1990 Amendment to the NPDES permitting regulations requires POTWs to submit the results of biological toxicity testing with their permit renewal applications (40 *CFR* 122.21[j]). POTWs that identify a problem through biological toxicity testing should develop local limits to correct the toxicity. Although EPA's Local Limits Guidance does not specify a method to calculate MAHLs based on the results of toxicity testing, additional guidance and references on the Toxicity Reduction Evaluation process are available to POTWs.

Calculating Maximum Allowable Headworks Loadings

The POTW must calculate the maximum amount (pounds/day) of each toxic pollutant that may be contributed by an industrial user or received at the headworks of the treatment plant that enables the POTW to meet all of the applicable environmental criteria. Figure 5-1 presents the formulae and data elements necessary to perform these calculations. In addition, Appendix C-1 presents a sample local limits headworks loading calculation. Nonconservative pollutants such as volatile organics require special consideration when conducting headworks analysis (e.g., alternative formulas and allocation methods).

During this step of the local limits development process, the POTW should demonstrate that an acceptable mass balance exists between the actual loadings of pollutants at the headworks and the estimated loadings of pollutants from specific discharge sources. This can be accomplished by calculating the actual loading of each pollutant from influent monitoring data and comparing this value with the sum of the estimated loadings from all individual sources (e.g., domestic, industrial, hauled waste).

Calculating Allowable Industrial Loadings

Once the POTW has calculated the MAHL, a safety factor should be applied and the value discounted for domestic/background loadings to determine the maximum allowable allocation available for industrial users. A safety factor is incorporated into the calculations to allow for future industrial and residential growth and discrepancies that may enter into the calculations because of the use of default data or variations in analytical procedures. Generally, this safety factor ranges from 10 to 30 percent.

After the allowable industrial loading has been calculated, the POTW allocates this loading according to the number and type of industrial users and the method of application (sewer use ordinance and permits). Where the current loading of a pollutant exceeds, or is

Figure 5-1. Equations for Deriving Allowable POTW Influent Loadings From In-Plant Criteria

<u>In-Plant Criterion</u>	<u>Mass Balance Equation</u>
NPDES permit limit	$L_{IN} = \dfrac{(8.34)(C_{CRIT})(Q_{POTW})}{(1-R_{POTW})}$
Water quality standard	$L_{IN} = \dfrac{(8.34)[C_{WQ}(C_{STR} + Q_{POTW}) - (C_{STR})(Q_{STR})]}{(1-R_{POTW})}$
Secondary treatment (e.g., activated sludge) threshold inhibition level	$L_{IN} = \dfrac{(8.34)(C_{CRIT})(Q_{POTW})}{(1-R_{PRIM})}$
Tertiary treatment (e.g., nitrification) threshold inhibition level	$L_{IN} = \dfrac{(8.34)(C_{CRIT})(Q_{POTW})}{(1-R_{SEC})}$
Sludge digester threshold inhibition level	$L_{IN} = \dfrac{(8.34)(C_{CRIT})(Q_{DIG})}{(R_{POTW})}$
Sludge disposal criterion/standard	$L_{IN} = \dfrac{(8.34)(C_{SLCRIT})(PS/100)(Q_{DISP})}{(R_{POTW})}$

where:

L_{IN}	=	Allowable influent loading, lbs/day
C_{CRIT}	=	In-plant criterion, mg/l
C_{SLCRIT}	=	Sludge disposal criterion/standard, mg/kg dry sludge
Q_{POTW}	=	POTW flow (million gallons per day)
R_{POTW}	=	Removal efficiency across POTW, as a decimal
Q_{STR}	=	Receiving stream (upstream) flow, mgd
C_{STR}	=	Receiving stream background level, mg/l
C_{WQ}	=	Receiving stream water quality standard, mg/l
R_{PRIM}	=	Removal efficiency across primary treatment, as a decimal
R_{SEC}	=	Removal efficiency across secondary treatment, as a decimal
Q_{DIG}	=	Sewage sludge flow rate to digester, mgd
Q_{DISP}	=	Sewage sludge flow rate to disposal, mgd
PS	=	Percent of sludge to disposal.

Uniform concentration local limits can be derived through the use of the following equation:

$$C_{LIM} = \frac{(1-SF)(L_{IN})-L_{DOM}}{(8.34)(Q_{IND})}$$

where:

C_{LIM}	=	Uniform concentration local limit, mg/l
L_{IN}	=	Maximum allowable influent loading, lbs/day
SF	=	Safety factor, as a decimal
L_{DOM}	=	Loading for domestic/uncontrollable sources, lbs/day
Q_{IND}	=	Total industrial flow, mgd.

expected to exceed, the MAHL, the POTW must establish a local limit to reduce loadings to within the range of the MAHL and protect against interference, pass through, and sludge contamination.

A variety of procedures exist for the allocation of the allowable industrial loading. The four allocation methods most frequently used by POTWs are:

- Uniform concentration – The MAHL for each pollutant is divided by the total flow for all industrial users (even those that do not discharge the pollutant). The resultant discharge concentration for each pollutant is applied to all industrial user discharges.
- Concentration based on industrial contributory flow – The MAHL for each pollutant is divided by the flow from only those industrial users that actually have the pollutant in their untreated wastewaters (in concentration greater than the background concentration level). The discharge limit derived is applied only to those industrial users that contribute the pollutant.
- Mass proportion – The ratio of the MAHL to the current loading for each industrial user contributing a particular pollutant is calculated, and the mass loading limit is derived by multiplying this ratio by the industry's current pollutant loading. The limit derived is unique for each industry, and limits are developed and applied only to industries that contribute the pollutant.
- Selected industrial reduction – Individual pollutant loading reductions for each industry are determined; typically the loading reductions are based upon the treatability of the industrial wastewater for each pollutant.

The uniform concentration method is the industrial loading allocation method most frequently used by POTWs. It is the only method identified above that results in local limits that are the same for all industrial users. The other three methods can be termed industry-specific. The POTW must employ best professional judgment to evaluate the relative advantages and disadvantages of each method and to select the most appropriate method to allocate the allowable loading to account for differences, such as the treatability of industrial wastewater or the current loading from different industrial facilities. A few POTWs have been known to use a "market forces" approach to allocate the MAHL, in which all industrial users have been gathered together to allow them to negotiate allocations. Regardless of the allocation approach used, the POTW must ensure that the resulting local limits will be enforceable and ensure protection of the treatment plant from interference and pass through.

Revising Local Limits

Many factors on which these local limits calculations are based may vary with time, and local limits must be revised periodically to reflect changes in conditions or assumptions (such as changes in environmental criteria, availability of additional monitoring data, new sources of pollutants, and changes in POTW processes, capacity, or configuration). 40 *CFR* 122.21 (j)(4) requires all pretreatment POTWs to submit a written evaluation of the need to revise local limits as an application requirement for NPDES permits.

Implementing Local Limits

Once local limits have been developed, they must be incorporated into the sewer use ordinance and/or some form of individual control mechanism, such as permits. Local limits may be more stringent than categorical standards for a particular user. The POTW must compare all applicable standards and apply the most stringent to each user. The POTW also may elect to apply both local limits and categorical standards at separate sampling locations. This comparison of local limits and categorical standards often involves complicated mathematical adjustments to account for dilute and unregulated flows; thus, POTWs may have difficulty in applying the correct standard.

5.2.2.2 Other Local Limits Approaches

POTWs have used other methods of local limits development, including the collection system approach, industrial user management practice plans, and case-by-case discharge limits. These approaches are described below briefly. EPA has published extensive guidance on the development and implementation of the local limits. Further information on each of these methods and the MAHL method can be found in EPA's Local Limits Guidance.

Collection System Approach

To apply this method, the POTW identifies pollutants that may cause fire and explosion hazards or other worker health and safety concerns. Pollutants found to be present are evaluated for propensity to volatilize and are modeled to evaluate their expected concentration in air. Comparisons are made with worker health exposure criteria and lower explosive limits. Where values are of concern, the POTW may set limits or require development of management practices to control the pollutants. The collection system approach may also consider the prohibition of pollutants with specific flashpoints to prevent discharge of ignitable wastes.

Industrial User Management Practice Plans

Under this approach, POTWs require industrial users to develop management practices as enforceable pretreatment requirements for the handling of chemicals and wastes. Such plans include chemical management practices and spill prevention plans. Management practice plans are usually narrative local limits.

<u>Case-by-Case Discharge Limits</u>

In this approach, a POTW may set numeric local limits based on best professional judgment and on the performance of available technologies known to be economically feasible. This approach is most often used when insufficient data are available to employ the other methods above.

5.3 Environmental and Technical Criteria

Environmental and technical standards and criteria developed by approval authorities are necessary prerequisites to setting local limits and revising categorical standards through removal credits. As noted in Chapter 1, the Agency has developed a number of regulatory programs, including the NPDES permitting program and the sludge management program, to control point source discharges and the deleterious impacts associated with sewage sludge disposal. These programs seek to limit in municipal permits the mass or concentration of pollutants that can enter the environment from POTW wastestreams. Regulators rely on numerous environmental standards, criteria, and regulations to set municipal environmental objectives. These tools are used, in turn, by municipalities charged with developing or revising local limits. Appendix C-2 contains some of these references, including:

- EPA's water quality criteria
- EPA's proposed pollutant limits for sewage sludge use and disposal.

The appendix lists the number of States that have EPA-approved water quality standards and air emission regulations. With respect to the pretreatment program, criteria are also necessary to ensure that the POTW treatment facility, its collection system, and those individuals who work in close proximity to these facilities are protected from adverse impacts of exposure to toxic pollutants. This section provides a brief overview of these environmental criteria and standards, along with observations about their adequacy.

5.3.1 Water Quality

In order to protect the integrity of our Nation's waters, Congress has established specific attainment goals that State and Federal regulations are directed to accomplish. To meet these goals, EPA publishes water quality criteria for use by States in establishing water quality standards that protect the intended uses of receiving water. The NPDES permitting program was established in part to implement these criteria and standards.

5.3.1.1 Criteria and Standards

Under Section 304(a) of the Clean Water Act, EPA must develop water quality criteria based on the most recent scientific knowledge:

> (A) of the kind and extent of all identifiable effects on health and welfare, including ...plankton, fish, shellfish, wildlife, plant life, shorelines, beaches, esthetics, and recreation which may be expected from the presence of pollutants in any body of water, including groundwater; (B) on the concentration and dispersal of pollutants, or their byproducts, through biological, physical, and chemical processes; and (C) on the effects of pollutants on biological community diversity, productivity, and stability, including information on the factors affecting rates of eutrophication and rates of organic and inorganic sedimentation for varying types of receiving waters.

In addition to establishing these criteria, EPA must develop information on protecting the integrity of water, fish, and wildlife and the use of water for recreational activities. Criteria and information developed must be made available to States and the public.

EPA requires States to develop water quality standards under 40 *CFR* Part 131. A water quality standard defines the water quality goals for that water body by designating how the water may be used and by setting numeric levels necessary to protect the uses. State water quality standards submissions must describe the following:

- Water use designations
- Methods used and analyses conducted to support water quality standards revisions
- Water quality criteria sufficient to protect the designated uses
- An antidegradation policy.

Separate criteria are derived for the protection of aquatic organisms and human health. Estimation of health risk requires predicting the effect of low doses for up to a lifetime. Two methods are used to formulate human health criteria, according to whether the most prominent effect for a pollutant is cancer or a noncancer effect. The first method involves extrapolation of cancer responses from high doses over short periods to low doses over longer periods. The second method (for noncarcinogenic adverse effects) estimates concentrations not expected to produce adverse health effects, based on acceptable daily intake and derived using no-observed-adverse-effect-level data from animal and human health studies.

EPA's water quality criteria are compared to concentrations of pollutants in receiving waters. If aquatic concentrations exceed these criteria, there is a reasonable chance that adverse effects could occur or are occurring in the water body. Thus, water quality criteria serve as a general guide for "acceptable" environmental quality.

The Water Quality Act of 1987 specifically required States to develop numeric standards for toxic pollutants that could be expected to interfere with the designated uses of the waters of the State and for which Federal water quality criteria had been developed. The average number of priority pollutants with standards adopted for aquatic life uses has risen from 10 (April 1986) to 30 (February 1990) per State; between 1986 and 1990, the number of States with at least some aquatic life standards adopted increased from 33 to 45 (55 *FR* 14350). However, overall progress has been slow. As of the February 4, 1990 statutory deadline, only 6 of 57 States and Territories (Montana, Oklahoma, Oregon, Wisconsin, Guam and Virgin Islands) had complied fully with requirements for adoption of approved water quality standards.

Since many States failed to adopt water quality standards by the February 4, 1990, statutory deadline, EPA is developing applicable standards for noncomplying States. Table 5-4 lists the number of States with water quality standards for priority pollutants.

5.3.1.2 Implementation (NPDES Permitting Program)

To implement the CWA's water quality goals, the NPDES permitting program establishes requirements for all point source discharges, including POTWs. The permit establishes the allowable volume and quality of the discharge into surface waters. Typically, NPDES permits to POTWs contain specific limits for conventional pollutants (e.g., biochemical oxygen demand [BOD], total suspended solids, fecal coliform) and some nonconventional pollutants (e.g., ammonia). In the past, however, regulation of toxic pollutants occurred through a narrative toxicity prohibition (e.g., no toxics in toxic amounts). Recent information obtained from the Permit Compliance System (PCS) data base has

Table 5-4. Number of States and Territories With Water Quality Standards for Priority Pollutants

Priority Pollutant	No. States w/Standards[1] Adopted	No. States w/Standards[1] Adopted/Expected
Acenapthene	16	31
Acrolein	17	34
Acrylonitrile	17	33
Benzene	21	44
Benzidine	23	38
Carbon Tetrachloride	20	41
Cholorbenzene	18	36
1,2,4-trichlorobenzene	8	11
Hexachlorobenzene	19	35
1,2-dichloroethane	20	40
1,1,1-trichloroethane	19	41
Hexachlorethane	17	33
1,1-dichlorethane	1	2
1,1,2-trichlorethane	18	35
1,1,2,2-tetrachlorethane	19	36
Chloroethane	1	1
Bis (2-chloroethyl) ether	17	33
2-chloroethyl vinyl ether	5	8
2-chloronapthalene	4	5
2,4,6-trichlorophenol	19	35
Parachlorometa cresol	16	30
Chloroform	22	39
2-chlorophenol	20	34
1,2-dichlorobenzene	18	35
1,3-dichlorobenzene	18	35
1,4-dichlorobenzene	19	38
3,3-dichlorobenzidine	15	31
1,1-dichloroethylene	19	41
1,2-trans-dichloroethylene	9	14
2,4-dichlorophenol	20	36
1,2-dichloropropane	6	8
1,2-dichloropropylene	17	32
2,4-dimethylphenol	14	28
2,4-dinitrotoluene	16	33
2,6-dinitrotoluene	7	8
1,2-diphenylhydrazine	16	32
Ethylbenzene	18	35
Fluoranthene	17	34
4-chlorophenyl phenyl ether	3	5
4-bromophenyl phenyl ether	4	6
Bis (2-chloroisopropyl) ether	15	31
Bis (2-chloroethoxy) methane	3	9
Methylene chloride	17	36
Methyl chloride	16	33
Methyl bromide	15	32
Bromoform	19	37
Dichlorobromomethane	19	37
Chlorodibromomethane	17	35
Hexachlorobutadiene	20	37
Hexachlorocyclopentadiene	18	34
Isophorone	17	33

Table 5-4. Number of States and Territories With Water Quality Standards for Priority Pollutants (continued)

Priority Pollutant	No. States w/Standards[1] Adopted	No. States w/Standards[1] Adopted/Expected
Naphthalene	8	10
Nitrobenzene	18	34
2-nitrophenol	6	8
4-nitrophenol	7	9
2,4-dinitrophenol	17	33
4,6-dinitro-o-cresol	14	32
N-nitrosodimethylamine	16	32
N-nitrosodiphenylamine	15	31
N-nitrosodi-n-propylamine	8	11
Pentachlorophenol	27	46
Phenol	33	43
Bis (2-ethylhexyl) phthalate	23	38
Butyl benzyl phthalate	12	13
Di-n-butyl phthalate	22	37
Di-n-octyl phthalate	10	12
Diethyl phthalate	21	34
Dimethyl phthalate	22	36
1,2-benzanthracene	15	34
Benzo (a) pyrene	16	36
3,4-benzofluoranthene	15	34
11,12-benzofluoranthene	15	34
Chrysene	15	34
Acenaphthylene	14	33
Anthracene	15	34
1,12 benzopyrylene	15	34
Fluorene	14	33
Phenanthrene	15	34
1,2,5,6-dibenzanthracene	16	35
Indeno (1,2,3-cd) pyrene	15	34
Pyrene	15	34
Tetrachloroethylene	20	40
Toluene	20	38
Trichloroethylene	20	42
Vinyl chloride	19	39
Aldrin	40	51
Dieldrin	39	51
Chlordane	38	50
4,4-DDT	37	51
4,4-DDE	17	33
4,4-DDD	18	34
Alpha-endosulfan	36	48
Beta-endosulfan	36	49
Endosulfan sulfate	23	33
Endrin	41	52
Endrin aldehyde	13	25
Heptachlor	37	49
Heptachlor epoxide	16	30
Alpha-BHC	19	35
Beta-BHC	19	36
Gamma-BHC (lindane)	38	51
Delta-BHC	7	10

Table 5-4. Number of States and Territories With Water Quality Standards for Priority Pollutants (continued)

Priority Pollutant	No. States w/Standards[1] Adopted	No. States w/Standards[1] Adopted/Expected
PCB-1242	40	51
PCB-1254	40	51
PCB-1221	40	51
PCB-1232	40	51
PCB-1248	40	51
PCB-1260	40	51
PCB-1016	40	51
Toxaphene	41	52
Antimony	19	35
Arsenic	42	53
Asbestos	9	24
Beryllium	24	39
Cadmium	43	53
Chromium	45	54
Copper	39	50
Cyanide	42	52
Lead	43	53
Mercury	43	53
Nickel	34	50
Selenium	45	54
Silver	44	53
Thallium	19	37
Zinc	40	51
Dioxin (2,3,7,8-TCDD)	19	42

(1) State has numeric standards for one or more uses.

revealed that of 1,865 treatment plants covered by an approved local pretreatment program, only 400 (about 21.5 percent) had one or more chemical-specific limits for toxic pollutants in their NPDES permits.

EPA's emphasis on water quality-based (including toxicity-based) permits has increased the number of NPDES permits containing specific water quality-based limits for toxic pollutants (including whole effluent toxicity limits) (see Table 5-5). However, fewer than one-third of all permits issued to POTWs contain any limits for toxic pollutants. For example, of the NPDES permits issued to pretreatment POTWs that will expire in FY 1990 (generally issued in 1985), 21 percent had limits for toxic metals and 11 percent had limits for toxic organic pollutants. Of the permits issued to pretreatment POTWs in FY 1989, 32 percent had limits for one or more toxic metals, and 11 percent had limits for toxic organics.

5.3.2 Standards for the Use and Disposal of Sewage Sludge

Section 405 of the Clean Water Act directs EPA to promulgate regulations and issue permits for the use and disposal of sewage sludge in order to protect public health and the environment from any reasonably anticipated adverse effects of these practices. These regulations must identify sludge uses and disposal practices, specify factors that will be used in developing standards and management practices for each specified use or disposal practice, and identify concentrations of pollutants that interfere with each use and disposal practice. EPA must establish numeric limitations for each toxic pollutant that may be present in sludge at concentrations that may adversely affect human health and the environment. For each use or disposal practice, EPA may also specify the acceptable management practices for sewage sludge containing pollutants of concern. To regulate these practices adequately and to protect public health and the environment from reasonably anticipated adverse effects, EPA is establishing numeric limits for a number of pollutants. Where such numerical limitations are not feasible, EPA may specify design, equipment, management practices, or operational standards.

5.3.2.1 Criteria and Standards

EPA proposed standards for the use and disposal of sewage sludge on February 6, 1989 (55 *FR* 5746). Standards are expected to be finalized as 40 *CFR* Part 503 in October 1991. These proposed standards contain numerical pollutant limits or formulas for calculating such limits for sludges that will be land applied, distributed and marketed, disposed of in a monofill,

Table 5-5. Number of Limits for Toxic Pollutants in NPDES Permits Issued to Pretreatment POTWs

	Total Number of Permits	Number of Permits With Metal Limits			Number of Permits With Organic Limits		
		0	1-3	Over 3	0	1-3	Over 3
Permits Expiring in 1990*	524	412 (79%)	36 (7%)	76 (14%)	467 (89%)	43 (8%)	14 (3%)
Permits Reissued in 1989	264	179 (68%)	25 (9%)	60 (23%)	236 (90%)	19 (7%)	9 (3%)

*These permits were generally issued in 1985.

Source: PCS (1990).

disposed of in a surface disposal site, or incinerated. The proposed pollutant limits are listed in Appendix C-2. The regulations also propose operation and management requirements for each practice.

EPA proposed regulations under both the CWA and RCRA on August 30, 1988 (53 *FR* 33314), establishing siting, design, construction, and operation requirements for municipal solid waste landfills. Under these proposed regulations (to be codified 40 *CFR* Part 258), POTWs would be able to dispose of sludge at landfills if, among other requirements, the sludge is not a RCRA hazardous waste (e.g., it passes the toxicity characteristic leaching procedure).

The proposed sludge standards do not cover ocean disposal. The Ocean Dumping Ban Act of 1988 prohibits the dumping of sewage sludge into ocean waters after December 31, 1991. Until the few existing municipalities that dispose of sludge in the ocean have instituted alternate disposal practices, this activity will be regulated by permits issued under the Marine Protection, Research, and Sanctuaries Act.

Until the proposed regulations are finalized, EPA will continue to regulate some aspects of sludge use and disposal through existing regulations. For example, Part 257 addresses land application of sludge, including co-disposal landfills and monofills, and 40 *CFR* Parts 60 and 61 govern air emissions from sludge incinerators. Part 257 limits the amount of cadmium that may be land applied. It also establishes limits for the concentrations of eight toxic metals, six organic compounds, nitrate, radium, and microbes in ground water beyond the boundary of the sludge disposal facility. Sludges that are hazardous wastes are regulated under 40 *CFR* Parts 261 through 268. Sludges with a PCB concentration greater than 50 mg/kg dry weight must be disposed of under 40 *CFR* Part 761. Subsection 5.3.3 presents the air regulations relevant to sludge and POTWs.

States wishing to implement and enforce their own sludge program may seek program approval from EPA similar to the way that States are authorized to administer other environmental programs. Pursuant to Section 405, EPA promulgated the State sludge management program regulations, which contain the programmatic elements that must be fulfilled prior to EPA approval of a State program (40 *CFR* Part 501). The State sludge management program must have the legal authority to require compliance with the standards for sewage sludge use and disposal promulgated by EPA pursuant to Section 405 (see 40

CFR 123.25[a][37] and 501.1[c][1]) unless the State enacts more stringent requirements (see 40 *CFR* 123.25 and 501.1[i] and [j]).

5.3.2.2 Implementation (Sewage Sludge Program)

As described previously, the Agency is developing standards for the use and disposal of sewage sludge. To facilitate implementation of these regulations once they are final, the Office of Water Enforcement and Permits has established regulations designed to incorporate sewage sludge use and disposal requirements into permits, as required under Section 405(d) of the Clean Water Act. On May 2, 1989, revisions to the NPDES permit regulations (40 *CFR* Parts 122, 124) and a new regulation (40 *CFR* Part 501) were promulgated. Revisions to 40 *CFR* Part 122 address the inclusion of sludge conditions under the NPDES permit program. The 40 *CFR* Part 501 regulations address sewage sludge conditions required for inclusion in future State sludge management program permits. Both regulations require the same minimum conditions, identified below, to be incorporated into NPDES permits or sludge permits issued under the State sludge management programs:

- Duty to comply with Section 405 of the Clean Water Act
- Statement specifying that Section 405 permit conditions are federally enforceable under Section 309 of the Clean Water Act
- Reopener clause
- Duty to mitigate
- Permit actions—modification, revocation, and termination
- Notification requirements
- Statement specifying proper operation and maintenance of sludge use and disposal facilities
- Inspection and entry
- Monitoring and report requirements
- Recordkeeping requirement.

EPA also developed a "Sewage Sludge Interim Permitting Strategy" (EPA, 1989) to ensure regulation of sewage sludge use and disposal practices by POTWs prior to the promulgation of final technical standards. The interim strategy requires that all POTW NPDES permits due for reissuance after February 1987 be reissued with the standard sludge conditions listed previously. In addition, recommended minimum monitoring requirements for all POTWs are included in the Interim Strategy.

The Interim Strategy also establishes a class of facilities requiring indepth analysis of sludge use and disposal practices to determine if additional sludge conditions are required to protect human health and the environment. It defines these Class I sludge management facilities as POTWs that (1) are required to have pretreatment programs or (2) have any other known or suspected problems with their sludge (e.g., POTWs using incinerators, starting new sludge operations, or having problems with sludge use or disposal). The Interim Strategy advocates that the permit writer evaluate the Class I facility and, if appropriate, include additional permit requirements developed on a case-by-case basis to protect public health and the environment.

A March 1990 report issued by the General Accounting Office (GAO) determined that the implementation of the sludge management program was inadequate. GAO found that State participation in the interim program is low and that EPA has not consistently issued permits or permit riders that address sludge when States have failed to do so. The report pointed out that EPA does not know how many permits being issued or renewed should or do contain sludge conditions (GAO, 1990). EPA has taken steps to gather information on the implementation status of the sludge management program.

5.3.3 Air Quality

Under Section 108 of the Clean Air Act, EPA must develop and publish a list of all pollutants whose emissions cause or contribute to air pollution. For the pollutants listed, EPA must develop air quality criteria that accurately reflect the latest scientific knowledge about the identifiable effects of various amounts of these pollutants on human health. In addition, EPA must issue information on air pollution control techniques to States and other air pollution control agencies. These criteria are expected to be used by the States in setting numeric specific air emission standards necessary to meet national primary and secondary ambient air quality standards. Primary and secondary air quality standards are developed by EPA and must be reviewed every 5 years. EPA also establishes new source performance standards under Section 111 of the Clean Air Act and emission standards for hazardous pollutants under Section 112.

Each State must adopt regulations addressing air emissions from sources located in the State. State regulations, as well as all of the procedures necessary to ensure the proper implementation and enforcement of the State-set standards, are contained in a State Implementation Plan (SIP). States then adopt source-specific or area-wide numeric limitations to ensure that the Federal (or more stringent State) ambient air quality standards are achieved. EPA approves the SIP if the plan provides for attainment of primary ambient air standards as soon as practicable and if it provides for attainment of secondary ambient air quality standards within a reasonable time. In cases where the State does not submit a SIP, or the SIP is inadequate, EPA is directed to develop an implementation plan on behalf of the State.

The number of air pollutant emissions regulated at the State level is limited, consisting primarily of particulate emissions. Forty-one States regulate particulate emissions from sewage sludge incinerators. Of the eight States that do not regulate sludge incinerators, some may not have any incinerators. (One hundred sixty-seven municipalities incinerate sludge at an average of about 3 per State.) Only seven States have emissions standards for toxic pollutants, and they pertain only to mercury and beryllium. Hawaii is the single State identified as having standards for volatile organic compound (VOC) emissions.

In general, POTWs are not regulated under existing air quality programs unless they operate sludge incinerators. The Clean Air Act Amendments of 1990 require EPA to promulgate emission standards for hazardous air pollutants from POTWs by October 1995.

5.3.4 POTW Protection and Worker Health and Safety

When developing local limits, POTWs also must consider site-specific criteria designed to protect the treatment works, the collection system, and workers from exposure to pollutants. In general, these criteria consist of unit process inhibition criteria, technical criteria regarding pollutant effects on various construction materials, and threshold exposure criteria developed to protect human health.

Unit process inhibition criteria are pollutant concentrations that have been shown to adversely affect the performance of the biological treatment processes used by POTWs. These concentrations are determined by field observations of pollutant effects on actual treatment systems and from laboratory and bench-scale testing of pollutant effects on simulated treatment systems. The results of these studies (when they have been published) have been summarized in EPA's Local Limits Guidance (EPA, 1987a) as ranges of specific pollutant concentrations that have demonstrated observable effects. POTWs may then use these values to predict effects at their plants for similar processes. Currently, however, these literature values are based on few data points and are available for only a few treatment processes. If POTWs have experienced plant upsets and have quantified the pollutant levels responsible for these effects, these site-specific values should be used.

With respect to collection system effects, POTWs generally rely on information provided by collection system manufacturers to predict the pollutant concentrations that may cause damage. In addition, some larger POTWs have performed in situ and bench-scale testing of various construction materials to determine observable effects. The results of these testing efforts are published in trade journals and manufacturers' literature but are not provided in summary form.

Currently, the Occupational Safety and Health Administration (OSHA) does not cover POTW workers. However, EPA has addressed POTW worker health and safety through regulations and guidance. On July 24, 1990 (55 *FR* 30082), EPA expanded the specific prohibitions to include additional prohibitions for explosivity and fume toxicity. While the revised explosivity provision established a specific numerical standard (closed-cup flashpoint less than 140°C), the fume toxicity provision is a narrative prohibition. The principal reason behind the narrative provision, as opposed to a numerical standard, is that fume toxicity is difficult to quantify and often results from reactions occurring within the collection system or collection system design. In addition, POTWs are advised in the Local Limits Guidance to consider worker health and safety during the development of local limits.

5.4 Data Sources and Methods

This section further delineates the two-tiered assessment, presented in the introduction to this chapter, that evaluates the availability to the POTW of environmental and technical criteria and the capability of the POTW to perform required technical tasks. By taking this approach, the Agency could separate those elements of standards development or revision beyond the control of POTWs (e.g., establishment of criteria and standards, and the technical framework for standards revision) from those dependent on the POTW (e.g, ability to collect data and perform calculations). In addition, this section provides an overview of the data that were available and used to evaluate these capabilities.

5.4.1 Methodology Utilized to Assess POTW Capability

In establishing a methodology to evaluate POTW capability to develop or revise pretreatment standards, the Agency first had to define "capability" in terms that would foster analysis. It was clear from the outset of this investigation that "capability" could not be defined simply in terms of how many POTWs had established a removal credits program or had adopted local limits, because it was known that many of these POTW-revised standards were not consistent with current regulation or guidance. In addition, "capability" encompasses not only those POTWs that have accomplished the defined tasks successfully but also those who could complete the tasks but have not yet done so.

The evaluation was structured to address each of these concerns. "Capability" was divided into two components: availability of technical objectives and capability to perform required technical tasks. The first component evaluates the criteria and standards that drive the revision process and determines whether they were sufficient to effectuate the intent of the regulations. The second component evaluates whether or not POTWs were capable of performing the individual tasks defined by these required processes. Figure 5-2 presents a schematic of this two-tiered approach and indicates that if both components of the evaluation were satisfied, then POTWs would be capable of developing or revising pretreatment standards. The next step in developing the methodology was to determine the specific technical objectives and technical tasks involved in the development of removal credits and local limits.

Table 5-6 presents the technical objectives and the technical tasks that were identified for developing removal credits and local limits. The individual technical tasks, listed below, were grouped by general subheadings that were then used to organize the remainder of this chapter:

- Collect requisite data
- Determine pollutants of concern
- Calculate pretreatment standards
- Apply pretreatment standards.

For consistency, these general groupings are used for the evaluation of both removal credits and local limits. Figures 5-3 and 5-4 provide a diagram of the removal credits and local limits development processes, with respect to these groupings.

5.4.2 Data to Assess Capability to Meet Technical Objectives

To assess the capability to achieve technical objectives, it is first necessary to establish what these technical objectives are. To this end, EPA reviewed the regulatory history of the National Pretreatment Program, the NPDES permitting strategy, and the environmental criteria and standards for water, sewage sludge, and air. Additionally, EPA reviewed the judicial challenges to the General Pretreatment Regulations, the court decisions in these suits, and the statutory and regulatory response to the court decisions. Subsections 5.5.1

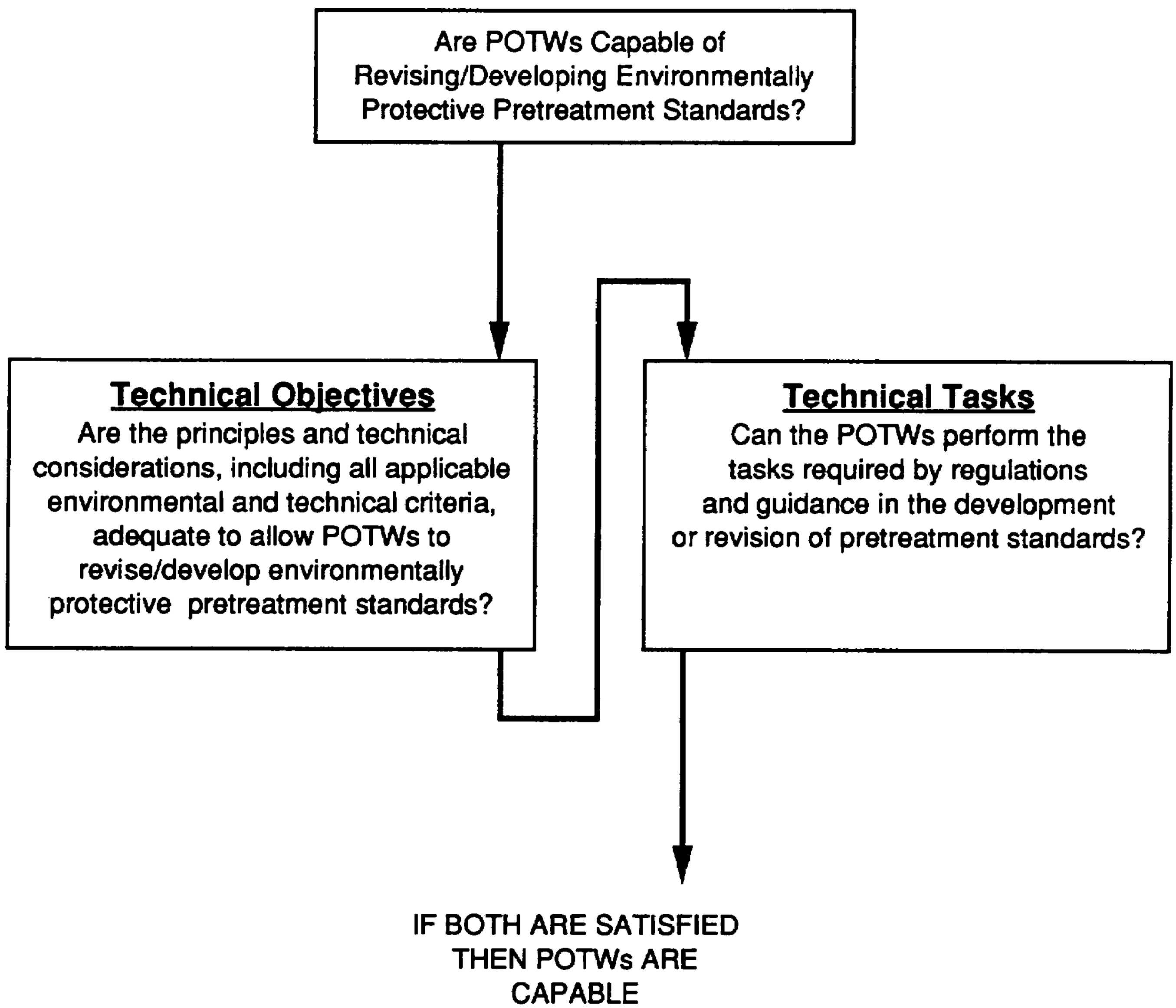

Figure 5-2. Evaluation Approach to Determining POTW Capability to Revise/Develop Pretreatment Standards

Table 5-6. Technical Objectives and Technical Tasks Involved in the Development of Removal Credits and Local Limits

	Removal Credits	Local Limits
Technical Objectives	• Does the removal credits development process ensure that indirect discharges are treated to the extent that would otherwise be provided if the discharge were direct? • Does the removal credits development process take into account the ultimate fate of the removed pollutant?	• Does the local limits development process ensure that POTWs identify and regulate all pollutants of concern? • Are the environmental and technical criteria, upon which local limits are based, in place for each pollutant of concern?
Technical Tasks	<u>Collect Requisite Data</u> • Characterize POTW influent, effluent, and sludge • Obtain industrial waste survey data	<u>Collect Requisite Data</u> • Characterize POTW influent, effluent, sludge, and collection system • Obtain industrial waste survey data • Characterize industrial/commercial sources • Characterize contributions from domestic sources
	<u>Determine Pollutants of Concern</u> • Identify applicable standards and criteria • Certify compliance with NPDES and sludge disposal requirements	<u>Determine Pollutants of Concern</u> • Identify applicable standards and criteria • Identify POTW protection criteria • Analyze characterization data in light of applicable standards and criteria

Table 5-6. Technical Objectives and Technical Tasks Involved in the Development of Removal Credits and Local Limits (continued)

	Removal Credits	Local Limits
Technical Tasks (continued)	Calculate Pretreatment Standards • Calculate pollutant removals across the POTW • Establish industry discharge standards • Prepare and submit application to approval authority	Calculate Pretreatment Standards • Calculate pollutant removals across the POTW • Calculate maximum allowable headworks loadings • Establish industry discharge standards
	Apply Pretreatment Standards • Incorporate standard in control mechanism • Continue monitoring of POTW pollutant removal rates • Implement compliance monitoring and enforcement activities	Apply Pretreatment Standards • Incorporate standard in control mechanism • Continue monitoring of POTW pollutant removal rates • Implement compliance monitoring and enforcement activities

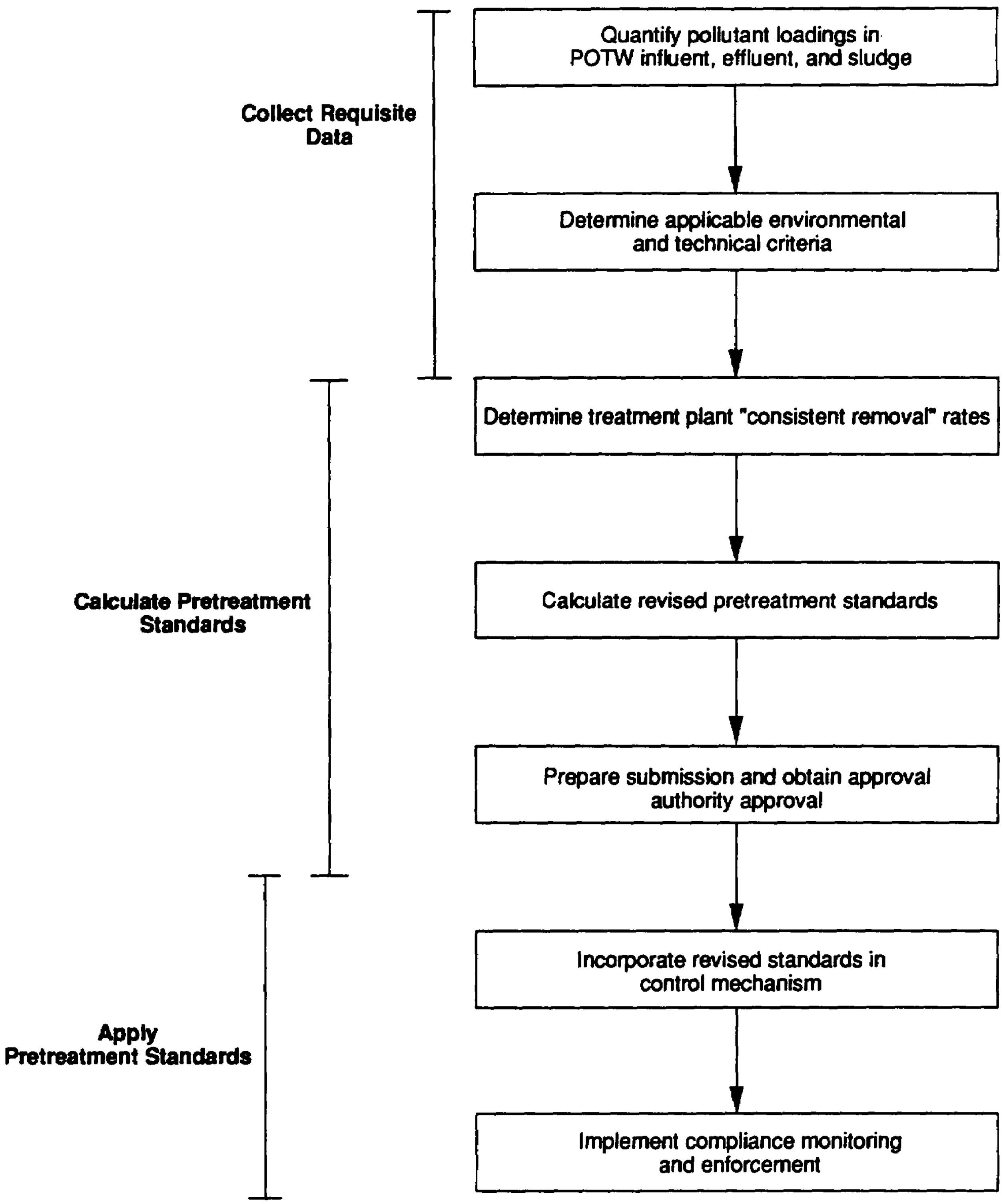

Figure 5-3. Outline of the Removal Credits Development Process

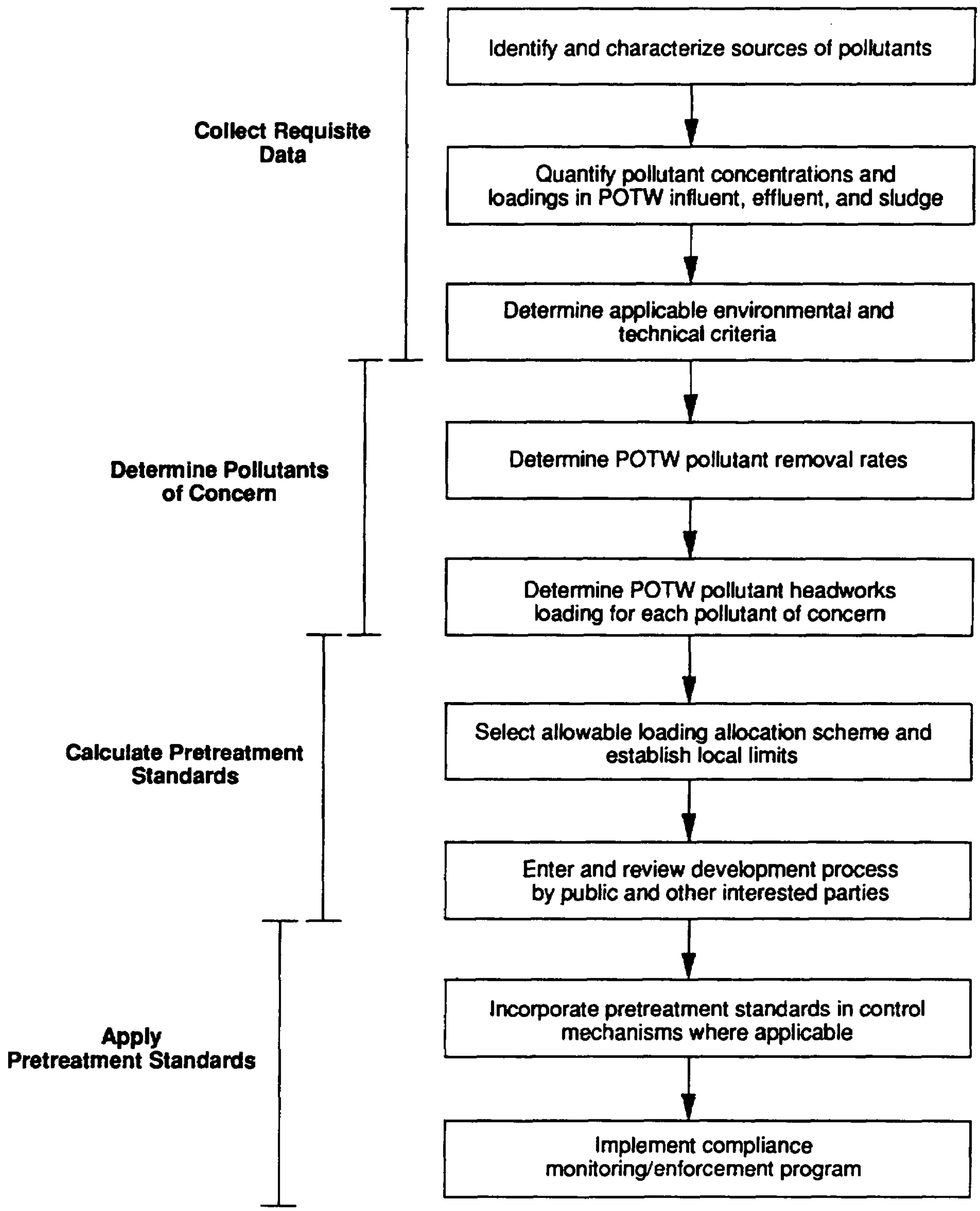

Figure 5-4. Outline of the Local Limits Development Process

and 5.6.1 summarize this historical background for removal credits and local limits, respectively. The history reveals the baseline technical objectives and the programmatic responsibilities of POTWs.

5.4.3 Data to Assess Capability to Perform Required Tasks

EPA extracted and analyzed data from several sources to measure the capabilities of POTWs to revise pretreatment standards. The data sources consisted of three national data bases:

- GAO Pretreatment Survey
- Permit Compliance System (PCS)
- Pretreatment Audit Summary System (PASS).

Chapter 2 describes these data sources in more detail.

EPA supplemented the information from the national data bases with information obtained during routine oversight activities conducted by EPA Regions and States, including available POTW local limits development documents and removal credit requests. EPA analyzed local limits development documents that were prepared by 57 POTWs in EPA Regions VI and IX as part of their local limits submittals to EPA for approval. They contained information on the procedures used in the development of the limits, the data and environmental criteria used to calculate the limits, and the resultant limits that were determined from the evaluation. EPA reviewed 18 removal credit requests and summary information on 6 others (i.e., 24 of the 28 submitted for approval). While these submissions varied significantly in level of detail, they generally included a discussion of the basic development procedures used, a summary of the data used in calculation of removal efficiencies, and the resultant percent removal claimed.

EPA then extracted information from these data sources to measure POTW performance of the technical tasks required for revision of pretreatment standards. Figure 5-5 lists the data sources consulted for evaluation of POTW capabilities and summarizes the information obtained from them.

In general, it was assumed that if any significant percentage (e.g., greater than 20 to 25 percent) of the POTWs for which data were available were performing a specific technical task successfully, that the "capability" to perform it was demonstrated for all POTWs. This

Data Source	Use
	Collect Requisite Information
Pretreatment Audit Summary System	POTW identification of all industrial users discharging to the system
PASS and Local Limits Data Base	POTW sampling and analysis for metals and organics in plant influent, effluent, and sludge
PASS and Local Limits Data Base	Frequency of POTW sampling of treatment plant wastestreams
Local Limits Data Base	POTW sampling of industry discharges
PASS	Accuracy and completeness of POTW's identification of contributing categorical industries
Removal Credit Applications	POTW use of 12 sampling data sets to support removal credits application
PCS	Frequency of NPDES limits
	Determine Pollutants of Concern
General Accounting Office, PASS, and Local Limits Data Base	POTW consideration of - Environmental protection criteria and standards - Treatment plant process inhibition thresholds - Worker health and safety
PCS	Frequency of NPDES limits (environmental protection standards)
	Calculate Discharge Standards
PASS	POTW access to PRELIM to assist in calculation of allowable headworks loadings
PASS and Local Limits Data Base	POTW development of technically based local limits
	Apply Discharge Standards
PASS	Adequacy of POTW - Control mechanism - Inspection program - Compliance sampling program

Number of POTWs in Each Data Source

PASS (530)	Local Limits Data Base (57)
Removal Credit Application (24)	GAO (428)

Figure 5-5. Data Sources Used to Determine POTW Capability to Revise Pretreatment Requirements

is not to say, however, that the task will in all cases (or even in most cases) be successfully accomplished by POTWs. Many factors, such as lack of resources, lack of political will, or lack of general interest in performing the task, might result in its nonperformance. In other words, the failure of a significant portion of POTWs to perform a task does not necessarily demonstrate a lack of capability.

5.5 EVALUATION OF POTW CAPABILITY TO DEVELOP REMOVAL CREDITS

The availability of technical objectives and the capability to perform technical tasks required to develop and implement removal credits will be considered separately in Subsection 5.5.2. To understand why these objectives and tasks are important, it is first necessary to consider the statutory and regulatory history of the removal credits process. This history is provided in Subsection 5.5.1 preceding the capability evaluation.

5.5.1 History of the Removal Credit Program

5.5.1.1 Statutory History

Since 1972, the legislative amendments to the Clean Water Act and accompanying historical records indicate that Congress expected EPA would not require (1) pretreatment of wastes that are compatible with the POTW treatment processes, and (2) pretreatment of wastes by industrial dischargers for compatible wastes in lieu of adequate treatment on the part of the POTW. This has been reaffirmed by each of the following statutory amendments:

- Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. 1251 et seq.)
- Clean Water Act Amendments of 1977 (P.L. 950217, 91 Stat. 1566)
- Water Quality Act Amendments of 1987 (P.L. 100-4, 101 Stat. 60).

Section 307(b)(1) of the Clean Water Act Amendments of 1977 provides that a POTW could be authorized to revise categorical standards for industrial sources contributing certain toxic pollutants to reflect the municipal treatment work's removal of those toxic pollutants under two conditions: (1) the combined removal of the pollutant by the POTW and the industrial user equals or exceeds the removal achieved by direct discharges, and (2) revision of the standard does not prevent the POTW from using or disposing of its sludge in accordance with Section 405 of the Clean Water Act.

5.5.1.2 Regulatory History

EPA has conducted five rulemakings and issued one notice that have resulted in the current removal credit provisions of the General Pretreatment Regulations:

- Pretreatment Standards, November 8, 1973 (38 *FR* 30983) (EPA promulgated as 40 *CFR* Part 128)
- General Pretreatment Regulations, June 26, 1978 (43 *FR* 27736) (promulgated as 40 *CFR* Part 403, replacing Part 128)
- General Pretreatment Regulations, January 28, 1981 (46 *FR* 9404) (revisions to Part 403)
- General Pretreatment Regulations, August 3, 1984 (49 *FR* 31212) (revisions to Part 403)
- General Pretreatment Regulations, November 5, 1987 (52 *FR* 42435) (notice regarding effect of partial judicial remand of August 3, 1984, regulation).

The common elements of the removal credit rulemaking efforts include the following: (1) authority will be granted only to POTWs that have applied for authority (industries cannot apply for removal credits), (2) removal credits can only be granted for the percentage for which the POTW can demonstrate "consistent removal" for each pollutant, and (3) to be eligible for removal credits, the POTW must be in compliance with all applicable sludge use or disposal practices. Rulemakings have included procedural requirements for contents of the application, monitoring requirements and submittal of the application, public notice and comment, followup reporting, application of the removal credit, and NPDES permit conditions to incorporate the percent removal for each pollutant.

One portion of the regulation that has been revised frequently is the definition of consistent removal. The successive regulations redefined consistent removal from that achieved 95 percent of the time (the lowest removal rate in any monthly sample [1978]), to that achieved 75 percent of the time (the average of the six samples showing the least removal [1981]), to that achieved 50 percent of the time (the average of all 12 monthly samples [1984]). Pursuant to the decision by the U.S. Court of Appeals for the Third Circuit in Natural Resources Defense Council (NRDC) v. U.S. EPA 790 F.2d 289 (3rd Cir. 1986) invalidating this aspect of EPA's 1984 rules, the 1981 definition of "consistent removal" (75 percent) has been reinstated. (See 52 *FR* 42435.)

A second area frequently addressed in rule revisions is the relevance of POTW combined sewer overflows (CSOs) to removal credits. The regulations have changed from requiring corrective action and minimization of bypasses (1978), to reduction of the removal credit calculated based on the frequency of the overflow discharge, additional industrial treatment, or suspension of discharge (1981), to deeming CSOs too insignificant to be relevant to the availability of removal credits (1984). The Third Circuit's invalidation of this portion of the 1984 Amendment reinstated the corresponding portion of the 1981 rule.

Court Challenges

Each rulemaking since 1978 has been challenged by industrial or environmental organizations. Decisions from the United States Courts of Appeals for the Third, Fifth, and Sixth Circuits have shaped the removal credit program. In its decision on NRDC v. U.S. EPA 790 F. 2d 289 (3rd Cir. 1986) cert. den., 479 U.S. 1084 (1987), the Third Circuit invalidated the 1984 regulations on four grounds:

- Defining "consistent removal" as "average removal" violated the statutory requirement that credit be granted only if total removal equaled that required of direct dischargers.
- Ignoring the effect of CSOs violated the requirement of equivalent treatment of direct and indirect dischargers.
- The standards for modification and withdrawal of credits violated the Clean Water Act.
- The Clean Water Act prohibits granting removal credits until POTW sludge disposal regulations are developed under Clean Water Act Section 405.

Statutory and Regulatory Response to the Court Decision

On February 4, 1987, Congress enacted Section 406(e) of the Water Quality Act Amendments of 1987, staying the Third Circuit's decision with respect to availability of removal credits before sludge disposal regulations were prohibited. With respect to availability of removal credits prior to EPA promulgation of technical sludge criteria, Section 406(e) stayed the Third Circuit Court decision until after August 31, 1987. On November 5, 1987, the Agency provided notice in the *Federal Register* clarifying that the 1984 rules remained in effect except for the specific provisions invalidated by the Third Circuit Court of Appeals. The notice stated that the 1981 regulations for these provisions were reinstated and that the Agency would grant removal credits according to the regulations once sludge regulations were promulgated.

No POTW can be authorized to grant removal credits until sludge use or disposal regulations applicable to its sludge practices are promulgated. Since the 1987 notice, the

Agency has proposed two sets of sludge regulations, listed below, and has taken the position that removal credits will be available for qualifying POTWs upon promulgation of either regulation:

- 40 *CFR* Part 258—Municipal Solid Waste Landfills (MSWLF) (53 *FR* 33314), to establish siting, financial responsibility, and other management practices for non-hazardous waste landfills
- 40 *CFR* Part 503—Standards for the Use and Disposal of Sewage Sludge (54 *FR* 5746), to establish numeric limits and management practices for pollutants disposed of using specific practices, such as land application, distribution and marketing, surface disposal, and incineration.

Under the Part 258 regulations as proposed, POTWs would be able to dispose of their sludge in landfills that meet the requirements of Part 258 if, among other requirements, the sludge was not a RCRA hazardous waste. If the Part 503 regulations are finalized as proposed, removal credits will be available for the 70 pollutants with numeric criteria identified in the proposed rule. An individual POTW will be eligible to apply for a credit only when a standard has been developed for the disposal option used by the POTW and the POTW is in compliance with that standard. The proposed rule does not cover every pollutant limited by a categorical standard. EPA expects to finalize the Part 503 proposal in October 1991.

Figure 5-6 illustrates significant developments in the history of removal credits.

Program Implementation

Rockford, Illinois was the first POTW to receive authority to grant removal credits. The May 30, 1984, approval (based on the 1981 regulations) gave Rockford the authority to grant removal credits for six parameters regulated by categorical standards (chromium, copper, lead, nickel, zinc, and total metals) for 38 categorical industries. Six additional applications had been approved by July 1985 when the Agency published the *Guidance Manual for the Preparation and Review of Removal Credit Applications* (EPA, 1985a). This guidance was available to POTWs, EPA, and State personnel to assist in the development and review of applications in accordance with the requirements of the 1984 removal credit regulations. Thirteen applications were approved (Memphis, Tennessee, submitted a separate application for each of its two POTWs) and 15 additional applications were pending when the Third Circuit Court decision in 1986 invalidated portions of the 1984 regulations.

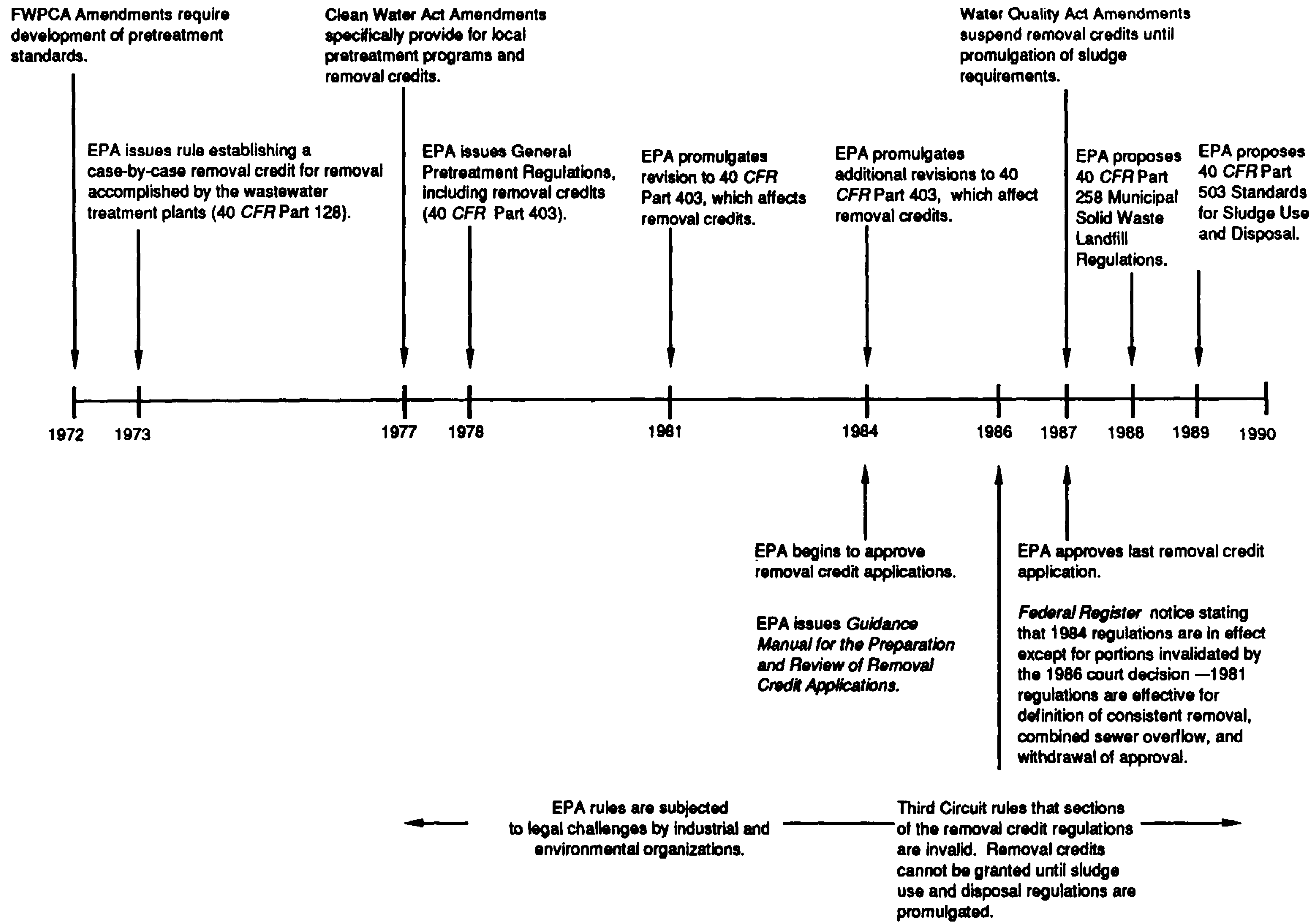

Figure 5-6. Time Line of Re[illegible]l Credits Milestones

In light of the Third Circuit's decision and Section 406(e) of the 1987 Water Quality Act, all categorical industries contributing to POTWs that had received approval for removal credit programs must be in compliance with categorical pretreatment standards, without adjustment, at least until EPA promulgates sludge standards under CWA Section 405 and the POTWs are approved to grant removal credits. This position has been upheld in court in Armco, Inc. v. U.S. EPA (6th Cir. 1988) and CMA v. U.S.EPA (5th Cir. 1989). Table 5-7 identifies the applicant cities and corresponding approval dates, and Table 5-8 lists the pollutants for which removals were requested.

5.5.2 *Capability to Develop Removal Credits*

As indicated in Subsection 5.4.1, the assessment of POTW capability is based on two elements: availability of technical objectives and capability to perform required tasks. With regard to the first element, the objective of Section 307(b)(1) and the removal credit requirements at 40 *CFR* 403.7 is that the combined removal by an indirect discharger and a POTW be consistent with the removal occurring under an effluent limitation or standard for a source discharging directly to surface waters rather than through a POTW. With regard to the second, the principal POTW tasks are here considered to be collecting data, identifying pollutants of concern (and their sources), calculating revised standards, and applying the revised standards as delineated in Table 5-6 in Section 5.4.

5.5.2.1 Availability of Technical Objectives

The first element of EPA's assessment of capability focused on the following two issues:

- Are indirect dischargers treated to the extent that is required of direct dischargers?
- Is the ultimate fate of the removed pollutant taken into account so that pollutants are not merely transferred to another medium?

If these elements are sufficiently covered by the development process mandated by regulation, then POTWs need only meet the regulatory minimums to ensure that the technical objectives are achieved.

Treatment Consistent With Direct Dischargers

The principle underlying the granting of removal credits is that the combination of industry and POTW wastewater treatment must be equivalent to that required of direct dischargers in the same industrial category under the Clean Water Act. The direct discharge

Table 5-7. Removal Credits Applications

POTW	Approval Date	No. of Pollutants Requested	No. of Industries Affected
Rockford, IL	May 30, 1984	6	38
Memphis, TN*	November 26, 1984	10	15
Sheboygan, WI	June 6, 1985	1	21
Speedway, IN	June 20, 1985	2	1
Gulf Coast Waste Disposal Authority, TX	July 12, 1985	2	2
Buffalo, NY	July 19, 1985	7	—
Milwaukee, WI	August 27, 1985	1	15
Kenosha, WI	September 6, 1985	4	9
Monroe Co., NY	September 16, 1985	7	38
Albuquerque, NM	September 21, 1985	8	unknown
Racine, WI	September 26, 1985	5	2
Galesburg, IL	April 9, 1986	1	1
Middletown, OH**	—	2	1
Sauget, IL**	—	6	3
Fond Du Lac, WI**	—	1	10
So. Milwaukee, WI**	—	1	unknown
Watertown, WI**	—	5	4
Grand Haven, MI**	—	1	1
Freeport, IL**	—	5	unknown
Chicago, IL**	—	10	321
Indianapolis, IN**	—	11	51
Tonawanda, NY**	—	1	1
Orange Co., CA**	—	—	—
Stockton, CA**	—	—	—
Berwick, ME**	—	1	1
Hartland, ME**	—	1	1
Manatowac, WI**	—	5	16

*Memphis prepared two separate submissions for its two treatment plants. Numbers given represent sum of both plants.

**Not approved at time of Third Circuit Court invalidation of removal credit program.

"—" Indicates submission was not available for review.

Table 5-8. Pollutants for Which POTWs Requested Removal Credits

Pollutant	Number of POTWs Applying for Removal Credit Authority	Percentage of Total POTWs Applying*
Arsenic	2	8.3
Cadmium	7	29.2
Chromium	21	87.5
Copper	11	45.8
Cyanide (T)	6	25.0
Cyanide (A)	1	4.2
Iron	1	4.2
Lead	10	41.7
Mercury	4	16.7
Nickel	10	41.7
Silver	3	12.5
Zinc	12	50.0
Total Metals	4	16.7
Ammonia	3	12.5
Oil and Grease	2	8.3
Phenols	3	23.1

*Based on data from 24 of the total of 28 removal credit submissions of which EPA is aware. The remaining four submissions were not available for review.

standards are based on best available technology economically achievable (BAT), best conventional pollutant control technology (BCT), best professional judgment, and new source performance standards (NSPS). Because they are technology-based, these numeric limitations are established according to the level of wastewater treatment that can be achieved. An assumption in determining the limitations is that the daily pollutant measurements are lognormally distributed. Monthly limitations are based on the distribution of averages of daily measurements. In most cases, the daily maximum and monthly average limitations are based on the 99th percentile of the distribution of daily measurements.

To achieve the technical objectives of Section 307(b)(1), the combination of industry and POTW treatment performance should provide treatment with the same level of consistency as direct discharge standards. To ensure that this consistency is achieved, the Agency has structured its removal credit regulations to require POTWs to demonstrate consistent removal of pollutants for which credits are requested. As discussed in Subsection 5.5.1, EPA initially (in 1978) required POTWs to collect 12 influent and effluent samples and to use the most restrictive of the 12 removal efficiencies calculated to determine allowable removal credits. This effort resulted in a credit being granted for removal achieved 95 percent of the time, slightly less than that required by other technology-based standards. EPA subsequently decided that this standard was unreasonably strict and likely to result in redundant treatment. Therefore, the General Pretreatment Regulations were revised in 1981 to provide that consistent removal could be demonstrated by the average of the lowest 6 of the 12 removal efficiencies calculated by the POTW (roughly equivalent to removal achieved 75 percent of the time). Because the regulation continued to be criticized as unworkable, EPA modified the General Pretreatment Regulations in 1984 to define consistent removal as that demonstrated by the average of all samples, which would allow credit based on removal 50 percent of the time. As discussed in Subsection 5.5.1.2, the Third Circuit Court of Appeals determined that the new definition was inconsistent with congressional intent; thus, the 75-percent definition from the 1981 regulation was reinstated.

In addition to invalidating the definition of consistent removal, the Third Circuit Court determined that the 1984 regulations did not adequately consider the impact of CSOs, which undermined the intent of Section 307(b)(1) regarding treatment consistent with direct dischargers.

Currently, while both BAT (direct discharge) and PSES (indirect discharge) standards are set such that the applicable technology can meet the limit 99 percent of the time, a

POTW's demonstration of "consistent" removal for purposes of removal credits does not require the same degree of confidence. Since a POTW pursuing removal credits for its industrial users need only show removal that it can achieve 75 percent of the time, its treatment combined with its industrial users' treatment may be less than that provided by direct dischargers. Additionally, the regulations do not provide that POTWs with combined sewers provide treatment consistent with that of direct dischargers. The demonstration of a POTW's consistent removal must also be seen in light of the extreme variability associated with POTW removals demonstrated in Chapter 4 of this report.

Environmental Protection

Pollutants reaching POTWs have four possible fates:

- Degradation (physical, chemical, or biological)
- Volatilization to air
- Discharge to receiving stream
- Partition to sewage sludge.

To protect environmental quality, standards or criteria governing each of these potential pathways should be considered with respect to the pollutants for which removal credits are sought.

Generally, pollutants that are degraded by biological treatment processes and are not toxic to the microorganisms that provide treatment to conventional wastes are suitable for removal credits. In addition, those pollutants that are reactive (physically or chemically) and are incidentally removed through conventional treatment are also suitable for credits. To be fully protective, however, it must be clear that these pollutants are not discharged to the receiving stream, sludge, or atmosphere in quantities that could degrade the environment. Therefore, standards for these media should be in place to ensure compliance.

For volatile pollutants, conventional biological treatment processes can transfer these pollutants from wastewater to the atmosphere. The current General Pretreatment Regulations do not specifically address the removal of pollutants by the POTW through volatilization; thus, credits could be granted under these regulations without consideration of volatilization. This is contrary to the position in the Conference Committee Report on the 1987 Water Quality Act, which stated:

> The purpose of removal credits under section 307(b)(1) is to allow reduced pretreatment requirements on the basis of treatment consistently achieved by the publicly owned treatment works. Evaporation into the air of toxic organic compounds does not constitute treatment of these pollutants. Consequently, removal credits cannot be issued for such pollutants on the basis of their evaporation from treatment works (132 Congressional Record H 10577 [daily ed. Oct. 15, 1986]).

In the preamble to the final Organic Chemicals, Plastics, and Synthetic Fibers regulation, the Agency cited this reference in its decision not to consider volatilization as removal for the purpose of determining whether BAT removals exceeded POTW removals (52 *FR* 42547). The removal credit regulation, however, was based on the language of Section 307(b)(1) itself, which requires consideration of the effects of removal credits on sludge quality but not on the air medium. In contrast, however, one rationale for allowing removal credits for volatile pollutants is that denying removal credits would not in itself prevent the industrial facility from meeting its pretreatment standard by using technologies that transfer the pollutants to the atmosphere.

The remaining pathways for the release of pollutants from POTWs (discharge through POTW effluent and sludge) are regulated under State and Federal discharge permitting programs, in particular, the NPDES permitting program. As discussed in Section 5.2, these programs have, in fact, primarily regulated the discharge of conventional pollutants, and only about 21 percent of these permits contain one or more toxic limits. Permits are also required to contain limitations on the disposal of sludge. However, the Agency's comprehensive sludge regulations (40 *CFR* Part 503) are currently being developed; until these regulations are final, there are few regulatory controls for sludge disposal.

Based on the above considerations, the existing removal credits framework is appropriate with respect to pollutants degraded during conventional biological treatment. Current regulations are silent as to whether removal credits may be authorized for volatile or semivolatile pollutants, and additional regulations would be required if removals due to volatilization are to be excluded from consideration. As to sludge and water, it is imperative that comprehensive environmental criteria or standards be in place to ensure that removals will not result in environmental degradation. According to the review of existing standards and criteria in Section 5.3, it is evident that environmental controls for most toxic pollutants are generally not comprehensive (i.e., they do not exist for all pathways), nor do they in each case regulate all pollutants for which removal credits have been sought.

5.5.2.2 Capability to Perform Required Tasks

The evaluation of POTW capability to perform required tasks is keyed to the four development and implementation phases discussed in Subsection 5.4.1:

- Collection of requisite data
- Determination of pollutants of concern
- Calculation of revised standards
- Application of revised standards.

The following sections review POTW success in performing these tasks.

<u>Collection of Requisite Data</u>

Identifying Categorical Industries

To apply for the authority to grant removal credits, a POTW must identify all categorical industries that may benefit from an adjustment to categorical standards based on demonstrated treatment plant removals for a particular pollutant. PASS indicated that 71 percent of POTWs identified their categorical industries correctly. Because removal credits would relax standards for affected industries, and industries have incentive to cooperate in the process, the success rate in identifying affected categorical industries for purposes of removal credits is likely to be higher than 71 percent.

Demonstrating Consistent Removal

Removal credit regulations require demonstration of consistent removal to be based on 12 monthly sampling events. Of the 12 removal credit applications EPA analyzed that contained detailed sampling information, 8 based their calculations on at least 12 sampling events of treatment plant influent and effluent. The remaining four POTWs calculated removals based on from one to six sampling events.

When considering POTW capability to collect at least the 12 samples required by the regulations, EPA also regarded the statistics assembled on local limits submittals, in which POTWs used an average of 13 influent, 11 effluent, and 7 sludge samples to support removals calculations. These data indicate that, in general, POTWs have the capability to collect the required 12 data sets for removal credits purposes.

Determination of Pollutants of Concern

The pollutants of concern in the removal credit process are those for which a POTW intends to pursue an adjustment of categorical standards. With respect to removal credits, no meaningful POTW capabilities are assessed in this step because the pollutants are limited to those regulated in the categorical standard intended for adjustment.

Calculation of Revised Standards

As shown in Subsection 5.2.1 and Appendix C-1, calculating removal credits to reflect demonstrated pollutant removals requires POTWs to apply a simple formula to arrive at a revised categorical standard. Following this revision, the POTW must prepare an application for approval authority review containing the revised standards and certification statements regarding continued compliance with applicable criteria and standards for approval authority review. The revised categorical standard is then placed in the industrial user control mechanism. Review of the 24 removal credit submittals did not reveal any significant POTW deficiencies in the calculation of removal efficiencies or removal credits, or in the preparation of the applications. EPA is confident that POTWs have received adequate support and have the capability to perform the calculations necessary to develop removal credits and to prepare submissions in accordance with applicable regulations.

Application of Revised Standards

According to PASS, 61 percent of POTWs have incorporated applicable pretreatment standards into control mechanisms. While this indicates that most POTWs are capable of this function, it is clear that many POTWs have had difficulty with this application. This may be due in part to the lack of a specific requirement for individual control mechanisms prior to the Domestic Sewage Study (DSS) regulations. The recent DSS revisions to the General Pretreatment Regulations included provisions requiring POTWs to issue individual control mechanisms containing all applicable pretreatment standards to each of their significant industrial users; thus, this task should be more fully implemented in the future.

All of the activities performed in the development of removal credits preceding this step are of limited use if the POTW fails to implement a compliance monitoring and enforcement program. Annual POTW sampling and inspections of significant industrial user discharges are required of POTWs with approved pretreatment programs by the July 1990 Amendments to the General Pretreatment Regulations. PASS indicates that, from 1986 to 1989, only 50 percent of POTWs had both sampled and inspected their users at this minimum frequency. While it is clear that the majority of POTWs have the capability to collect and analyze samples and to perform facility inspections, the successful completion of these tasks has been limited by the availability of resources. Chapter 7 of this report more completely evaluates the overall effectiveness of POTW compliance monitoring and enforcement activities.

5.6 EVALUATION OF POTW CAPABILITY TO DEVELOP AND IMPLEMENT LOCAL LIMITS

The capability to achieve technical objectives and the POTW's capability to perform the technical tasks required to develop and implement local limits will be considered separately in Subsection 5.6.2. This evaluation will address each of the objectives and tasks identified in Figure 5-2 and Table 5-6 (Section 5.4). To identify appropriate objectives, Subsection 5.6.1 considers the local limits process with respect to its statutory, regulatory, and programmatic history.

5.6.1 History of the Development and Implementation of Local Limits

5.6.1.1 Statutory History

The statutory basis for the National Pretreatment Program is the Federal Water Pollution Control Act of 1972. Section 307(b) requires EPA to develop pretreatment standards designed to prevent the discharge to POTWs of pollutants "which interfere with, pass through, or are otherwise incompatible with such works." Section 402 of the Clean Water Act Amendments of 1977 included additional pretreatment requirements. Specifically, POTWs became responsible for development and implementation of local pretreatment programs and for ensuring compliance with pretreatment standards. Such standards consist of categorical standards, prohibited discharge standards, and local limits (see Section 5.1).

5.6.1.2 Regulatory and Programmatic History

EPA first promulgated regulations that addressed industrial discharges to POTWs on November 8, 1973 (38 *FR* 30983, 40 *CFR* Part 128), including provisions that prohibited certain discharges of wastewater by nondomestic users of POTWs. No specific requirements, however, were included that addressed development of local discharge standards.

Following the passage of the Clean Water Act Amendments in 1977, on June 26, 1978 (43 *FR* 27736), EPA promulgated the General Pretreatment Regulations to implement the new pretreatment-related requirements of Section 402 of the Clean Water Act. These regulations, codified as 40 *CFR* Part 403, incorporated the prohibitions of 40 *CFR* Part 128, defined the term interference, and established a requirement for POTWs to develop and implement local pretreatment programs to enforce these prohibitions. Subsection 5.1.1 presents in greater detail the general and specific prohibitions of the General Pretreatment Regulations.

Section 403.5(c) of the General Pretreatment Regulations of 1978 required POTWs that were establishing pretreatment programs to "develop and enforce specific limits for discharges of pollutants" identified in the general and specific prohibitions. Section 403.5(c) of the regulations also required POTWs that were experiencing NPDES permit violations to develop limits to prevent recurrence of the violations, whether or not the POTW was required to have a pretreatment program. These specific limits are more commonly referred to as local limits.

On January 28, 1981, EPA promulgated revisions to the General Pretreatment Regulations that added the definition of pass through and required POTWs to provide public notice of the development of local limits.

In October 1983, EPA issued the *Guidance Manual for POTW Pretreatment Program Development* (EPA, 1983). Chapter 4 and Appendix L of this guidance manual included a methodology for determining local discharge limitations to be followed as part of the POTW program development process. The local limit evaluation was intended to be part of the pretreatment program submission for review by the approval authority. In 1984, the Agency issued the first of a series of computer programs/models called PRELIM (PREtreatment LIMits) to assist POTWs in the calculation of the local discharge limits. PRELIM was intended to facilitate the development of POTW pretreatment programs and numeric effluent limitations consistent with the 1983 guidance manual. The July 1990 amendments to the NPDES permitting regulations require POTWs to submit with their NPDES permit renewal applications a written technical evaluation of the need for local limits (40 *CFR* 122.21[j][4]).

The National Association of Metal Finishers (NAMF) brought suit against EPA for the 1981 revisions to the General Pretreatment Regulations. In NAMF v. EPA, 719 F. 2d 624

(3rd Cir. 1983), the definitions of "interference" and "pass through" were successfully challenged, along with other provisions of the regulations.

To address concerns by approval authorities and to evaluate the National Pretreatment Program during this period of regulatory maturation, EPA established the Pretreatment Implementation Review Task Force (PIRT). Chapter 1 provides an overview of the focus of the task force and the major findings included in the January 1985 *Pretreatment Implementation Review Task Force: Final Report to the Administrator* (EPA, 1985b). The task force determined that POTWs "do not understand the relationship between categorical standards and local limits or even how to develop local limits." The report recommended that EPA define clearly the specific requirements for local limits development and provide guidance that would enable POTWs to understand and develop these limits.

EPA built upon the existing guidance for development of local limits to implement the PIRT findings. On August 5, 1985, the Office of Water Enforcement and Permits issued a memorandum clarifying the expectations for POTW local limit development and identifying the minimum number of pollutants for which the local limits evaluation must be conducted. In addition, PRELIM was upgraded and released as Version 3.0 in January 1987, accompanied by the *PRELIM USERS GUIDE: Documentation for the EPA Computer Program/Model for Developing Local Limits for Industrial Pretreatment Programs at Publicly Owned Treatment Works* (EPA, 1987b). At the same time, the Agency began developing more extensive guidance on the development of local limits. EPA subsequently issued the *Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program* (EPA, 1987a). This manual contained the second local limits policy memorandum. A March 22, 1988, memorandum from the Office of Water Enforcement and Permits to users of the guidance manual states that "each POTW must assess all of its industrial discharges and employ sound technical procedures to develop defensible local limits which will assure that the POTW, its personnel, and the environment are adequately protected." The memorandum also expanded the list of pollutants for which the POTW should conduct the analysis.

On January 14, 1987, the Agency promulgated revised definitions for interference and pass through (52 *FR* 1600). The new definitions provide a regulatory basis for determining the interference and pass through of pollutants. Additional regulatory revisions that affected local limits development were promulgated on October 17, 1988 (53 *FR* 40610). These revisions resulted from the PIRT report and required POTWs seeking approval of their pretreatment programs to develop technically based local limits, or to demonstrate that these limits are not necessary, prior to program approval. In addition, the preamble of the revisions explains that POTWs with approved programs that have not performed a technical evaluation of the need for local limits will have their NPDES permits modified "as soon as feasible" to include a requirement to do so.

In accordance with the DSS, EPA proposed regulatory revisions that would further strengthen the regulatory requirements for POTW pretreatment programs and development of local limits. These revisions to 40 *CFR* Parts 403 and 122 (the General Pretreatment and NPDES Regulations) (55 *FR* 30082) were promulgated on July 24, 1990. The rule requires all POTWs with approved pretreatment programs to evaluate in writing the need to update their local limits as part of their NPDES permit application (i.e., every 5 years) unless the permit issuing authority requires more frequent evaluation in the permit. By adding specific prohibitions to the General Pretreatment Regulations, the rule also requires that local limits be established to ensure that nondomestic users meet the new specific prohibitions.

Figure 5-7 summarizes the major statutory, regulatory, programmatic, and court developments relating to local limits.

5.6.2 Capability to Develop Local Limits

As explained in Section 5.4, the assessment of POTW capability is based on two elements: availability of technical objectives and capability to perform required technical tasks. With respect to local limits, the principal technical objectives are to develop standards for all pollutants of concern necessary to meet the POTW's NPDES permit limits, water quality standards, sludge use, and disposal requirements; protect the treatment plant and its collection system; and ensure that the health of POTW workers and the public is not jeopardized by exposure to these pollutants. EPA has identified the principal POTW tasks as collecting data, identifying pollutants of concern, calculating revised standards, and applying these standards.

5.6.2.1 Capability to Achieve Technical Objectives

The capability to achieve the technical objectives identified previously depends on two key elements:

- Does the local limits development process ensure that POTWs identify and regulate all pollutants of concern?

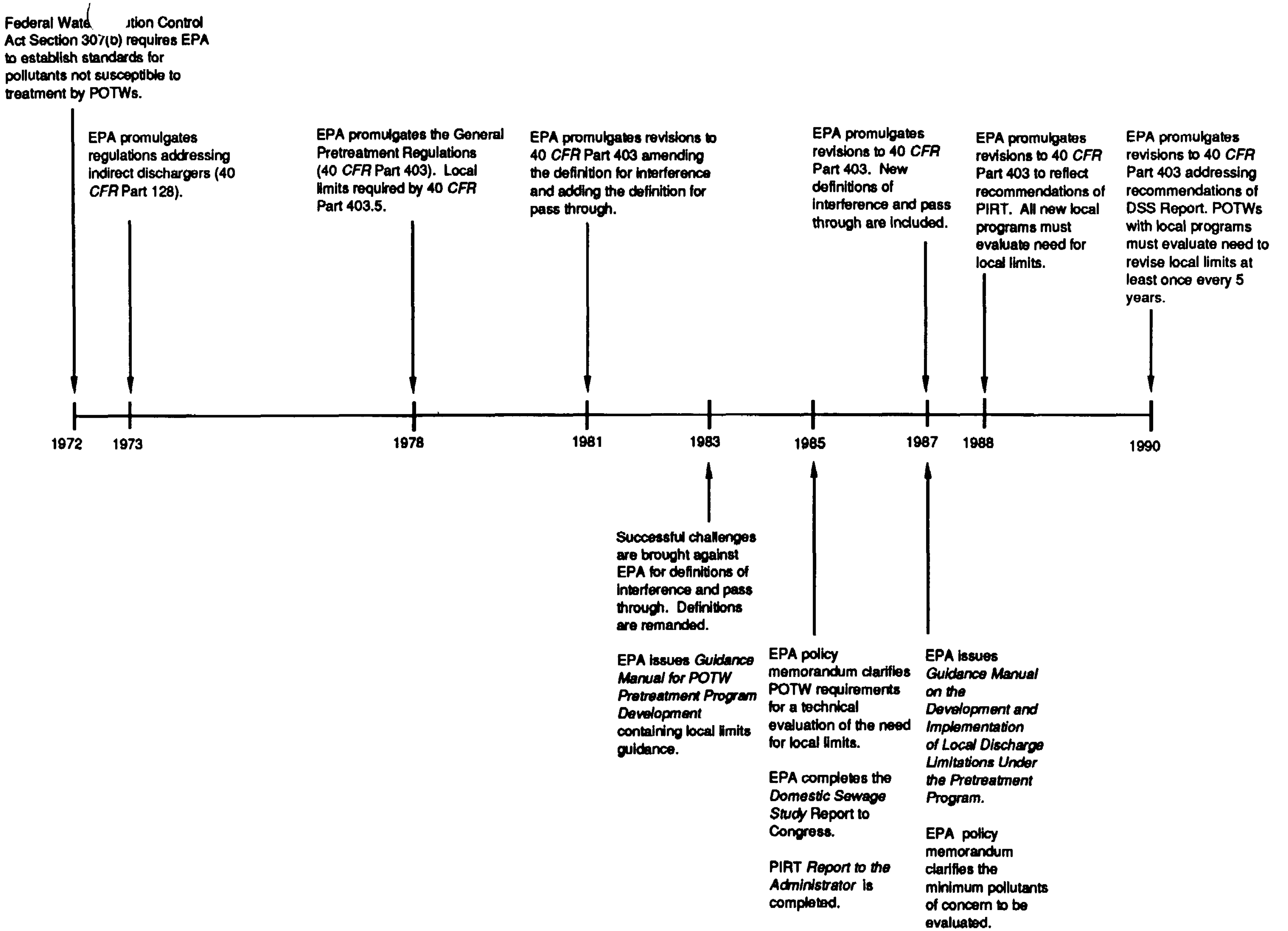

Figure 5-7. Time Line of Local Limits Milestones

- Are the environmental and technical criteria upon which local limits are based in place for each pollutant of concern and are they sufficiently protective of the environment and public health?

If these elements are covered sufficiently by the development process mandated by regulation, POTWs will need only meet the regulatory minimums to ensure that the technical objectives are achieved.

<u>Identification and Regulation of Pollutants</u>

To evaluate fully potential pollutants of concern, POTWs must review industrial, domestic, and POTW sampling data and evaluate the results with respect to meeting the second technical objective, listed above. Because POTWs have historically been concerned with conventional pollutant control, few toxic pollutant data are often available for their use. Even with the absence of these data, POTWs have made substantial progress with regard to adopting limits. Table 5-9 identifies the types of pollutants currently regulated by 200 POTWs for which EPA analyzed audit results from between 1985 and 1990. While it only represents those POTWs with limits, it clearly indicates that the overall scope and coverage of toxic pollutant control through local limits is quite extensive, particularly for metals. As discussed in Subsection 5.3.1.2, POTWs' NPDES permits generally limit few toxics; thus, this relatively high number of toxics controlled by local limits indicated in Table 5-9 demonstrates the understanding of POTWs concerning the need for toxics controls at the local level.

A number of factors affect the capability of POTWs to identify and regulate pollutants of concern. As discussed in Subsection 5.2.2, there are no regulatory minimums regarding POTW data collection for this purpose. Agency guidance recommends at least 6 months of monthly POTW influent and effluent data, or 5 consecutive days of monitoring designed specifically for local limits development. While some States, EPA Regions, and POTWs have interpreted this to mean priority pollutant scans, many POTWs have collected data only for the pollutants recommended by EPA guidance (i.e., arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc). While Agency review of POTW pollutant loadings has revealed significant concentrations of pollutants beyond these 10 (see Chapter 3), there are no regulatory requirements that specify which pollutants must be monitored. Additionally, those POTWs performing pollutant scans rarely increase the scope of these scans beyond the 126 priority pollutants.

Table 5-9. Pollutants for Which Selected POTWs Have Established Local Limits*

Pollutant	Range of Concentration		Number of POTWs with Limit	Percentage of 200 POTWs with Local Limits
	Min (mg/l)	Max (mg/l)		
Copper	0.03	15	195	97.5
Cadmium	0.0019	15	186	93
Lead	0.02	5	186	93
Nickel	0.05	18.1	184	92
Zinc	0.05	30	184	92
Chromium (total)	0.05	73	169	84.5
Cyanide	0	10	162	81
Mercury	0	3.17	151	75.5
Arsenic	0	6	145	72.5
Silver	0.03	30	145	72.5
Phenols	0	100	99	49.5
Oil and Grease	2	350	74	37
Selenium	0.01	11.1	69	34.5
Iron	0.3	100	68	34
pH	5	12	59	29.5
Barium	1	183	53	26.5
Chromium (hexavalent)	0	3.5	50	25
Boron	0.1	2.5	50	25
Manganese	0.05	10	48	24
Temp	47	150	44	22
Chlorinated Hydrocarbons	0	3.5	38	19
Fluoride	1	224	34	17
Sulfide	0.1	100	32	16
Chlorides	200	3000	30	15
Sulphates (SO_4)	20	1000	27	13.5
Beryllium	0.022	0.8	21	10.5
TTO	0.01	5	18	9
Ammonia	25	1215	17	8.5
COD	400	1000	17	8.5
Total Metals	5	10.5	16	8
Tin	0	4	14	7
Cobalt	0.15	9.3	13	6.5
Antimony	0.02	260	13	6.5
Sodium	90	4000	12	6
Phosphorous	2	15	11	5.5
Chromium (trivalent)	0.5	3.5	11	5.5

*Local limits were examined for 200 pretreatment control authorities known to have local limits for one or more pollutants.

Table 5-9. Pollutants for Which Selected POTWs Have Established Local Limits*
(continued)

Pollutant	Range of Concentration Min (mg/l)	Range of Concentration Max (mg/l)	Number of POTWs with Limit	Percentage of 200 POTWs with Local Limits
Oil & Grease (petroleum)	100	100	10	5
Aluminum	2	500	10	5
TDS	515	1000	9	4.5
PCB	0.000000012	0.18	9	4.5
Methylene Chloride	0.1	30	9	4.5
Thallium	0.2	30	7	3.5
Phosphates	1	45	7	3.5
Calcium	50	8000	6	3
Vinyl Chloride	0.01	0.5	6	3
MBAS	10	150	5	2.5
TOC	10	200	5	2.5
Tetrachloroethylene	0	28.54	5	2.5
Nitrogen	22	60	5	2.5
Toluene	0.025	500	5	2.5
Hardness (total)	35	320	5	2.5
Endrin	0.001	0.1	4	2
Sulfite	2	2	4	2
Trichloroethylene	0	0.5	4	2
Formaldehydes	5	5	4	2
Chloroform	5.81	45	4	2
Bromine, Chlorine, Iodine	1	10	4	2
Pentachlorophenol	0.01	0.1	4	2
Bis(2-ethylhexyl) Phthalate	0.1	1.03	3	1.5
Benzene	25	30	3	1.5
Toxaphene	0.03	0.35	3	1.5
Molybdenum	0.1	50.3	3	1.5
Magnesium	10	50	3	1.5
Cresols	1	1	2	1
Methoxychlor	0.04	0.3	2	1
Ethyl Benzene	0.025	26.25	2	1
Benzidine	0.001	0.001	2	1
Vanadium	0.1	12.4	2	1
Lindane	0.01	0.02	2	1
Heptachlor	0.001	0.002	2	1
Carbon Tetrachloride	8.5	50	2	1

*Local limits were examined for 200 pretreatment control authorities known to have local limits for one or more pollutants.

Note: Local limits for 72 additional toxic pollutants have been established by no more than one POTW.

Generally, the sampling performed by POTWs for local limits development conforms to Agency guidance or other approval authority requirements. These minimum frequencies are less rigorous than is required for a POTW application for authority to grant removal credits (i.e., 5 or 6 samples versus 12). In addition, as mentioned above, the limited scope of pollutants for which sampling is routinely performed reduces the POTWs' ability to identify all pollutants of concern.

Adequacy of Environmental and Technical Criteria

Environmental and technical criteria are the bases for the establishment of local limits; they establish the total amounts of pollutants that the POTW can accept without inhibiting its treatment processes or discharge without adversely affecting the environment or public health. To establish local limits, POTWs generally rely on NPDES permit limits, applicable water quality and sludge disposal standards, and unit process inhibition criteria. In addition, a few POTWs have considered collection system criteria and worker health and safety while developing limits.

The discharge of pollutants from POTWs to the environment through effluent and sludge is regulated under State and Federal discharge permitting program, particularly, the NPDES permitting program. As discussed in Section 5.3, the NPDES program principally regulates the discharge of conventional pollutants, with only about 21 percent of those permits issued to pretreatment POTWs containing one or more toxic limits. In addition, NPDES permits are required to contain limitations on the disposal of sludge. The Agency's comprehensive sludge regulations (40 *CFR* Part 503) are currently being developed. Until these regulations are final, few regulatory controls concern sludge disposal (see Section 5.3). The number of pollutants regulated by local limits should increase with the presence of more extensive limits in POTW permits.

As explained in Subsection 5.3.4, to protect unit treatment processes from inhibition or upset due to toxic pollutants, POTWs can establish limits based on known pollutant concentrations that cause these adverse effects. In general, inhibition levels are only available in literature for activated sludge processes and anaerobic digestion, and only for the more common toxic pollutants. The appropriateness of literature values has been contested by POTWs that receive pollutant loadings that are significantly above the supposed inhibition thresholds—and to no ill effect. Where treatment plant performance is not indicative of process inhibition at the pollutant concentrations indicated by existing inhibition criteria, this may be explained by the limited coverage of current literature data and site-specific factors, such as process acclimation or pollutant interactions that reduce the toxicity of the pollutant.

To ensure that POTW workers are adequately protected from exposure to toxic pollutants, POTWs should also use worker health and safety criteria for establishing local limits. Currently, few POTWs have developed numeric worker health and safety criteria, primarily because the methodology for establishing these limits for volatile organic compounds has not been developed fully. As described in Subsection 5.2.2, many POTWs require industrial users to adhere to wastewater management practices that protect POTW workers. Such controls, however, are generally not reflected in local limits submittals or the 200-POTW local limits data base analyzed in Table 5-9. They are not reflected in the Local Limits Data Base either, which contains detailed information on local limits development of 57 POTWs.

5.6.2.2 Capability to Perform Required Technical Tasks

The evaluation of POTW capability to perform required tasks is keyed to four development and implementation technical tasks, as discussed in Subsection 5.4.1:

- Collection of requisite data
- Determination of pollutants of concern
- Calculation of revised standards
- Application of revised standards.

To assist POTWs in performing these tasks, EPA developed the Local Limits Guidance, as well as the PRELIM computer program and Users' Guide, and provided local limits training throughout the United States. Each of the specific technical tasks identified in this section is covered by these guidance materials and training.

EPA notes that a POTW's performance on these tasks may be less closely linked to its capability than to its relative willingness or interest, which will affect how it allocates its limited resources. Although willingness to achieve an intended goal relates to whether a task will be completed successfully, it is not measurable and EPA did not address it in this evaluation.

<u>Collection of Requisite Data</u>

Characterize Discharges to the Collection System

To characterize discharges to the collection system, POTWs must identify all sources of pollutants and characterize the nature of the discharges. According to PASS, 79 percent of POTWs have successfully identified <u>all</u> industries that discharge to the sewer system and 71 percent have identified their categorical industries correctly. In addition, 65 percent of POTWs were found to have sampled their significant industrial users at least annually.

Observations from the Local Limits Data Base provide insights into POTW efforts to characterize contributions from nonindustrial sources. Twenty-seven of the 57 POTWs used actual sampling data to characterize the pollutant contribution from nonindustrial (i.e., domestic and commercial) sources. Additionally, 6 of the 57 POTWs used default literature values for pollutant loadings from domestic sewage. Data were not available to determine the sources of domestic contribution information from the other POTWs in the data base.

The data presented above indicate that a majority of POTWs are capable of identifying pollutant sources and characterizing the nature of the discharges. This, however, must be viewed in conjunction with the findings in Chapter 3 of this report, which indicate that significant pollutant loadings may occur from sources other than industrial users, and that the number of pollutants being discharged to sewers significantly exceeds the 126 priority pollutants.

Characterize Pollutant Removals Achieved by the POTW

To identify pollutant removals achieved at their wastewater treatment plants, POTWs must design and carry out sampling programs to characterize their plants' influent (raw sewage), effluent (treated wastewater discharge), and sewage sludge. Indicators of this capability in the Local Limits Data Base show that POTWs used data from an average of 13 influent, 11 effluent, and 7 sludge samples to support removals calculations. Forty-five of the 57 POTWs in the data base analyzed samples for at least 10 pollutants, while only 2 of 57 conducted complete priority pollutant scans.

These data indicate that the vast majority of POTWs are generally capable of sampling and analyzing treatment plant wastestreams in order to calculate pollutant removals. Current Agency guidance (local limits guidance manual) suggests that POTWs undertake at least 5 consecutive days of sampling of treatment plant wastestreams for both metals and organics.

The information presented previously indicates that POTWs often exceed the recommended minimum sampling frequencies, particularly for the 10 pollutants of concern: arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc.

As mentioned in Chapter 4, a complicating factor in the use of POTW influent and effluent data in the calculation of POTW removals is the fact that pollutant concentrations may be near or below analytical detection levels. Using these data often results in the development of removals that may not indicate actual POTW performance or, where influent and effluent data are both below detection levels, removal cannot be determined.

While it may appear that pollutants at these low concentrations are not a problem, they can concentrate in the POTW's sludge and interfere with proper disposal or beneficial reuse. In instances where removals cannot be calculated or where the POTW has failed to collect the necessary data to develop site-specific removals, POTWs often rely on default or literature removals data available through several sources, including EPA's local limits guidance manual. This use of default removals must, however, be viewed in relation to the data presented in Chapter 4 indicating that substantial variability may exist in the pollutant removals achieved at a treatment plant; thus, data collection may need to be expanded to understand treatment plant performance accurately.

<u>Identification of Pollutants of Concern</u>

Starting with the list of pollutants known or suspected to be discharged to the sewers, POTWs must develop a list of pollutants of concern that are either (1) a potential threat to the operation of the POTW or POTW workers, or (2) subject to sludge disposal or NPDES limits.

Identification of Applicable Environmental Criteria

POTWs must identify the environmental criteria to be considered during the calculation of environmentally protective local limits. EPA's Local Limits Data Base revealed the following:

- Thirty-eight of 57 POTWs considered NPDES limits
- Thirty-six of 57 considered sewage sludge use and disposal standards
- Thirteen of 57 considered Federal water quality criteria
- Twenty of 57 considered State water quality criteria or standards.

Data from the GAO (1989) report indicate that of a total of 393 POTWs, 354 evaluated an average of 15.5 pollutants and adopted local limits for 14, and 15 POTWs evaluated the need for control on an average of 14 pollutants and adopted no local limits (the remaining 24 POTWs were not included in the evaluation). Of the 354 POTWs with limits, only 109 had limits for toxic pollutants in their NPDES permits, suggesting that local limits were derived from other criteria related to plant protection or sludge disposal or were developed using an approach other than EPA's MAHL technique.

Identification of Applicable Plant and Worker Protection Criteria

Plant protection. EPA's Local Limits Data Base indicates that 43 of the 57 POTWs used literature values for process inhibition. This suggests that POTWs are capable of identifying and using available literature values (as opposed to site-specific concentrations) for threshold process inhibition pollutant levels. However, EPA notes that in many cases, the actual pollutant concentration entering the various POTW treatment processes exceeds the literature inhibition concentrations with no apparent negative effect. This may be due to system acclimation to higher pollutant levels or to other POTW-specific conditions not represented in the development of the literature values. In these instances, it is appropriate for POTWs to substitute the actual measured loadings in lieu of the literature values if there is clear evidence that no negative process effects will occur.

Worker health and safety. Only 3 of the 57 POTWs in the Local Limits Data Base considered worker health and safety issues when developing the list of potential pollutants of concern. While this appears quite low, EPA is aware that many POTWs require contributing industries to adhere to wastewater management practices that protect POTW workers. Such controls are not reflected in local limits submittals and therefore would not be included in the Local Limits Data Base. This is likely to change given EPA's commitment to increasing POTW awareness of worker health and safety issues as part of its implementation of the recent amendments to the General Pretreatment Regulations (particularly the specific prohibitions addressing toxic gases).

Calculation of Discharge Standards

The calculation of local limits generally requires two steps:

- Calculation of allowable pollutant headworks loadings that ensure that the POTW will meet the identified NPDES limits, sludge use and disposal standards, and POTW protection criteria

- Calculation of discharge standards that allocate the allowable pollutant loadings to industrial users.

As shown in Figure 5-1 (Subsection 5.2.2) and Appendix C-1, the mathematics involved in calculating local limits is straightforward, involving only addition, subtraction, multiplication, and division. The only complications in this effort arise from the relatively large amount of required data.

To assist POTWs in performing the calculations necessary to develop local limits, EPA has developed the PRELIM computer program. To date, EPA has provided POTWs with 1,266 copies of the PRELIM software and users' manual. In addition, 31 of the 57 POTWs in the Local Limits Data Base are known to have used PRELIM in their calculations. PASS indicates that 34 percent of POTWs have calculated technically based local limits. Of those POTWs that have not calculated technically based limits, the reasons generally relate to issues other than capability (see discussion in Section 5.7). EPA is confident that POTWs are receiving the necessary support and have the capability to perform the calculations necessary to develop local limits.

Incorporation of Discharge Standards in Control Mechanisms

The POTW must incorporate local limits into its legal ordinance or control mechanism, so that they are enforceable at the local level, and develop a program of compliance monitoring and enforcement to ensure that the standards are being implemented. In particular, the POTW should apply these standards through its industrial user permit system or other approved control mechanism. Both local limits and categorical discharge standards should be reflected in the industrial user's control mechanism and should subject the user to the POTW's compliance/enforcement program.

Subsection 5.2.2.1 notes the difficulties encountered by many POTWs with respect to the point of application of local limits versus categorical standards (i.e., end-of-pipe versus end-of-process) and the difficulty in comparing these standards directly. Because it is difficult to compare these limits directly, including the most stringent limit in the discharge permit is often difficult. PASS revealed that 27 percent of POTWs have not performed this comparison successfully. Chapter 7, Effectiveness of the National Pretreatment Program, discusses this issue in greater detail.

According to PASS, 61 percent of POTWs have incorporated applicable discharge standards (local limits and/or categorical standards) into control mechanisms. Several factors may explain why this number is not higher. Many POTWs are still in the process of developing local limits. Other POTWs are reluctant to revise their ordinance-based systems or address individual discharges through permit systems because of the resource demands of a permit system and sometimes because of a perceived lack of the need for local limits. POTWs may go through the exercise of developing discharge standards but regard implementation of local limits as superfluous as long as NPDES limits and sludge standards are being met. Except for the lack of resources, these reasons do not indicate that POTWs are not capable of incorporating the limits into control mechanisms, however.

5.7 Status of POTW Efforts to Develop Removal Credits and Local Limits

This section evaluates the current status of POTW efforts to develop removal credits and local limits. Information on the efforts of three case study POTWs follows this evaluation.

5.7.1 Removal Credit Status

The current status of removal credits is clear (as described previously): the program has been suspended pending promulgation of national sludge standards. Once national sludge standards are promulgated (promulgation of the initial set of standards is expected during the latter part of 1991), the principal obstacle blocking removal credits will be removed, and the Agency will reevaluate the adequacy of the regulations.

The Agency has continued to improve its knowledge concerning the fate of pollutants introduced to POTWs. As standards to protect all environmental media to which pollutants may partition are promulgated and updated, EPA may reassess the appropriateness of the existing removal credit regulation.

5.7.2 Status of Local Limits

POTWs are currently implementing local limits derived in a number of ways. Table 5-10 illustrates the general types of local limits that have been adopted and implemented by POTWs. POTWs have allocated the allowable industrial loadings to industrial users using methods such as those identified in Section 5.2.2.1. The most frequently employed method is allocation of a uniform concentration limit (e.g., allocating 2 mg/l of copper for all industrial users). POTWs surveyed by GAO were implementing local limits for an average of 14 toxic pollutants (they had evaluated the need for limits for even more pollutants, an average of

Table 5-10. Types of Local Limits Being Implemented by POTWs

Type of Local Limit	Number of POTWs[1]	Percent of POTWs[1]
Limits in Place	459	89.5
No Numeric Limits	54	10.5
Limits That Are Technically Based[2]	173	33.7
Technical Evaluation Performed, but Preexisting Limits Retained	26	5.1
Limits Based on Categorical Standards	35	6.8
Limits With No Known Technical Basis	225	43.9

1. Based on a total of 513 pretreatment programs audited from 1985 to 1990.

2. Technically based means having conducted a headworks loading analysis, as suggested in EPA's Local Limits Guidance (1987a).

Source: PASS (1990).

15.5). Of 513 pretreatment programs for which detailed information on local limits was available from pretreatment program audits, 459 (nearly 90 percent) had adopted numeric local limits for one or more toxic pollutants. One hundred and seventy-three POTWs (approximately one-third) had adopted technically based local limits. Twenty-six POTWs (5.1 percent) had performed a technical evaluation but retained their existing limits. Generally, POTWs retained their existing limits when the evaluation showed that technically based limits would be less stringent. Another 35 POTWs (6.8 percent) had adopted national categorical standards (usually electroplating or metal finishing standards) as local limits applicable to all industries. Finally, 225 POTWs (43.9 percent) had local limits with no known technical basis; in many of these cases, POTWs simply adopted a neighboring city's limits or limits described in the literature. As shown in Table 5-9 (Section 5.6), POTWs regulate a wide range of pollutants with local limits. While no projections to the universe of pretreatment POTWs can be drawn from this table, these data show that, in general, POTWs have been responsive to EPA guidance. Over 70 percent of the 200 POTWs had adopted local limits for the 10 pollutants EPA's 1987 guidance recommended for consideration. Significantly fewer POTWs regulate other pollutants, although many POTWs do regulate one or more pollutants not included in EPA's guidance. Overall, nearly all priority pollutants, as well as a number of nonconventional pollutants, are regulated by one or more POTWs. It should be noted that not all of the local limits for these 200 POTWs were technically based (i.e., based on EPA's 1987 Local Limits Guidance). The types of limits developed include all of those described in Table 5-10. Thus, even though the range of pollutants regulated by POTWs is impressive, many of these POTWs (and their respective approval authorities) may not have a clear idea of whether they are regulating the appropriate pollutants or whether their limits are set at an appropriate level.

Of particular note is that POTWs regulate many more pollutants than are regulated in the POTWs' NPDES permits. According to EPA's permit compliance system (PCS), 32 percent of NPDES permits for pretreatment POTWs issued in 1989 contained limits for one or more toxic pollutants.

As noted, some POTWs have determined that local limits based on applicable environmental criteria and on protection of the treatment plant would be less stringent than their current limits, which may have been taken from the literature or from other sources. In some cases, for example, local limits based on NPDES permit limits and environmental standards and criteria might allow significant increases in pollutant discharges from indirect dischargers without affecting designated uses or violating these applicable limits and standards. Some POTWs—those with industries meeting the more stringent local limits—will prefer to continue implementing preexisting limits. However, Federal and many State regulations require only that local limits ensure compliance with the General and Specific Discharge Prohibitions (which, in turn, are based on compliance with NPDES and sludge requirements).

5.7.3 Case Studies

To provide illustrative information with respect to POTW revision of pretreatment standards, case studies were developed for three pretreatment POTWs: Thomasville, North Carolina; Hampton Roads Sanitation District (HRSD), Virginia; and Pocatello, Idaho. For each of these POTWs, data regarding the types of pollutants monitored and regulated were collected and are presented in Tables 5-11, 5-12, and 5-13 and in Figure 5-8. None of the case study POTWs had applied for or had been granted removal credits approval; thus, the findings presented here concern only local limits.

Table 5-11 presents the case study findings regarding the numbers of toxic pollutants regulated by these POTWs' local limits in relation to the numbers of toxic pollutants detected at the POTWs and regulated by applicable standards and criteria. Figure 5-8 charts the results. The data indicate that for these POTWs the <u>number</u> of pollutants regulated by local limits is similar to the <u>number</u> of pollutants detected in the POTWs' influent, effluent, and sludge. However, in each case, the number of toxic pollutants regulated by the POTWs' NPDES permits and sludge disposal requirements is significantly lower, generally at zero. While this pattern cannot be used to predict the situation at other POTWs, it does agree with the evaluation of Section 5.6: namely, that the standards and criteria necessary to drive the local limits development process are not generally in place.

Table 5-12 presents case study data with respect to the frequency of sampling and types of toxic pollutants for which sampling was performed at these POTWs. In general, the sampling frequencies reported did not follow any patterns across these POTWs; however, the types of pollutants for which sampling was performed were more consistent. At each of the POTWs, metal parameters and cyanide were of primary concern. This is also in agreement with other chapter findings.

Table 5-13 presents the results of the case studies with respect to the number of samples utilized in the development of local limits at each POTW. Again, there was no clear

Table 5-11. Number of Toxic Pollutants Detected and Regulated by Local Limits and Environmental Criteria

City/POTW	Number of Toxic Pollutants									
	Regulated by Local Limit	Technical Evaluation Conducted	Detected In:			Regulated By:				
			Influent	Effluent	Sludge	NPDES Permit	State WQ Standard	State Sludge Standard	Air Standard	Other
Thomasville, NC	8	8	6	6	7	5	5	0	0	3[1]
Hampton Roads Sanitation District (HRSD), VA	12	0[2]	8[3]	8[3]	8[3]	0	10	0	0	0
Pocatello, ID	12 (including TTO as 1)	12	10[4]	6[4]	11[4]	0	0	0	0	0

1. State of North Carolina action levels (not enforceable).
2. No headworks analysis was done. However, POTW examined various technical sources for information and data and for criteria to develop limits.
3. Detected at least once at 1 or more of the 10 plants in 1989.
4. Data from 1983 to 1990.

Table 5-12. Sampling Frequency by Case Study POTWs, 1989

	Number of Samples			
City/POTW	Influent	Effluent	Sludge	Pollutants Analyzed For
Thomasville, NC	80	85	4	Six to seven metals and cyanide (CN)
HRSD, VA	12 1	12 1	12 1	Six metals Priority pollutant scan
Pocatello, ID	6	6	2	Nine metals, CN, and fluoride

Table 5-13. Number of Samples Used by Case Study POTWs to Develop Local Limit

City/POTW	Number of Samples Used				
	Influent	Effluent	Sludge	In-Plant	Other
Thomasville, NC	17*	17*	2*	0	0
HRSD, VA	Not Applicable**				
Pocatello, ID	6	6	2	0	0

*For metals only.

**HRSD did not develop technically based local limits as defined in the current EPA Guidance.

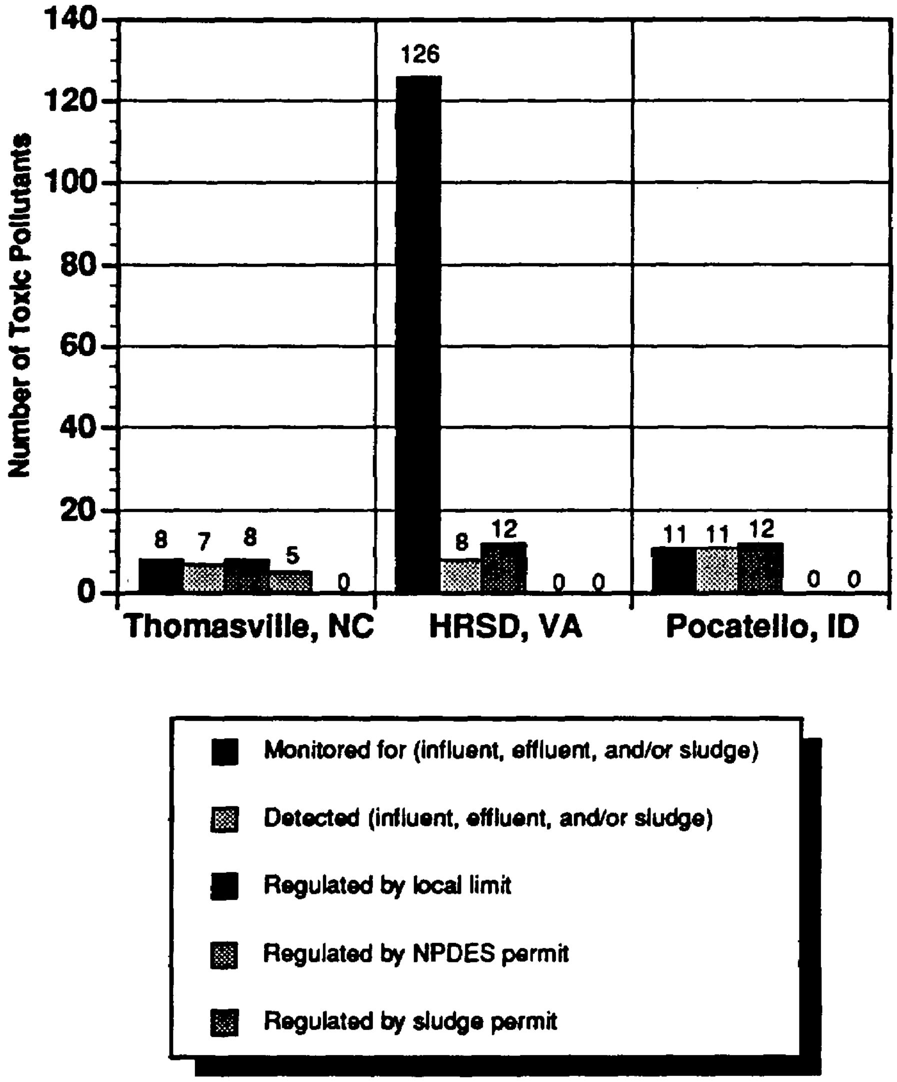

Figure 5-8. Numbers of Pollutants Monitored, Detected, and Regulated at Case Study POTWs, 1989

pattern across these POTWs; however, at two of the three POTWs the minimum sampling recommended by EPA was performed.

5.8 FINDINGS

This section summarizes the findings of the evaluation of POTW capability to revise pretreatment standards. The findings are divided into two sections, local limits and removal credits. As an introduction, each of these sections briefly discusses issues affecting these program elements.

5.8.1 Local Limit Findings

The development of technically based local limits to control the discharge of toxic pollutants from POTWs has been constrained because technical objectives cannot currently be achieved by most POTWs.

- Few POTW NPDES permits contain limits for toxic pollutants. According to PCS, only 32 percent of the NPDES permits for pretreatment POTWs issued in 1989 contained limits for one or more toxic pollutants. This is, in part, due to the fact that many States have not yet developed water quality standards for all their receiving waters.
- Numeric criteria for sludge use and disposal practices have not been promulgated by EPA. Most States do not have comprehensive sludge standards.
- The Clean Air Act Amendments of 1990 do not require that emission standards for toxic pollutants applicable to POTWs be promulgated until 1995.
- Literature data to predict pollutant concentrations that may result in unit process inhibition are available for only a few pollutants, are based on a limited sample size, and may not characterize site-specific conditions accurately.

POTWs appear to be capable of performing the technical tasks to develop numeric local limits. The <u>number</u> of pollutants limited by POTWs often exceeds the number limited by the POTW's applicable environmental criteria, including NPDES permit limits and sludge requirements. POTWs surveyed by the General Accounting Office were found to impose local limits for an average of 14 toxic pollutants.

- POTWs have failed to collect the necessary influent, effluent, and sludge monitoring data to calculate site-specific treatment plant removals and to establish allowable headworks loadings based upon these removals.
- The sampling and analysis involves a commitment of resources that many POTWs are unwilling to devote to developing local limits, particularly when they are not

required to do so because of the absence of limits for toxic pollutants in their NPDES permits.

- Additional factors can affect the development and implementation of local limits.
- While the methodology exists for developing local limits for conservative pollutants (e.g., metals), there are no similar methods for establishing limits for organic and reactive pollutants. POTWs that have adopted numerical limits for these types of pollutants have generally used a best professional judgment approach.
- The point for determining compliance for local limits can be different from that for determining compliance with categorical standards. This has created difficulty for some POTWs.
- The uniform concentration method of allocating the POTW treatment plant allowable industrial loading is the most frequently used because it results in the same limit for all industrial users. Some POTWs have alternatively used a market-based approach that allows industrial users to negotiate allocations among themselves.

POTWs that have not developed or adopted local limits tend to believe that local limits are not necessary because:

- They may have no evidence that pass through or interference is occurring, partly because of the lack of toxic controls in the NPDES permit or toxic controls applicable to sludge.
- They may believe that categorical standards are adequate to protect their treatment system and the environment.

5.8.2 Removal Credit Findings

Section 307(b)(1) establishes the technical objectives of the removal credits program. Removal credits cannot be made available under the current regulations until those objectives are met.

- Because most POTW NPDES permits do not contain numeric limitations based on water quality standards, in the past removal credits were generally granted without consideration of their water quality impact.
- In any future revision of the removal credits regulation, the definition of "consistent removal" will remain an issue. While both BAT (direct discharge) and PSES (indirect discharge) standards are set such that the applicable technology can meet the limit 99 percent of the time for daily maximum and monthly average limitations, a POTW's demonstration of "consistent" removal for purposes of removal credits does not require the same degree of confidence. Since a POTW pursuing removal credits for its industrial users need only show removal that it can achieve 75 percent of the time, its treatment combined with its industrial users treatment may be less than that provided by direct dischargers.

- Removal credits cannot be made available until EPA develops standards for the sludge use and disposal options employed by the POTW applying for removal credit authority.
- Current regulations do not specifically address the removal of pollutants during treatment through volatilization to the atmosphere. If this type of removal is to be prohibited, regulations will need to be revised.
- The current regulation decreases the removal credit that can be made available by POTWs whose influent bypasses treatment because of combined sewer overflows. However, CSOs may result in the effluent from an indirect discharger being treated less consistently than a direct discharger's effluent if the indirect discharger is relying on a removal credit to comply with categorical standards.

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6. Adequacy of Data On the Environmental Effects of Toxic Discharges from POTWs

Section 519(a)(1) of the Water Quality Act (WQA) of 1987 requires the U.S. Environmental Protection Agency (EPA) to study "the adequacy of data on environmental impacts of toxic industrial pollutants discharged from publicly owned treatment works [POTWs]." This chapter addresses that requirement. It also uses available data to indicate which environmental impacts are caused by the discharge of toxic pollutants by POTWs. Section 6.1 provides a general overview of the fate and effects of toxic pollutants discharged to POTWs. This section sets the basis for the evaluation of the adequacy of available data on discharges and environmental effects.

Sections 6.2 through 6.4 address discharges to surface water, sludge, and air, respectively. These sections are organized similarly, providing information on the adequacy of existing data, an analytical framework, and the results of the analysis.

Section 6.2, Surface-Water Effects, is the most detailed of these sections, reflecting the historical emphasis of EPA's Clean Water Act (CWA) programs. As witnessed by recent and planned initiatives, the National Pretreatment Program is increasingly emphasizing sludge quality and worker health and safety issues, and more data are likely to be generated on these issues as a result. Currently, as shown in Sections 6.3 and 6.4, data on sludge quality and worker health and safety issues are limited.

Sections 6.2 through 6.4 rely upon quantitative evaluations of national data wherever possible. However, as noted throughout this chapter and elsewhere in this report, the absence of comprehensive criteria and standards for surface water, sludge, and air has limited EPA's ability to gather data that tangibly demonstrate the environmental effects of toxic discharges from POTWs.

Since more environmental effects data exist at the local than at the national level, EPA used surrogate and case-study measures of environmental effects in cases where comprehensive national data were not available. Local program managers must collect such data to revise pretreatment standards and comply with their permit limits; yet because the primary audience for such information is not at the national level, it is not reported to national program managers in a form that is consistent or amenable to quantitative analysis.

Section 6.5 concludes the chapter with a summary list of findings related to data adequacy of the environmental effects of toxic discharges from POTWs.

6.1 GENERAL FATE AND EFFECTS OF TOXIC POLLUTANTS DISCHARGED TO POTWS

Chapter 3 of this report documented the sources and kinds of toxic pollutants that are discharged to POTWs, indicating the wide range of sources and large number of pollutants for which data exist. Chapter 4 determined that removal of toxic pollutants from the wastestream at treatment plants is highly variable and discussed the fact that at least some pollutants do not biodegrade easily or consistently during treatment, but instead partition to sludge, volatilize to air, or discharge to receiving waters.

Pollutants received by a POTW can be released to the environment at many locations. Figure 6-1 shows the general locations at a POTW from which pollutants may be released to air, surface waters, and ground waters. (Other receiving environments may also be affected, but to a lesser extent. Soils, for example, are also considered a receiving environment, but concerns with soil contamination primarily relate to subsequent ground-water contamination or incorporation into the food chain following sewage sludge disposal—both of which are discussed under ground-water releases.)

6.1.1 Fate of Toxic Pollutants Discharged to POTWs

The primary purpose of wastewater treatment at a POTW is to reduce the concentration of conventional pollutants (e.g., biochemical oxygen demand, suspended solids) in wastewaters so that the environmental impacts of discharges are acceptably small. As noted in Chapter 4, reductions in concentrations of toxic pollutants typically are incidental to reductions in conventional pollutants. Conventional, nonconventional, and toxic pollutants either are destroyed by biological or chemical conversion to less objectionable chemicals, or they are physically removed from the wastestream.

Pollutant destruction occurs primarily through biological activity; microorganisms metabolize organic chemicals in wastewater, ultimately converting them to carbon dioxide and water (in aerobic systems) or to methane (in anaerobic systems). Other elements attached to organic compounds (such as nitrogen, sulfur, chlorine and other halogens, and metals) can interfere with such metabolism and make the destruction of organics in treatment systems less efficient.

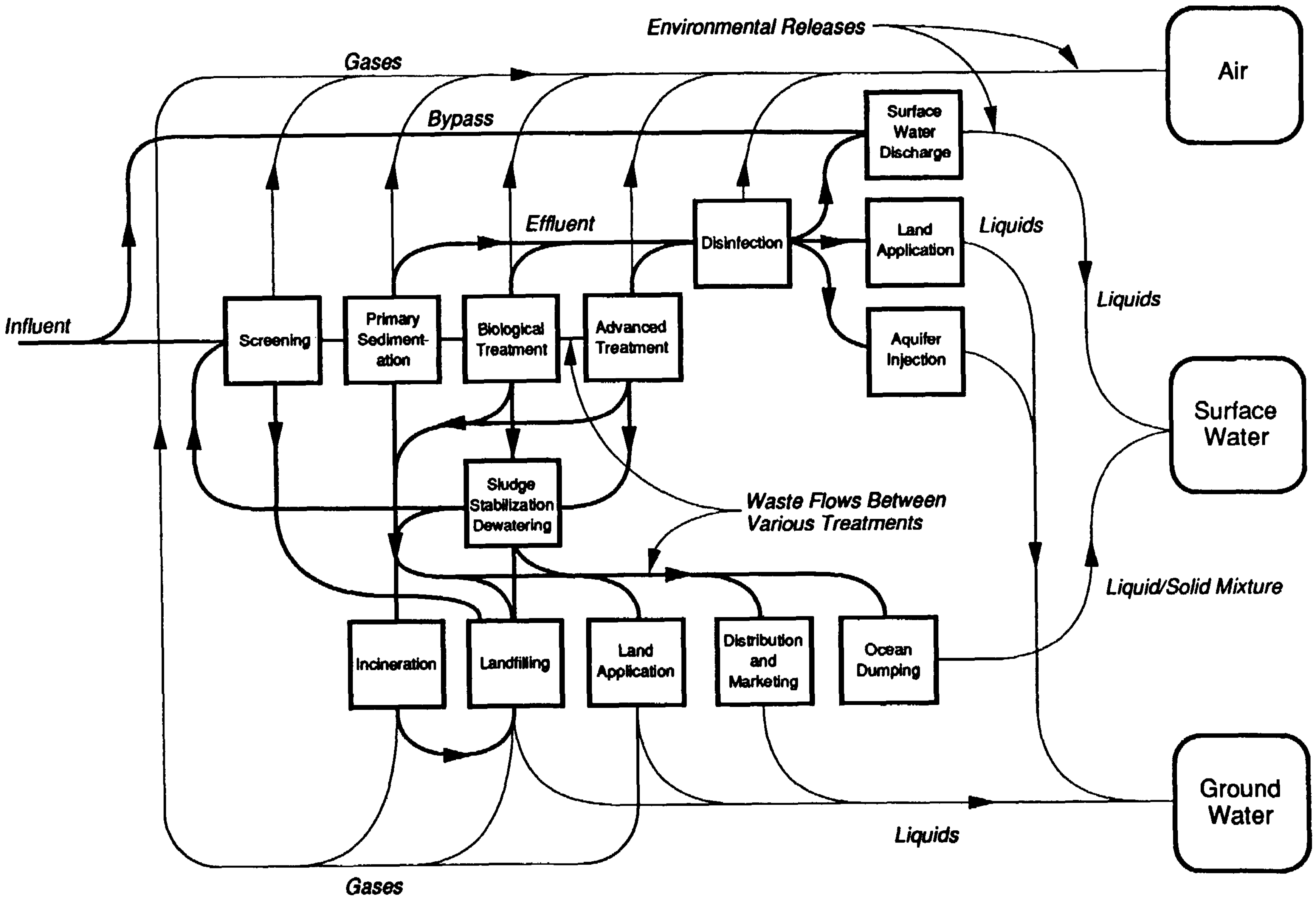


Figure 6-1. Points of Release of Toxic Pollutants from POTWs for Major Receiving Environments

Pollutants that are not destroyed by biological activity are either physically removed from wastewaters through volatilization (loss to air) and partitioning to sludge, or else they remain in the wastestream and are discharged to receiving waters. Any pollutant that is not destroyed in a POTW has the potential to harm receiving water, air, and ground water. The next two subsections provide some background on releases from POTWs to air and ground water.

6.1.1.1 Releases to Air

As Figure 6-1 shows, pollutants may volatilize at many locations in a wastewater treatment plant. Chemicals begin to volatilize in the collection system and are released to the atmosphere at manholes, pump stations, and the headworks of the treatment system. Pollutants also volatilize in the treatment system, particularly where there is strong aeration or turbulence (such as an activated sludge process).

The gases released from POTWs include volatile organic compounds (VOCs), carbon dioxide, hydrogen sulfide, ammonia, and nitrogen. VOCs may be released in the collection system, at the plant headworks, in aeration tanks, and in the activated sludge process. These VOCs are typically organic solvents, such as hexane and benzene, and other compounds used primarily in industrial processes. Other gases are typically created by microbial activity in sewers or during treatment at the plant. Carbon dioxide is generated by the aerobic decomposition of organics in the wastestream, hydrogen sulfide by the reduction of organic sulfur compounds, methane by the anaerobic decomposition of organic compounds, and nitrogen gas by denitrification of inorganic nitrogen compounds. Ammonia may be present in large concentrations in the influent or may be generated by biological activity during treatment.

Most gaseous releases consist of carbon dioxide or methane, the two major end products of biological decomposition of organic compounds. The relative volumes of releases of other chemicals depend on their concentrations (or the concentrations of their precursors) in the sewage and the extent to which they are decomposed biologically before they have a chance to volatilize.

In addition to the compounds volatilized during treatment, a small fraction of organic compounds volatilize from sludge during conditioning or disposal. By volume, the amount of volatilization from sludge is very small compared to that occurring during treatment. The gases released consist of carbon dioxide (from aerobic digestion and from chemical oxidation of the organic matter in sludge), methane (from anaerobic digestion), or both (from composting).

Gaseous emissions also occur during sludge incineration, which is one of the common disposal methods for sludge for larger POTWs. Typically, the greatest focus has been on particulate emissions from sludge incinerators because toxic metals tend to sorb to, and be released with, particulates. Mercury and beryllium, however, volatilize at low temperatures (well below incineration temperatures) and may be emitted even if particulate emissions are low. Similarly, small amounts of organic constituents may be formed and released from incinerator stacks as products of incomplete combustion. The relative importance of metal and organic emissions depends on the chemical composition and dryness of the sludge, incinerator design, and operating conditions.

6.1.1.2 Releases to Ground Water

Releases to ground water may occur from a variety of processes at all stages of municipal wastewater treatment. Under limited circumstances, such as when a sewer is above the water table, wastewater can exfiltrate from the collection system to ground water. This mechanism appears to be of only local importance (EPA, 1989); furthermore, it is not well understood and needs further investigation on a national basis before conclusions can be drawn about its impact on ground water.

Losses to ground water may also occur when municipal wastewaters are stored or treated in lagoons. The potential for ground-water contamination from such storage or treatment practices is low; however, some lagoons with industrial discharges may be potential sources of ground-water contamination (EPA, 1987).

Finally, and perhaps most importantly, ground-water contamination may occur during or after disposal of sewage sludge. Sludge is generated during primary and secondary (and sometimes tertiary) treatment of wastewater. It consists of both inert and organic solids—some from the influent, some from microbial biomass grown during treatment—in an aqueous suspension. Many chemicals that have low solubility in water sorb to sludge particles, particularly metals (such as mercury, cadmium, lead, copper, and zinc) and organic compounds (such as organochlorine pesticides and PCBs). Since sludges are removed from the wastestream during clarification, pollutants that partition to sludge are not discharged directly to receiving waters.

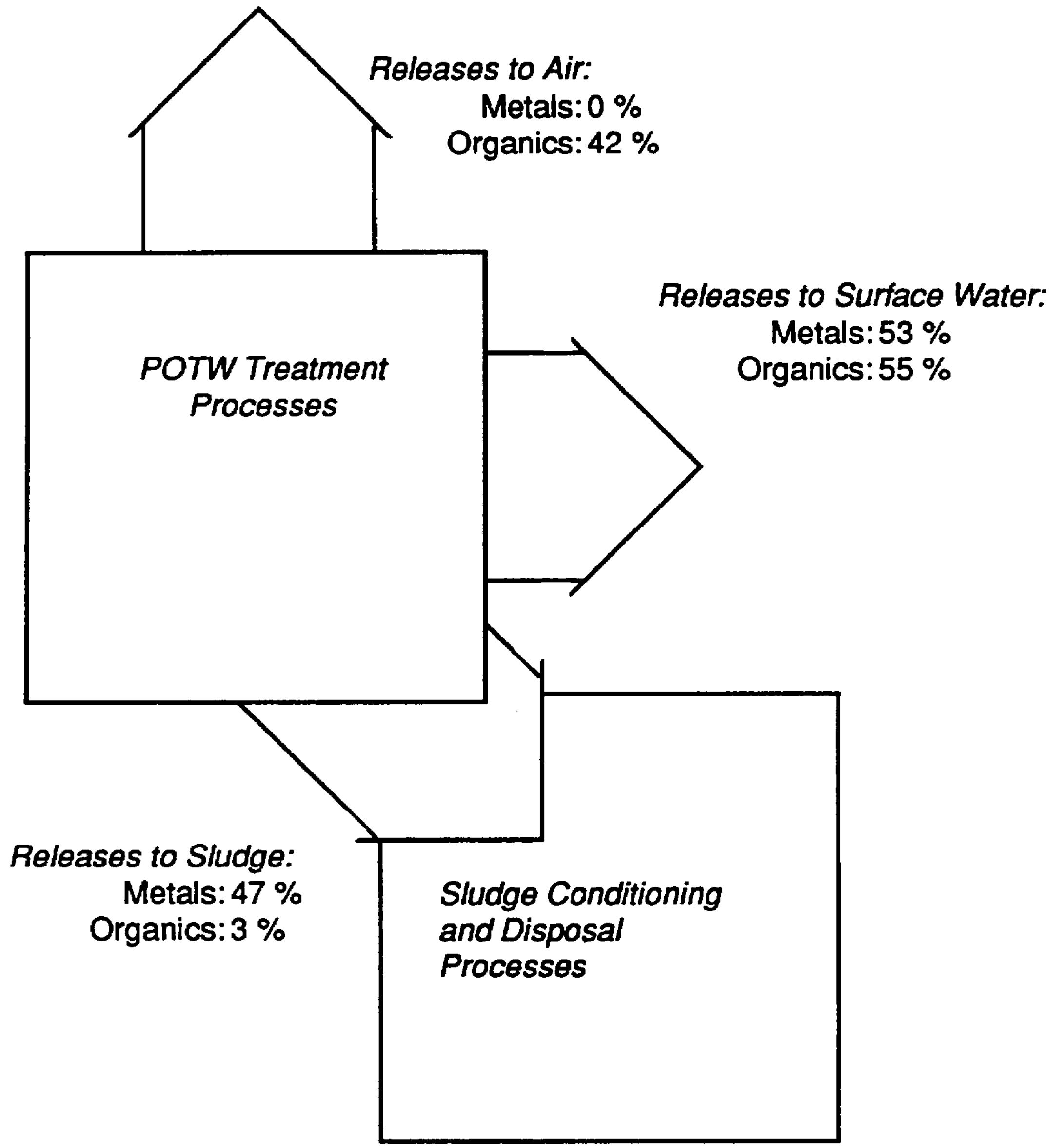
The three sludge disposal options with the highest potential for ground-water contamination are land application, landfilling, and distribution and marketing. Land application involves the mixing of sludge with, or addition of sludge to, the surface layers of soil for its nutrient and stabilizing properties. Landfilling generally involves placing dried sludge into a confined area in the ground. Distribution and marketing involves selling or giving away sludge, usually in dry form, as a fertilizer or soil conditioner. Regardless of the disposal method, once sludge is in soil it slowly decomposes, gradually releasing any contaminants present. Rain water percolating through the soil may leach pollutants to ground water.

6.1.1.3 Relative Magnitudes of Releases to Different Environments

When pollutants are not biodegraded, they are released to one or more receiving media. Most organic compounds, for example, are discharged to surface waters, volatilize to air, and partition to sludge. The relative amounts released to each medium determine the general environmental impacts of industrial pollutants discharged to sewers. Overall, about half of the mass of the most common toxic pollutants that are released to the environment from POTWs is released to surface waters (see Figure 6-2; IJC, 1989). The remainder of the toxic metals tends to partition to sludge, and the remainder of the toxic organics tends to volatilize. Small amounts (up to 3 percent) of the organics partition to sludge (IJC, 1989).

Chapter 4 presents estimates made in the Domestic Sewage Study (DSS) on the proportions of many toxic pollutants in POTW influent that are discharged to surface waters, volatilized to air, or partitioned to sludge. Table 6-1 summarizes DSS data for a number of the more common pollutants. The entries in the table are sorted so that the pollutants estimated to have the highest potential for discharge to surface waters appear first.

The table shows both single percentages and ranges of percentages for releases of each chemical to the different environments. As described in Chapter 4, however, actual treatment system performance in removing toxic pollutants from wastewater may be much more variable than DSS estimates indicate. The ranges reflect the differences between acclimated and unacclimated treatment systems, as estimated during the original study.



Source: Adapted from International Joint Commission, 1989

Figure 6-2. Percent of Environmental Releases from POTWs Entering Air, Water, or Sludge

Table 6-1. Percentages of Selected Pollutants in POTW Influents Released to the Environment in Surface Waters, Air, and Sludge[1]

Pollutant	To Surface Water	To Air	To Sludge
1,1,2-Trichloroethane*	20 - 80[2]	16 - 40	1
Nitrobenzene*	10 - 80		2 - 9
1,1,2,2-Tetrachloroethane*	10 - 80	12 - 36	1 - 4
Pentachlorophenol*	5 - 80		4 - 17
Cadmium*	73		27
1,2-Dichloroethane*	10 - 70	27 - 45	2 - 5
Bis-2 Chloroethyl Ether*	10 - 70	0 - 2	3 - 9
Methyl Isobutyl Ketone	10 - 70		3 - 9
Methyl Ethyl Ketone	5 - 70	0 - 2	3 - 10
Nickel*	65		35
Parathion	10 - 60		3
Methyl Parathion	10 - 60		3 - 7
Mercury*	50	0 - 3	48
Arsenic*	50		50
Selenium*	50		50
2,4-D	10 - 50		4 - 7
2,4-Dichlorophenol*	5 - 50		4 - 8
2,4,6-Trichlorophenol*	5 - 50		4 - 8
Cyanide*	40	0 - 3	57
Antimony*	40		60
Dimethyl Phthalate*	5 - 40		0
2-Chlorophenol*	5 - 40		5 - 8
Lead*	30		70
Chromium*	30		70
1,2-Dichloropropane*	10 - 30	45 - 63	0
Acrylonitrile*	10 - 30	0 - 4	7 - 9
N-Nitrosodimethyl Amine*	10 - 30		7 - 9
2,4-Dinitrophenol*	10 - 30		7 - 9
Diethyl Phthalate*	10 - 30		1
Pentachloroethane	5 - 30	42 - 57	11 - 14
Naphthalene*	5 - 30	0 - 4	20 - 27
Formaldehyde	15 - 20	0 - 4	8 - 9[2]
Carbon Tetrachloride*	10 - 20	72	9 - 12
Chloroform*	10 - 20	63 - 72	2
Trans-1,2-Dichloroethylene*	10 - 20	63 - 72	8 - 27

*Priority pollutant.

1. Pollutants not released to surface water, air, or sludge are biologically degraded during treatment.

2. Ranges reflect differences between acclimated and nonacclimated treatment systems and natural variability of treatment efficiency.

Source: Tables 4-7, 4-8, and 4-9 in EPA, 1986b.

Table 6-1. Percentages of Selected Pollutants in POTW Influents Released to the Environment in Surface Waters, Air, and Sludge[1] (continued)

Pollutant	To Surface Water	To Air	To Sludge
Tetrachloroethylene*	10 - 20	45 - 64	2 - 3
2,4-Dimethyl Phenol*	5 - 20		6 - 8
Phenol*	5 - 20		12 - 14
1,3-Dichlorobenzene*	10 - 15	45 - 77	3
1,4-Dichlorobenzene*	10 - 15	45 - 77	9 - 23
1,2-Dichlorobenzene*	10 - 15	45 - 77	9 - 32
1,1,1-Trichloroethane*	5 - 15	76 - 77	1
Trichloroethylene*	5 - 15	67 - 68	5 - 6
Xylenes	5 - 15	24 - 68	13 - 14
Methoxychlor	10	54	8
Chlorobenzene*	10	27 - 45	14
Tetrachlorobenzene	10	27	33
Chlordane*	10	9	33
Barium	10		90
Silver*	10		90
Bis-2-Ethylhexyl Phthalate*	10		66
Aldrin*	10		33
1,1-Dichloroethylene*	5 - 10	76 - 81	0
Toxaphene*	5 - 10	57 - 72	4
Benzene*	5 - 10	24 - 72	2
Ethyl Benzene*	5 - 10	24 - 72	5 - 6
Toluene*	5 - 10	22 - 72	18 - 27
1,1,2,2-Tetrachloroethane*	5 - 10	48 - 63	4
Hexachloro-1,3-Butadiene*	5 - 10	0 - 5	8 - 9
Hexachloroethane*	5 - 10	0 - 5	8 - 9
Butyl Benzyl Phthalate*	5 - 10		41 - 43
Endrin*	5 - 10		33 - 35
PCB*	8	9	22
Acrolein*	5	0-5	10

*Priority pollutant.

1. Pollutants not released to surface water, air, or sludge are biologically degraded during treatment.

2. Ranges reflect differences between acclimated and nonacclimated treatment systems and natural variability of treatment efficiency.

Source: Tables 4-7, 4-8, and 4-9 in EPA, 1986b.

EPA estimates that about half the compounds in Table 6-1 may have less than 20 percent of their influent mass discharged to surface waters under unacclimated conditions.[1]

The table also indicates that a number of organic pollutants, but few of the metals, may be removed from the aquatic wastestream through volatilization—particularly the chlorinated benzenes and the low carbon chlorinated alkanes (e.g., the tetrachloroethanes).

Based on this table, it is apparent that the destruction of toxic organic compounds is limited and that metals are not destroyed at all. Overall, the DSS (EPA, 1986b) concluded that 14 to 25 percent of the mass of all toxic pollutants volatilizes to air, 43 to 62 percent biodegrades, 14 to 16 percent partitions to sludge, and 8 to 18 percent is discharged to surface waters. Specific pollutants, however, particularly metals, are much more likely to be discharged to surface waters and partition to sludge than the most common toxic organic compounds.

6.1.2 Toxic Effects of Commonly Released Toxic Pollutants

Toxic effects can be seen at all levels of the organization in the biological system: at the ecosystem level, through changes in system biomass, productivity, or nutrient cycling; at the community level, through changes in community structure, species diversity, or species dominance; at the population level, through increased death rates, decreased growth rates, or reduced reproductive success; at an organism level, through changes in gross morphology, individual growth, or behavior; at the organ level, through development of organ malfunctions or tumors; and at the molecular level, through changes in enzyme systems, DNA, or energy transformation. At each of these levels of organization, there are myriad variations in the type and magnitude of effects that can be caused by toxic pollutants.

Several tests are available that measure the toxicity of chemicals. Some measure the toxicity of a substance by injecting it into the body, some by exposure as gases, some in food or water, and some by inhalation. Each species reacts in a slightly different way to exposures by different routes, but in general, more-toxic chemicals exert effects at lower concentrations than less-toxic chemicals. Therefore, the concentration at which a chemical exerts a toxic effect indicates how serious an effect it may have in the environment.

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1. As discussed in Chapter 4, unacclimated conditions are likely to provide a better approximation of full-scale POTW performance.

Toxicological studies generally focus on four major categories of effects: lethal, carcinogenic, teratogenic, and mutagenic. Lethal effects are those that cause death, usually after exposure to chemicals for short durations. For this reason, tests that measure lethality are often called acute tests. Tests that measure carcinogenic (cancer producing), teratogenic (producing developmental abnormalities), or mutagenic (producing genetic abnormalities) effects are often considered chronic tests, because the effects being measured are normally observed only over longer exposures.

Over the last several years, considerable research has been conducted on the toxic effects of a large number of pollutants. The Agency has compiled lists of hundreds of compounds that have significant effects on biota, including humans. Table 6-2 lists the toxic characteristics of a small subset of these compounds (primarily, CWA priority pollutants) according to their lethal, carcinogenic, teratogenic, mutagenic, and bioaccumulative potential. Table 6-2 also indicates persistence to incorporate some measure of the length of time that the pollutant may exert an effect after release into the environment.

The criterion for listing a compound in a particular category of effect was whether it was known to cause the effect at a concentration less than a predetermined value. A compound is considered lethal if it kills 50 percent of the organisms in a toxicity test (the LC_{50}) at less than (i.e., its LC_{50} is less than) 10 milligrams per liter in an aquatic environment or 100 milligrams per cubic meter in air. To ascertain whether a compound had these effects, EPA used data from the National Institute of Occupational Safety and Health's Registry of Toxic Effects of Chemical Substances (RTECS), which contains evaluations of the literature on many toxicity test results, including an assessment as to whether the data on each compound indicate that it is a known or suspected carcinogen, teratogen, or mutagen.

Finally, chemicals that have bioconcentration factors greater than 1,000 were listed as bioaccumulative. A bioconcentration factor (BCF) is a measure of a chemical's tendency to concentrate in tissues of aquatic organisms. There are two primary means of deriving BCFs: from experimental measures or prediction using structure-activity relationships. The most common method used to calculate a BCF is to divide the measured concentration of the chemical of concern in the exposed tissue by the measured concentration of the chemical in the exposure water, after a steady-state condition is reached, i.e.,

$$BCF = \frac{\text{Concentration in tissue}}{\text{Concentration in water}}$$

Table 6–2. Toxic Effects of Common Pollutants in Aquatic and Terrestrial Environments

Pollutant	Lethal[1]	Carcinogenic[2]	Teratogenic[3]	Mutagenic[4]	Bioaccumulative[5]	Persistent[6]
DDT*	+	+	+	+	+	+
Dioxin (2,3,7,8–TCDD)*	+	+	+	+	+	+
PCBs*	+	+	+	+	+	+
Arsenic (trivalent)*	+	+	+	+	+	+
Aldrin*	+	+	+	+	+	–
Toxaphene*	+	+	+	+	+	–
Dieldrin*	+	+	+	+	+	
Carbon Tetrachloride*	+	+	+	+	–	+
Hexachlorobutadiene*	+	+	+	+	–	+
Benzene*	+	+	+	+	–	–
Formaldehyde	+	+	+	+	–	–
Hexachlorocyclohexane – gamma*	+	+	+	+	–	–
Methylene Chloride*	+	+	+	+	–	–
Ethylhexyl Phthalate, bis 2*	+	+	+	+		
Chlordane*	+	+	–	+	+	+
DDT Metabolite, DDE*	+	+	–	+	+	+
Heptachlor*	+	+	–	+	+	–
DDT Metabolite, TDE*	+	+	–	+	+	
Beryllium*	+	+	–	+	–	+
Dichlorobenzidine*	+	+	–	+	–	–
Hexachlorocyclohexane – Alpha*	+	+	–	+	–	
Hexachloroethane*	+	+	–	–	–	+
Hexachlorocyclohexane – Technical	+	+	–	–	–	
Cadmium*	+	–	+	+	+	+
Endrin*	+	–	+	+	+	+
Hexachlorobenzene*	+	–	+	+	+	+
Nickel*	+	–	+	+	+	+
Methoxychlor	+	–	+	+	+	–
Mirex	+	–	+	+	+	
Lead*	+	–	+	+	–	+
Chlorpyrifos	+	–	+	+	–	–
Ethylbenzene*	+	–	+	+	–	–
Pentachlorophenol*	+	–	+	+	–	–
Toluene*	+	–	+	+	–	–
Malathion	+	–	+	+	–	
Demeton	+	–	+	+		

*Priority pollutant.

1. Has water quality criterion <10 mg/l or acute or air quality criterion <100 mg/m^3.
2. Listed in RTECS as a carcinogen or suspected carcinogen.
3. Listed in RTECS as a teratogen or suspected teratogen.
4. Listed in RTECS as a mutagen or suspected mutagen.
5. Has bioconcentration factor ≥1,000 as documented in PHRED (Public Health Risk Evaluation Database 1987) or in *Water-Related Environmental Fate of 129 Priority Pollutants* (EPA, 1979).
6. Has environmental half-life ≥365 days as documented in PHRED.

Key: "+" = has characteristic; "–" = does not have characteristic; blank = no data.

Table 6–2. Toxic Effects of Common Pollutants in Aquatic and Terrestrial Environments (continued)

Pollutant	Lethal[1]	Carcinogenic[2]	Teratogenic[3]	Mutagenic[4]	Bioaccumulative[5]	Persistent[6]
Endosulfan*	+	–	+	+		
Guthion	+	–	+	+		
Copper*	+	–	+	–	+	+
Selenium*	+	–	+	–	–	+
Hexachlorocyclopentadiene*	+	–	+	–	–	–
BHC*	+	–	+	–	–	
Mercury*	+	–	–	+	+	+
Chlorine	+	–	–	+	–	–
Ammonia	+	–	–	+	–	
Chloroisopropyl Ether (bis-2)*	+	–	–	+	–	
Dinitro–O–Cresol 2,4	+	–	–	+	–	
Isophorone*	+	–	–	+	–	
Chlorophenol 4	+	–	–	+		–
Hexane (n–hexane)	+	–	–	+		
Parathion	+	–	–	+		
Cyanide*	+	–	–	–	+	+
Silver*	+	–	–	–	+	+
Zinc*	+	–	–	–	+	+
Thallium*	+	–	–	–	+	+
Chromium (hexavalent)*	+	–	–	–	+	–
Barium	+	–	–	–	–	+
Chlorophenol 2*	+	–	–	–	–	–
Dimethyl Phenol 2,4*	+	–	–	–	–	–
Chromium (Trivalent)*	+	–	–	–	–	
Pentachlorinated Ethanes	+	–	–	–	–	
Manganese	+	–	–	–		+
Aluminum	+	–	–	–		
Chlorinated Naphthylenes	+	–	–	–		
Chlorotoluene O	+	–	–	–		
Methyl Isobutyl Ketone	+	–	–	–		
Sulfide–Hydrogen Sulfide	+	–	–	–		
Polynuclear Aromatic Hydrocarbons	–	+	+	+	+	+
Chloroform*	–	+	+	+	–	+
Vinyl Chloride*	–	+	+	+	–	+
Tetrachloroethylenes*	–	+	+	+	–	–
Trichloroethylene*	–	+	+	+	–	–
Dinitrotoluene*	–	+	+	+	–	

*Priority pollutant.

1. Has water quality criterion <10 mg/l or acute or air quality criterion <100 mg/m^3.
2. Listed in RTECS as a carcinogen or suspected carcinogen.
3. Listed in RTECS as a teratogen or suspected teratogen.
4. Listed in RTECS as a mutagen or suspected mutagen.
5. Has bioconcentration factor ≥1,000 as documented in PHRED (Public Health Risk Evaluation Database 1987) or in *Water-Related Environmental Fate of 129 Priority Pollutants* (EPA, 1979).
6. Has environmental half-life ≥365 days as documented in PHRED.

Key: "+" = has characteristic; "–" = does not have characteristic; blank = no data.

Table 6–2. Toxic Effects of Common Pollutants in Aquatic and Terrestrial Environments (continued)

Pollutant	Lethal[1]	Carcinogenic[2]	Teratogenic[3]	Mutagenic[4]	Bioaccumulative[5]	Persistent[6]
Dinitrotoluene 2,4*	–	+	+	+	–	
Acrylonitrile*	–	+	+	+		–
Nitrosodimethylamine N*	–	+	+	+		–
Xylene	–	+	+	+		–
Nitrosodibutylamine N	–	+	+	+		
Nitrosodiethylamine N	–	+	+	+		
Arsenic*	–	+	–	+	+	+
Arsenic (pentavalent)	–	+	–	+	+	+
Trichlorophenol 2,4,6*	–	+	–	+	+	–
Asbestos*	–	+	–	+	–	+
Tetrachloroethane 1,1,2,2*	–	+	–	+	–	+
Benzidene*	–	+	–	+	–	–
Chlorinated Benzenes	–	+	–	+	–	–
Dichloroethane 1,2*	–	+	–	+	–	–
Trichloroethane 1,1,2*	–	+	–	+	–	–
Nitrosodiphenylamine N*	–	+	–	+	–	
Nitrosopyrolidine N*	–	+	–	+		
Dichloroethylenes	–	+	–	–	–	–
Hexachlorocyclohexane – Beta*	–	+	–	–	–	
Trichlorinated Ethanes	–	+			–	+
Halomethanes	–	+			–	
Nitrosamines	–	+			–	
Tetrachlorophenol 2,3,4,6	–	–	+	+	+	
Trichloroethane 1,1,1*	–	–	+	+	–	+
Dichlorobenzenes	–	–	+	+	–	–
Dimethyl Phthalate*	–	–	+	+	–	–
Methyl Ethyl Ketone	–	–	+	+	–	–
Monochlorobenzene	–	–	+	+	–	–
Naphthalene*	–	–	+	+	–	–
Phenol*	–	–	+	+	–	–
Diethyl Phthalate*	–	–	+	+	–	
Chlorophenoxy Herbicides (2,4–D)	–	–	+	+		
Dibutyl Phthalate	–	–	+	+		
Pentachlorobenzene	–	–	+	–	+	
Dichlorophenol 2,4*	–	–	+	–	–	–

*Priority pollutant.

1. Has water quality criterion <10 mg/l or acute or air quality criterion <100 mg/m^3.
2. Listed in RTECS as a carcinogen or suspected carcinogen.
3. Listed in RTECS as a teratogen or suspected teratogen.
4. Listed in RTECS as a mutagen or suspected mutagen.
5. Has bioconcentration factor ≥1,000 as documented in PHRED (Public Health Risk Evaluation Database 1987) or in *Water-Related Environmental Fate of 129 Priority Pollutants* (EPA, 1979).
6. Has environmental half-life ≥365 days as documented in PHRED.

Key: "+" = has characteristic; "–" = does not have characteristic; blank = no data.

Table 6–2. Toxic Effects of Common Pollutants in Aquatic and Terrestrial Environments (continued)

Pollutant	Lethal[1]	Carcinogenic[2]	Teratogenic[3]	Mutagenic[4]	Bioaccumulative[5]	Persistent[6]
Chlorophenoxy Herbicides (2,4,5,–TP)		–	–	+	–	–
Carbon Dioxide	–	–	+	–		
Fluoranthene*	–	–	–	+	+	–
Acrolein*	–	–	–	+	–	+
Tetrachloroethanes*	–	–	–	+	–	+
Nitrobenzene*	–	–	–	+	–	–
Acenaphthene*	–	–	–	+	–	
Dichloropropane*	–	–	–	+	–	
Dichloropropene	–	–	–	+	–	
Diphenylhydrazine 1,2*	–	–	–	+	–	
Nitrophenols	–	–	–	+	–	
Chloride	–	–	–	+		
Diphenylhydrazine*	–	–	–	+		
Antimony*	–	–	–	–	+	+
Tetrachlorobenzene 1,2,4,5	–	–	–	–	+	
Dinitriphenols	–	–	–	–	–	+
Trichlorophenol 2,4,5	–	–	–	–	–	–
Chloro–4 Methyl–3 Phenol	–	–	–	–		
Iron	–	–	–	–		
Pthalate Esters	–	–			+	
Haloethers	–	–			–	
Chloroalkyl Ethers	–	–				
Chloroethyl Ether (bis–2)*	–	–				

*Priority pollutant.

1. Has water quality criterion <10 mg/l or acute or air quality criterion <100 mg/m^3.
2. Listed in RTECS as a carcinogen or suspected carcinogen.
3. Listed in RTECS as a teratogen or suspected teratogen.
4. Listed in RTECS as a mutagen or suspected mutagen.
5. Has bioconcentration factor ≥1,000 as documented in PHRED (Public Health Risk Evaluation Database 1987) or in *Water-Related Environmental Fate of 129 Priority Pollutants* (EPA, 1979).
6. Has environmental half-life ≥365 days as documented in PHRED.

Key: "+" = has characteristic; "–" = does not have characteristic; blank = no data.

Bioconcentration factors can also be calculated experimentally by dividing a chemical's kinetic uptake rate (k_1) by its elimination rate (k_2), i.e.,

$$BCF = k_1/k_2$$

Alternatively, a BCF can be estimated using structure-activity relationships based on a well-documented relationship between the BCF and the n-octanol/water partition coefficient for organic chemicals.

The chemicals in Table 6-2 are listed in descending order of an estimated magnitude of environmental harm. This order was determined by assuming that a substance with a lethal effect is more damaging than one that is carcinogenic. Similarly, a compound that is lethal, carcinogenic, and teratogenic was assumed to be more harmful than one that is only lethal and carcinogenic. Most heavy metals and pesticides appear near the top of this list; those compounds that exert few effects (or for which there are inadequate data) appear near the end.

In Table 6-3, EPA sorted the most current values of water quality criteria, developed by EPA's Criteria and Standards Division, according to the acute and chronic freshwater criteria and the criterion to protect human health (for consumption of fish and water). The primary sort was on the acute values and the secondary sort on chronic values. As was the case in Table 6-2, pesticides and heavy metals appear near the top of the list. It is also significant that the chemicals deemed the most toxic (i.e., are toxic at lower concentrations), as indicated by the water quality criteria, are also listed as persistent in Table 6-2; these compounds are not easily degraded and exert their toxic effects for years or decades if present in sufficiently high concentrations.

6.2 Surface-Water Effects

This section discusses the sources and adequacy of data concerning the effects on surface water of toxic pollutant discharges from POTWs, a methodology for determining those effects, and the results of employing the methodology.

6.2.1 Sources and Adequacy of Data

A variety of information sources can be used to assess the impacts of toxic pollutant discharges by POTWs. As the previous section indicated, substantial information exists on

Table 6-3. Water Quality Criteria for Compounds With Acute or Chronic Freshwater Criteria*

	Freshwater		Marine		Fish and Water	Fish
	Acute	Chronic	Acute	Chronic		
Dioxin (2,3,7,8 - TCDD)	<0.01	<0.00001			1×10^{-5} ng/l	1×10^{-5} ng/l
Parathion	0.065	0.013				
Toxaphene	0.073	0.0002	0.021	0.0002	0.71 ng/l	0.73 ng/l
Chlorpyrifos	0.083	0.041	0.011	0.0056		
Endrin	0.18	0.0023	0.037	0.0023	1	
Endosulfan	0.22	0.056	0.034	0.0087	74	159
Heptachlor	0.52	0.0038	0.053	0.0036	0.28 ng/l	0.29 ng/l
DDT Metabolite, TDE	0.60		3.6			
DDT	1.1 ng	0.001	0.13	0.001	0.024 ng/l	0.024
Hexachlorocyclohexane (Lindane)	2.0	0.08	0.16			
PCBs	2.0 ng	0.014	10	0.03	0.079 ng/l	0.079
Chlordane	2.4	0.0043	0.09	0.004	0.46 ng/l	0.48 ng/l
Mercury	2.4	0.012	2.1	0.025	144 ng/l	146 ng/l
Dieldrin	2.5 ng	0.0019	0.71	0.0019	0.071 ng/l	0.076
Aldrin	3.0 ng		1.3		0.074 ng/l	0.079
Cadmium	3.9	1.1	43	9.3	10	
Silver	4.1	0.12	2.3		50	
Hexachlorocyclopentadiene	7.0	5.2	7		206	
Chromium (hexavalent)	16	11	1,100	50	50	
Copper	18	12	2.9	2.9		
Chlorine	19	11	13	7.5		
Pentachlorophenol	20	13	13	7.9	1.01 mg/l	
Selenium	20	5	300	71	10	
Cyanide	22	5.2	1	1	200	
Phenol, 4-Chloro 3-Methyl	30					
Acrolein	68	21	55		320	780
Lead	82	3.2	140	5.6	50	
Hexachlorobutadiene	90	9.3	32		0.45	50
BHC	100		0.34			
Zinc	120	110	95	86		
Beryllium	130	5.3			6.8 ng/l	117 ng/l
Nitrophenols	230	150	4,850			
Chlorinated Benzenes	250	50	160	129	488	
Diphenylhydrazine, 1,2-	270					
Dinitrotoluene	330	230	590	370		
Arsenic (trivalent)	360	190	69	36		
Haloethers	360	122				
Arsenic (pentavalent)	850	48	2,319	13		
Phthalate Esters	940	3	2,944	3.4		
Hexachloroethane	980	540	940		1.9	8.74
DDT Metabolite, DDE	1,050		14			
Dichlorobenzenes	1,120	763	1,970		400	2.6 mg/l
Nickel	1,400	160	75	8.3	13.4	100

*All values in µg/l unless otherwise marked.

Table 6-3. Water Quality Criteria for Compounds With Acute or Chronic Freshwater Criteria* (continued)

	Freshwater		Marine		Fish and	
	Acute	Chronic	Acute	Chronic	Water	Fish
Thallium	1,400	40	2,130		13.0	48
Chlorinated Naphthalenes	1,600		7.5			
Acenaphthene	1,700	520	970	710		
Chromium (trivalent)	1,700	210	10,300		170 mg/l	** g
Dichlorophenol, 2,4-	2,020	365			3.09 mg/l	
Dimethyl Phenol, 2,4-	2,120					
Naphthalene	2,300	620	2,350			
Benzidine	2,500				0.12 ng/l	0.53 ng/l
Fluoranthene	3,980		40	16	42	54
Chlorophenol, 2-	4,380	2,000				
Tetrachloroethylenes	5,280	840	10,200	450	0.8	8.85
Benzene	5,300		5,100	700	0.66	40
Nitrosamines	5,850		3,300,000		0.8 ng/l	1.24
Dichloropropene	6,060	244	790		87	14.1 mg/l
Pentachlorinated Ethanes	7,240	1,100	390	281		
Acrylonitrile	7,550	2,600			0.058	0.65
Antimony	9,000	1,600			146	45.0 mg/l
Tetrachloroethanes	9,320					
Phenol	10,200	2,560	5,800		3.5 mg/l	
Halomethanes	11,000		12,000	6,400	0.19	15.7
Dichloroethylenes	11,600		224,000		0.033	1.85
Toluene	17,500		6,300	5,000	14.3 mg/l	424 mg/l
Trichlorinated Ethanes	18,000					
Dichloropropane	23,000	5,700	10,300	3,040		
Nitrobenzene	27,000		6,680		19.8 mg/l	
Chloroform	28,900	1,240			0.19	15.7
Ethylbenzene	32,000		430		1.4 mg/l	3.28 mg/l
Carbon Tetrachloride	35,200		50,000		0.4	6.94
Trichloroethylene	45,000	21,900	2,000		2.7	80.7
Isophorone	117,000		12,900		5.2 mg/l	520 mg/l
Dichloroethane, 1,2-	118,000	20,000	113,000		0.94	243
Chloroalkyl Ethers	238,000					
Chloride	860,000	230,000				
Mirex		0.001		0.001		
Guthion		0.01		0.01		
Methoxychlor		0.03		0.03	100	
Malathion		0.1		0.01		
Demeton		0.1		0.1		
Sulfide-Hydrogen Sulfide		2		2		
Trichlorophenol, 2,4,6-		970			1.2	3.6
Iron		1,000			0.3 mg/l	
Tetrachloroethane, 1,1,2,2-		2,400	9,020		0.17	10.7
Trichloroethane 1,1,2		9,400			0.60	41.8

*All values in µg/l unless otherwise marked.

**Level of chromium (trivalent) likely to adversely affect freshwater organisms and must be estimated based upon water hardness.

Source: EPA (1986a).

the toxic effects of individual pollutants in both aquatic and terrestrial systems. These data are useful in identifying pollutants that pose risks to the environment and the relative concentrations at which adverse effects might be expected. However, they are limited in their ability to predict actual effects of POTW discharges on specific individuals or populations due to the complexity of chemical, physical, and biological components of the discharge and the receiving environment.

National data bases, developed and maintained by the Agency for storing and retrieving data on the aquatic environment and for monitoring compliance with National Pollutant Discharge Elimination System (NPDES) and pretreatment regulations, provide only some of the data necessary to fully address environmental impacts. For example, STORET, a large data base containing monitoring data on the vast majority of the Nation's waterways, cannot be used to determine the environmental effects of POTW discharges nationwide because the concentrations of chemicals and the biotic characteristics stored in STORET reflect a wide variety of factors that would have to be controlled to separate out the effects of POTW discharges. These factors include other point and nonpoint source discharges, stream flow, and other water body characteristics. Assessing the relative importance of these or other factors for thousands of POTWs was beyond the resources available for this study.

The Agency does have access to information that provides insight into the magnitude of surface-water effects of toxic pollutant discharges. The first is information contained in reports prepared by States on the overall quality of their waters and the reasons for their failure to attain "fishable, swimmable" standards. This nationwide assessment, completed every 2 years under Section 305(b) of the CWA, provides a general understanding of the relative magnitude of problems caused by discharges of toxic pollutants (versus other types of pollutants) and by POTWs (versus other sources).

In a similar way, the Permit Compliance System (PCS), a national data base containing information on the compliance of POTWs (and other dischargers) with their NPDES permits, allows a partial assessment of surface-water effects. PCS allows, but does not require, users to input pollutant and flow data for their discharges. Where this facility has been used, the data can be accessed on a nationwide basis. As explained in Chapter 2, however, PCS does not contain sufficient data in many fields to perform a defensible assessment (largely because it was designed and is used for purposes described in Chapter 2, and not for the uses required for this report). Thus, PCS data must be matched and supplemented with data from other sources before meaningful results can be obtained. Such an approach was taken in this analysis, as described in the following subsection.

6.2.2 Methodologies for Determining Impacts

EPA conducted three separate analyses to assess the aquatic impacts of discharges of toxic chemicals from POTWs. The first, based on data provided by States in their 305(b) reports, indicates the overall importance of toxic discharges in preventing the attainment of designated uses in water bodies and independently indicates the importance of POTW contributions in failures to attain designated uses. The second uses data from a variety of sources to calculate the number of exceedances of Federal water quality criteria potentially caused by discharges of toxic chemicals from POTWs. The third uses data from PCS to indicate the number of exceedances of the Federal toxicity criteria by POTW discharges. The following subsections summarize how these analyses were conducted.

6.2.2.1 305(b) Summary Data

During 1988, EPA requested States to prepare reports on water quality for the Report to Congress required by Section 305(b) of the CWA. In guidance provided to the States, EPA sought specific information on a number of topics, including the pollutants responsible for nonattainment of use designations for receiving waters and the sources of those pollutants (e.g., nonpoint sources, municipal or industrial point sources). EPA prepared tables summarizing these data on a nationwide basis. Detailed information was presented in EPA's *National Water Quality Inventory 1988 Report to Congress* (EPA, 1990a) and is summarized in Subsection 6.2.3.

6.2.2.2 Water Quality Criterion Exceedances

In its second analysis, EPA combined data from three national data bases to calculate the likely prevalence with which water quality criteria are being exceeded nationwide. Described in more detail in Chapter 2, these data bases were as follows:

- PCS, which contains data on 15,747 POTWs. Of major interest from PCS was monitoring data on the concentrations of pollutants in discharges.
- NEEDS '88, which contains data on 15,591 POTWs. Data obtained from NEEDS included individual POTW flows and the discharge reach (i.e., receiving water body) for each POTW.
- GAGE File, a national data base containing receiving water flow information for most reaches within the United States. Of particular interest was the 7-day low flow that recurs in 10 years (the 7Q10), an important design flow for developing water quality-

based effluent limitations for discharges to surface waters, and the flow used for predicting water quality criterion exceedances in this analysis.

PCS and NEEDS had several common elements, including names of POTWs, operating authority, locations, discharge volumes, and NPDES permit number. Of these items, the NPDES permit number was the shared element that allowed the simplest matching between the two data sets. For those numbers that did not match, EPA compared location, authority, design flow, and other types of information. If the NEEDS POTW matched the PCS POTW in two or three ways (e.g., matched three of the following: same city, same authority, same name, same location, approximately the same flow), they were assumed to be the same POTW. If, however, any of the nonmatching fields indicated that the plants were different, both were dropped from the analysis (an order-of-magnitude difference in design flows was often a reason for eliminating plants from the merge). Of the more than 15,000 plants in each data base, 12,249 plants (more than 80 percent) matched.

After eliminating all unmatched records, the remainder of PCS was then searched for data on concentrations of pollutants for which EPA has developed water quality criteria (see Table 6-3). Of the 12,249 POTWs in the PCS/NEEDS match, 7,778 had no data in PCS on effluent concentrations, leaving 4,471 plants (37 percent of the matched POTWs) with at least some data on both pollutant concentrations and plant flow.

The 4,471 plants were then matched with the GAGE data for receiving water flow information. Of these plants, 731 (16 percent of the matched plants with data) could not be matched to receiving waters for which there were flow data. Therefore, the data available for analysis concerned 3,740 POTWs, about 25 percent of the original data set of more than 15,000 POTWs.

Data on these 3,740 POTWs were available regarding toxic pollutant concentrations in their effluents (from PCS), average discharge flow (from NEEDS), and receiving water flow (from GAGE). Data on these plants could, therefore, be used to calculate the receiving water concentration of each pollutant that would have resulted, under low flow conditions, from the POTW's average discharge assuming no pollutants in the receiving water. This calculation used the following equation:

$$C_r = (C_e * Q_e) / (Q_e + Q_r)$$

where:

C_r = Concentration of the pollutant in the receiving water

C_e = Concentration of the pollutant in the effluent

Q_e = Flow volume of the effluent

Q_r = Flow volume of the receiving water (based on 7Q10).

The values for C_e for each plant were calculated as the arithmetic mean of all data for a parameter for a plant. Concentration values marked as "less than" or "nondetected" values were entered as one-half of the detection limit value. Concentration values marked as "greater than" values were eliminated from the analysis. If all values for a POTW were listed as not detected, the plant was counted as having data, but no receiving water concentration was calculated, and the plant was deemed to have a receiving water concentration that was less than EPA's water quality criterion for that pollutant.

To identify the potential environmental impacts of the concentrations derived for pollutants in receiving water, EPA compared the derived receiving-water concentrations to Federal ambient water quality criteria. As discussed in Subsection 5.3.1.1, Federal water quality criteria are intended to protect the highest uses of surface waters and are the basis of State-developed water quality standards, which are intended to protect various levels of designated uses.

In this analysis, EPA used Federal water quality criteria rather than State standards as its benchmark for water quality exceedances, even though POTWs are subject to State standards and although (as Chapter 5 noted) local limits and NPDES permit limits are designed to protect State-designated uses. EPA used Federal criteria because they are developed with consistent methods and purpose, cover a wide range of pollutants, and are intended to protect the highest uses of surface waters. Conversely, State standards vary in value, encompass fewer pollutants, and do not exit for some pollutants in some States.

Finally, for each plant for which effluent concentrations were derived, a tally was kept of the number that did not meet the water quality criterion for a particular pollutant out of the total number of plants that measured for that pollutant. This number was reported as a percentage of the plants monitoring for the pollutant and is presented and discussed in Subsection 6.2.3.

6.2.2.3 Toxicity

A toxicity test is a laboratory procedure that uses test organisms to indicate the toxicity of a gas or a solution. Results are normally expressed in terms of the LC_{50} (the concentration at which 50 percent of organisms are killed over a given exposure period), the EC_{50} (the concentration at which 50 percent show some predetermined effect), and the NOEC (the concentration at which no observed effect will occur at continuous exposure to test organisms).

Toxicity tests are used on POTW effluents to determine whether a chemical or a group of chemicals are causing the effluent to be toxic, regardless of whether their identities are known. Whole-effluent toxicity testing enables POTWs to characterize toxicity in their effluents and to limit it if necessary. Such toxicity may be attributable to non-priority pollutants, complex pollutant mixtures, or chemicals added or created during the treatment process at POTWs. EPA's July 24, 1990, revisions to the General Pretreatment Regulations require pretreatment POTWs and POTWs with greater-than-1-mgd flows to provide whole-effluent toxicity testing results to their approval authorities as part of their NPDES permit applications. Implementation of this requirement ultimately will improve awareness of POTWs' impacts on receiving waters at both the local and the approval authority levels.

PCS maintains separate data fields for effluent test results of different lengths of time, different species, and different exposure mechanisms (static, static renewal, and flow through). For this analysis, test results from one of four data fields were converted to toxic units, according to procedures explained in the *Technical Support Document for Water Quality-Based Toxics Control* (EPA, 1985). Toxic discharges then were diluted in receiving waters as if they were concentrations, as explained previously. The resulting receiving water concentrations were compared with EPA's Criterion Maximum Concentration (CMC) for toxicity (i.e., 0.3 acute toxic units, TU_a) or the Criterion Continuous Concentration (CCC) (i.e., 1 chronic toxic unit, TU_c)(EPA, 1985). Tallies were kept of the numbers of POTWs that exceeded either criterion and the total number of plants that conducted toxic tests on the effluent.

In addition, some toxicity tests in PCS are reported with pass/fail results. Pass/fail tests are typically specified as measurements at the end of a discharge pipe (i.e., they do not allow for dilution). Pass/fail tests are summarized by counting the number of passes and fails for each test across all plants and calculating the overall percentage of tests that passed. The results of these analyses are reported in the next subsection.

6.2.3 Results

This subsection presents the results of the three analyses described in Subsection 6.2.2.

6.2.3.1 305(b) Summary Data

For EPA's 1988 biennial 305(b) Report to Congress, States assessed and reported on 29 percent of river and stream miles, 41 percent of lake acres, and 76 percent of estuarine square miles nationwide. Of the water bodies assessed, 30 percent of river waters, 27 percent of lake waters, and 29 percent of estuarine waters were reported as either not attaining or partially attaining designated uses.

States were asked to identify the causes of failure of these waters to fully support designated uses. Table 6-4 summarizes the State-reported data for 1988 on the extent to which rivers, lakes, and estuaries failed to meet use designations for the reasons indicated.

The table indicates that of the three categories of toxic pollutants for which data were available (and for those waters for which States reported partial or nonattainment), toxic metals were responsible for 11 percent of the river miles, 7 percent of the lake acres, and 9 percent of the area of estuaries and coastal areas that failed to meet use designations. Pesticides were responsible for 10 percent of the river mile failures, 5 percent of the lake acre failures, and 1 percent of the estuarine and coastal area failures. Finally, priority organic pollutants were responsible for failure of about 8 percent of the lakes and 4 percent of the coastal areas to attain applicable use designations.

According to Table 6-4, nearly 50 percent of the failures in use attainability are attributable to causes other than toxic pollutants. Nutrients, pathogens, siltation, and organic enrichment are all given higher overall rankings than known toxic chemicals in causing failures to meet use designations. Few independent data can be used to verify the accuracy of this estimate. There are at least two reasons why other causes are indicated more frequently than toxics.

First, the determination of use attainability depends on the existence of State water quality standards for the pollutants of interest and a monitoring program for concentrations of those pollutants in receiving waters. If States in general did not have water quality standards for toxic pollutants when reporting under 305(b), the relative importance of toxic pollutants in causing use nonattainment would be underestimated. States have more

Table 6-4. Amount of Assessed Surface Waters Not Fully Meeting Use Designations in 1988 Because of the Cause Listed (from all sources)

	Rivers (thousands of miles [%])[1]		Lakes (millions of acres [%])		Estuaries (thousands of sq. miles [%])	
Nutrients	38.0	(26.6)[2]	1.297	(48.8)	3.424	(49.6)
Pathogens	26.6	(18.6)	0.228	(8.6)	3.320	(48.1)
Siltation	60.6	(42.4)	0.677	(25.4)	0.463	(6.7)
Organic Enrichment	20.9	(14.6)	0.672	(25.3)	2.001	(29.0)
Metals	15.5	(10.8)	0.198	(7.4)	0.655	(9.0)
Oil and Grease	ND[3]	ND	ND	ND	1.617	(23.4)
Salinity	8.7	(6.1)	0.380	(14.3)	ND	ND
Habitat Modification	8.2	(5.7)	0.301	(11.3)	ND	ND
Pesticides	14.7	(10.3)	0.141	(5.3)	0.072	(1.0)
Suspended Solids	8.9	(6.2)	0.200	(7.5)	ND	ND
Priority Organics	ND	ND	0.217	(8.2)	0.283	(4.1)
pH	7.3	(5.1)	0.137	(5.1)	0.028	(0.4)
Flow Alteration	8.3	(5.8)	0.087	(3.3)	ND	ND
Unknown Toxics	ND	ND	ND	ND	0.353	(5.1)
Thermal Modification	3.5	(2.4)	ND	ND	ND	ND
Other Inorganics	ND	ND	ND	ND	0.036	(0.5)

1. Percentages are of miles (rivers), acres (lakes), and square miles (estuaries) reported by States as not fully meeting designated uses, not of total miles, acres, or square miles.

2. Percentages sum to greater than 100% because some uses may not be met for more than one reason.

3. ND = No data.

Source: EPA (1990a).

standards for toxic pollutants now than in 1986 and 1987, when the data for the most recent 305(b) Report to Congress were being generated. Forty or more States (see Table 5-4 and Appendix C-2) currently have standards for all metals except beryllium (24 States have standards), nickel (34 States), thallium (19 States), and copper (39 States). Fewer than 24 States have standards for organic priority pollutants except for PCBs (40 States), pesticides (7 to 41 States, depending on the pesticide), phenol (33 States), and pentachlorophenol (27 States).

Second, problems attributable to toxic pollutants may be masked by problems from other pollutants, such as nutrients, particularly in States where there are few water quality standards for toxic pollutants or little data on the incidence of toxics.

"Municipal" sources of pollutants (POTWs and CSOs [combined sewer overflows]) are seen by the States to be significant contributors to use attainability problems. In Table 6-5, for example, municipal sources are listed as second in importance only to agriculture in causing use nonattainability. However, the effects attributed to municipal sources under 305(b) by States do not represent only those effects caused by toxic pollutants; conventional pollutants are also included in States' allocations of responsibility.

Pursuant to Section 304(l) of the WQA of 1987, EPA and States develop lists of facilities that contribute to water quality criterion exceedances for toxic pollutants in receiving waters, where criterion exceedances are expected to be due entirely or substantially to discharge from point sources. Of the 888 facilities on the list, 254 are POTWs, 171 of which have approved pretreatment programs. POTWs were put on the list primarily because of their metal discharges (see Table 6-6), with 97 POTWs selected because of copper discharges, 73 for lead discharges, and more than 50 for mercury, zinc, or cadmium discharges. Only 10 POTWs were placed on the list for phenols, and six or fewer facilities were listed for other toxic organic compounds.

6.2.3.2 Water Quality Criterion Exceedances

The set of pretreatment POTWs that was used to calculate water quality criterion exceedances was limited by the availability of data. Table 6-7 presents information on the numbers of pretreatment POTWs that could be used for the analysis at each step of the procedure. Of the 2,015 POTWs covered by local pretreatment programs, 995 (less than 50 percent) had the requisite data from PCS, NEEDS, and GAGE to foster this analysis. For individual pollutants, there were even fewer plants for which adequate data were available.

Table 6-5. Amount of Assessed Surface Waters Not Fully Meeting Use Designations in 1988 Because of the Source Listed

	Rivers (thousands of miles [%])[1]		Lakes (millions of acres [%])		Estuaries (thousands of sq miles [%])	
Agriculture	79.4	(55.2)[2]	1.564	(58.2)	0.899	(18.6)
Municipal (POTWs and CSOs)	23.4	(16.3)	0.405	(15.1)	2.571	(53.1)
Storm Sewers	12.7	(8.8)	0.744	(27.7)	1.38	(28.5)
Land Disposal	6.4	(4.4)	0.711	(26.5)	1.328	(27.4)
Resource Extraction	18.8	(13.0)	0.113	(4.2)	1.657	(34.2)
Habitat Modification	18.6	(12.9)	0.89	(33.1)	0.234	(4.8)
Industrial	12.3	(8.5)	0.208	(7.7)	0.588	(12.1)
Construction	9	(6.3)	0.088	(3.3)	0.608	(12.5)
Combined Sewers	5.3	(3.7)	0.008	(0.3)	0.499	(10.3)
Silviculture	12.4	(8.6)	0.025	(0.9)	0.077	(1.6)

1. Percentages are of miles (rivers), acres (lakes), and square miles (estuaries) reported by States as not fully meeting designated uses, not of total miles, acres, or square miles.

2. Percentages sum to greater than 100% because some uses may not be met for more than one reason.

Source: EPA (1990a).

Table 6-6. Number of POTWs on the 304(l) Short-List of Facilities Contributing to Water Quality Standards Exceedances for Toxic Pollutants

Pollutant	Number of POTWs
Copper	97
Lead	73
Mercury	59
Zinc	57
Cadmium	56
Silver	41
Nickel	23
Chromium	20
Phenols*	10
Chloroform	6
PCBs	6
Thallium	5
Dioxin	5
Beryllium	4
Selenium	4
Arsenic	4
Phenol*	3
Aldrin	2
Endosulfan	2
Heptachlor	2
Dieldrin	1
Benzidine	1
Chlordane	1
Whole Effluent Toxicity	1

* "Phenol" is a single chemical compound. "Phenols" include a variety of chemical compunds closely related to phenol in terms of chemical structure.

Table 6-7. Number of POTWs Included in the Water Quality Criterion Exceedance Analysis

Category	Number of POTWs	Percent of POTWs
Pretreatment plants	2,015	100
in PCS	1,952	97
matched with NEEDS	1,764	88
with 7Q10 > 0 in GAGE file	1,404	70
with concentration data in PCS	1,032	51
with units data in PCS	995	49

It was not possible for EPA to ascertain how representative this analysis is of the 2,015 pretreatment POTWs. North Carolina, for example, has an extensive monitoring program for POTWs (particularly for heavy metals), but no North Carolina POTWs listed data for toxic pollutants in PCS. Similarly, Ohio requires an annual priority pollutant scan for all of its POTWs, yet most of these data are not entered into PCS. EPA expects that these and other omissions may have biased the results of the analysis.

On the other hand, the criterion exceedance analysis is particularly rigorous. It uses data from about half of the pretreatment POTWs in the United States and determines whether each may cause receiving water impacts irrespective of other discharges and ambient concentrations in receiving waters.

Table 6-8 presents the results of the analysis of water quality criterion exceedances. Note that of the 995 pretreatment POTWs that reported concentrations for at least one pollutant, roughly one-third report average or maximum concentrations of eight metals (copper, cadmium, zinc, chromium, silver, mercury, nickel, and lead), and less than 2 percent report data on any of the organic priority pollutants or pesticides.

The exceedance data indicate that there is a high probability that pretreatment POTW discharges of toxic pollutants are causing receiving water impacts. For example, nearly 53 percent of the dischargers that report the concentrations of mercury are calculated to exceed chronic water quality criteria in the receiving waters. More than 20 percent of the POTWs discharging copper, cyanide, cadmium, mercury, PCBs, silver, and lead are calculated to

Table 6-8. Number of Water-Quality Criterion Exceedances Expected to Be Caused by Pretreatment POTW Discharges at Low Flow (7Q10)

	Average Concentrations			Maximum Concentrations	
Pollutant[1]	N[2,4]	Percent Greater Than Acute[3]	Percent Greater Than Chronic[3]	N[2,4]	Percent Greater Than Acute[3]
Copper[5]	273	23.1	28.2	343	27.4
Cyanide	178	11.8	29.8	245	15.5
Cadmium[5]	265	10.6	23.4	332	15.4
Zinc[5]	277	8.3	8.7	346	10.1
PCBs	28	7.1	25.0	39	10.3
Chromium (hexavalent)[5]	133	4.5	6.8	139	4.3
Silver[5]	113	3.5	32.7	141	11.4
Mercury[5]	205	3.4	52.7	263	3.4
Arsenic[5]	59	1.7	1.7	89	3.4
Chromium (trivalent)[5]	71	1.4	1.4	79	1.3
Nickel[5]	236	1.3	1.7	288	2.1
Lead[5]	246	0.8	32.9	324	1.9
Iron[5]	29		3.5	44	
Selenium[5]	19			54	1.9
Chloroform	8			22	0.0
Tetrachloroethylene	5			21	0.0
Beryllium	11			10	
DDT	11			11	
Endrin	11			11	
Hexachlorocyclohexane	11			13	
Toluene	2			12	
Trichloroethylene	4			12	
Toxaphene	11			11	

1. Pollutants are all priority pollutants for which more than 10 POTWs reported data in the MCAV or MCMX field of PCS.
2. N refers to all pretreatment plants in PCS that have effluent data for average concentrations (left columns) or maximum concentrations (right columns)
3. Percent exceedances are calculated on the observed number of pretreatment POTWs reporting data for a particular pollutant, not the total number of pretreatment POTWs.
4. Exceedances are not calculated when data were available for fewer than 20 POTWs.
5. Metals represent total recoverable metals, not readily bioavailable metals, and thus the percentages of exceedances may be overestimated.

Source: PCS for POTWs meeting data requirements in Table 6-7.

exceed chronic criteria. Acute criteria for copper, cyanide, and cadmium are exceeded by the discharges of more than 10 percent of POTWs.

Copper was the pollutant for which EPA calculated exceedances for the highest percentage of POTWs. The average concentrations and the maximum concentrations were estimated to exceed water quality criteria, after dilution by receiving waters, for about 30 percent of the measured discharges. Copper is ubiquitous, often entering POTWs from drinking-water distribution systems, and is moderately toxic to receiving water biota. (The acute water quality criterion is 18 micrograms per liter [μg/l] at 100 mg/l hardness.) Like most metals, it tends to attach to particles and, thus, partitions to sludge or settles and remains in sediments if discharged.

Cyanide is a soluble toxic pollutant that typically has a greater effect on vertebrates (fish) than invertebrates (insects, crustacea, molluscs). It ranked second in the percentages of exceedances of water quality criteria. Cyanide is less acutely and chronically toxic than most of the heavy metals and exerts its toxic effect by attaching to the respiratory pigment hemoglobin, preventing oxygen transfer and exchange. It is primarily an industrial chemical used by electroplaters, organic chemicals, and pharmaceutical manufacturers. Cyanide generally is removed from wastewaters by partitioning to sludge.

Cadmium was the third-ranked pollutant predicted to exceed water quality criteria. Average receiving water values of cadmium were estimated to exceed the acute water quality criterion in more than 10 percent of the cases. It is a mobile and toxic metal, similar in toxicity to the pesticides aldrin and dieldrin. Cadmium was responsible for Itai-Itai in Japan, a malady causing severe rheumatic and myalgic pain. Although cadmium readily sorbs to sediments and other particles in the water column, it also can become part of soluble organic compounds and is easily complexed. It is typically used in electroplating and paint manufacture.

Zinc is a common metal pollutant that generally is discharged from industries, but a portion also arises from water distribution systems (in some POTWs, this fraction may be significant). It is commonly incorporated into cosmetic and medicinal preparations because of its therapeutic value with topical application. With ingestion, it is an emetic (i.e., causes vomiting). Average receiving water values exceeded acute and chronic water quality criteria for about 8 percent of the discharges.

PCBs are a group of related organic compounds that are toxic, carcinogenic, and very persistent. Seven percent of POTWs' discharges of PCBs were calculated to cause acute criterion exceedances and 25 percent to cause chronic criterion exceedances. However, only 28 and 39 POTWs reported average concentrations and maximum concentrations, respectively. Use of PCBs in transformers as dielectric fluids has caused their widespread distribution, even though the production of PCBs for domestic use has been banned for more than 10 years. Current sources of PCBs to POTWs are thought to be runoff from land that has been contaminated with PCBs by atmospheric deposition or accident (which may enter POTWs through combined sewers) or from recyclers involved in transformer recovery. PCBs are resistant to biological degradation, attach readily and strongly to sediments, and are relatively volatile. They are as acutely toxic to aquatic life as the most toxic metals and cause chloracne in humans at high concentrations.

Chromium is a moderately toxic metal that is commonly used in chrome plating, pigment manufacturing, and leather tanning. It caused criterion exceedances less than 7 percent of the time in its hexavalent (more toxic) form.

Silver ranked seventh in the exceedance percentages, exceeding chronic criteria for more than 30 percent of the reported discharges. Silver is similar in toxicity to mercury and cadmium and may be removed from POTW wastewaters by partitioning to sludge. Its source is primarily commercial and industrial, but its economic value means that pollutant recovery is often practiced at industrial sites prior to discharge to sewers. The high number of exceedances is due primarily to the low chronic criterion value (0.12 μg/l).

Mercury, a toxic and mobile metal, had the eighth highest percentage of exceedances, primarily due to the number of discharges exceeding the chronic water quality criterion. The chronic criterion is set by the Agency at 0.012 μg/l to prevent the accumulation of mercury in edible fish above the Food and Drug Administration Action Level of 1.0 milligrams per kilogram. The very high bioaccumulation of organic mercury compounds requires this low criterion. The most common form of organic mercury, methylmercury, is created readily from inorganic mercury by biological activity in sediments and in biota. It was this form of mercury that was responsible for Minimata disease, mercury poisoning arising from eating contaminated fish and shellfish. Mercury is typically discharged from POTWs in its inorganic, less soluble form.

Lead is the only other pollutant to exceed both acute and chronic criteria. In the aquatic environment, it is one of the least toxic metals (82 µg/l acute criterion). It enters POTWs primarily from industrial sources, but may also come from water distribution systems (lead pipes) in older communities. Previously an additive to gasoline, lead has had widespread distribution in aquatic environments due to atmospheric deposition and runoff from roads and highways. In this analysis, average concentrations of lead in receiving waters exceeded chronic criteria more than 30 percent of the time.

The exceedance data generally appear to be consistent with the data reported by the States in their 305(b) reports. The high likelihood of a criterion exceedance caused by a POTW discharge, as calculated from discharge data, indicates that water quality below POTW outfalls may often be impaired. The 305(b) data indicate that over 23,000 miles of rivers are reported to be affected adversely by POTW discharges—about 1.5 river miles for each POTW listed in either PCS or NEEDS. Both of these essentially independent findings indicate significant POTW impacts, although the 305(b) data do not indicate specific toxic effects. Although neither data source establishes a link between POTW impacts and the presence of a pretreatment program, both indicate that additional controls over toxic discharges from POTWs are warranted.

6.2.3.3 Toxicity

Although PCS has over 50 codes for incorporating whole effluent toxicity test data into the data base, only 11 codes have more than four observations on which to base an analysis. These codes were for the two most common test organisms used in the NPDES program (*Ceriodaphnia sp* and *Pimephales promelas*) for static and static renewal toxicity tests.

POTWs' data presented in Table 6-9 (representing 1987, 1988, and 1989) indicate, as did the individual toxic pollutant data (Table 6-8), that POTW discharges have a strong likelihood of causing criterion exceedances in receiving waters. In acute tests, about 17 percent of the static tests for *Ceriodaphnia* and 17 percent of the static renewal tests for *Pimephales* would result in receiving water concentrations that exceeded EPA's CMC. Chronic tests indicated an even higher percentage of exceedances, with 30.4 percent of *Ceriodaphnia* and 14.3 percent of *Pimephales* tests resulting in receiving water concentrations that would exceed the CCC. Finally, the pass/fail results (results that incorporate receiving water standards implicitly) indicated that 70 percent or more of all tests failed. (The pass/fail criteria are not known for these tests. It is assumed that no observed effect [or only a small percentage effect] was required to pass.)

Table 6-9. Criterion Exceedances Indicated by Toxicity Test Results on POTW Effluents

Species	Endpoint	Test	Number of Plants	Percent of Test Failures[1]
Acute				
Ceriodaphnia	LC_{50}	STAT 48 hr	23	17.4
Pimephales	LC_{50}	STAT 48 hr	18	5.6
Ceriodaphnia	LC_{50}	STATRE 96 hr	7	0.0
Pimephales	LC_{50}	STATRE 96 hr	18	16.7
Chronic				
Ceriodaphnia	NOEL	STATRE 7 day	23	30.4
Pimephales	NOEL	STATRE 7 day	21	14.3
Pass/Fail				
Ceriodaphnia	P/F	STATRE 7 day	37	73.3
Pimephales	P/F	STATRE 7 day	37	91.3

1. Total number of test results, divided by the number of tests that failed, multiplied by 100.

Key:

STAT = Static test
STATRE = Static renewal test
LC_{50} = Lethal concentration for 50 percent of organisms tested
NOEL = No observable effect level for organisms tested
P/F = Pass/fail

Source: PCS.

It is difficult to interpret the significance of these data, or how well they represent pretreatment POTWs or the entire POTW population. These results all come from POTWs in a single EPA Region. The tests may have been conducted as part of Toxicity Identification Evaluations, in which case they would have been performed only at POTWs known to have toxic discharges. EPA did not determine whether a link exists between an exceedance of a toxicity criterion and the presence or absence of a pretreatment program.

6.3 GROUND-WATER EFFECTS

This section discusses the sources and adequacy of data concerning the effects on ground water of toxic releases from POTWs, a methodology for determining effects, and the results of employing the methodology.

6.3.1 Sources and Adequacy of Data

POTWs' primary impacts on ground water come from the treatment of sewage in lagoons and from disposal of sewage sludge. There are 5,476 municipal lagoons in the United States (from NEEDS, as quoted in EPA Lagoon Study). The Agency does not currently require the monitoring of impacts from these two activities on ground water, so there are only limited data on the environmental impacts of POTW operations on ground water. A study of the impacts of lagoons and the ultimate risk to human health was reported to Congress in 1987 (EPA, 1987). The data that are contained in this study are limited to relatively few lagoons, but the distribution of the lagoons analyzed was selected to be representative of lagoons nationwide. Although the data do not represent a large portion of the lagoons that may have impacts, they are suggestive of the kinds of impacts that might be expected. Subsection 6.3.3 discusses the results.

The major releases to ground water from sludge occur during or after disposal. But once pollutants get to sludge, there is no large-scale model available to determine their ultimate fate. On the national scale, the greatest amount of sewage sludge is disposed of by land application (2.3 million dry metric tons per year), followed by co-disposal landfills (1.1 million dry metric tons), and incineration (760,000 dry metric tons, see Table 6-10). The remaining disposal practices, including ocean disposal, surface disposal, and monofills, account for an additional 1.7 million dry tons per year. Thus, the great majority of sludge disposal practices have at least the potential to contaminate ground water, but few data indicate the size of that potential.

Table 6-10. Numbers of POTWs Using Specific Sludge Disposal Practice as Primary Sludge Disposal Practice and Amounts of Sludge Disposed of Using Each Practice

Disposal Method	Numbers of POTWs	Percent of POTWs	Total Amount of Sludge[1]	Percent of Total Amount of Sludge
Co-Disposal Landfills	1,851	17	1,124.3	20
Incineration	294	2.7	759.8	14
Land Application	3,542	32.5	2,336.7	42
Distribution and Marketing	308	2.8	321.3	6
Ocean Disposal[2]	25	0.2	265.2	5
Other	1,526	14	107.9	2
Surface Disposal	3,147	28.9	512.3	9
Monofills	203	1.9	108.8	2
Total	10,896	100.0	5,536.3.	100.0

1. Total amount of sludge is in thousand dry metric tons. Total is extrapolated to all POTWs with secondary treatment or better.

2. Based upon number of existing permits.

Source: EPA (1990b).

In support of the proposed sewage sludge regulations (40 *CFR* Part 503), the Agency gathered and analyzed a large amount of existing information on the environmental effects of sewage sludge and disposal. EPA used two main sources of information on sludge quality and management: the 40-POTW Study and the Association of Municipal Sewerage Agencies sludge study. These studies, however, are now somewhat outdated and apply to a limited number of POTWs. The Agency, therefore, conducted the National Sewage Sludge Survey, beginning in August 1988, in which questionnaires were sent to 479 POTWs seeking information about sludge quality and disposal practices; sludge samples at 208 POTWs were analyzed for a wide range of toxic pollutants. The results of this survey were used for this analysis.

6.3.2 Methodologies for Determining Impacts

The Lagoon Study (EPA, 1987) determined the number and size of municipal lagoons, the types and quantities of waste contained in those lagoons, and the extent to which the waste has been or may be released from lagoons and has contaminated or may contaminate ground water. EPA initiated a limited sampling program and used the results in EPACMS, a model that evaluates the migration of pollutants to selected points in underlying aquifers. The model was used to determine whether acceptable ground-water concentrations would be exceeded for lagoons with typical concentrations for different representative geologic conditions. The results of this study are summarized in the following subsection.

Because the Part 503 technical standards for sludge use and disposal have not yet been finalized, EPA could not compare the NSSS data with the Part 503 Standards to determine potential impacts of sludge on ground water.

6.3.3 Results

6.3.3.1 Lagoon Study

The Lagoon Study (EPA, 1987) sampled 14 wastewater treatment lagoons and determined which would exceed either Safe Drinking Water Act Maximum Contaminant Levels (MCLs) for drinking water or Risk Specific Doses (RSDs) for either a 10^{-5} or 10^{-6} incremental cancer risk for the compound selected. Based on a sampling for the 126 priority pollutants, four compounds were found to exceed levels necessary to maintain compliance with MCL levels in aquifers: benzene, 1,2-dichloroethylene, arsenic, and selenium. Of these compounds, selenium was found to exceed the MCL most frequently (for 43 percent of the samples). A significantly greater number of compounds were found to exceed RSDs. The following compounds were found to exceed RSDs for more than 20 percent (3) of the samples: 2,4,6-trichlorophenol, benzidine, bis(2-ethylhexyl) phthalate, 2,4-dinitrotoluene, and hexachlorobenzene. Other compounds that exceeded RSDs at least twice included hexachloroethane, n-nitrosodiphenylamine, and methylene chloride.

These results, however, are not necessarily representative of the full effects of the lagoon treatment process. In the conclusions of the study, the Agency indicated that there was a low potential for ground-water contamination from municipal wastewater lagoons, but that lagoons with industrial discharges may be potential sources of ground-water contamination. Similarly, the Agency concluded that the human health risks associated with ground-water contamination from wastewater treatment lagoons receiving only domestic wastes are generally low, but that lagoons with significant industrial discharges pose a potential risk to human health.

6.3.3.2 Sludge Disposal

The national pollutant concentration estimates in Table 6-11 were taken from the Notice of Availability of information and data from the National Sewage Sludge Survey (NSSS). This survey was conducted to support the development of the Part 503 regulations. The pollutant concentrations in Table 6-11 are estimates for the distribution among POTWs of pollutant concentrations in dry weight sewage sludge that is ready for disposal and that is generated by secondary or better treatment of wastewater.

The Part 503 standards proposed in 54 *FR* 5746 (see Appendix C) are currently being reviewed, and the final standards may be higher or lower than those proposed. As a result of information and comments provided by scientific peer review panels and other interested parties, as well as the findings of the NSSS, EPA is considering revising the elements of the proposed Part 503 standards pertaining to domestic septage, emissions of organic pollutants from incinerators, non-agricultural land application, surface impoundments, distribution and marketing, and agricultural land application. In general, these revisions are intended to encourage beneficial reuse practices while protecting public health and the environment from possible risks.

Because the Part 503 standards have not yet been promulgated, it was not possible to evaluate the impacts of sludge disposal. However, in general, many of the constituents that appear to pose human health risks if disposed of in sludge by inappropriate methods are also poorly degraded in wastewater treatment plants and do not volatilize appreciably. These constituents are likely to contaminate either receiving waters or sludge no matter what technologies are applied to the wastewaters containing them. The only effective way to prevent their environmental release and the potential for adverse environmental effects is to prevent them from reaching treatment works.

6.4 AIR EFFECTS

This section discusses the sources and adequacy of data regarding environmental effects of airborne toxic releases from POTWs, addresses a methodology for determining effects, and presents the results of employing the methodology.

6.4.1 Sources and Adequacy of Data

Compared to data on surface and ground waters, there is substantially less information on the impacts of releases to air. Few data are available on ambient air concentrations of toxic pollutants, and emissions of toxics from POTWs are poorly understood.

Table 6-11. Mean Concentration of Selected Toxic Pollutants in Sewage Sludge from the National Sewage Sludge Survey (1988 data)*

Chemical	Mean Concentration	Standard Deviation	Unit (dry weight)	Percent Detects	Number of Samples
Copper	741	962	mg/kg	100	199
Zinc	1,202	1,554	mg/kg	100	199
Chromium	119	339	mg/kg	91	199
Arsenic	9.93	18.84	mg/kg	80	199
Lead	134	198	mg/kg	80	199
Cadmium	6.94	11.76	mg/kg	69	198
Nickel	42.7	94.83	mg/kg	66	199
Selenium	5.16	7.34	mg/kg	65	199
Mercury	5.22	15.54	mg/kg	63	199
Bis(2-Ethylhexyl) Phthalate	74,721	598,375	µg/kg	62	200
Molybdenum	9.24	16.58	mg/kg	53	199
Beryllium	0.37	0.34	mg/kg	23	199
Aldrin	1.86	171.6	µg/kg	3	198
4,4'-DDT	29.18	33.96	µg/kg	2	198

*Pollutants with means that could be estimated were selected for inclusion in this table.

Source: EPA (1990b); 55 *FR* 47210.

The National Emissions Data System (NEDS) is an EPA data base containing data entered by States on facilities that emit more than 100 tons per year of any Clean Air Act criteria pollutant, which include particulates, sulfur dioxide, carbon monoxide, nitrogen oxides, ozone/VOCs, and lead. Only 27 POTWs, including only 12 with sludge incinerators, are represented (by Standard Industrial Classification) in NEDS. Of these, 19 were POTWs that could be located in either PCS or NEEDS.

The best information on air emissions from sludge incinerators available to the Agency was developed in support of the proposed sludge technical standards (40 *CFR* Part 503). These data were published in the *Incineration of Sewage Sludge Technical Support Document* (EPA, 1988) and represents measurement of emissions from sludge incinerators under controlled conditions. These data were used in the analysis described below.

Emissions of toxic VOCs from POTWs are even more poorly studied than incinerator emissions. Most studies and regulation of VOC emissions are based on modeling, not monitoring, and it is difficult to obtain and interpret data on the actual emissions of volatile materials from POTWs.

In 1990, EPA cosponsored a workshop with the Water Pollution Control Federation on emissions of air toxics from POTWs. The draft proceedings of the workshop (WPCF/EPA, 1990) indicated that the compounds of greatest concern are the potentially hazardous air pollutants (PHAPs): trichloroethylene, tetrachloroethylene, methylene chloride, acrylonitrile, and carbon tetrachloride, all of which are VOCs. They also indicate that the increase in cancer deaths per year caused by emission from POTWs of these chemicals is less than 1.5. This implies that the effects on the general public of VOC emissions are essentially negligible.

This does not imply that the actual quantities of VOCs emitted from POTWs are negligible, however. The DSS indicated that 0.1 percent of the mass of national emissions of VOCs may come from POTWs, primarily from the industrial contributions to POTWs. Noll and DePaul (1987) estimated that POTWs operated by the Metropolitan Sanitary District of Greater Chicago contributed about 0.1 percent of the VOC emissions in Cook County, Illinois, amounting to annual contributions of tens of thousands of metric tons of VOCs nationwide.

The low risk from volatile air emissions appears to be borne out by available information on POTW worker health and safety. Most studies of POTW worker health focus on the effects of infectious agents or toxins generated by microorganisms found in wastewater or sludge. A body of literature addresses confined-space accidents, which involve employee exposure to gases, such as carbon dioxide, methane, or hydrogen sulfide, while working in collection systems or treatment plants.

A relatively small portion of the above literature directly addresses POTW worker exposure to hazardous materials. Most of this literature involves studies conducted at single plants (Elia et al., 1983) or small groups of plants (Scarlett-Kranz et al., 1986; Pellizari and Little, 1980). Occupational Safety and Health Administration records documenting inspections and testing at work sites usually do not address POTW employees because the Agency's jurisdiction does not extend to municipal workers.

6.4.2 Methodologies for Determining Impacts

Because so few data exist on the environmental impacts of gaseous emissions from POTWs, EPA did not conduct any specific analyses to determine impacts. Instead, the following sections summarize available studies on the nature of incinerator emissions and the effects of VOC emissions on POTW workers.

6.4.3 Results

This subsection summarizes information used for the development of the Part 503 sewage sludge technical standards. It also describes the results of a literature search on worker health and safety at POTWs.

6.4.3.1 Sludge Incinerator Emissions

While developing the proposed sludge technical standards (40 *CFR* Part 503), the Agency collected extensive information on the emission characteristics of sewage sludge incinerators and sewage sludges. Table 6-12 presents information on the average concentrations of metals in sewage sludge, the 10th percentile removal efficiencies as calculated from emission and sludge feed data, the relative potency of the pollutant for causing cancer in exposed individuals (a higher number indicates a higher incidence of cancer per unit of dose or concentration), and the relative risk posed by emission of the pollutant (calculated by dividing the emission by the potency). In this analysis, the higher the relative risk number, the more cancers are likely to be caused by the pollutant.

Although Table 6-12 indicates a removal efficiency for metals in sewage sludges, it is important to recognize that when the metals are removed, they become part of some other

Table 6-12. Relative Emissions of Pollutants Per Unit of Incinerated Sludge and Relative Cancer Risks Posed by Emission

Pollutant	Percent Detected	Mean Concentration	10th Percentile Removal Efficiency	Emission Per Metric Ton of Sludge	q1*[1]	Relative Risk
Zinc	100	1,202	94.17	70.1		
Lead	80	134.4	66.73	44.7		
Chromium	91	119	96.12	4.62	41 [1]	0.11 [3]
Cadmium	69	6.94	65.15	2.42	6.1	0.40
Nickel	66	42.7	95.00	2.14	1.05	2.03
Mercury	63	5.2	79.84[2]	1.05		
Arsenic	80	9.9	95.52	0.444	15	0.03
Selenium	65	5.2	99.44	0.0291		
Beryllium			99.98		8.4	

1. Relative potency for causing cancer in exposed individuals (higher numbers indicate higher cancer incidence per unit dose/concentration).
2. The maximum value for percentage mercury removal.
3. Emissions per metric ton of sludge divided by q1*.

Sources: EPA (1990b).
EPA (1988).

wastestream (scrubber water or ash). They are not destroyed during incineration and continue to have the potential to cause environmental effects.

The data in Table 6-12 are incomplete for several metals. Mercury and beryllium are subject to national air quality standards for toxic pollutants, and emissions of these pollutants are regulated under State laws (see Appendix C-3). Emission limits are not set on beryllium and mercury based on their cancer-inducing potency. Therefore, data on these chemicals are not comparable to other data presented. Similarly, sludge standards for lead are based on toxicological effects other than cancer that may be caused by lead in blood. Lead is, therefore, not comparable strictly to the other pollutants in this table. The most commonly emitted metal—zinc—is not considered carcinogenic by EPA's Carcinogen Assessment Group and does not have other significant toxicological effects. Therefore, no risks are calculated for zinc.

The relative risks posed by nickel emissions are five times those of cadmium. However, this assessment, according to EPA's *Incineration of Sewage Sludge Technical Support Document* (1988), is based on a particularly carcinogenic nickel compound that may not be representative of the compounds expected from the incineration of sewage sludge. EPA is reviewing these data to determine if alternative values might be more appropriate.

6.4.3.2 Worker Health and Safety

The Water Pollution Control Federation (WPCF) has conducted a safety survey of employees at POTWs annually since 1967. However, the data collected in the survey do not address directly the issue of injuries due to industrial discharges of toxic pollutants, partially because the data are limited to "disabling injuries" resulting in 1 or more lost days from work. Another limitation in using these data to identify injuries related to industrial effluents is the absence of the most common symptoms of toxic inhalation (nausea, headache, dizziness) from the list of potential responses. The types of injuries reported to WPCF are only a subset of the injuries that are potentially traceable to industrial effluents. Of the 2,414 disabling injuries reported, 2.4 percent (58) involved respiratory injuries, 5.1 percent (123) involved irritation (from exposure to chemicals), and 1.6 percent (39) involved chemical burns.

Respiratory injuries in the WPCF survey data include incidents involving asphyxiants commonly encountered in wastewater treatment. Many of the injuries reported are unlikely to be attributable directly to toxic pollutants. The types of asphyxiants typically involved (carbon dioxide or hydrogen sulfide) rarely are caused directly by industrial effluents. However, several examples point out that this may not always be the case. One example (Pederson and Simonsen, 1982, cited in Clark et al., 1984) involves the 1982 death of two workers who were overcome by dissolved carbon dioxide released from influent wastewater. This release was later traced to an industrial discharge.

A literature review identified incidents of POTW worker injuries due to materials originating in industrial discharges. Table 6-13 summarizes examples of incidents that have occurred since 1977. Incidents of fatalities from asphyxiants commonly occurring in wastewater collection and treatment systems (hydrogen sulfide or carbon dioxide) have been excluded from this table; as noted, injuries from these causes are poorly correlated with industrial discharges.

The most common incidents involve VOCs. Workers are more often injured than killed by exposure to contaminants. Injuries most often reported were nausea, headache, dizziness, and respiratory distress.

Exposure to contaminants usually occurs in the collection system, in confined spaces at POTWs, or near the headworks of the plant (influent weir, bar screens, grit chamber). It may be relevant to note that all but 1 of the nearly 30 incidents involved two or more workers. In only one incident was a single worker injured (a case involving a rash caused by direct contact with wastewater).

Three other studies provide additional evidence of POTW worker injuries due to industrial discharges. A 1984 study of 14 POTWs in New York State found workers to be 12.9 times more likely to test positive for urinary mutagens than similar workers at drinking water plants. The same workers also reported diarrhea, blurred vision, and headaches more often than their counterparts. Research analyzing death certificates from former POTW workers in the Chicago, Illinois, area (Clark et al., 1984) revealed that the proportion of workers with leukemia was almost twice the expected rates. For another relatively rare cause of death, esophageal cancer, the rate among these workers was also nearly twice the national rate.

6.5 FINDINGS

This chapter addresses the issue of the adequacy of data available to determine the environmental impact of toxic pollutant discharges from POTWs.

Table 6-13. Health Incidents At\ ,uted to POTW Air Emissions

Sources	Locality	State	Year	Industrial User Category	Pollutants	Symptoms
Kominsky, et al., 1980	Louisville	KY	77	Pesticide Manufacturer	Hexachlorocyclopentadiene and Fuel Oil	Skin and eye irritation, sore throat, cough
Elia, et al., 1983	Memphis	TN	78	Pesticide Manufacturer	Hexachlorocyclopentadiene, Hexa-chlorobicyclopentadiene, Chlordane	Eye, throat, nose, lung, and skin irritation
Salisbury, et al., 1982	Roswell	GA	79	NA	1,1,1-Trichloroethane, Aliphatics	Headache, fatigue, nausea, eye irritation, cough
EPA, 1986b	Baltimore	MD	80-85	Paint Manufacturing	Benzene, Toluene, Solvents	Nausea
EPA, 1986b	Louisville	KY	80-85	NA	Hexane	Nausea
EPA, 1986b	Mount Pleasant	TN	80-85	Hazardous Waste Treatment	Organics, Metals	Nausea
EPA, 1986b	Passaic Valley	NJ	80-85	Leather Tanning	Volatile Compound, Solvents	Shortness of breath, skin irritation
EPA, 1986b	Pennsauken	NJ	80-85	Organic Chemicals Manufacturing	Benzene, Toluene, Phenol, Chloroform	Shortness of breath, watering eyes
EPA, 1986b	St. Paul	MN	80-85	Electronics, Metal Finishing, Printing	Solvents	Headache
EPA, 1986b	Tampa	FL	80-85	NA	Organic Solvents	Nausea
EPA, 1986b	Gloucester County	NJ	80-85	NA	1,1,1-Trichloroethane	Fatality by inhalation
SAIC, 1985	Phoenix	AZ	80-85	NA	Chlorine, Ammonia, Solvent	Illness
SAIC, 1985	Tacoma	WA	80-85	NA	Volatile Organics, Solvent	Illness
SAIC, 1985	Philadelphia	PA	80-85	NA	Cumine, Solvents	Illness
Johnson and Horan, 1982	Cincinnati	OH	80	NA	NA	Mucous membrane and eye irritation
McGlothlin and Cone, 1981	Cincinnati	OH	81	Pigment Manufacturing	1,1,1-Trichloroethane, Mineral Spirits	Irritation of the eyes and nose, nausea, dizziness, vomiting, acute bronchitis
Lucas, 1982	Cincinnati	OH	81	NA	Hexane, Toluene, Xylene, Aliphatic Naphtha, 1,1,1-Trichloroethane, Trichloroethylene, Chlorobenzene, o-Chlorotoluene, Trichlorobenzene	Eye and nose irritation, difficulty in breathing
Morgan, et al., 1984		TX	81	Petroleum Refining	NA	Relative risk of fetal loss increased if paternal WWTP exposure occurred near time of conception
Scarlett-Kranz, et al., 1986	14 Cities	NY	84	NA	NA	Death, nose and throat irritation, numbness, tingling of hands and feet, nausea, vomiting, and fatigue
Clark, et al., 1984				NA	NA	Doubled leukemia risk
Nethercott and Holness, 1988	Toronto	ON	85	NA	None Identified	Cough, sputum production, wheezing, sore throat, skin irritation

Table 6-13. Health Incidents Attributed to POTW Air Emissions (continued)

Sources	Locality	State	Year	Industrial User Category	Pollutants	Symptoms
Wong, et al., 1985, cited in Clark, 1986		TX	85	Petroleum Refining	NA	Spontaneous abortion risk found in Morgan, et al., 1984 did not impair fertility
Kraut, et al., 1988	New York City	NY	86	NA	Benzene, Toluene, Other Organic Solvents	Lightheadedness, fatigue, increased sleep requirement, nausea, headache
Tozzi, 1990	Bergen County	NJ	88	NA	Organic Solvents	Headache, difficulty in breathing

NA = Not available.

The first major finding is that few data currently exist on which to base a true evaluation of environmental impacts due to discharges of toxic pollutants by POTWs. Existing national data bases are limited in scope and completeness, and often are not quality controlled sufficiently for rigorous analysis. Other studies and data collection efforts are too fragmented to contribute to a consistent and reasoned view of impacts caused by toxic discharges from POTWs.

About half of all pretreatment POTWs had data in national data bases that could be used to determine the environmental effects of their discharges to receiving waters. The great majority of plants with data had information in national data bases for only one or two toxic pollutants. However, POTWs may retain environmental effects data that are not reported to approval authorities or incorporated into national data bases. Recent revisions to the General Pretreatment Regulations, which require pretreatment and greater-than-1-mgd POTWs to report whole-effluent toxicity testing results to approval authorities with their permit applications, will improve POTW and approval authority knowledge of POTWs' toxic effects on receiving waters.

Of equal if not greater importance, drinking water, surface water, and sludge standards for assessing impacts are in existence for comparatively few pollutants. This makes assessment of POTW impacts even more difficult.

Second, EPA finds that despite the lack of consistent monitoring data, receiving water impacts are likely due to the discharge of toxic pollutants from POTWs (although the relative role of pretreatment POTWs in causing such impacts could not be ascertained). Water quality criterion exceedances were predicted for large percentages of reporting POTWs. The fact that PCS reports a much lower percentage of POTWs as not in compliance because of toxic discharges points out the need for States to continue developing water quality standards and the need for coordination at both the State and Federal level regarding the reporting and management of exceedances data.

This leads to the third major finding—available standards against which POTW discharges are judged (and limited) are developed inconsistently across States for each of the media affected by POTW operation (air, water, and sludge). Significant nationwide reductions in toxic discharges can be expected once appropriate standards for receiving media are developed and implemented consistently among States. Water quality standards for toxic pollutants currently are being developed by EPA for those States that do not have appropriate standards and are not developing them. Air standards are limited to mercury and beryllium; no effective standards exist for VOCs, and none are being developed. Sludge standards are in the process of being developed.

There are more State standards and more data for toxic metals than for toxic organic compounds. States are likely to have targeted metals for their standards development efforts because they found metals more pervasive as well as easier and cheaper to analyze.

Finally, this chapter and those preceding it point out that the only feasible method of reducing the release of toxic pollutants from POTWs is to reduce their input to POTWs—either through pretreatment or through pollution prevention activities at the source. Unless toxic pollutants are readily and quickly degraded in a POTW, they are either discharged in effluent, enter into sludge, or volatilize. Pollutants that are removed from the wastewater through volatilization or partitioning to sludge are only changing the exposure pathway by which they enter the environment. The release of persistent, toxic compounds into the environment, no matter what the receiving medium, only contributes to a problem that must eventually be addressed.

During this study, EPA found that the major environmental effects of POTW operation (to the extent that the effects could be evaluated) appear to occur in the aquatic environment. Information on worker health and safety, as well as the small estimate of increased cancer deaths nationwide, suggests that VOC emissions from POTWs are not as serious a problem as aquatic discharges. At this time, there are insufficient data on which to base any conclusions about sludge disposal. EPA's ongoing rule-making activities to develop technical sludge criteria should enable the Agency to fill the relative absence of data on this exposure pathway.

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7. EFFECTIVENESS OF THE NATIONAL PRETREATMENT PROGRAM

This chapter evaluates the extent to which the National Pretreatment Program, as currently conceived and implemented, has been successful in achieving the objectives of the Clean Water Act (CWA). The discussion assesses the program's effectiveness in two ways: by focusing on the process and procedures associated with implementing the program and by addressing the effectiveness of the program in reducing or preventing toxic pollutant discharges to publicly owned treatment works (POTWs). In evaluating the strengths and weaknesses of the current program, this chapter supports the identification and consideration of alternative regulatory strategies given in Chapter 8.

A comprehensive evaluation of the National Pretreatment Program necessitates both an understanding and an analysis of how the program is currently being implemented. Section 7.1 examines the current scope and coverage of the program. This section evaluates whether the program covers those POTWs whose size or industrial discharges make them likely to receive toxic pollutants in quantities that could affect treatment plant operations or the environment. It also examines the extent to which the program addresses those industries known to discharge toxic pollutants and the pollutants being discharged. Section 7.2 evaluates the effectiveness with which POTWs have implemented the requirements of the National Pretreatment Program. Because successful program implementation is key to achieving the CWA's objectives, this evaluation provides an indirect measure of overall program effectiveness. Section 7.3 examines the effectiveness of POTWs in achieving the environmental objectives of the program and the CWA. Section 7.4 concludes the chapter by summarizing major findings.

7.1 ASSESSMENT OF THE SCOPE OF THE NATIONAL PRETREATMENT PROGRAM

This section assesses the coverage of POTWs, industrial dischargers, and pollutants by the National Pretreatment Program.

7.1.1 POTWs Covered by Pretreatment Programs

One critical measure of the National Pretreatment Program's effectiveness is the extent to which the program regulates the POTWs that <u>should</u> be regulated because of their size, the nature of their industrial community, or the impact of their discharge on the environment. This subsection examines the extent to which the program currently covers such POTWs. Although EPA believes that most of the POTWs that should be regulated are already subject to pretreatment requirements, some POTWs should be evaluated for the need to develop an approved pretreatment program because of the nature of their industrial discharges.

The General Pretreatment Regulations (40 *CFR* 403.8) require the following POTWs to develop local pretreatment programs:

- POTWs with a total design flow greater than 5 million gallons per day (mgd) that receive discharges from industrial users that cause pass through or interference, or are otherwise subject to pretreatment standards, unless the State exercises its option to assume local responsibilities under 40 *CFR* 403.10(e)
- POTWs with a design flow of 5 mgd or less if the nature of their industrial influent, treatment plant upsets, violations of POTW permit limits, contamination of municipal sludge, or other circumstances so warrant in order to prevent interference or pass through.

Within this regulatory framework, some U.S. Environmental Protection Agency (EPA) Regions and States have established specific criteria for the development of local pretreatment programs. North Carolina, for example, requires any POTW, regardless of its size, that receives discharges from a categorical or other significant industrial user to develop and implement a program. Wisconsin, on the other hand, does not require POTWs with flows less than 5 mgd that have categorical industries to develop local programs; rather, the State itself regulates categorical industries at such POTWs.

By early 1990, 1,442 local pretreatment programs, covering 2,015 individual treatment plants, had been approved by EPA Regions and States. In addition, the "403.10(e) States" of Alabama, Connecticut, Mississippi, Nebraska, and Vermont (where pretreatment requirements are implemented by States rather than local POTWs) were regulating industrial discharges to approximately 314 treatment plants. An additional 100 local programs, covering 113 treatment plants, were under development in response to EPA Region and State requirements.

7.1.1.1 Relationship Between POTW Size and Program Coverage

EPA found that most large POTWs are covered by the National Pretreatment Program. Although only 10 percent of the Nation's POTWs are subject to the program, these POTWs provide more than 82 percent of the Nation's municipal wastewater treatment capacity. Of the nearly 1,000 treatment plants with design flows exceeding 5 mgd, 893 (89 percent) are currently covered by local or State-run programs or are now in the process of developing a local program. The remaining 11 percent (105 POTWs) receive only small industrial contributions.

7.1.1.2 Relationship Between Industrial Contributions and Program Coverage

Most POTWs that receive significant quantities of their wastewater from industrial sources are covered by the National Pretreatment Program. Table 7-1 lists industrial contributions to pretreatment and nonpretreatment POTWs, based on flow data reported in the 1988 NEEDS survey.[1] The table shows that more than half of the pretreatment POTWs receive at least 5 percent industrial flow. It also indicates that a substantial portion of POTWs not covered by an approved pretreatment program (nearly 86 percent) does not receive any industrial discharges. The table also shows that 147 treatment plants, which are reported to receive more than 50 percent of their flow from commercial and industrial sources, are not covered by either a local or a State-run (403.10[e] State) pretreatment program. These tend to be small treatment plants, with an average design flow of about 1 mgd. (In areas where industrial users [IUs] discharge to POTWs that do not have an approved pretreatment program, it is the responsibility of either the approved State or EPA Region to regulate the IU directly to ensure compliance with all applicable pretreatment requirements.)

In addition, the POTWs that receive the largest amounts of toxic chemicals are covered by the pretreatment program. As described in Chapter 3, EPA's Toxic Release Inventory (TRI) provides information on the amounts of specific toxic chemicals that are estimated to be discharged to POTWs by certain types of industrial facilities. Table 7-2 lists those POTWs reported to have received over 1 million pounds of toxic chemicals in 1988. Of the 73 POTWs listed in Table 7-2, 65 (covering a total of 154 treatment plants) are covered by local (64 programs, 153 plants) or State-run (1 plant) programs; another 3 (covering 3 plants) are currently required to develop local programs. Altogether, the 153 treatment plants operated by the 64 approved local programs received two-thirds (460 million pounds) of the nearly 690 million pounds of toxic chemicals reported to have been discharged to all treatment plants. Five POTWs, which together received 15,400,000 pounds (2.2 percent of TRI-reported discharges), do not have pretreatment programs and may not be required to do so.

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1. NEEDS reports industrial flow (including flow for noncategorical industries) and POTW design flow based on POTW self-reporting.

Table 7-1. Industrial Discharges to Pretreatment and Other POTWs

Percent of Total Treatment Plant Flow Reported as Being Industrial Flow[3]	Pretreatment POTWs[1]			Nonpretreatment POTWs[2]		
	Treatment Plants		Average Daily Flow Rate per Treatment Plant (mgd)	Treatment Plants		Average Daily Flow Rate per Treatment Plant (mgd)
	Number	Percentage		Number	Percentage	
0	674	32.1	4.3	8,645	85.8	0.32
0< - ≤5	216	10.3	11.7	252	2.5	1.31
5< - ≤10	204	9.7	13.6	263	2.6	1.10
10< - ≤25	499	23.8	17.1	513	5.1	1.02
25< - ≤50	363	17.3	12.8	257	2.5	0.93
>50	142	6.8	6.3	148	1.5	1.2
Total	2,098	100.0	10.6	10,078	100.0	0.43

1. POTWs covered by approved local pretreatment programs, POTWs with local programs under development, and POTWs in Alabama, Connecticut, Mississippi, Nebraska, and Vermont with industrial users regulated by the States.
2. All other POTWs.
3. Includes categorical and noncategorical industries.

Source: NEEDS '88 for design flow information (from POTW self-reporting); POTWs represented are those in both NEEDS '88 and PCS with design flow information.

Table 7-2. Pretreatment Status of POTWs Receiving the Largest Amounts of Toxic Chemicals, 1988

State	Pretreatment Status	Number of Plants	POTW*	Estimated Million Pounds Per Year**
AZ	L	1	Mesa	2.0
	L	2	Phoenix	2.6
CA	L	4	Los Angeles (city)	4.4
	L	11	Los Angeles County S.D.	32.6
CO	L	1	Sterling	1.2
CT	S	1	Naugatuck	1.5
DE	L	1	Wilmington	2.0
FL	R	1	Bay County (Panama City)	8.3
	R	1	Port St. Joe	6.2
GA	L	1	Dalton	1.7
	L	3	Macon/Bibb County (Macon)	2.5
IA	L	1	Cedar Rapids	3.3
	L	1	Sioux City	1.4
IL	L	7	Chicago MSD	13.7
	L	1	Sauget	39.5
	R	1	Wood River	1.8
IN	L	1	Hammond Sanitary District	2.3
	L	2	Indianapolis	4.8
	L	1	Kokomo	2.9
KS	L	5	Kansas City	2.5
KY	L	9	Louisville/Jefferson County MSD (Louisville)	1.2
LA	—	1	Saint Martinville	3.4
MA	L	1	Fall River	1.0
	L	1	Holyoke	3.0
	L	2	Massachusetts Water Resources Authority (Boston)	1.3
	L	1	Springfield	5.7
	—	1	Templeton WWTF (Baldwinville)	1.1
	L	1	Upper Blackstone (Millbury)	2.0
MD	—	1	Upper Potomac River (Westernport)	2.7
ME	L	1	Hartland	1.6
MI	L	1	Detroit	6.3
	L	1	Kalamazoo	3.8
	L	2	Muskegon County	3.7
MN	L	11	Metropolitan Waste Control Commission (Minneapolis/St. Paul)	2.6
	L	1	Western Lake Superior (Duluth)	2.3
MO	L	1	St. Joseph	3.9
	L	15	St. Louis MSD	64.8
	L	2	Springfield	1.0
NC	L	2	Gastonia	1.2
NJ	L	1	Joint Meeting of Essex and Union (Elizabeth)	1.1

Table 7-2. Pretreatment Status of POTWs Receiving the Largest Amounts of Toxic Chemicals, 1988 (continued)

State	Pretreatment Status	Number of Plants	POTW*	Estimated Million Pounds Per Year**
NJ	L	1	Linden-Roselle S.A. (Linden)	7.1
	L	1	Bergen County Utility Authority (Little Ferry)	2.5
	L	7	Passaic Valley Sewerage Commission (Newark)	33.2
	L	1	Rahway Valley Sewage Authority	6.9
	L	1	Middlesex County Utility Authority (Sayreville)	7.6
NY	L	1	Binghamton-Johnson CityJoint S.D. (Binghamton)	3.0
	L	1	Buffalo Sewer Authority	1.5
	L	1	Glens Falls	3.0
	L	3	Monroe County (Rochester)	1.2
	L	1	Niagara Falls	1.6
	L	4	Onondaga County (Syracuse)	4.6
	L	1	Orangetown Sewer District No. 2	2.5
	L	1	Rensselaer County (Troy)	3.9
OH	L	4	Hamilton County MSD (Cincinnati)	11.8
	L	1	Middletown	2.0
	L	4	Northeast Ohio Regional S.D. (Cleveland)	1.2
	L	1	Toledo	1.1
	L	1	Youngstown	1.9
OR	—	1	St. Helens	6.4
PA	L	1	Erie	3.8
	L	3	Philadelphia	7.9
PR	L	2	P.R. Aqueducts and Sewer Authority - PRASA (Barceloneta/Ponce)	6.7
RI	L	1	Blackstone Valley District (East Providence)	1.5
TN	L	1	Chattanooga	1.1
	L	2	Memphis	21.5
TX	—	1	Cactus	1.8
	L	1	Fort Worth	1.4
	L	4	Gulf Coast Waste Disposal (Pasadena)	35.4
VA	L	1	Hopewell	35.3
	L	1	Lynchburg	1.0
WI	L	1	Green Bay MSD	2.3
	L	2	Milwaukee MSD	16.8
WV	L	1	South Charleston	2.8

L = Approved local pretreatment program.
R = Local pretreatment program required by EPA or State approval authority, but not yet approved.
S = State-run program regulates industrial users at POTW.
— = Not covered by local or State-run pretreatment program.
* = Location of POTW is in parenthesis if different from municipal entity name.
** = Rounded to nearest 100,000 pounds.

Source: Toxic Release Inventory. POTWs listed are those to which industrial facilities reported discharging over 1,000,000 pounds of toxic chemicals in 1988.

7.1.1.3 Relationship Between Environmental Quality and Program Coverage

The pretreatment program's goal of preventing interference and pass through establishes a link with the CWA's broader environmental goals. Pursuant to Section 304(l) of the CWA, EPA or States were required to identify those waters (or stream segments) that are not expected to attain water quality standards or the designated beneficial use after technology-based requirements are met, due entirely or substantially to discharges from point sources of toxic pollutants. For each such stream segment, EPA or States were to list the point sources discharging the toxic pollutant(s) believed to be preventing or impairing water quality.[2] EPA has identified 254 POTW treatment plants that discharge to surface waters that are impaired because of point source discharges of toxic pollutants. Of these 254 plants, 170 have approved pretreatment programs in place. EPA or approved States are required to develop individual control strategies (National Pollutant Discharge Elimination System [NPDES] permits) for such point sources that will provide for compliance with applicable water quality standards within 3 years of establishment of the individual control strategy.

EPA Regions and States are continuing to identify POTWs with a need for pretreatment programs. Currently, about 100 local programs are being developed. It is likely, however, that additional POTWs, such as the 84 POTWs that are not covered by pretreatment programs and that have been identified by EPA as causing nonattainment of water quality standards, should be required to implement local pretreatment programs. To the extent that industrial discharges at treatment plants contribute to pass through or interference, EPA Regions and States will target such plants for pretreatment programs.

7.1.2 Industries and Pollutants Regulated by the National Pretreatment Program

Another measure of National Pretreatment Program effectiveness is the ability of the program to identify those industries known to discharge toxic pollutants to POTWs and to regulate those discharges and pollutants. Although the National Pretreatment Program is designed to regulate all nondomestic users nationwide, in practice the efforts of most POTWs, as well as EPA Regions and States, focus on categorical industrial users (CIUs) and other significant industrial users (SIUs). (Chapters 3 and 5 describe in detail these

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2. Development of these lists of stream segments and POTWs varies on a State-to-State basis according to the manner in which States develop water quality standards, assign designated uses, and identify impaired uses.

two classes of industrial users.) It is estimated that approximately 30,000 categorical and other significant industrial users are controlled by pretreatment POTWs and States.

Chapter 3 of this report discussed the industries and industrial categories that are, or have the potential to be, sources of toxic discharges to POTWs. For the 47 industrial categories (and subcategories) examined previously, Table 7-3 provides the number of categories known to discharge each of the 126 priority pollutants. It should be noted, however, that not all facilities in a category discharge the same pollutants and that some facilities and categories discharge very small amounts of some pollutants. Table 7-3 does not indicate the relative magnitude of discharges; rather, it indicates only the known presence of priority pollutants in industrial discharges. As can be seen from the comparison of the first two columns of this table, toxic pollutants, both metals and organics, are discharged to POTWs by many more industries than are currently regulated by national categorical standards.

EPA has devoted resources to developing standards for those industrial categories known to discharge large amounts of toxic pollutants on a national basis (e.g., electroplating, metal finishing, organic chemicals). Relatively fewer resources have been devoted to industries and categories that may be important on a local level but are of less concern nationally. (It should be noted that Congress acknowledged that limitations in resources would require EPA to exercise discretion in determining which pollutants should be covered by national standards [House Conference Report, 95th Congress, first session, No. 95-830, p. 85].)

The pretreatment program provides that POTWs (or States in some cases) not only apply national standards promulgated by EPA, but also develop and implement local limits, as necessary, to provide additional control where national standards are inadequate to prevent pass through or interference at their facilities or to regulate other industries and pollutants of local concern. Local limits are driven by applicable sludge standards and by permit limits (NPDES permits and, in some cases, sludge disposal permits), as well as by specific prohibitions outlined in the General Pretreatment Regulations (e.g., the protection of worker health and safety). The POTW's NPDES permit limits for toxic pollutants are, in turn, driven by EPA's secondary treatment requirements and by the application of pertinent environmental standards (primarily State or Federal surface water or sludge standards), which are translated into specific requirements for the POTW. Table 7-3 shows the number of States that have established water quality standards (for one or

Table 7-3. Priority Pollutants Discharged and Regulated at POTWs Covered by the National Pretreatment Program

Pollutants[1]	Number of Industrial Categories[2]		Number of States With Water Quality Standards[5]	Proposed Federal Sludge Standards (40 *CFR* 503)[6]	Percentage of Pretreatment POTWs	
	Discharging to POTWs[3]	With Categorical Standards[4]			Limits in NPDES Permits[7]	Local Limits[8]
Acenaphthene	u[9]	2 (3)	16		<1	<1
Acrolein	8	1 (2)	17		0	0
Acrylonitrile	12	1 (2)	17		<1	0
Benzene	28	2 (3)	21	x	<1	<2
Benzidine	4	1 (2)	23		<1	1
Carbon Tetrachloride	12	2 (3)	20		<1	1
Chlorobenzene	22	2 (2)	18		<1	0
1,2,4-Trichlorobenzene	14	2 (3)	8		<1	<1
Hexachlorobenzene	2	3 (2)	19	x	<1	<1
1,2-Dichloroethane	18	2 (3)	20		<1	0
1,1,1-Trichloroethane	37	2 (5)	19		<1	0
Hexachloroethane	4	2 (2)	17		<1	0
1,1-Dichloroethane	12	2 (3)	1		0	0
1,1,2-Trichloroethane	11	2 (3)	18		<1	0
1,1,2,2-Tetrachloroethane	7	1 (3)	19		<1	0
Chloroethane	2	2 (2)	1		0	0
Bis (2-Chloroethyl) Ether	6	1 (3)	17		<1	0
2-Chloroethyl Vinyl Ether	2	1 (2)	5		0	0
2-Chloronaphthalene	5	1 (2)	4		0	0
2,4,6-Trichlorophenol	3	3 (3)	19		0	<1
Para-Chloro-Meta Cresol	8	1 (3)	16		<1	0
Chloroform (Trichloromethane)	29	2 (5)	22		1.1	2
2-Chlorophenol	3	1 (4)	20		<1	0
1,2-Dichlorobenzene	18	2 (3)	18		<1	0

Table 7-3. Priority Pollutants Discharged and Regulated at POTWs Covered by the National Pretreatment Program (continued)

Pollutants[1]	Number of Industrial Categories[2] Discharging to POTWs[3]	Number of Industrial Categories[2] With Categorical Standards[4]	Number of States With Water Quality Standards[5]	Proposed Federal Sludge Standards (40 *CFR* 503)[6]	Percentage of Pretreatment POTWs: Limits in NPDES Permits[7]	Percentage of Pretreatment POTWs: Local Limits[8]
1,3-Dichlorobenzene	9	2 (3)	18		0	0
1,4-Dichlorobenzene	11	2 (3)	19		0	0
3,3-Dichlorobenzidine	3	1 (2)	15		0	0
1,1-Dichloroethylene	11	2 (4)	19		<1	0
1,2-Trans-Dichloroethylene	u[9]	2 (2)	9		<1	0
2,4-Dichlorophenol	15	1 (3)	20		<1	0
1,2-Dichloropropane	5	2 (2)	6		0	0
1,3-Dichloropropylene (1,3-Dichloropropene)	u[9]	2 (2)	17		0	0
2,4-Dimethylphenol	12	2 (2)	14		0	0
2,4-Dinitrotoluene	4	1 (3)	16		0	0
2,6-Dinitrotoluene	3	1 (3)	7		<1	0
1,2-Diphenylhydrazine	1	1 (4)	16		0	0
Ethylbenzene	35	2 (5)	18		<1	1
Fluoranthene	u[9]	2 (3)	17		<1	1
4-Chlorophenyl Phenyl Ether	u[9]	1 (2)	3		0	0
4-Bromophenyl Phenyl Ether	u[9]	1 (2)	4		0	0
Bis (2-Chloroisopropyl) Ether	1	1 (2)	15		<1	0
Bis (2-Chloroethoxy) Methane	1	1 (2)	3		<1	0
Methylene Chloride (Dichloromethane)	39	2 (5)	17		<1	0
Methyl Chloride (Chloromethane)	u[9]	2 (3)	16		<1	4.5
Methyl Bromide (Bromomethane)	2	1 (2)	15		0	0
Bromoform (Tribromomethane)	4	1 (2)	19		0	<1
Dichlorobromomethane	u[9]	1 (3)	19		<1	<1

Table 7-3. Priority Pollutants Discharged and Regulated at POTWs Covered by the National Pretreatment Program (continued)

Pollutants[1]	Number of Industrial Categories[2]: Discharging to POTWs[3]	Number of Industrial Categories[2]: With Categorical Standards[4]	Number of States With Water Quality Standards[5]	Proposed Federal Sludge Standards (40 *CFR* 503)[6]	Percentage of Pretreatment POTWs: Limits in NPDES Permits[7]	Percentage of Pretreatment POTWs: Local Limits[8]
Chlorodibromomethane	u[9]	1 (2)	17		<1	<1
Hexachlorobutadiene	3	2 (2)	20	x	<1	<1
Hexachlorocyclopentadiene	2	1 (2)	18		<1	<1
Isophorone	8	1 (4)	17		<1	0
Naphthalene	24	3 (5)	8		<1	1
Nitrobenzene	11	2 (2)	18		0	0
2-Nitrophenol	5	2 (3)	6		0	0
4-Nitrophenol	4	2 (3)	7		0	0
2,4-Dinitrophenol	1	1 (2)	17		0	0
4,6-Dinitro-O-Cresol	1	2 (2)	14		0	0
N-Nitrosodimethylamine	u[9]	1 (2)	16	x	0	0
N-Nitrosodiphenylamine	2	1 (4)	15		<1	<1
N-Nitrosodi-N-Propylamine	2	1 (2)	8		<1	0
Pentachlorophenol	16	3 (4)	27		<1	2
Phenol	33	5 (4)	33		1	0
Bis (2-Ethylhexyl) Phthalate	22	2 (5)	23	x	<1	1.5
Butyl Benzyl Phthalate	20	1 (4)	12		<1	1
Di-N-Butyl Phthalate	17	2 (5)	22		<1	<1
Di-N-Octyl Phthalate	9	1 (2)	10		0	0
Diethyl Phthalate	16	2 (3)	21		<1	1
Dimethyl Phthalate	12	2 (2)	22		<1	<1
Benzo(a)anthracene (1,2-Benzanthracene)	u[9]	1 (2)	15		0	0
Benzo(a)pyrene (3,4-Benzopyrene)	1	2 (3)	16	x	0	0

Table 7-3. Priority Pollutants Discharged and Regulated at POTWs Covered by the National Pretreatment Program (continued)

Pollutants[1]	Number of Industrial Categories[2]		Number of States With Water Quality Standards[5]	Proposed Federal Sludge Standards (40 *CFR* 503)[6]	Percentage of Pretreatment POTWs	
	Discharging to POTWs[3]	With Categorical Standards[4]			Limits in NPDES Permits[7]	Local Limits[8]
3,4-Benzofluoranthene	u[9]	1 (3)	15		0	0
Benzo(k)fluoranthane (11,12-Benzofluoranthene)	1	1 (3)	15		0	0
Chrysene	2	1 (3)	15		<1	<1
Acenaphthylene	3	1 (3)	14		0	0
Anthracene	7	2 (5)	15		0	0
Benzo(ghi)perylene (1,12-Benzoperylene)	1	1 (3)	15		0	0
Fluorene	5	2 (3)	14		0	0
Phenanthrene	5	2 (5)	15		0	<1
Dibenzo(A,H)Anthracene (1,2,5,6-Dibenzanthracene)	u[9]	1 (3)	16		0	0
Indeno (1,2,3-CD) Pyrene (2,3-o-Phenylenepyrene)	1	1 (3)	15		0	0
Pyrene	4	2 (3)	15		<1	<1
Tetrachloroethylene	24	3 (5)	20		<1	2.5
Toluene	43	2 (6)	20		<1	2.5
Trichloroethylene	26	2 (5)	20	x	<1	2
Vinyl Chloride (Chloroethylene)	6	2 (2)	19		<1	3
Aldrin	u[9]	1 (2)	40	x	<1	<1
Dieldrin	u[9]	1 (2)	39	x	<1	<1
Chlordane (technical mixture & metabolites)	1	1 (2)	38	x	<1	1
4,4-DDT	u[9]	1 (2)	37	x	<1	<1
4,4-DDE (p,p-DDX)	u[9]	1 (2)	17	x	0	0
4,4-DDD (p,p-TDE)	u[9]	1 (2)	18	x	<1	0

Table 7-3. Priority Pollutants Discharged and Regulated at POTWs Covered by the National Pretreatment Program (continued)

Pollutants[1]	Number of Industrial Categories[2]		Number of States With Water Quality Standards[5]	Proposed Federal Sludge Standards (40 *CFR* 503)[6]	Percentage of Pretreatment POTWs	
	Discharging to POTWs[3]	With Categorical Standards[4]			Limits in NPDES Permits[7]	Local Limits[8]
Alpha-Endosulfan	u[9]	1 (2)	36		<1	0
Beta-Endosulfan	u[9]	1 (2)	36		<1	0
Endosulfan Sulfate	u[9]	1 (3)	23		<1	<1
Endrin	2	1 (3)	41		<1	2
Endrin Aldehyde	u[9]	1 (3)	13		0	0
Heptachlor	3	1 (2)	37	x	<1	1
Heptachlor Epoxide	1	1 (2)	16		<1	0
Alpha-BHC (Hexachlorocyclohexane)	2	1 (2)	19		<1	<1
Beta-BHC	1	1 (2)	19		<1	0
Gamma-BHC (Lindane)	u[9]	1 (2)	38	x	<1	1
Delta-BHC	1	1 (2)	7			0
PCB-1242 (Arochlor 1242)	5	1 (3)	40	x	1.1	0
PCB-1254 (Arochlor 1254)	5	1 (3)	40	x	1.1	0
PCB-1221 (Arochlor 1221)	5	1 (3)	40	x	1.1	0
PCB-1232 (Arochlor 1232)	5	1 (3)	40	x	1.1	0
PCB-1248 (Arochlor 1248)	5	1 (3)	40	x	1.1	0
PCB-1260 (Arochlor 1260)	5	1 (3)	40	x	1.1	0
PCB-1016 (Arochlor 1016)	5	1 (3)	40	x	1.1	0
Toxaphene	u[9]	1 (2)	41	x	0	1.5
Antimony (total)	36	5	19		<1	6.5
Arsenic (total)	28	5	42	x	3.7	72.5
Asbestos (fibrous)	4	1	9		0	<1
Beryllium (total)	10	2	24	x	<1	10.5
Cadmium (total)	31	8	43	x	13.4	93

Table 7-3. Priority Pollutants Discharged and Regulated at POTWs Covered by the National Pretreatment Program (continued)

Pollutants[1]	Number of Industrial Categories[2]		Number of States With Water Quality Standards[5]	Proposed Federal Sludge Standards (40 *CFR* 503)[6]	Percentage of Pretreatment POTWs	
	Discharging to POTWs[3]	With Categorical Standards[4]			Limits in NPDES Permits[7]	Local Limits[8]
Chromium (total)	42	17	45	x	9.5	84.5
Copper (total)	45	11	39	x	15.7	97.5
Cyanide (total)	31	12	42		8.7	81
Lead (total)	39	14	43	x	13.2	93
Mercury (total)	27	4	43	x	10.4	75.5
Nickel (total)	41	10	34	x	10.9	92
Selenium (total)	27	3	45	x	1.7	34.5
Silver (total)	27	7	44		5.8	12.5
Thallium (total)	3	1	19		<1	3.5
Zinc (total)	44	17	40	x	15	92
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)	u[9]	3	19		0	0

1. For pollutants regulated in different permits as different compounds, the total includes only the compounds appearing most frequently in NPDES permits.
2. Industries are described in Chapter 3 (47 categories in total).
3. Sources: EPA (1986), TRI, and EPA's Industrial Technology Division (see Chapter 3).
4. Number of categories for which pollutants are regulated as part of a Total Toxic Organic (TTO) standard rather than a pollutant-specific standard are in parentheses.
5. Source: EPA, 1990c. Includes States with freshwater, marine, human health, and/or other standards.
6. Source: 54 *Federal Register* 5746 et seq.
7. Source: PCS. Also see note 1.
8. Source: (see Chapter 5.) Percentages are based on an examination of local limits for 200 POTWs. Percentages do not account for the 10.5 percent of pretreatment POTWs that are estimated to have no numeric local limits.
9. u = unknown. Small quantities have been detected in those categories for which EPA has established a pollutant-specific standard or a TTO standard.

more types of surface waters or effects) for each priority pollutant. It also identifies those pollutants that are proposed for regulation under the draft technical standards for sludge use and disposal (see proposed 40 *CFR* Part 503). As can be seen, less than half of the States have standards for most toxic organic pollutants, even pollutants (such as benzene and toluene) that are discharged by many industrial facilities and categories. Most States do have water quality standards for pesticides (which are contributed more by nonindustrial sources, including nonpoint sources, than by industrial sources), polychlorinated biphenyls, and metals.

In addition, Table 7-3 shows that relatively few NPDES permits issued to pretreatment POTWs contain chemical-specific limits for toxic pollutants. Most permits contain narrative restrictions, such as no toxics in toxic amounts, and some permits contain whole effluent toxicity limits. The absence of numeric limits is particularly noticeable for toxic organics. According to EPA's Permit Compliance System (PCS), less than 2 percent of pretreatment POTWs are subject to limits for any single toxic organic pollutant. Limits on metals are somewhat more common, although less than 16 percent of pretreatment POTWs are subject to limits on copper, which is the priority pollutant most commonly limited in NPDES permits. Since the regulatory definitions of pass through and interference (the environmental basis for the program) are tied to the POTW's NPDES permit limits, the general lack of toxic limits in permits restricts the POTW's basis for developing local limits.

To address local interference and pass through problems, the POTW must establish local limits. Table 7-3 shows the percentage of POTWs (out of a sample of 200 POTWs known to have local limits) with numerical local limits for specific priority pollutants. Although relatively few POTWs have local limits for toxic organics, most POTWs place limits on metals and cyanide (about 80 percent of POTWs have local limits for six metals). In large part, this is due to EPA's local limits policy issued in 1985 and extensive guidance issued in 1987, which promoted local limits, particularly for metals, cyanide, and other pollutants of particular concern, based on their widespread occurrence in POTW influent and effluent and their potential for causing adverse effects on POTW operations. As noted in Table 7-3, many POTWs have developed local limits covering more toxic pollutants than they themselves are regulated for in their NPDES permit (e.g., cadmium, lead, and chromium).

Commercial and domestic sources may also be major contributors of toxic pollutants. As industrial users reduce their pollutant loadings, toxic pollutants from commercial and domestic sources may become more significant. Beyond any improvements that may be made in the coverage of major industries and pollutants currently being addressed, the regulation by POTWs of other nondomestic users currently not considered significant sources of toxic pollutants may reduce pollutants further. The flexibility of the National Pretreatment Program allows POTWs to address local environmental concerns themselves. Each POTW has the ability to tailor its pretreatment program to reflect site-specific circumstances, but local POTWs are sometimes constrained by a lack of permit limits on which to base the development of local limits.

7.2 PROGRAM IMPLEMENTATION

This section evaluates the implementation status of the National Pretreatment Program at the local level, at the State level in cases where the State implements the program, and at the EPA level. Implementation activities include identifying industries discharging toxic pollutants, issuing control mechanisms, inspecting and sampling the industries, and taking enforcement actions where necessary to obtain compliance. Such activities are necessary to achieve reductions in the discharge of toxic pollutants to POTWs.

7.2.1 POTW Pretreatment Programs

EPA and the States monitor implementation of local POTW pretreatment programs using three tools: annual pretreatment compliance inspections (PCIs), program audits, and annual reports. A PCI evaluates the POTW's compliance monitoring and enforcement program. It usually lasts for 1 day and may include inspections or visits to local industrial users. An audit, in contrast, is more detailed than the PCI and is conducted less frequently, usually once every 5 years. An audit, which examines all aspects of the POTW's pretreatment program, may take 1 to 3 days and includes interviews with local officials, file reviews, and industrial site visits. POTWs are also required to submit, at a minimum, annual reports on program performance that summarize the POTWs' program activities. Some EPA Regions and the States require these reports to be submitted more frequently.

Information collected from these activities is entered into EPA's Permit Compliance System (PCS). As described in Chapter 2, the PCS data base has 65 discrete data elements pertaining to pretreatment implementation. Most of the data fields containing these elements are blank since data entry is required for only 15 of these elements (largely because of resource constraints).

Table 7-4 summarizes the PCS information on 12 programmatic measurements. The data indicate that most SIUs have been issued control mechanisms and have been inspected or sampled. Significant non-compliance (SNC) by SIUs is high compared to the level of SNC for direct dischargers; an estimated 17 percent of the SIUs are in SNC with a discharge limit, a monitoring or reporting requirement, or a compliance schedule as compared to 7 percent for direct dischargers.[3] A document on industrial compliance in the Great Lakes region (IJC, 1989) reported 17 percent of the industries in SNC in four States: Michigan, Ohio, Indiana, and Wisconsin. A General Accounting Office survey (GAO, 1989) of 428 POTWs reported that 41 percent of the industrial users were in violation of one or more of their discharge limits.

When confronted by noncompliance, POTWs rely overwhelmingly on issuing notices of violation and administrative orders. PCS indicates that 84 percent of all pretreatment POTWs have taken such actions. Civil or criminal enforcement actions against noncompliant industries appear to be taken much less frequently. Only 5 percent of POTWs have pursued these enforcement actions. However, this does not necessarily indicate ineffective enforcement; if a POTW issues a large number of notices of violation that effectively obtain compliance, the POTW does not need to initiate civil actions. Another indicator of effective enforcement may be a low percentage of repeat violators, but this type of information generally is not gathered during audits or PCIs or provided in POTW annual reports.

While the PCS data, which provide a measure of programmatic implementation, indicate a high rate of programmatic implementation activity, significant implementation problems persist. Based on audit information, EPA has identified a number of program implementation deficiencies that may comprise the effectiveness of these activities in

3. Based on information from 97.2 percent of the POTWs with approved local programs.

Table 7-4. Status of POTW Program Implementation

Program Activities	Evaluation
Local Limits[1,2]	• 86 percent of POTWs have completed required technical evaluation. • 82 percent have adopted technically based local limits.
Permitting	• 84 percent of SIUs have been issued control mechanisms.[1,3]
Compliance Monitoring	• 90 percent of SIUs have been inspected or sampled.[1,3]
Enforcement	• Total number of SIUs in SNC ranges from 10-17 percent.[1] - SNC with standards and reporting requirements is 10 percent. - SNC with self-monitoring requirements is 4 percent. - SNC with schedule requirements is 3 percent. • 44 percent of POTWs with SIUs in SNC have not published a list of these violators in the local newspaper. • 5 percent of POTWs have taken civil or criminal enforcement actions against noncompliant IUs. • 84 percent of POTWs have issued notices of violation or administrative orders. • 15 percent of POTWs have collected penalties from noncompliant IUs. • 20 percent of POTWs with SIUs in SNC have taken no enforcement actions.

1. Based on information from 97.2 percent of POTWs with approved programs.
2. According to Table 5-10, another data source (PASS) suggests that while the percentage of POTWs with local limits in place is very high (90 percent), the percentage with technically based local limits is about 34 percent.
3. Based on a universe of 30,280 SIUs.

Source: PCS (1990).

reducing toxic discharges. Table 7-5 lists these deficiencies, the most common of which are as follows:

- Correct discharge limits were not applied (i.e., not all the pollutant limits were in the control mechanisms, the wrong categorical standards were in the control mechanisms, or the local limits were not in the control mechanisms). POTWs continue to have difficulty determining whether a particular industrial facility is subject to categorical standards and whether the most stringent limit for a particular pollutant is the categorical standard or the local limit. In addition, they often apply production-based standards incorrectly because of errors in identifying all regulated processes and production levels.
- The sampling location either was not identified in the control mechanism or was incorrect.
- Inspections were not adequately documented, and sampling chain-of-custody procedures were not employed or not completed.
- Samples were not analyzed for all regulated pollutants; inspections were not sufficiently comprehensive to identify all wastestreams containing possible toxic pollutants and to evaluate the adequacy of industrial controls and industrial self-monitoring.
- Sample collection and analytical protocols are improper.
- Enforcement actions are inadequate. POTWs have been reluctant to take stronger enforcement actions because (1) POTWs have traditionally been service-oriented toward industries and in some cases are uncomfortable in the role of regulators, and (2) some have received unenthusiastic enforcement support by local government officials (e.g., city councils, mayors, or district boards) because of possible economic impacts (GAO, 1989).

The Agency has developed guidance for reporting and evaluating POTW noncompliance with pretreatment requirements. This guidance establishes criteria covering five basic areas of POTW program implementation: (1) control mechanisms, (2) inspection and sampling, (3) POTW enforcement, (4) POTW reporting to the approval

Table 7-5. Specific Program Deficiencies Identified in Audits

Program Element	Type of Deficiency[1]
Control Mechanism	• Sampling location not identified • Applicable discharge limits not specified • Standard conditions missing • Sample type not specified • Self-monitoring requirements not present • Reporting requirements not present • Effective and/or expiration dates not specified • Reference to legal authority/ordinance lacking • Other (including no control mechanisms)
Application of Categorical Standards	• Appropriate TTO limitation not applied • Inaccurate, incomplete, or no category/subcategory determinations • Sampling location does not contain all regulated flows or is not representative • Combined wastestream formula not used or used improperly • More stringent limitation (local limits vs. categorical standards) not applied • All categorical industrial users not identified • Appropriate long-term average not applied • Production-based standards not applied or misapplied
Inspections	• Inspections not documented adequately • All categorical and other significant industrial users not inspected • Categorical and other significant industrial users not inspected annually • Inspections not comprehensive
Sampling	• Inadequate chain-of-custody procedures • All categorical and other significant industrial users not sampled • Improper or inadequate parameters sampled • Inadequate sampling frequency • Inadequate sample types • Improper sampling protocols

1. Deficiencies are rank ordered by prevalence.
Source: PASS (1990).

authority, and (5) other requirements. These criteria provide the framework to determine whether the POTW is considered in "reportable non-compliance" (RNC).[4]

With regard to these criteria, recent data from PCS show that:

- Fifteen percent of all 1,442 pretreatment POTWs have failed to issue control mechanisms to 90 percent of their SIUs.
- Twelve percent of pretreatment POTWs have failed to inspect or sample at least 80 percent of their SIUs.
- Twenty-nine percent of pretreatment POTWs have determined that at least 15 percent of their SIUs are in SNC.
- Twenty percent of POTWs with SIUs in SNC have failed to take any enforcement action against their non-compliant SIUs.
- Forty-four percent of POTWs with SIUs in SNC have failed to report those SIUs in the largest local newspaper.

EPA has determined that 44 percent of the Nation's POTWs with approved pretreatment programs meet at least one of the four major RNC criteria. Once a facility is determined to be in RNC, it must be reported on EPA's Quarterly Non-Compliance Report (QNCR). If a facility is on the QNCR for two or more quarters, formal enforcement action must be initiated against the facility.

Various guidance and training activities have addressed these deficiencies. EPA and States actively assist local officials by providing guidance and holding workshops on various aspects of the pretreatment program. EPA's pretreatment guidance documents have increased from 12 in 1985 to 39 in 1990. Table 7-6 lists most, if not all, of these

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4. RNC is defined as failure to take effective action against IUs for instances of pass through and/or interference; failure to submit pretreatment reports (annual report or publication of significant violators) to the approval authority within 30 days of a specified due date; failure to complete a pretreatment implementation compliance schedule milestone within 90 days of a specified due date; failure to issue, reissue, or ratify control mechanisms for at least 90 percent of the SIUs within 180 days of a specified date; failure to conduct a complete inspection or sampling of at least 80 percent of the SIUs; failure to enforce pretreatment standards and reporting requirements; and any other violation of substantial concern to the approval authority. See *FY 1990 Guidance for Reporting and Evaluating POTW Noncompliance With Pretreatment Requirements*. EPA Office of Water Enforcement and Permits, September 1989 (EPA, 1989a).

Table 7-6. Guidance Materials Applicable to the Pretreatment Program

General Guidance Manuals for POTWs

Guidance Manual for POTW Pretreatment Program Development (October 1983)

Guidance Manual for Preparation and Review of Removal Credit Applications (July 1985)

RCRA Information on Hazardous Wastes for POTWs (September 1985)

Environmental Regulations and Technology—The National Pretreatment Program (July 1986)

Pretreatment Compliance Monitoring and Enforcement Guidance (September 1986)

Guidance Manual for the Identification of Hazardous Wastes Delivered to Publicly Owned Treatment Works by Truck, Rail, or Dedicated Pipe (June 1987)

Guidance Manual for Preventing Interference at POTWs (September 1987)

Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program (December 1987)

Non-Consent Decree Categorical Pretreatment Standards (August 1988)

Guidance Manual for Control of Slug Discharges to POTWs (February 1989)

Memorandum: Local Limits Requirements for POTW Pretreatment Programs (August 5, 1989)

Industrial User Permitting Guidance Manual (September 1989)

Guidance for Developing Control Authority Enforcement Response Plans (September 1989)

Overview of Selected EPA Regulations and Guidance Affecting POTW Management (September 1989)

Supplemental Guidance on the Development and Implementation of Local Discharge Limitations Under the National Pretreatment Program (draft) (December 1990)

Guidance Manuals on Application of Categorical Standards

Guidance Manual for Electroplating and Metal Finishing Pretreatment Standards (February 1984)

Guidance Manual for Pulp, Paper, and Paperboard and Builder's Paper and Board Mills Pretreatment Standards (July 1984)

Guidance Manual for the Use of Production-based Pretreatment Standards and the Combined Wastestream Formula (September 1985)

Guidance Manual for Iron and Steel Manufacturing Pretreatment Standards (September 1985)

Guidance Manual for Implementing Total Toxic Organic (TTO) Pretreatment Standards (September 1985)

Guidance Manual for Leather Tanning and Finishing Pretreatment Standards (September 1986)

Guidance Manual for Battery Manufacturing Pretreatment Standards (August 1987)

Categorical Pretreatment Standards Summary (March 1988)

Guidance Manual for Aluminum, Copper, and Nonferrous Metals Forming and Metal Powders Pretreatment Standards (December 1989)

Guidance Manuals for Approval Authorities

Procedures Manual for Reviewing a POTW Pretreatment Program Submission (October 1983)

Guidance Manual for Preparation and Review of Removal Credit Applications (July 1985)

Pretreatment Compliance Inspection and Audit Manual for Approval Authorities (July 1986)

Guidance for Implementing RCRA Permit-by-Rule Requirements at POTWs (July 1987)

Guidance for Reporting and Evaluating POTW Noncompliance With Pretreatment Implementation Requirements (September 1987 and September 1989)

NPDES Compliance Inspection Manual (May 1988) guidance documents. In addition, EPA has issued eight pretreatment bulletins since 1985. The number of workshops held annually by EPA has increased from 3 in 1983 to 46 in 1990. POTWs responding to the GAO survey ranked EPA guidance as one of the most important factors having a positive impact on program implementation and, thus, improving POTW and industrial compliance.

Furthermore, EPA has recently amended the General Pretreatment Regulations (40 *CFR* Part 403) in response to the findings of the Domestic Sewage Study (DSS). These regulatory changes were principally aimed at strengthening the program's control of hazardous waste discharged to sewer systems. However, several of these regulatory provisions, listed below, will also address some of the pretreatment program deficiencies identified previously.

- POTWs with local programs must issue permits or equivalent control mechanisms to SIUs. Control mechanisms must contain, at a minimum, such elements as discharge limits and monitoring and reporting requirements. These changes should improve control over SIU discharges.
- The prohibition against hauled wastes except at designated sites will improve the control of liquid waste haulers, which may be a significant source of unpermitted toxic discharges.
- The requirement to inspect and sample all significant industrial users annually will improve POTW control of the discharges from regulated industrial users.
- The requirement that local officials commit their enforcement procedures and protocols to writing in an enforcement response plan is expected to promote more timely and consistent enforcement actions. Once approved by EPA or approved States, the enforcement response plan becomes an enforceable part of the POTW's local program. At this time, only two States have provided information in PCS on the status of POTW enforcement response plans for a majority of their POTWs. Kentucky indicates that 10 percent of its POTWs have such plans, and Illinois reports that 42 percent of its POTWs have them.[5]

7.2.2 States as Control Authorities

Under 40 *CFR* 403.10(e), States may assume responsibility for carrying out the requirements of the National Pretreatment Program in lieu of requiring POTWs to develop local programs. Five States—Alabama, Connecticut, Mississippi, Nebraska, and

5. States are not required to enter information on enforcement response plans in PCS. This information is not available for about 91 percent of the POTWs.

Vermont—administer the National Pretreatment Program at the State, rather than the local, level. EPA recently audited these State-run programs. The Agency believes that the effectiveness of these programs is generally comparable to locally administered programs. The States used NPDES permitting-type procedures to regulate both categorical and noncategorical industries, inspected and sampled industrial users, and imposed penalties for violations with nearly the same frequency as locally administered programs.

The audited State programs were generally less effective than POTWs in some respects. States had not developed technically based local limits to cover discharges to individual POTWs, although local factors were taken into account in developing some individual permits. The States were less likely than POTWs to use formal enforcement procedures, such as administrative orders or notices of violation. States failed to publish the names of significant violators in local newspapers. Compared to locally run programs, State-run programs also regulated a lower proportion of noncategorical SIUs compared to total SIUs.

Some States run the program at both levels. For example, Ohio has required 100 POTWs to run local pretreatment programs. Yet, at smaller POTWs without pretreatment programs, the State regulates categorical industrial users directly. States that regulate some SIUs directly tend to have the same program deficiencies as the 403.10(e) States with regard to developing and applying technically based local limits. The top part of Table 7-7 provides some limited data on the permitting and inspection activities of States for nonpretreatment POTWs and the industrial user compliance status of those industries directly regulated by the States. Most states listed here have issued some type of control mechanism, but several States have difficulty in inspecting all SIUs. This table reflects data contained in PCS and does not reflect the results of the recent audits by EPA.

7.2.3 EPA as the Control Authority

Where a POTW has not been approved to administer a local pretreatment program and the State has not been approved to administer the National Pretreatment Program, EPA remains the control authority. As was indicated in Chapter 3 (Table 3-1), locally run programs regulate far more industrial facilities than EPA. This is particularly true for noncategorical industries; for example, in four of the six EPA Regions for which data were available, no noncategorical SIUs were regulated by EPA. The difference in coverage of

Table 7-7. State and EPA Activities as Control Authorities for Non-Pretreatment POTWs

States as Control Authority: Control of SIUs Discharging to Non-Pretreatment POTWs in States With Approved State Pretreatment Programs

State	SIUs	SIUs in SNC		SIUs Inspected		SIUs With Control Mechanism	
	(No.)	(No.)	(%)	(No.)	(%)	(No.)	(%)
CT[1]	250	60	24	228	91.2	152	60.8
RI	14	0	0	14	100	0	0
VT[1]	14	8	57.1	9	64.3	14	100
NJ	8	3	37.5	0	0	6	75
AL[1]	310	0	0	299	96.5	310	100
MS[1]	117	11	9.4	117	100	117	100
AR	27	1	3.7	1	3.8	0	0
IA	46	7	15.2	23	50	46	100
MO	24	2	8.3	24	100	24	100
UT	4	0	0	0	0	4	100

EPA as Control Authority: Control of SIUs Discharging to Non-Pretreatment POTWs in States Without Approved State Pretreatment Programs

State	SIUs	SIUs in SNC		SIUs Inspected		SIUs With Control Mechanism	
	(No.)	(No.)	(%)	(No.)	(%)	(No.)	(%)
MA	42	0	0	42	100	0	0
ME	16	0	0	0	0	0	0
NH	30	1	3.3	1	3.4	0	0
NY	23	7	30.4	0	0	0	0
PA	16	7	43.7	11	68.8	12	75
FL	8	0	0	5	62.5	8	100
KS	36	10	27.7	36	100	36	100
CO	21	0	0	0	0	21	100
MT	1	0	0	0	0	1	100
ND	10	0	0	0	0	10	100
SD	25	0	0	0	0	25	100
WY	1	0	0	0	0	1	100

1. State-run pretreatment program.

Source: PCS (1990).

noncategorical SIUs is largely due to EPA regional priority on ensuring effective local program implementation.

Again, there are limited data on EPA activities where it is the control authority, but as the information in the bottom part of Table 7-7 indicates, EPA, and unapproved States under agreement with EPA, have not issued control mechanisms to all SIUs nor have they conducted inspections at all SIUs. Also, pretreatment programs at the regional level lack established procedures, such as those under the NPDES system for direct dischargers, for developing and applying effluent limits. (Categorical industries, by contrast, are required by law to identify themselves to regulatory authorities, and their effluent limits are provided in national guidelines.)

Twenty-two States are included in Table 7-7; since all SIUs in Michigan and North Carolina are regulated under local programs, 24 States are represented. Because PCS data are unavailable for the remaining States and coverage may also be incomplete for the States in the table, EPA estimates that the table covers less than half of the SIUs nationwide where EPA or the State is the control authority.

7.2.4 EPA and State Oversight Activities

EPA and approved States have an important oversight role in the National Pretreatment Program. Currently, 27 States have approved pretreatment programs. EPA exercises direct oversight in the remaining 30 States and Territories. Under the CWA, every State that has been authorized to implement the NPDES program was required to obtain, by 1980, authority to administer the National Pretreatment Program as well. Of the 39 NPDES States, 27 have approved pretreatment programs; the 12 with NPDES authority but not pretreatment are:

- Colorado
- Delaware
- Illinois
- Indiana
- Kansas
- Montana
- Nevada
- New York

- North Dakota
- Pennsylvania
- U.S. Virgin Islands
- Wyoming.

The most frequent reason for these States not having assumed pretreatment program responsibilities is inadequate legal authority and resources to administer all aspects of the program. Most of these States do, however, perform some of the required activities. For example, some States, such as Indiana and Kansas, conduct oversight activities through a memorandum of agreement with EPA.

Between 1985 and 1990, EPA and the States performed 3,601 PCIs and audits at 1,328 (92%) of the 1,442 approved POTW pretreatment programs.[6] From July 1, 1989, to June 30, 1990, 70 percent of the POTWs with approved programs were audited or inspected (PCS, 1990).

The Agency's oversight role includes an enforcement component. EPA has conducted two pretreatment enforcement initiatives targeting POTWs. In 1985, it filed civil complaints against 20 POTWs for failure to submit an approvable local pretreatment program. In October 1989, EPA initiated a special pretreatment enforcement initiative in which 61 POTWs were targeted for administrative penalty orders or judicial enforcement for failure to implement their programs. Subsequently, EPA and the States have taken similar action against an additional 37 cities; the Agency is making plans to take enforcement actions against additional cities.

In the past 2 years, the number of pretreatment administrative orders issued by EPA and the States against noncompliant POTWs and industrial users has grown from 261 in fiscal year 1988 to 323 in fiscal year 1989 (EPA, 1990a). During that same time, the number of judicial referrals by States and EPA dropped from 617 in FY 1988 to 405 in FY 1989. The number of administrative penalty orders issued by EPA against POTWs and

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6. Information from two data bases (Pretreatment Audit Summary System [PASS] and PCS) was used to determine the number of audits conducted and number of POTWs audited. It is likely that additional audits and inspections were performed by States and EPA Regions in 1984, 1985, and 1986 than are recorded in either PASS or PCS.

industrial users for pretreatment violations has increased from 1 in 1987 to 42 as of August 1, 1990. The number of civil judicial penalty cases for pretreatment violations filed by EPA since 1987 is 61; approximately half of those cases were against POTWs. Although less frequently used than administrative or civil actions, criminal prosecutions have been taken against industries and POTWs for pretreatment violations 15 times since 1983; 8 of these cases were filed in 1989.

The civil enforcement actions, on average, take approximately 13.5 months to resolve when brought against industrial users and 15.5 months when brought against POTWs. Although some have been resolved in less than a month, the longest case against an industrial user took 43 months and the longest case against a POTW took 51 months. According to EPA internal tracking, the average penalty assessed against POTWs for pretreatment violations since 1984 was $55,000; the average penalty assessed against industries in the same period was slightly higher ($61,000). The Agency has received approximately $2.2 million in penalties from POTWs and about $6.2 million from industries. The total penalty amounts may be underestimated, however, since many pretreatment enforcement actions are often part of larger NPDES enforcement actions.

7.3 Program Performance

This section examines the effectiveness of the National Pretreatment Program in achieving environmental objectives. As previously described, the program's environmental goals are to prevent pass through and interference (including sludge contamination that interferes with sludge disposal options) and to protect worker health and safety. Subsection 7.3.1 discusses reductions of toxic pollutant discharges to POTW influents, effluents, and receiving waters. Subsection 7.3.2 examines changes in pollutant loadings to sludge. Subsection 7.3.3 considers worker health and safety, and Subsection 7.3.4 discusses air.

Four principal factors limited the Agency's ability to evaluate the program's environmental performance:

- "Baseline" data (before pretreatment) are lacking for the late 1970s and early 1980s, because most POTWs had little or no toxic monitoring data before they were required to develop and implement pretreatment programs.
- Existing toxic pollutant monitoring data collected before and after program implementation are stored in manual or electronic form at individual POTWs and are not readily accessible or easily converted into a large national data base.

- EPA's national data base for POTW effluent quality is archived after 6 years. Information in the system is incomplete for many States, particularly in FYs 1984-1986; records before 1984 have been deleted.
- As pointed out in previous chapters, ambient environmental data (particularly for toxic organics) that measure the program's environmental effectiveness are not collected with any consistency.

The above limitations notwithstanding, it is still possible to develop some insights into POTWs' achievement of the objectives of the National Pretreatment Program. EPA took two approaches to arrive at these insights. First, the Agency reviewed environmental data available at POTWs as a result of audits and PCIs, submissions of annual reports and local limits, and the nomination and evaluation process for EPA's pretreatment excellence awards. Unfortunately, none of these activities is designed specifically to obtain environmental data that would support rigorous examination of the program's environmental effectiveness. (PCIs and audits, for example, focus on programmatic activities and ask only two questions regarding environmental effectiveness.)

As an alternative approach, EPA used studies or reports, performed by individual POTWs on an ad hoc basis, that document environmental effectiveness. Because environmental results from such sources are not statistically representative of the 1,442 pretreatment POTWs nationwide, EPA did not extrapolate them to the large population of POTWs or pollutants. Thus, EPA presents them here as illustrative—rather than representative—of pretreatment program effectiveness.

7.3.1 Water Quality

7.3.1.1 Pollutant Concentrations in POTW Influent and Effluent

Measurement of pollutant loadings is perhaps the most direct way to assess the effectiveness of the pretreatment program in reducing pollutant discharges to and from POTWs. However, pollutant loadings are also affected by factors other than pretreatment. Such factors can mask the influence of pretreatment on pollutant loadings to surface waters. Such factors include the following:

- Increase or decrease in flow—Changes in wastewater flow, with no change in pollutant concentration, can result in increased or decreased loadings of pollutants.

- Growth or decline in industrial base—Pollutant loadings can change due to an increase or decrease in the number of industrial dischargers and in the production levels of dischargers.
- Modifications at POTW—Upgrading the treatment processes at the POTW can improve effluent quality even if influent loadings remain the same.

To illustrate some of these factors, the following paragraphs present a few examples documented by POTWs.

Union Sanitary District, California

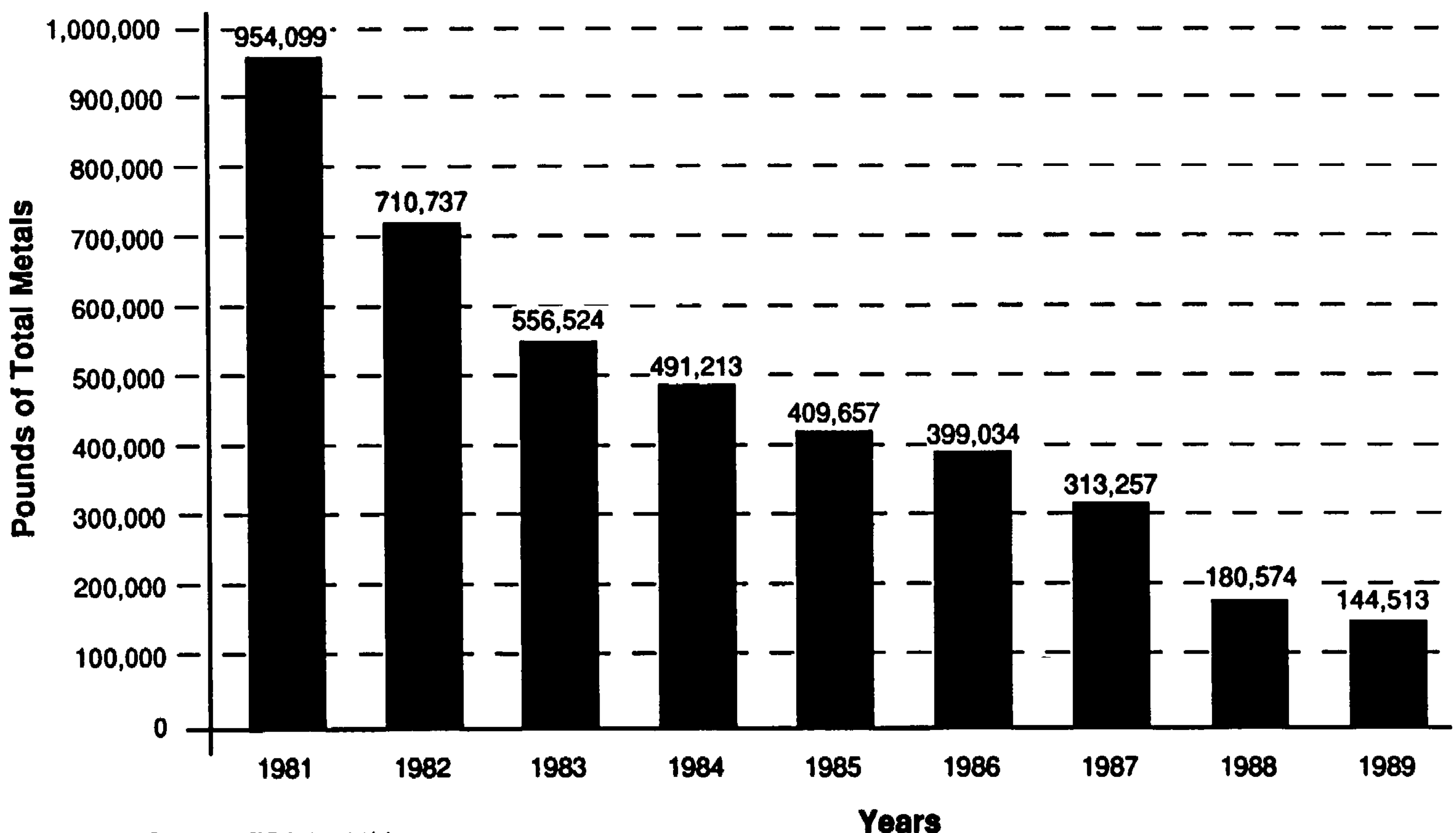
Despite an increase in plant flow of 6 mgd and an increase in number of SIUs from 11 to 47, the Union Sanitary District of California reports that the total quantity of metals discharged to San Francisco Bay was reduced from 68.5 kilograms per day to 20.8 kg/day from 1975 to 1985, as a result of its pretreatment program.

Narragansett Bay Commission, Rhode Island

The Narragansett Bay Commission operates a 64 mgd secondary treatment plant with daily average flow of 54 mgd, 10 percent of which is industrial wastewater. There are 169 SIUs, of which 123 are categorical industries. The Commission monitors its influent, effluent, and sludge for metals and cyanide about six to eight times per month. From these data, it has calculated total metal loadings to the POTW. As Figure 7-1 indicates, the total metals loading decreased from 954,099 pounds per year in 1981 to 144,513 pounds per year in 1989. The Commission attributes this decrease in metal loadings to installation of pretreatment equipment by its metal finishers. However, declines in metal loadings were evident before the 1983 deadline for compliance with categorical standards for metal finishers and before the Commission began implementation of its approved pretreatment program in 1984. The Commission revised its local limits in 1987 and saw a large decline in the total metals occur the next year (from 313,257 pounds in 1987 to to 144,513 pounds in 1989).

Cedar Rapids, Iowa

The Cedar Rapids POTW has a daily average flow of 34 mgd; 32 percent of the flow is industrial. Twelve CIUs and 10 other SIUs are in the POTW's service area. The POTW found that, with one exception, categorical standards for metal finishing protected the plant and receiving stream. However, it determined that a more stringent limit was required for cadmium. Prior to pretreatment, the cadmium concentration in sludge was between 25 and 30 milligrams per kilogram (mg/kg) and was sufficiently high to restrict



Source: EPA (1990b).

Figure 7-1. Total Annual Metals Loading (in influent) to the Field's Point Wastewater Treatment Facility, Narragansett Bay Commission, RI (total pounds per year)

land application of the sludge. After implementation of the pretreatment program and the stricter local limit, the cadmium concentration was reduced to 10 to 15 mg/kg, which is below the State sludge criterion for land application. Copper and nickel reductions were also observed after the pretreatment program began.

Miami-Dade Water and Sewer Authority, Florida

The Miami-Dade Water and Sewer Authority (WASA) in Florida found that the application of categorical standards alone was not sufficient to safeguard its sludge disposal practice adequately. The Miami-Dade WASA operates three wastewater treatment plants with a combined daily average flow of 247 mgd, of which 5 percent is industrial flow. The POTW has 124 SIUs; 76 of these are CIUs. Sludge quality data in 1987 indicated that levels of nickel in the Central District plant had doubled from historical levels and exceeded the nickel criterion (100 mg/kg) for Grade I for agricultural use. Initial investigations found that most of the facilities were in compliance with the electroplating and metal finishing standards for nickel. A new local limit of 1.5 milligrams per liter for nickel was implemented in March 1988, and WASA initiated an extensive sampling program to verify compliance with the local limit for nickel. Routine sampling of CIUs showed compliance with the new local limit for nickel, but WASA continued to detect high levels of nickel in the collection system. WASA conducted sampling after normal operating hours and during weekends; detailed inspections of CIUs were also conducted, and automatic samplers were installed in the collection system to identify illegal dumps. These efforts determined that 13 of the 26 metal finishers were in violation of the more stringent local limit for nickel. When the majority of these violators achieved compliance, the nickel levels were reduced significantly so that by February 1989 the sludge quality was within Grade I criterion.

Erie, Pennsylvania

The City of Erie, Pennsylvania, operates a 68.6 mgd secondary treatment plant with daily average flow of 53.8 mgd; 32 percent of this flow is industrial wastewater. It services 41 SIUs; 21 of them are categorical industries. Changes in industrial users, extensions to the collection system, and improvements in the treatment system make it difficult to use plant data alone to determine the impact of pretreatment on effluent quality. However, the reduction of regulated pollutants discharged by industrial users that were in operation before and after implementation of the city's pretreatment program reflects the effectiveness of pretreatment in reducing pollutant loadings to the POTW. As illustrated in Figure 7-2, one industrial user substantially decreased its metals concentrations between 1986 and 1989 after installation of pretreatment equipment.

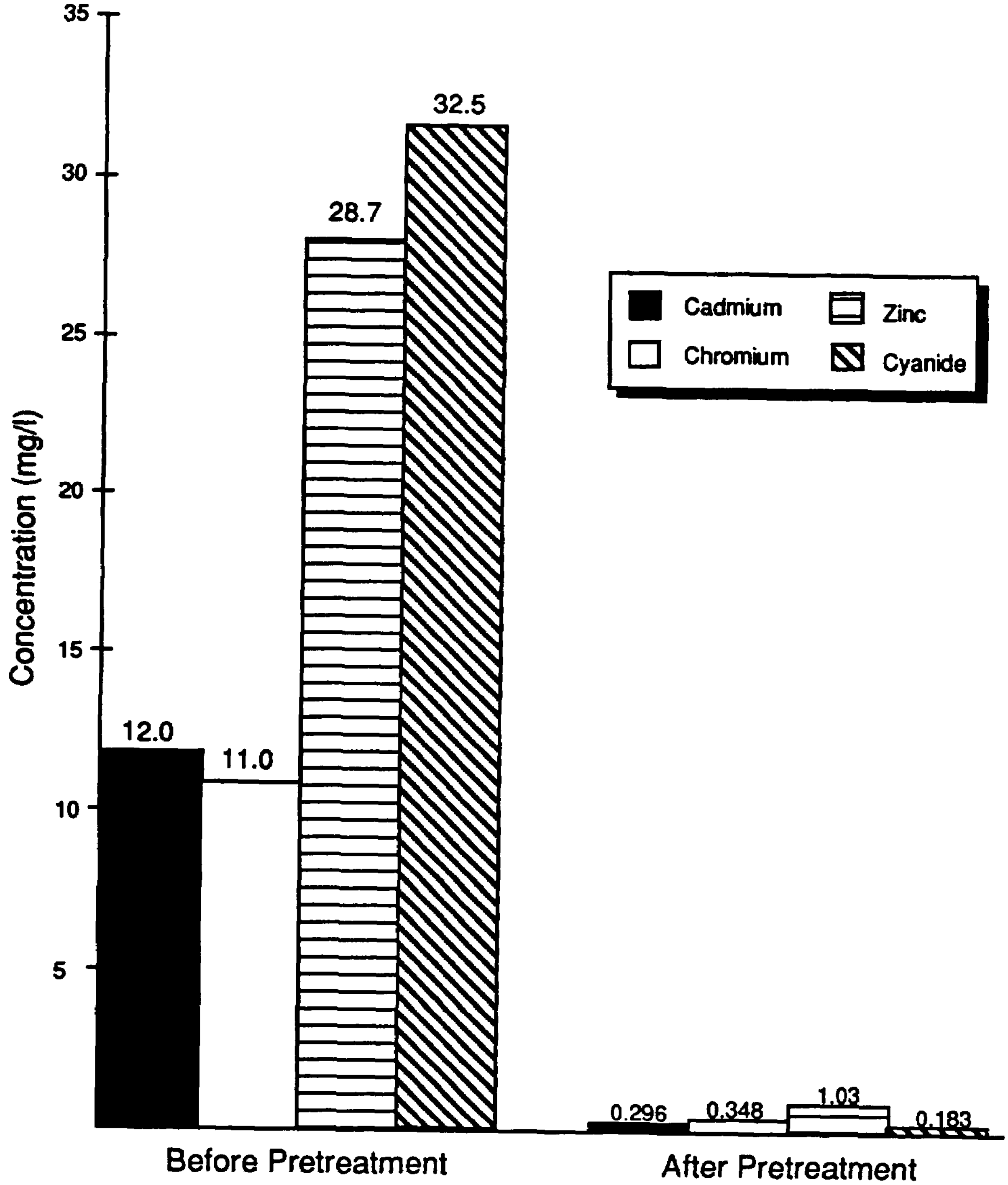
Springettsbury Township, Pennsylvania, and Lockport, New York

Both Springettsbury Township, Pennsylvania, and Lockport, New York, have reduced NPDES violations. Springettsbury indicates that, while pretreatment contributed to the reductions, major physical improvements to the treatment process and modifications to NPDES permit limits probably contributed significantly to the 99-percent reduction in NPDES violations over the past 10 years (271 violations in 1978, 3 in 1988). On the other hand, the pretreatment coordinator of Lockport indicates that pretreatment program implementation was one of the major factors in reducing the number of NPDES violations. Lockport, which experienced 191 violations in 1986, reduced the violations to 1 in 1988 and had none through May 1989. Lockport indicated that an industry in violation of its phosphorus limit was, in turn, causing the POTW to violate its NPDES permit limit. Once the industry was identified and achieved compliance, the POTW met its NPDES permit and the need for phosphorus removal at the POTW was eliminated.

POTWs have reported reductions in loadings or concentrations of various metals and cyanide in the influent and effluent. Table 7-8 summarizes the percent reductions reported by 23 POTWs. Data for this table were obtained from two sources: either from one of the case studies prepared for EPA's Supplemental Guidance (EPA, 1991) or from applications submitted by POTWs for pretreatment excellence awards. As Table 7-8 shows, POTWs from less than 1 mgd to greater than 100 mgd have experienced reductions in pollutant concentrations or pounds ranging from 16 to 100 percent. It should be noted, however, that a rigorous statistical analysis of the data in this table was not possible because raw data and other factors that may have affected pollutant reductions were not available.

California Regional Water Quality Control Board

The California Regional Water Quality Control Board in San Francisco reports that the toxic heavy metal loadings for arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc to the San Francisco Bay have been reduced by 80 percent from 1,439 kilograms per day in 1975 to 287 kilograms per day in 1985 despite a 15 percent increase in flows from municipal wastewater treatment plants to the Bay (Wu, et al., 1989). The Bay receives treated municipal wastewater from 29 POTWs. Historical



Source: EPA (1990b).

Figure 7-2. Metals Reductions by an Industry in Erie, PA

Table 7-8. Reported Reductions in Concentrations or Loadings of Metals and Cyanide in Influent and Effluent

POTW (actual flow)	Source*/ Years	Reductions in Influent	Reductions in Effluent
Holly, MI (0.8 mgd)	B/85-87	(Est.) Zn - 90%	Unknown
East Providence, RI (4.2 mgd)	C/79-89	Cd - 89% Cr - >75% Cu - 43% Pb - >68% Ni - >70% Zn - 43%	Cd - 94% Cr - 76% Cu - 66% Pb - 90% Ni - >54% Zn - 44%
Lewisville, TX (6.2 mgd)	B/85-89	Pb - 100% Zn - 44%	Unknown
Cranston, RI (12 mgd)	B/85-89	Unknown	(Est.) Total metals - 52% Cd - 85% Cr - 61% Cu - 38% Pb - 74% Ni - 46% Ag - 20% Zn - 17%
La Crosse, WI (14 mgd)	B/81-88	(Est.) Cd - 90% Cr - 71%	Unknown
Muncie Sanitary District, IN (17.5 mgd)	B/72-89	Cr - 75% Cu - 75% Pb - 98% Ni - 92% Zn - 80%	Cr - 92% Cu - 83% Pb - 98% Ni - 97% Zn - 79%
Springfield, OH (19.9 mgd)	B/84-89	Unknown	Cd - 50% Cr - 79% Cu - 74% Pb - 37% Ni - 79% Zn - 80%
Union Sanitary District (Fremont), CA (22.4 mgd)	A/75-85	Unknown	Total metals - 70%
Harrisburg, PA (24 mgd)	A/87-89	Cd - 60% Cu - 33% Cr - 84% Zn - 16%	Cu - 87% Pb - 33% Zn - 23%

Table 7-8. Reported Reductions in Concentrations or Loadings of Metals and Cyanide in Influent and Effluent (continued)

POTW (actual flow)	Source*/ Years	Reductions in Influent	Reductions in Effluent
Winston-Salem, NC (30 mgd)	B/81-90	Cd - 85% Cr - 69% Cu - 47% Ni - 70% Zn - 39%	Unknown
Cedar Rapids, IA (34.15 mgd)	A/82-88	(Est.) Ni - 72%	(Est.) Ni - 67%
Narragansett Bay Comm. (49.77 mgd)	A/81-89	1989 Total Metals - 83% Cd - 77% Cr - 85% Cu - 93% Pb - 72% Hg - 74% Ni - 81% Ag - 78% Zn - 72% Cn - 80%	1989 Unknown
Grand Rapids, MI (54.5 mgd)	A/69-89	(Est.) Metals - 93%	(Est.) Metals - 92%
Dayton, OH (67 mgd)	B/84-90	Cd - 74% Cr - 88% Cu - 75% Pb - 35% Ni - 78% Zn - 50%	Unknown
Fairfax County (Lorton), VA (84.3 mgd)	B/75-88	(Est.) Cu - 45% Cd - 100% Cr - 30% Hg - 71% Ag - 100% Zn - 23%	(Est.) Cu - 78% Cr - 84% Hg - 100% Zn - 43%
Fort Worth, TX (105 mgd)	B/82-89	Cd - 95% Cu - 71% Pb - 38%	Cd - 50% Cu - 83% Pb - 25%
Louisville & Jefferson Counties, KY (106.99 mgd)	B/80-88	(Est.) Cd - 94% Cr - 86% Pb - 89%	Unknown

Table 7-8. Reported Reductions in Concentrations or Loadings of Metals and Cyanide in Influent and Effluent (continued)

POTW (actual flow)	Source*/ Years	Reductions in Influent	Reductions in Effluent
Hampton Roads (Virginia Beach), VA (135.1 mgd)	A/79-87	(Est.) Total Metals - 41%	Total Metals - 68%
Buffalo, NY (159 mgd)	C/87-88	Zn - 41% Ag - 58% Cu - 16% Cd - 67%	Cd - 50%
County Sanitation Districts of Orange County, CA (242 mgd)	C/79-89	Cd - 70% Cr - 60% Cu - 36% Pb - 60% Ni - 60% Zn - 55%	Unknown
Passaic Valley (Newark), NY (250 mgd)	C/78 - 83	Hg - 99%	Unknown
Northeast Ohio Regional (Cleveland), OH (280 mgd)	B/77-88	Three Treatment Plants Cd - 77%, 53%, 6% Ni - 67%, 72%, 51% Cu - 67%, 40%, 42% Pb - 78%, 86%, 70%	Three Treatment Plants Cd - 93%, 77%, 82% Ni - 27%, 79%, 77% Cu - 88%, 82%, 91% Pb - 94%, 90%, 90%
County Sanitation of LA County, CA (534 mgd)	A/75-Early 1980's	As - 60% Cd - 67% Cr - 78% Cu - 68% Pb - 75% Ni - 73% Zn - 68% CN - 96%	Unknown

*Key to sources:
A = EPA (1989c).
B = EPA (1990b).
C = EPA (1990d).

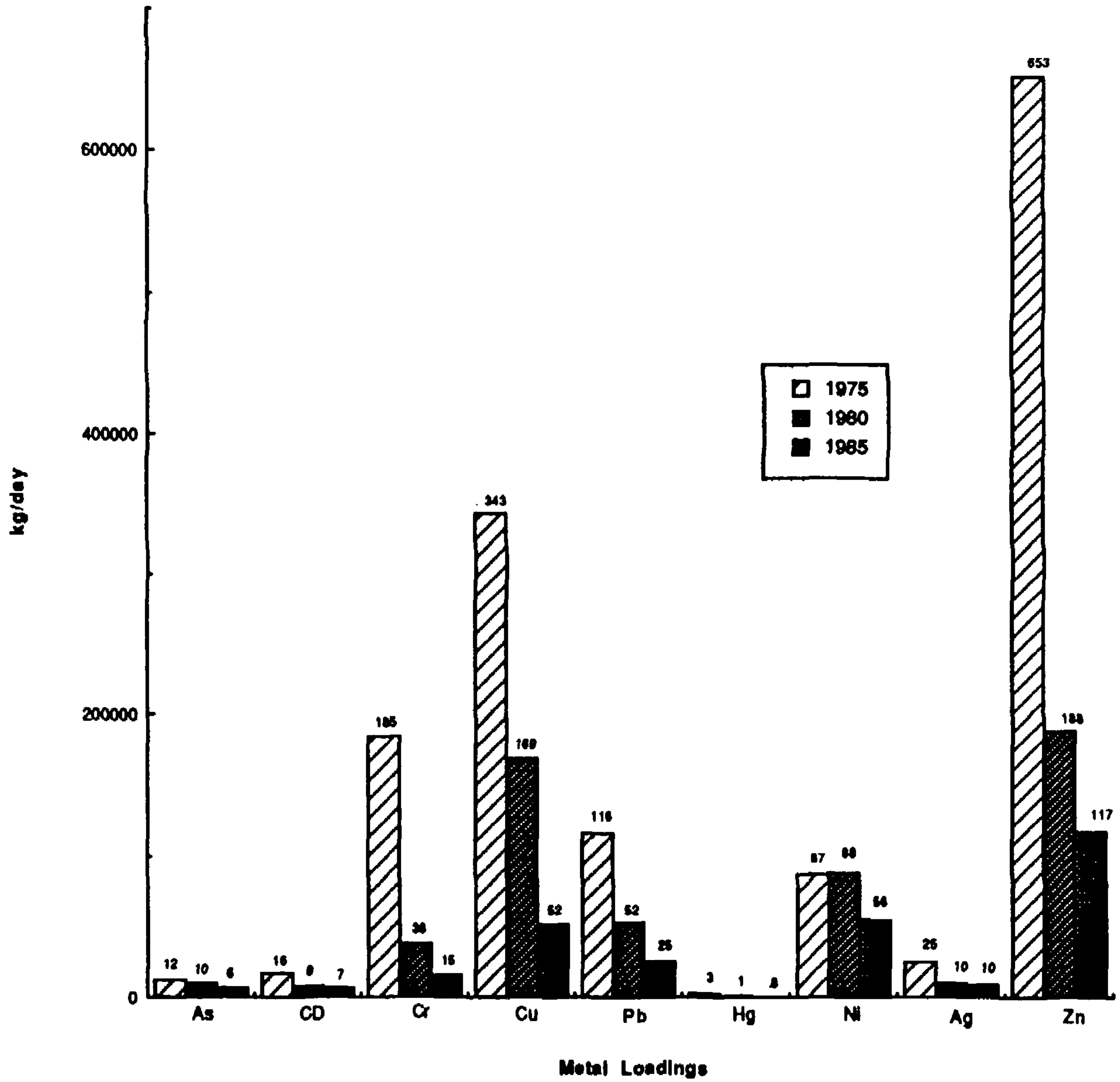
monitoring data from 1975, 1980, and 1985 were available for 15 of the 29 POTWs, and the total loadings from these POTWs for 9 heavy metals are graphically represented in Figure 7-3. The Board attributes these significant reductions of metal loadings to the Bay to a combined effect of the implementation of the pretreatment program and POTWs' upgrading to the secondary treatment level.

Hampton Roads Sanitation District

Figure 7-4 illustrates reductions in cumulative influent and effluent loadings for six metals—nickel, chromium, lead, cadmium, copper, and zinc—that occurred at one of the case studies, Hampton Roads Sanitation District (HRSD), from 1979 to 1987. HRSD states that these reductions are a direct result of its pretreatment program. The reductions occurred despite the fact that overall flow to HRSD plants increased during this period. The increased loadings in 1984 and 1985 are attributed to the additional new service area, additional industrial users, and three new wastewater treatment plants. Figure 7-5 shows reductions for two metals—lead and cadmium—and Figure 7-6 shows reductions for copper and zinc. As these figures illustrate, influent loadings of copper and zinc do not show as dramatic reductions as the other two metals. HRSD attributes this high "background" influent concentration to the use of copper or galvanized (zinc-coated) plumbing in local residences. In summary, over the past 10 years, HRSD has reduced its metal discharges greatly. The District states that such discharges were 360 percent greater in 1979 than they were in 1987.

7.3.1.2. Water Quality Criterion Exceedances

Indicators of improvements in or nondegradation of existing water quality are influenced by factors other than the National Pretreatment Program. For example, pollution from agricultural uses or stormwater runoff from urbanized areas can degrade the water quality of the receiving stream or prevent improvements to water quality despite pollutant reductions from POTWs. Because of these other factors that contribute to water pollution, it is difficult to evaluate the extent to which the pretreatment program has improved or prevented the degradation of the water quality of the receiving streams. Properly designed investigations at individual POTWs can determine the influence of each factor and assess the pretreatment program's influence on pollutant reductions or improved water quality. To date, however, this type of investigation for a large number of pretreatment POTWs has not been conducted.



Note: Totals are approximate numbers

Figure 7-3. Historical Changes in Municipal Metal Loadings in the San Francisco Bay System 1975-1985

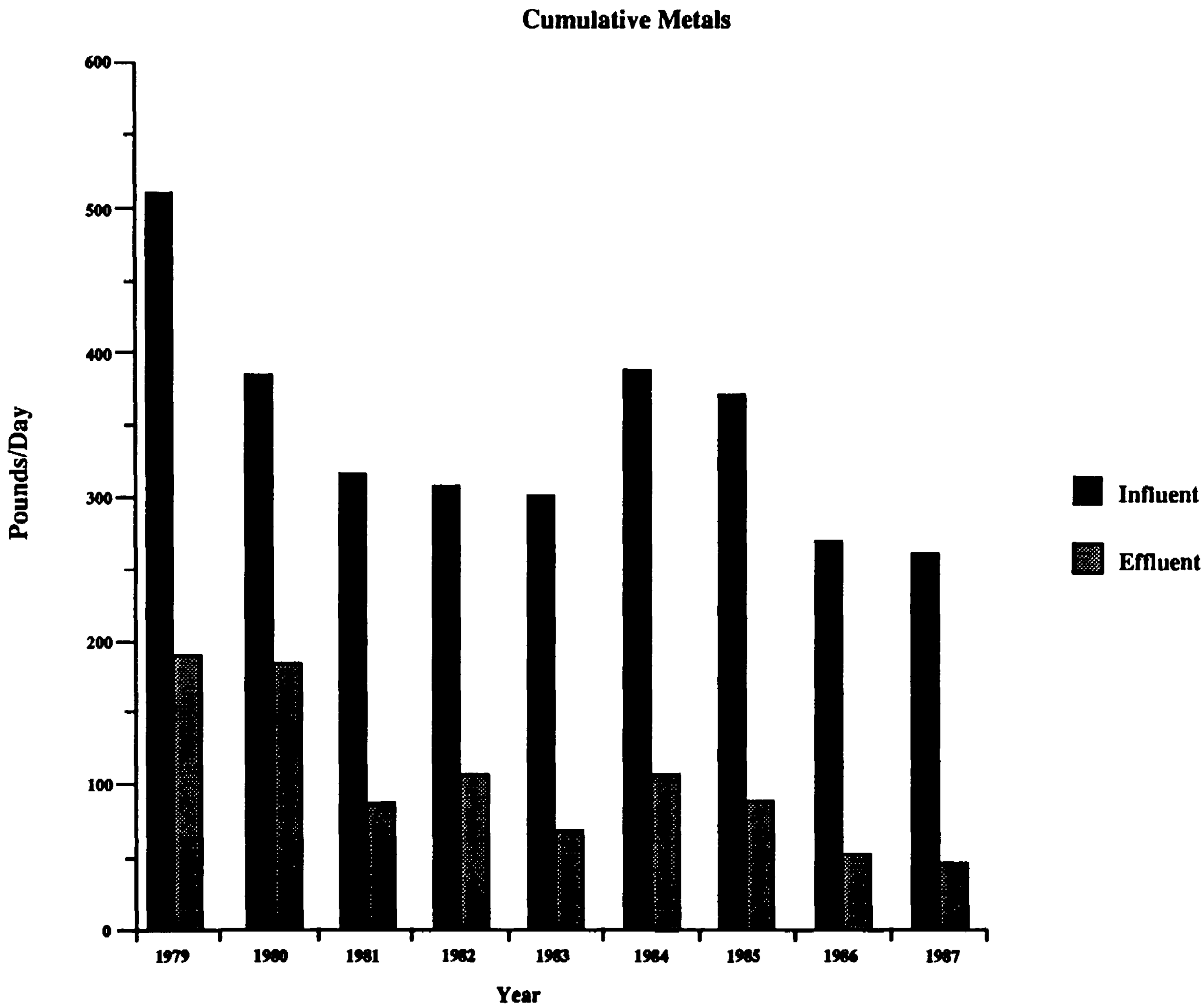
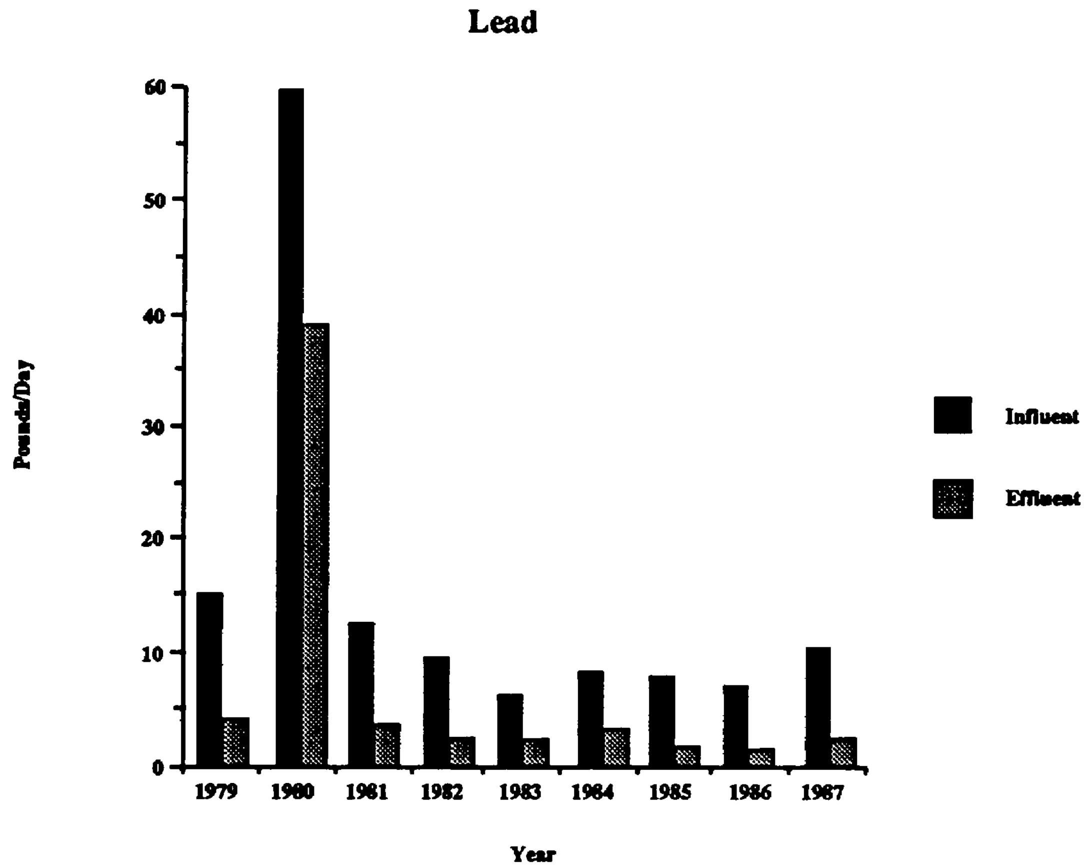


Figure 7-4. Reductions in Cumulative Influent and Effluent Loadings of Six Metals in Hampton Roads Sanitation District's Wastewater Treatment Plants



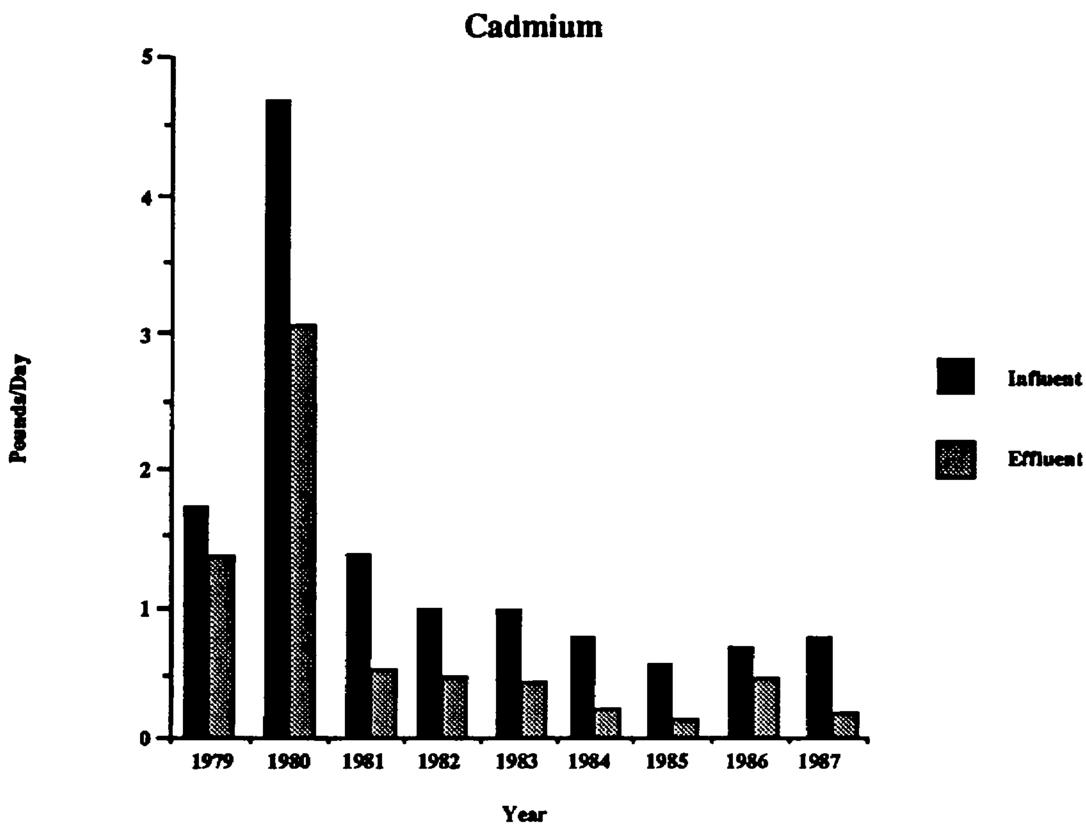


Figure 7-5. Influent and Effluent Reductions in Lead and Cadmium at Hampton Roads Sanitary District's Wastewater Treatment Plants

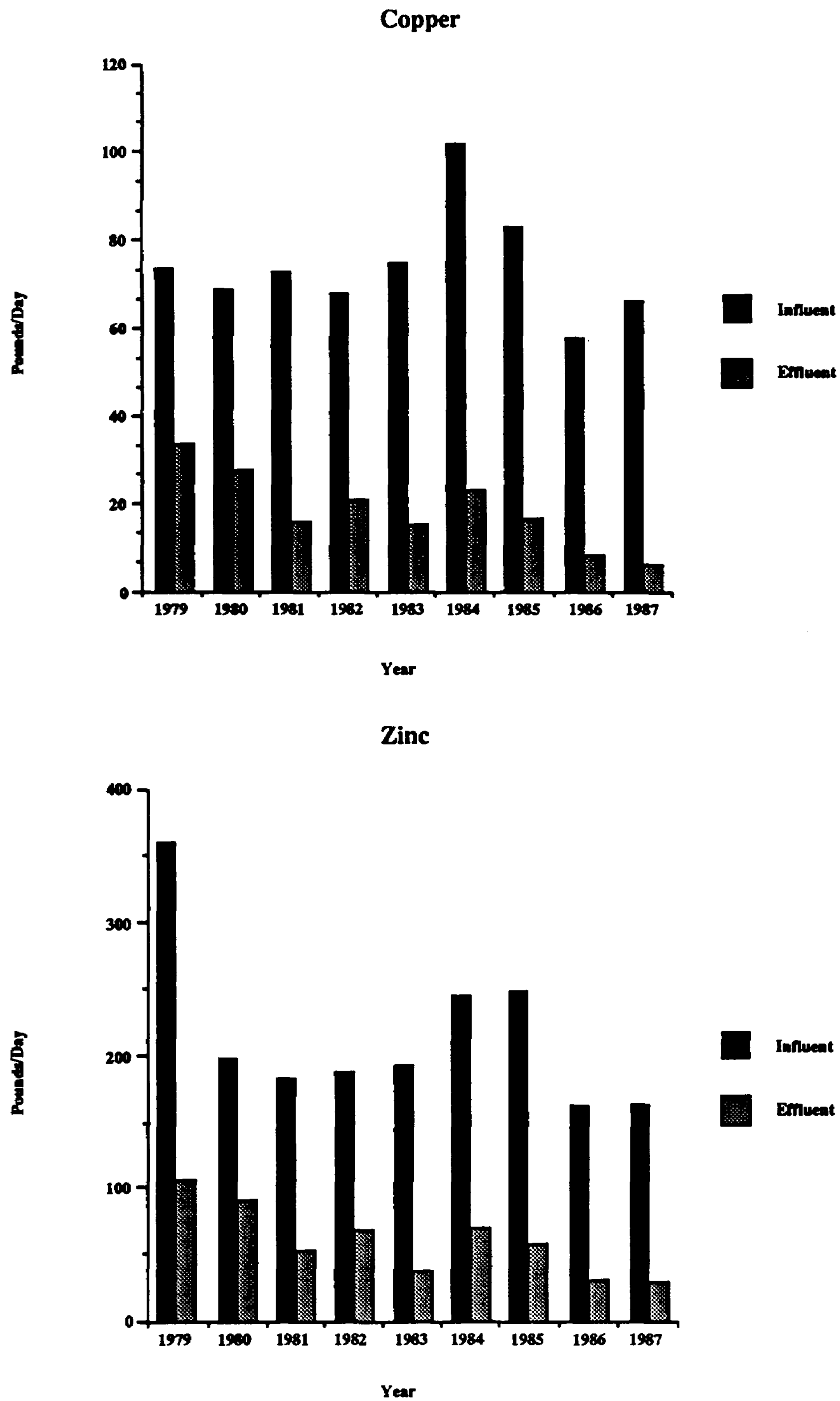


Figure 7-6. Influent and Effluent Reductions in Copper and Zinc at Hampton Roads Sanitary District's Wastewater Treatment Plants

It is possible to project, based on a POTW's effluent quality, whether the POTW's effluent alone could cause exceedances of water quality criteria. Using the simple dilution model approach described in Chapter 6, EPA compared the instream concentrations resulting from POTWs' effluents to national water quality criteria for pretreatment and nonpretreatment POTWs. Results are presented in Table 7-9 for selected metals and cyanide. The table shows that water quality criteria exceedances occurred at both pretreatment and nonpretreatment POTWs (less than 30 percent of POTWs reporting). Given that toxic loadings would be expected to be much higher at pretreatment POTWs, this may be a solid indicator of program success. Exceedances in the nonpretreatment group may indicate that a local pretreatment program has not been required at some POTWs where it is needed to achieve compliance with water quality criteria. Alternatively, exceedances by nonpretreatment POTWs could indicate the presence of other sources of toxic pollutants than industrial users.

EPA's *Report to Congress Water Quality Improvement Study* (EPA, 1989d) studied the effectiveness of best available technology effluent limitations for controlling pollutant discharges from industrial sources and the resulting improvements in the quality of the streams receiving these discharges. The study looked at 1,546 stream reaches comprising 8,434 river miles, many of which receive POTW effluent (although the number of POTWs discharging to the reaches looked at in the study is unknown). The study compared receiving-water monitoring data between 1970 and 1980 to similar data from 1985 to 1988. Table 7-10, which is excerpted from the report, summarizes the receiving-water concentration trends for seven pollutants. Cadmium and mercury show the greatest decreases in concentration (84 and 87 percent of the river miles improved, respectively). Zinc showed the least improvement (69 percent improvement) and the greatest extent of deterioration (25 percent of the river miles showed concentration increases). The report concluded that "overall trends showed roughly 76 percent of the river miles with monitoring data available had an overall improvement (or net decrease in pollutant concentrations); 14 percent had a net increase (deterioration) and 11 percent had no significant change." The study did not address the benefits of other toxic control programs, such as the pretreatment program, on water quality improvements. However, EPA believes it is likely that the pretreatment program's control of toxic discharges contributed to this significant measure of water quality improvement.

Table 7-9. Number and Percent of Reporting POTWs With Instream Concentrations Exceeding National Water Quality Criteria

Parameter	Number Reporting Average Concentrations	Pretreatment (P) or Nonpretreatment (N)	Percent With Average Concentrations Greater Than Acute Criteria	Percent With Average Concentrations Greater Than Chronic Criteria	Number Reporting Maximum Concentrations	Percent With Maximum Concentrations Greater Than Acute Criteria
Arsenic	59	P	1.7	1.7	89	3.4
Arsenic	17	N	*	*	25	<0.1
Chromium (hexavalent)	133	P	4.5	6.8	139	4.3
Chromium (hexavalent)	38	N	2.6	5.3	50	2.0
Chromium (trivalent)	71	P	1.4	1.4	79	1.3
Chromium (trivalent)	28	N	<0.1	<0.1	41	<0.1
Copper	273	P	23.1	28.2	343	27.4
Copper	101	N	12.9	21.8	184	11.4
Cyanide	178	P	11.8	29.8	245	15.5
Cyanide	34	N	11.8	20.6	50	8.0
Lead	246	P	0.8	32.9	324	1.9
Lead	78	N	<0.1	35.9	159	<0.1
Mercury	205	P	3.4	52.7	263	3.4
Mercury	80	N	<0.1	57.5	148	2.0
Nickel	236	P	1.3	1.7	288	2.1
Nickel	76	N	<0.1	<0.1	151	<0.1
Silver	113	P	3.5	32.7	141	11.4
Silver	16	N	*	*	25	8.0
Zinc	277	P	8.3	8.7	346	10.1
Zinc	95	N	1.1	1.1	177	1.7

*No exceedances.

Table 7-10. Summary of Ambient Monitoring Data Analysis: Pollutant Trends

		Improved	No Change	Deteriorated	Total Monitored
Cadmium	River Miles	3,822.6	193.0	519.5	4,535.1
	Percent	84	4	11	
Mercury	River Miles	2,807.4	31.5	375.6	3,214.5
	Percent	87	1	12	
Copper	River Miles	4,349.9	667.3	1,238.2	6,255.4
	Percent	70	11	20	
Lead	River Miles	4,659.7	279.3	766.1	5,705.1
	Percent	82	5	13	
Nickel	River Miles	3,590.4	229.8	1,172.9	4,993.1
	Percent	72	5	23	
Zinc	River Miles	5,296.2	498.1	1,889.7	7,684.0
	Percent	69	6	25	
Cyanide	River Miles	1,228.2	110.7	205.3	1,544.2
	Percent	80	7	13	

Source: EPA (1989c).

7.3.2 Sewage Sludge

During wastewater treatment, some pollutants are partitioned from wastewater to the sewage sludge. Reducing pollutant concentrations in the influent of a wastewater treatment plant can reduce pollutant concentrations in sludge and expand the range of potential disposal options. Currently, several disposal options are available to POTWs, including landfilling, incineration, and beneficial reuse (i.e., land application). Landfilling is the most common sludge disposal practice in the U.S. However, this practice will eventually have to be reduced significantly because of the increasingly limited capacities of the Nation's landfills. Incineration is another sludge disposal option; however, capital and operating costs are high, and the ash is often disposed of in landfills. EPA encourages beneficial reuse of sludge through uses such as fertilizer or soil conditioner. When employing reuse options, reducing pollutant concentration becomes particularly important to minimize the risk of deleterious effects, such as soil contamination, surface water contamination from runoff, ground-water contamination, and food chain effects.

An attempt to evaluate whether implementation of the pretreatment program has achieved nationwide reductions in toxic pollutant levels in sewage sludge was hindered by the lack of a comprehensive national data base containing information on sewage sludge quality both before and after implementation of the pretreatment program. EPA consulted three sampling surveys with data on sewage sludge quality (the 40-POTW Study in 1978 [EPA, 1982], the Association of Metropolitan Sewerage Agencies survey in 1987 [AMSA, 1987], and the National Sewage Sludge Survey in 1989 [EPA, 1989b]). However, these surveys were one-time sampling efforts and were not designed to determine long-term trends in sewage sludge quality.

For this report, EPA conducted a small analytical exercise to assess the pretreatment program's effect on sludge quality; the Agency evaluated sludge data from 24 Wisconsin treatment plants to determine whether average metal concentrations in sludge at those facilities had dropped since implementation of their pretreatment programs. Data for eight metals were examined; measurements dated from periodic monitoring performed since 1977, although the number and timing of measurements available for each plant varied. To assess differences in pollutant levels before and after pretreatment, data at each facility (and for each metal) were split into two groups, corresponding to the official date on which a pretreatment program was approved for that POTW. Such a division only approximates the actual implementation of pretreatment since, at some facilities, a startup phase was necessary. The changeover points used represent the best information available at the time of analysis, however.

EPA divided the sludge data into two groups (one before the POTW began its pretreatment program and one after), computed statistical means on each metal at each facility, and ran statistical tests to identify any significant differences between the mean concentrations before and after pretreatment.[7] Table 7-11 indicates the results of these tests and shows the extent of significant increases and decreases over time. As the table illustrates, 21 of the 24 treatment plants experienced significant reductions in concentrations of at least one metal in their sludges after pretreatment program approval; 10 plants significantly reduced their concentration of at least four pollutants in their sludges. Seventeen plants experienced significant reductions in lead and 13 plants in chromium. Fourteen of the 24 facilities showed significant decreases in average total metal concentrations.

Numerous other POTWs nationwide have reported pollutant reductions in their sewage sludge after implementing pretreatment requirements; Table 7-12 presents information reported by 22 POTWs. These POTWs reported that metal concentrations in their sludges were reduced for one or more of the following metals: cadmium, chromium, copper, nickel, lead, silver, mercury, and zinc. Reductions ranged from a low of 6 percent to a high of 100 percent, which occurred at two POTWs. Four POTWs reported that they reduced loadings to sludge of at least two metals by more than 90 percent.

Figure 7-7 shows pollutant loadings in sludge for 10 metals at one case study, the Pocatello POTW, from January 1983 to August 1990. As can be seen from this figure, pollutant loadings varied from sample to sample and from year to year. In general, half of the metals—nickel, chromium, arsenic, lead, and zinc—showed decreasing trends. For the other five metals, data either indicate an increasing trend or are not conclusive in establishing a trend. This suggests that Pocatello has not significantly reduced its loadings of toxic pollutants to sludge.

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7. The statistical test performed was the t-test.

Table 7-11. Changes in Mean Pollutant Concentrations Before and After Pretreatment in the Sludge of 24 Wisconsin Treatment Plants (since 1977)

	Pollutant								
Treatment Plant	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn	Total Metals
Green Bay		↓	↓				↓		↓
Appleton				↓	↓				↓
Beloit	↓					↓		↓	↓
Brookfield	↑			↑	↑		↑	↑	↑
DePere		↓	↓			↑	↓	↓	
Eau Claire	↓		↓	↓		↓	↓		↓
Fond du Lac		↓	↓			↓	↓	↓	↓
Madison	↓	↓		↑		↓		↓	↓
Manitowoc	↓	↓	↓		↓		↓	↓	↓
Milwaukee Jones Island		↓					↓		
Milwaukee So. Shore		↓	↓		↓	↓	↓		↓
Oshkosh					↓		↓		
Racine	↑	↓		↓			↓		
Sheboygan	↑		↓			↓	↓	↑	
Wausau							↓		
West Bend		↓	↓			↓	↓	↓	↓
Neenah Menasha		↑	↑			↑		↑	↑
Watertown					↑				↑
Kenosha		↓	↓	↓		↓	↓	↓	↓
So. Milwaukee			↓	↓		↓	↓	↓	↓
La Crosse Isle la Plume				↑		↓			
Waukesha			↓			↓	↓		↓
Janesville			↓	↓		↓	↓		↓
Heart of the Valley			↓	↑		↑	↓		↓

↓ = Statistically significant decrease in mean concentration, $p<.05$.
↑ = Statistically significant increase in mean concentration, $p<.05$.

Table 7-12. Examples of POTWs Demonstrating Reductions in Loadings of Metals in Sludge

POTW (actual flow)	Source*/ Years	Reported Reductions in Loadings to Sludge
Holly, MI (0.8 mgd)	B/84-89	(Est.) Zn - 24%
Bowling Green, KY (5 mgd)	B/81-89	(Est.) Zn - 97% Cr - 72% Cd - 91% Pb - 90% Ni - 100% Cu - 88%
Pocatello, ID (7 mgd)	B/85-88	(Est.) Cd - 57% Cr - 67% Cu - 42% Pb - 36% Ni - 56% Zn - 45%
Springettsbury Township, PA (8 mgd)	A/81-90	Cu - 41% Zn - 59% Pb - 69% Cr - 65% Hg - 23% Ni - 23%
St. Charles, MO (8.97 mgd)	B/86-88	Cr - 63% Cu - 17% Pb - 32% Ni - 6% Zn - 24%
Largo, FL (10.4 mgd)	B/85-88	Cd - 100% Cu - 29% Pb - 50% Ni - 94%
Altoona, PA (12 mgd)	C/85-89	Cu - 60% Zn - 67% Pb - 23% Cr - 94% Cd - 89%
Fort Collins, CO (13.5 mgd)	C/84-89	Cu - 35%

*Key to sources:
A = EPA (1989c).
B = EPA (1990b).
C = EPA (1990d).

Table 7-12. Examples of POTWs Demonstrating Reductions in Loadings of Metals in Sludge (continued)

POTW (actual flow)	Source*/ Years	Reported Reductions in Loadings to Sludge
Albany, GA (15 mgd)	A/83-87	Cd - <50% Cr - 99% Cu - 99% Pb - 98% Ni - 99% Zn - 94%
Muncie Sanitary District, IN (17.5 mgd)	B/73-89	Pb - 96%
Springfield, OH (19.9 mgd)	B/84-89	Cd - 79% Cr - 79% Cu - 53% Pb - 87% Ni - 50% Zn - 77%
Aurora Sanitation District (Oswego), IL (22.8 mgd)	B/85-90	Cd - 96% Cr - 92% Cu - 50% Mn - 72% Ni - 78% Pb - 47% Zn - 56% CN - 75%
Harrisburg, PA (24 mgd)	A/87-89	Cd - 42% Cu - 27% Cr - 42% Zn - 26%
Cedar Rapids, IA (34.15 mgd)	A/82-88	(Est.) Cd - 57% Cu - 52% Ni - 75%
Unified Sewerage Agency (Hillsboro), OR (38.3 mgd)	A/85-89	(Est.) Cd - 54% Pb - 38% Cr - 1% Zn - 9%
Cobb County, GA (66.83 mgd)	B/85-88	Cr - 90%

*Key to sources:
A = EPA (1989c).
B = EPA (1990b).
C = EPA (1990d).

Table 7-12. Examples of POTWs Demonstrating Reductions in Loadings of Metals in Sludge (continued)

POTW (actual flow)	Source*/ Years	Reported Reductions in Loadings to Sludge
Louisville & Jefferson Counties, KY (97.9 mgd)	C/Unknown	Total Metals - 70%
Fort Worth, TX (105 mgd)	B/82-89	Cd - 83% Cr - 74% Cu - 54% Pb - 68% Ni - 25% Zn - 79%
METRO Seattle, WA (156 mgd)	C/81-89	Cd - 38% Cu - 56% Pb - 46%
Columbus, OH (157.9 mgd)	A/85-86	Cd - 68% Pb - 34% Cr - 41%
	A/86-87	Cd - 56% Pb - 38% Cr - 48%
	A/87-88	Cd - 23% Pb - 21% Cr - 18%
Milwaukee Metro, WI (190 mgd)	C/80-89	Cd - 85%
Miami-Dade, FL (247 mgd)	A/88-89	Three Treatment Plants Ni - 81%, 41%, 20%

*Key to sources:
A = EPA (1989c).
B = EPA (1990b).
C = EPA (1990d).

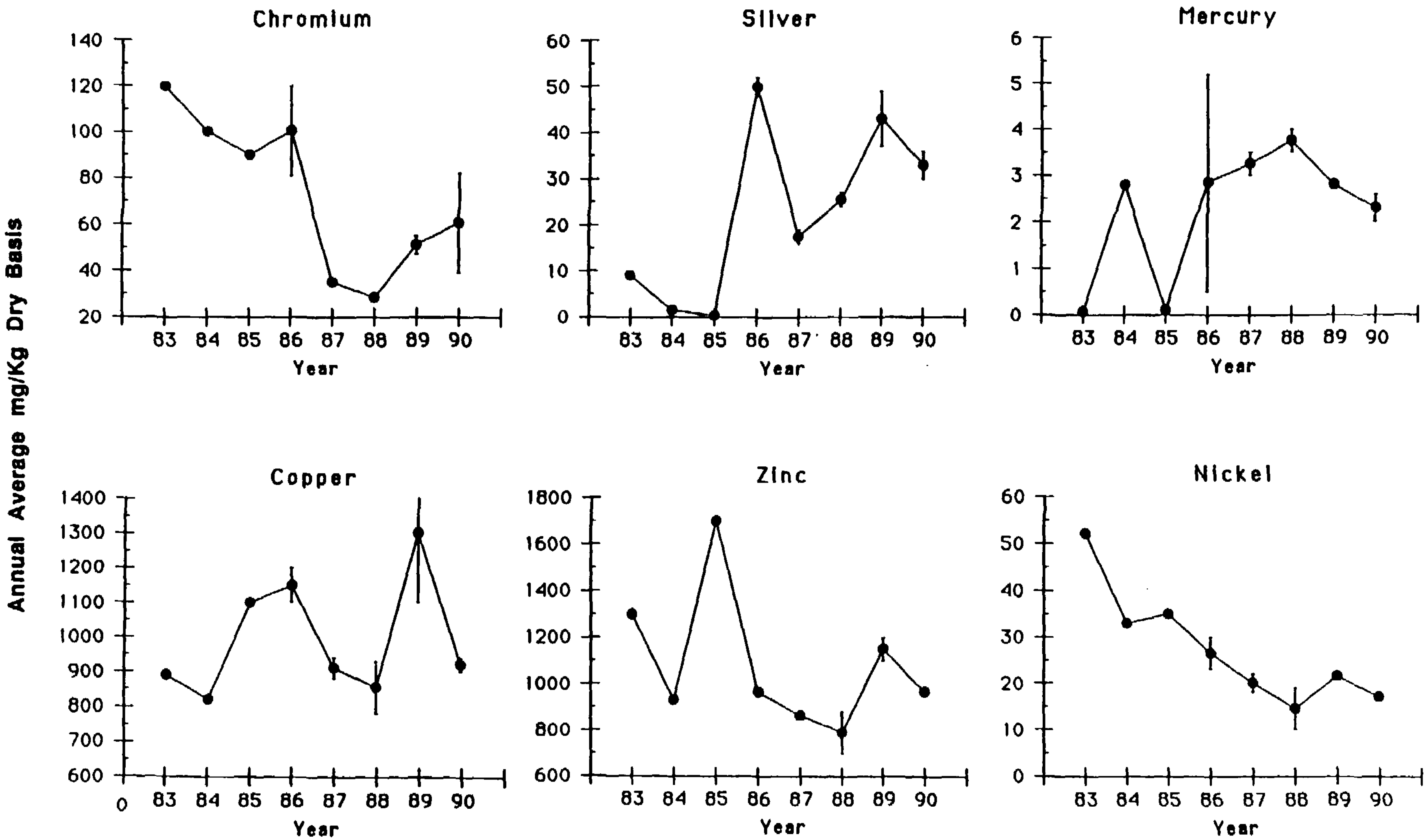

Figure 7-7. Metals Loadings in Sludge at Pocatello POTW

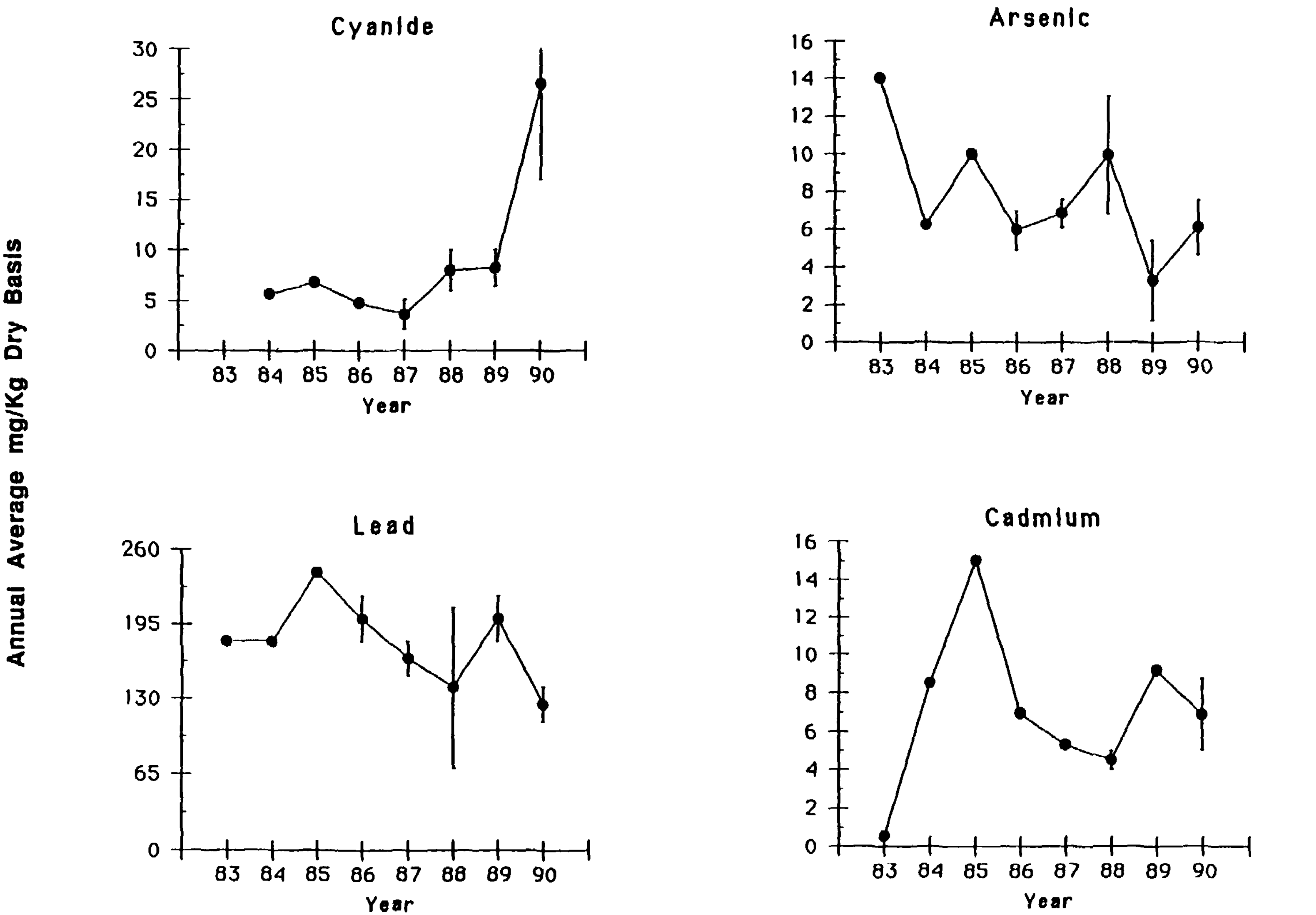

Figure 7-7. Metals Loadings in Sludge at Pocatello POTW (continued)

7.3.3 *Worker Health and Safety*

The pretreatment program's role in reducing potential POTW worker health hazards associated with toxic industrial discharges cannot be evaluated properly since currently available data are inadequate. While no data base addresses worker injuries attributed solely to industrial discharges, numerous incidents of POTW worker injuries due to such discharges are reported in the literature. As discussed in Chapter 6, these incidents typically involve severe effects on one or two individuals by a one-time discharge of highly concentrated toxic substances or less severe symptoms of a chronic nature exhibited by a larger group of workers. The literature does not provide sufficient data showing that the rate of incidents has increased or decreased over the life of the pretreatment program. The pretreatment program has been used to implement solutions when problems have occurred, however. In addition, the recently promulgated prohibition against discharges of pollutants that result in toxic gases, fumes, or vapors that would cause acute worker health and safety problems is expected to provide increased protection of worker health and safety. EPA is now developing guidance on this issue.

7.3.4 *Air*

Little information exists on the nature and volume of toxic pollutants released to the air from POTWs (see Chapter 6). However, data presented in Chapter 3 suggest that industrial users are predominantly responsible for the discharge of volatile compounds into the sewer system. Recent development, implementation, and enforcement of control on industrial discharge of volatile organics is thought to have reduced the quantity of the compounds in the sewer system. Despite the lack of empirical assessment of such reductions, it is possible to estimate reductions on a theoretical basis, based on assumptions of pollutant loadings with and without industrial pretreatment. Such an approach was taken in previous studies (e.g., Pretreatment Regulatory Impact Analysis and DSS) to forecast reductions in toxic pollutants expected after industrial compliance with categorical standards. For example, EPA expects the categorical standards for the Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) industrial category will reduce discharges of volatile and ignitable/reactive compounds at OCPSF facilities from 1,667 million kilograms per year to 3 million kg/yr (DSS). The promulgation of the standards for the pesticides industries is expected to reduce discharges of volatile and ignitable/reactive substances from 1,085 million kg/yr to less than 1 million kg/yr. In addition, compliance with the categorical standards for total toxic organics in six industrial categories and the implementation of solvent management plans in a number of industries are expected to reduce discharges of volatile and ignitable/reactive substances in the sewer system even further.

7.4 FINDINGS

The following observations summarize principal findings on the effectiveness of the existing pretreatment program.

1. Pretreatment program requirements are currently being implemented by 1,442 local control authorities at 2,015 wastewater treatment plants and by five States at 314 wastewater treatment plants. Another 100 local programs, covering 113 plants, are currently being developed. These pretreatment programs and their POTWs are collectively responsible for over 82 percent of the Nation's municipal wastewater treatment capacity; they receive the vast majority of all industrial discharges to POTWs in the United States.
2. EPA Regions and States have been successful in identifying those POTWs where receipt of industrial discharges makes pretreatment a necessity. However, 147 POTWs without pretreatment programs are reported to receive more than 50 percent of their flow from industrial sources. The universe of pretreatment POTWs will continue to undergo expansions and contractions as new POTWs enter the program and others are found not to require continued implementation of programs.
3. Enforcement of local limits and categorical standards is the primary means by which POTWs ensure that environmental standards and criteria are met. Local limits are driven by existing environmental standards and criteria, which, in turn, drive NPDES and other permit limits. The lack of environmental standards or permit limits for many toxic pollutants discharged by POTWs may restrict the development of local limits for these pollutants.
4. Many more toxic pollutants, particularly toxic organics, are discharged by categorical and other industrial users than are regulated by either national categorical standards or local limits. In addition, relatively few NPDES permits impose chemical-specific limits on POTWs' discharges of toxic pollutants. Recent changes to the General Pretreatment Regulations may increase the number of pollutants of concern that are regulated by POTWs.
5. Measurements of programmatic implementation by EPA, States, and POTWs indicate a program in which great progress has been made. About 70 percent of the 1,442 pretreatment POTWs have been audited or inspected within the past year. Based on information obtained from audits and inspections, about 84 percent of the 30,000 SIUs discharging to these POTWs have been issued control mechanisms. In addition, substantial POTW efforts have been directed towards inspection and sampling activities. However, significant deficiencies in program implementation by POTWs are apparent, such as issuing inadequate permits, applying categorical standards inappropriately, and failing to take effective enforcement actions (as evidenced by the high percentage of SIUs in SNC). Specific programmatic implementation issues have surfaced, such as the need for POTWs to develop technically based local limits, for EPA to establish

national standards for toxic pollutants (particularly organics and nonpriority pollutants), and to strengthen enforcement of all program requirements, to ensure that POTWs are fully implementing their pretreatment programs and that industrial users are complying with all pretreatment standards and requirements.

6. Local implementation allows the program to be tailored to individual environmental concerns. In contrast to state-run programs, EPA believes that local programs generally regulate more noncategorical industries, have established local limits designed specifically to prevent pass through and interference, and conduct more frequent monitoring. However, local implementation has some disadvantages; standards may not be uniform, and similar IUs may be regulated differently by different POTWs.

7. A lack of comprehensive environmental data makes it difficult to evaluate the program's effectiveness in achieving the goals of the CWA. However, evidence from various data sources suggests that the pretreatment program has reduced the discharge of toxic pollutants to POTWs and the environment. In cases were site-specific environmental data exist, EPA found that many POTWs have documented significant pollutant reductions in influent, effluent, and sludge.

8. A general lack of data on organic concentrations in POTW influents and effluents makes it very difficult to characterize the effectiveness of pretreatment in controlling the discharge of these chemicals from industry and the effect that pretreatment has had on reducing the discharge of these chemicals from POTWs.

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8. Evaluation of Alternative Regulatory Strategies

This chapter evaluates alternative regulatory strategies for pretreatment of toxic pollutants as called for by Congress in Sections 519(a)(4)-(6) of the Water Quality Act (WQA) of 1987. Specifically, Congress directed the U.S. Environmental Protection Agency (EPA) to study:

(4) Possible alternative regulatory strategies for protecting the operations of publicly owned treatment works (POTWs) from industrial discharges, and the extent to which each such strategy identified may be expected to achieve the goals of this Act

(5) For each such alternative regulatory strategy, the extent to which removal of toxic pollutants by publicly owned treatment works results in contamination of sewage sludge and the extent to which pretreatment requirements may prevent such contamination or improve the ability of publicly owned treatment works to comply with sewage sludge criteria developed under Section 405 of the Federal Water Pollution Control Act

(6) The adequacy of Federal, State, and local resources to establish, implement, and enforce multiple pretreatment limits for toxic pollutants for each such alternative strategy.

Restated, this statutory mandate requires EPA consideration of alternative strategies to protect POTWs from industrial discharges. It sets up as key evaluation measures the extent to which each alternative: (a) achieves the goals of the Clean Water Act (CWA) (see Table 8-1) and (b) results in or prevents contamination of sewage sludge. Lastly, it requires an assessment of the adequacy of governmental resources at all levels to develop, implement, and enforce pretreatment requirements under each alternative.

The scope of this evaluation of regulatory alternatives for pretreatment was also influenced by the legislative history of Section 519, as well as previous policy studies of the National Pretreatment Program. As discussed in Chapter 1, Congress did not seek a fundamental reexamination of the need for pretreatment in specifying EPA's obligations under Section 519. Instead, Congress directed EPA to consider program improvements that might better achieve the goals of the CWA.

Alternatives that narrowed the coverage of the National Pretreatment Program (e.g., regulating fewer industries, granting large city waivers, reducing the role of local programs to guidance only) were not considered in light of previous EPA evaluation and congressional

Table 8-1. Goals of the Clean Water Act

A. Explicit Goals

To restore and maintain the chemical, physical, and biological integrity of the Nation's waters through the policies enumerated below:

- The discharge of pollutants into the navigable waters is to be eliminated by 1985.
- Wherever attainable, water quality is to be provided for the protection and propagation of fish, shellfish, and wildlife and for recreation in and on the water by 1983.
- The discharge of toxic pollutants in toxic amounts is to be prohibited.

B. Implicit Policies/Goals

- Where attainable, waters of the United States should be fishable and swimmable. This ensures clean water and a healthy environment.
- Water is a valuable resource, and no person has the right to use it as a system to convey or dispose of pollutants. Persons who wish to do so must obtain a permit.
- The regulatory program contains water quality-based provisions that are intended to be technology forcing. It sets protective standards that must be met by dischargers regardless of available technology.
- Ensuring the health of the Nation's waters is a responsibility shared by all levels of government. Although the allocation and specific use of water remains of State and local concern, the Federal Government has asserted its paramount interest in ensuring the integrity and stability of this natural resource.
- CWA programs should involve the public in all decisions regarding the issuance of permits, the enforcement of laws, and the transfer of functions from EPA to State and local agencies (or changes thereto).

review of policy alternatives in the pretreatment Regulatory Impact Assessment, the Three-City Study, and the Domestic Sewage Study (DSS).

Therefore, policy alternatives pertaining to the status of the Resource Conservation and Recovery Act's (RCRA's) domestic sewage exclusion (DSE) were not evaluated. Reconsideration of the DSE was not undertaken in light of the fact that EPA prepared an entire report on the topic (the DSS) for congressional review recommending retention of the exclusion. Moreover, EPA has undertaken several regulatory studies (e.g., 304[m] industrial evaluations) and recently promulgated the so-called DSS regulation to improve control of hazardous constituents at POTWs.

Thus, EPA's evaluation focuses on measures to strengthen, refine, or improve toxics control in the National Pretreatment Program as the common denominator for all alternatives considered. This chapter first explains the methods EPA used to perform this evaluation, covering how alternatives were designed, screened, and selected for further analysis based on Section 519 study findings (Section 8.1). Section 8.2 then details the regulatory alternatives and supporting options, and Section 8.3 presents qualitative and quantitative assessments of the alternatives. Given the number of regulatory alternatives and options considered in this chapter, both Sections 8.2 and 8.3 are organized according to the five alternatives selected for evaluation.

8.1 ALTERNATIVE DEVELOPMENT AND SELECTION

EPA's approach to selecting regulatory alternatives for the pretreatment program involved the following steps: (1) identification of potential alternatives for evaluation, (2) screening and selection of alternatives based on study findings, and (3) selection of evaluation methods and data sources. Major aspects of each of these steps are described briefly in this section.

8.1.1 Identification of Potential Alternatives

As an initial step in this Report to Congress, EPA convened two focus groups comprising experts knowledgeable about pretreatment to generate a tentative list of suggestions for improvements to the pretreatment program. EPA intended these focus groups to define a wide range of conceivable alternatives early enough in the study to ensure that data collection was broad enough to encompass all possible choices. The members of each group were asked to identify key changes that would most improve the National Pretreatment Program.

Table 8-2 lists in random order the results from the focus groups (by overall subject area). These cover areas ranging from new types of industrial controls to options emphasizing environmental objectives, alternatives requiring POTW program improvements, technical assistance, and program implementation changes. A number of the suggestions clearly fall within existing regulatory authority (e.g., more aggressive enforcement and more resources); these are identified in Table 8-2 by hollow squares. Others denoted by blackened squares would constitute significant new initiatives for the pretreatment program that would necessitate major regulatory and/or statutory changes (e.g., mandatory pollution prevention for industrial users, corrective action authority in the CWA, and Federal assumption of pretreatment control authority).

The statutory/regulatory alternatives identified in Table 8-2 were carried forward to the next phase—screening and selection of alternatives. (The presentation of alternatives in this document should not be construed as indicating the Administration's policy preferences. It is purely an evaluation of possible courses of action.)

8.1.2 Screening and Selection of Alternatives in Light of Report Findings

Initial recommendations for alternatives to the pretreatment program were first screened against the statutory objectives of Section 519. In addition, alternatives that had previously been considered and rejected in other major studies and Reports to Congress were dismissed. Then, for each major subject analyzed in this report, EPA considered the central findings and their implications for the National Pretreatment Program. Table 8-3 aligns report findings with their corresponding regulatory alternatives. In summary, several shortcomings of the current program hinder full attainment of CWA objectives for control of the indirect discharge of toxic pollutants. Areas warranting further analysis and possible regulatory attention include the following:

- Industrial sources and/or pollutants not yet regulated by categorical standards, commercial establishments, and domestic households may be significant sources of uncontrolled toxics, particularly as industrial sources covered by categorical standards achieve reductions in their discharges.
- One of the program's fundamental strengths, implementation at the local level, provides the flexibility necessary to respond to site-specific conditions. Yet this decentralized approach can result in inconsistent implementation nationwide and potentially in inconsistent environmental results. In particular, variation in the technical merit of local limits may hinder achievement of consistent environmental benefits nationwide.

Table 8-2. Initial Suggestions for Improving Pretreatment Program— Regulatory/Statutory(■) and Nonregulatory (□) Alternatives

Industrial User Controls

- ■ Establish variance system for pollution prevention
- ■ Promulgate categorical standards for additional industries and pollutants
- □ Develop additional controls for centralized waste treaters (CWTs)
- ■ Regulate contributors to CWTs
- ■ Repeal DSE
- ■ Make semiannual inspections mandatory
- ■ Repeal removal credits
- ■ Require zero discharge of all toxics/persistent toxics

Environmental Objectives/Controls

- ■ Impose minimum requirements on pollutant-by-pollutant basis applicable to all industrial users (IUs) (e.g., single concentration-based limit; eliminate Combined Wastestream Formula, and mass- and production-based limits)
- ■ Include more standards/limits in POTW permits (e.g., sludge, toxicity, water quality limits)
- ■ Pursue integrated multimedia permitting
- □ Improve State water quality standards
- ■ Acquire corrective action authority for environmental contamination
- ■ Institute toxic surcharges/environmental benefit fund
- ■ Expand basis for local limits (e.g., beyond existing pass through/interference definitions to a direct basis on environmental criteria)
- ■ Standardize information requirements for local limits approval
- ■ Expand list of Section 307(a) toxics
- ■ Promulgate numerical sludge quality criteria for all use and disposal options (including co-disposal)
- ■ Control domestic sources of toxics

POTW Controls

- □ Improve operator training and/or certification requirements for POTWs
- □ Institute laboratory certification/audit program
- ■ Require administrative penalty authority
- ■ Require mandatory monthly influent/effluent/sludge sampling
- □ Expand inspection authority
- ■ Evaluate nondischarging POTWs for development of local programs
- □ Establish POTW best management practices (BMPs), operation, treatment enhancement
- ■ Establish influent antibacksliding policy for influent quality
- ■ Require civil and criminal penalty authority

Program Implementation

- □ Improve oversight of existing State and local programs
- □ Improve uniformity of program administration and regulation interpretation across all levels (EPA, States, locals)
- □ Identify top 10 POTW permits needing modifications
- ■ Remove POTWs as control authority (Federal/State control authorities)
- ■ Make EPA the control authority; POTWs perform sampling, analysis, inspection, etc.
- □ Pursue aggressive Federal/State enforcement against POTWs
- □ Pursue aggressive Federal/State enforcement against IUs
- ■ Implement at State level
- □ Improve followup of POTW inspections/audits
- □ Withdraw poor State programs
- □ Seek more State program approvals
- □ Identify all facilities subject to new categorical standards
- □ Expand State involvement
- ■ Require regulation (permits) of industries by EPA in absence of effective State or local regulation
- ■ Require IUs to fund program/user fees
- □ Allow partial POTW programs
- ■ Shift technical responsibilities from POTWs to industries and approval authorities (e.g., local limit development)
- □ Make State/EPA enforcement authority equivalent
- ■ Make pretreatment regulations applicable to POTWs self-implementing (i.e., no need to first modify permit)

Technical Assistance

- □ Obtain more money for all levels
- □ Provide more direct technical assistance to POTWs (e.g., local limit development)
- □ Demonstrate innovative technology for pretreatment and waste minimization
- □ Increase public education

Key
□ = Alternative within existing regulatory authority.
■ = Regulatory/statutory alternative.

Table 8-3. Report to Congress Findings and Alternatives

Study Issue (chapter)	Report to Congress Findings	Associated Alternatives
Toxic Discharges to POTWs—Chapter 3	• Categorical pretreatment standards have not been developed for several potentially significant industrial categories. • Data on industrial discharges are incomplete at local, State, and national level for some pollutants and industries. • Industries discharge many toxic pollutants, some of which are not sufficiently controlled. • Proven pollution prevention technologies are available for some industries. • Domestic sources may be significant in limited situations.	• Expand technology-based controls to other industries • Require more industrial monitoring • Develop national pollutant standards for all IUs • Incorporate pollution prevention into industrial pretreatment controls • Best professional judgment (BPJ) limits for IUs not covered by categorical standards
Secondary Treatment Removal of Toxics—Chapter 4	• Biodegradation is the only true removal. • POTW removal is highly variable. • POTW removal typically is too variable to supplant pretreatment. • Certain pollutants end up in sludge, air, or receiving waters, or they biodegrade. • Extensive monitoring is necessary to quantify POTW removals.	• Limit removal credits to pollutants that biodegrade • Issue zero discharge standards to IUs for nonbiodegradable pollutants • Require more monitoring to establish POTW-specific removals
POTW Capability To Control Toxics—Chapter 5	• Most removal credits have been granted for nonbiodegradable pollutants. • Comprehensive environmental criteria are lacking to develop environmentally protective local limits and assess the impacts of removal credits. • POTWs have developed some local limits to control toxics in the absence of sludge standards and National Pollutant Discharge Elimination System (NPDES) limits. • Basis for POTW local limits is variable—33 percent of local limits have known technical basis.	• Allow removal credits only for biodegradable pollutants • Allow removal credits only for pollutants limited in NPDES permits • Require local limits to meet environmental criteria • Base NPDES permits on environmental criteria • Tighten procedural basis/ establish consistent technical basis for developing local limits

Table 8-3. Report to Congress Findings and Alternatives (continued)

Study Issue (chapter)	Report to Congress Findings	Associated Alternatives
Environmental Impacts—Chapter 6	• Key pathways are: - Effluent: surface water, sediments - Sludge: ground water, soils, direct contact, air - Incinerator: air, ash - Volatilization: air - Plant integrity: corrosion, explosion, worker health and safety. • Standards for discharges/releases are scattered; implementation is inconsistent and incomplete. • Significant amounts/concentrations of persistent and other toxics are discharged by POTWs, with known potential for adverse impacts. • Data useful in assessment of impacts were collected for many purposes and are not entirely adequate for assessment. Data on sludge, air, human health, collection systems are much less extensive than for surface water. • Monitoring data to measure impacts are lacking. • Criteria for assessing impacts are available for only a limited number of pollutants	• Expand priority pollutant list • Develop criteria and standards for all receiving media • Establish mandatory NPDES permit limits for releases to all media • Require corrective action for environmental contamination • Increase ambient environmental monitoring and reporting
Program Effectiveness—Chapter 7	• Regulation of categorical industrial users and significant industrial users at nonpretreatment POTWs is incomplete and inconsistent. • POTWs can be effective regulators but face political and resource obstacles. • It is difficult to assess environmental effectiveness at the national level, but pretreatment POTWs have reduced toxic pollutant loadings and adverse environmental impacts. • Incomplete environmental criteria hamper environmental evaluation and limit development of requirements; existing criteria are not incorporated adequately.	• Expand Federal authority to regulate IUs directly • Emphasize inclusion of environmental criteria for toxics: – In NPDES and sludge permits – As basis for local limits • Require more IU, POTW, and environmental monitoring

- The pretreatment program's dependence on environmental criteria to control discharges to surface water, air, and sludge creates an integrated, multimedia approach to the control of toxic discharges. Regulatory programs concerned with surface water, sludge, and air quality, as well as worker health and safety, ultimately play an important role in the success of the pretreatment program; many criteria and standards under such programs drive the numeric limits in NPDES permits and ultimately are incorporated into local limits.
- Lack of national data makes it difficult to evaluate the impacts of toxic pollutants on the environment and the program's effectiveness in controlling these impacts. While there is no "ideal" data base that provides accurate, comprehensive information, the expansion of information at the POTW, State, and Federal level on three basic subjects—IU discharges, POTW operations, and environmental effects—is key to enhanced program development, implementation, and enforcement.

In light of these central findings and given the number of alternatives and refinements provided in Table 8-3, the alternatives were reorganized into four procedural aspects of the pretreatment program that may warrant improvement—national indirect discharger controls, POTW-specific source controls (including removal credits and local limits), environmental controls, and monitoring. Additionally, an alternative shifting governmental administrative responsibilities for toxics control actions to States and the Federal Government was carried forward to address potential issues about local program adequacy and capability. This organizational scheme is broad enough to capture the diverse alternatives to be considered, but simple enough to support differentiation and evaluation.

Table 8-4 presents the revised alternatives (and associated options for each) selected for final evaluation in this Report to Congress. As can be seen, EPA carried forward five types of regulatory improvements for evaluation: strategies to further reduce industrial toxics loadings at both the national and local levels (alternatives 1 and 2, respectively); mechanisms to emphasize environmental protection at pretreatment POTWs (alternative 3); approaches to gather more information on toxics discharges and POTW performance (alternative 4); and changes in responsibilities for administering the program (alternative 5). Within each of these major alternatives are a number of optional approaches for attaining the broader goals of the alternatives. (To distinguish between the major alternatives and supporting options, the terms *alternative* and *option* are always used distinctly.) Options within an alternative may vary in terms of the regulatory technique, the target, or the outcome sought. For example, as shown in Table 8-4, options within alternative 1 reflect different approaches to reduce industrial loadings at the national level by varying the basis for coverage (e.g., technology-based, pollutant-based, zero discharge) and scope of coverage

Table 8-4. Overview of Regulatory Alternatives and Options

1. Enhance national pretreatment standards

    1.1 Develop categorical standards for 304(m) industries and revise existing standards, including regulation of additional pollutants

    1.2 Integrate pollution prevention technologies into all categorical pretreatment standards where practicable

    1.3 Promulgate national nondomestic pretreatment standards on a pollutant-by-pollutant basis to cover all nondomestic dischargers (including commercial facilities)

    1.4 Issue zero discharge standards for industries discharging persistent non-biodegradable toxic pollutants

    1.5 Prohibit the discharge of certain products/substances from households to sewers (household hazardous waste control)

2. Improve/restrict site-specific toxic discharge standards

    2.1 Limit removal credits to pollutants that are biodegraded in municipal systems

    2.2 Stiffen removal demonstrations required to qualify for removal credits

    2.3 Establish mandatory local limits development requirements (e.g., pollutants, use of actual data, review procedures)

    2.4 Mandate that local limits be developed to meet all applicable environmental criteria

3. Enhance environmental controls on POTWs

    3.1 Promulgate environmental criteria for all POTW receiving media (receiving water, air, sludge, sediment)

    3.2 Require inclusion of toxic limits in permits for all pretreatment POTWs, covering all wastestreams (air, water, sludge)

    3.3 Require corrective action at POTWs where environmental monitoring reveals releases and/or contamination

Table 8-4. Overview of Regulatory Alternatives and Options (continued)

4. Expand pretreatment monitoring requirements

   4.1 Expand significant industrial user monitoring requirements

   - Increase effluent monitoring for all toxic/hazardous pollutants
   - Conduct toxicity testing or inhibition testing on industrial discharges
   - Require prohibited discharge monitoring

   4.2 Expand POTW wastestream monitoring requirements

   - Increase frequency and pollutants covered in influent, effluent, sludge sampling/analysis
   - Increase toxicity testing

   4.3 Require POTWs to monitor ambient receiving environments

   - Monitor ambient water quality sampling upstream and downstream from all POTW outfalls
   - Monitor air monitoring onsite and downwind
   - Monitor sediment upstream and downstream
   - Monitor ground water where pipe exfiltration, injection, or leaching from unlined lagoons or sludge ponds may occur

5. Shift administrative burdens/responsibilities in National Pretreatment Program

   5.1 Shift more responsibilities, such as category determinations and enforcement responsibility, from control authorities (POTWs) to approval authorities (States and EPA Regions) responsibility

   5.2 Centralize program—expand Federal/State authority to regulate industrial users (e.g., categorical industrial users [CIUs], all significant industrial users [SIUs]) of the proposed standard. Section 8.2 describes in greater detail the alternatives and associated options.

8.1.3 Methods and Data Sources for Alternatives Evaluation

In evaluating alternatives for the National Pretreatment Program, EPA assessed each both qualitatively and quantitatively. As a starting point, each alternative (and each option within each alternative) is defined in Section 8.2. The potential benefits of each alternative are compared with the goals of the CWA and its impact on sludge quality, as called for in Section 519. Then, a more quantitative evaluation is performed for each option addressing, to the degree possible, the number of affected parties, compliance costs, government administrative costs, and expected results. Finally, the adequacy of Federal, State, and local resources required to establish, implement, and enforce each alternative is presented.

The data used for this assessment are drawn from report findings, Agency resource estimates, and BPJ where estimates were otherwise unavailable. An underlying caveat to this alternatives evaluation is that it is speculative, relying on judgment to predict the future effects and outcome of alternatives. Given this degree of uncertainty, quantitative estimates are intended to indicate the direction and relative magnitude of a change or impact, but are not offered as precise values.

8.2 DETAILED CHARACTERIZATIONS OF REGULATORY ALTERNATIVES

This section presents a more detailed description of the regulatory alternatives proposed as potential improvements to the existing National Pretreatment Program. Each alternative addresses a major functional component of the existing program. The alternatives can be considered discrete or complementary strategies for program improvement that are, for the most part, not mutually exclusive. Moreover, options within each alternative may be selected independently or in conjunction with others. Key linkages among alternatives are also highlighted in the following descriptions.

8.2.1 Alternative 1: Enhance National Pretreatment Standards

Options within this regulatory alternative would reduce toxic loadings to POTWs as a result of EPA-promulgated national pretreatment standards. Implicit in this alternative is the premise that toxic discharges from industries at many POTWs remain too high despite the prohibited discharge standards, categorical standards for existing and new sources, and local limits currently in place. This alternative further presumes that EPA is best equipped to address some subset of these unregulated or underregulated sources of toxics because of the Agency's experience, resources, and political will. This option would also be supported by perception of the need for national consistency and equity.

As may be observed in Table 8-4, the options within this alternative vary with respect to the specific source to be controlled—additional new categorical industries (option 1.1), selected existing categorical industries (options 1.2 and 1.4), all significant industries and commercial facilities (option 1.3), and domestic sources (option 1.5). Many of the source control options also vary with respect to the basis for the new standards. Thus, options 1.1 and 1.2 call for EPA promulgation of technology-based standards, with option 1.1 relying on a traditional approach and option 1.2 mandating consideration of pollution prevention approaches as the basis for numerical standards in establishing industrial water pollution controls. Option 1.3, calling for national pretreatment standards on a pollutant-by-pollutant basis, might be implemented using treatment plant inhibition levels or operational parameters as the basis for limits. Lastly, options 1.4 and 1.5 rely on absolute bans as the basis for standard setting, requiring EPA action to determine the unacceptable pollutant parameters.

These options are not mutually exclusive; rather, they could be combined to achieve the magnitude of incremental pollutant reductions desired in the most efficient manner. Option 1.1 targets the additional industries being investigated as a result of the DSS and the 304(m) process. As discussed in Chapter 3, these industries include machinery manufacturing, pharmaceuticals manufacturing, hazardous waste treatment, and industrial laundries. Option 1.2 would reduce loadings by identifying industries where pollution prevention technologies or processes would reduce or eliminate pollutant discharges. This would build upon current Agency practice of incorporating pollution prevention practices into BAT. Industries would be targeted according to the feasibility of, and opportunities for, pollution prevention, in addition to the mass of pollutants that would be reduced. This would tie into other major EPA environmental initiatives.

Option 1.3, with its emphasis on pollutant-specific rather than industry-specific pretreatment standards, would seek to simplify national standards to assist POTW implementation and enforcement and to overcome common complaints over complexities associated with the current pretreatment program (e.g., industrial category determinations, production-based standards, and the combined wastestream formula). Under this option, categorical standards for specific pollutants would gradually be supplemented by uniform pollutant-specific standards. This option would cast the widest net with respect to source control obligations, but would necessarily not account for economic or technological achievability by industrial source categories.

Option 1.4 is distinct in its realization of one of the fundamental goals of the CWA: elimination of the discharge of toxic pollutants. The specific rationale for controls under this option is that toxic pollutants that are not degraded by wastewater treatment plant processes but merely transferred to another medium (e.g., air, sludge, sediment, or soils) and that persist in the environment for prolonged periods should not be discharged to the Nation's waters if they pose a significant environmental risk (see discussion in Chapters 4 and 6). Such a proscription is consistent with the WQA's objectives and is the basis for cross-media pollution control initiatives under the Great Lakes Water Quality Agreement.

Finally, option 1.5 would adopt at a national level what some municipalities have undertaken locally: namely, system-wide controls on household hazardous or toxic wastes. Such programs may include public education on desirable waste disposal practices, disposal programs for domestic hazardous wastes, bans on the use or dumping of certain commercial/household products (e.g., liquid drain cleaners), promotion of less toxic consumer products, and enhancement of corrosion control programs for municipal drinking water systems. As Chapter 3 indicates, control of domestic sources of toxics has been shown to be effective in some pretreatment cities where a major share of toxic loadings comes from residential wastewaters. Domestic controls would be appropriate at the national level were it to be shown that industrial categorical standards and local limits were broadly insufficient to enable POTWs to comply with municipal sludge criteria or more pervasive toxics limits in their NPDES permits.

8.2.2 Alternative 2: Improve/Restrict Site-Specific Toxic Discharge Standards

The underlying premise of alternative 2, like that for alternative 1, is that further reductions in loadings are necessary to protect POTWs and the environment. However, contrary to the preceding alternative, options within this alternative tighten control of toxic discharges at the local, rather than national, level, relying on local expertise and proximity to develop controls. Within this alternative are two distinct types of options: options 2.1 and 2.2 limit the availability of removal credits; options 2.3 and 2.4 strengthen local limits.

Option 2.1 would restrict removal credits availability to pollutants shown to be biodegraded in POTW wastewater treatment plants. Many pollutants are volatilized, partitioned to sludge, or passed through to receiving waters without destruction or degradation. Option 2.1 would preclude POTW relaxation of national categorical standards for any pollutant that was not actually degraded within the POTW treatment plant, independent of environmental effect of the release or discharge. This option is a companion to option 1.4, which calls for the elimination of the industrial discharge of persistent toxics.

Option 2.2 would require more rigorous demonstration of removals for POTWs to qualify for removal credits. The most recent removal credits regulations required a minimum of 12 individual samples per year and allowed the use of historical data to demonstrate POTW removals. Option 2.2 would require an intensification of removal monitoring to support removal credits applications. For evaluation purposes, it is assumed that POTWs would be required to monitor continuously over some predetermined period (e.g., daily measurements over 4 separate months representing four separate seasons) to determine consistent removal and that historical data could not be used.

It should be noted that the scope of both removal credits options may be relatively narrow, given the small number of POTWs that have applied for and qualified for removal credits to date. These options may have little effect in reducing current toxic loadings, but they would prevent prospective increases that might result with the return of removal credits after EPA promulgation of the sludge criteria.

Options 2.3 and 2.4 would reduce toxic discharges by POTWs by improving local limits. They recognize that some municipalities have been successful in addressing local problems but seek to make local toxic discharge limitations more consistent and widespread across all pretreatment POTWs. In particular, these options would strengthen the role of environmental objectives in the development of local limits by POTWs. To this end, they depend on aggressive promulgation of Federal environmental criteria, standards, and permit limits, as called for in alternative 3. Also implicit in these alternatives is that the cooperative intergovernmental approach to promulgation of categorical standards and local limits remains desirable. Equitable national controls with local polishing is seen as a potential regulatory strategy that would be enhanced by enumeration of more concrete regulatory guidelines and objectives.

Option 2.3 would codify the essential components of EPA's *Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program* (EPA, 1987) and provide precise regulatory guidelines on such components as (1) POTW requirements to consider certain pollutants for local limits and specifying methods to be used for identifying others; (2) the specific technical bases required for limits development; and (3) data requirements to support local limits (i.e., POTW-specific versus national or other default removals data). Presumably, this option would have minimal effect on those pretreatment POTWs that have been found by program audits to have technically based local limits (about 34 percent of pretreatment programs, nationally, have some technically based local limits), but would provide clearer direction and technical support to municipalities that should have already developed technically based local limits, but failed to do so.

Option 2.4 broadens the legal basis for local limits. The current pretreatment regulations link local limits principally to pass through and interference, which in turn are based on violations of NPDES permit conditions. This option would tie local limits to all environmental criteria (e.g., water quality, sludge, and air quality criteria, standards, NPDES permit limits, and worker health and safety criteria) relevant to POTW discharges. This change would require municipalities to consider all wastestreams and media in evaluating the need for and developing local limits. This option also presumes a major effort by EPA/States in development of guidance and training, which would explain methods for application of the criteria to site-specific situations. This option corresponds to the environmental monitoring and control options (option 4.3 and options 3.1-3.3, respectively).

A variant of options 2.3 and 2.4 would involve issuing guidance to assist municipalities in setting local limits for nonconservative and reactive compounds. Issuing guidance and conducting followup, targeted training recognizes the effectiveness of current guidance and training efforts.

8.2.3 Alternative 3: Enhance Environmental Controls on POTWs

Whereas alternatives 1 and 2 rely on more stringent source controls to improve local pretreatment programs, alternative 3 directly strengthens environmental objectives for POTWs as a means of improving toxic pollutant control by pretreatment POTWs. This approach relies on one of the program's underlying premises: that POTWs will tighten down on industrial, commercial, and domestic sources of toxics as necessary to attain environmental objectives. Local programs are intended to prevent pass through, interference, and sludge contamination. POTW NPDES permits are to contain water quality-based toxic limits to protect receiving waters. As a result of the Water Quality Act of 1987, NPDES permits will increasingly contain toxic limits for sludge disposal. Moreover, POTWs are also subject to State and local air quality, ground water, and health and safety regulations.

Nevertheless, implementation of this approach has been slow and, as discussed in Chapters 5 and 6, few POTWs possess a full complement of environmental objectives that provide benchmarks for toxics control. The three options in alternative 3 represent different approaches to improving the integration of environmental measures into the pretreatment program.

Options 3.1 and 3.2 are integral to each other. Option 3.1 calls for EPA to issue environmental criteria for pollutants in all POTW receiving environments. This would require EPA to further develop water quality criteria, sludge standards (presently underway), and air quality standards for toxic pollutants. These criteria and standards could serve as the basis for the mandatory permit limits for all pretreatment POTW discharges, releases, and emissions envisioned under option 3.2. Alternatively, State and EPA permit writers could implement option 3.2 using BPJ or technology-based approaches to derive POTW environmental limits.

The data generated as a result of options 3.1 and 3.2 would enable control authorities to assess the adequacy of environmental protection by pretreatment POTWs. As a corollary to this option, municipalities might receive greater programmatic flexibility if they were to achieve consistent compliance with comprehensive environmental limits. It is not the intent of these options, however, that enhanced environmental controls on POTWs should supplant either Federal technology-based pretreatment standards or local discharge limitations. Instead, these options would provide environmental standards that would enhance the effectiveness of pretreatment measures by driving the development of additional local limits.

Option 3.3 is modeled after the corrective action program under RCRA. It would require approval authority oversight to conduct and evaluate POTW environmental assessments. This option is remedial, rather than preventive, and would require municipalities to correct environmental problems associated with toxic releases from POTWs to all environmental media. Option 3.3 would, of necessity, depend on the comprehensive environmental monitoring called for in option 4.3 and the environmental benchmarks established in option 3.1 and/or option 3.2. Under this option, a pretreatment POTW would monitor all releases and endpoints associated with toxic discharges. Where monitoring revealed contamination above applicable environmental criteria, the POTW would be required to initiate corrective measures (e.g., removal or immobilization of contaminated sediments or retrofitting of sludge monofills). The controlling premise behind this proposal is that environmental problems associated with toxic releases at POTWs may not be widespread enough to warrant extensive remedial actions across all POTWs but that where problems do exist they should be identified and corrected.

8.2.4 Alternative 4: Expand Pretreatment Monitoring Requirements

Alternative 4 consolidates options that would increase the monitoring responsibilities of industrial users and/or POTWs. This alternative would ensure that more information is available to control authorities and approval authorities on pollutants present in industrial discharges, POTW wastestreams, and POTW receiving environments so that impacts resulting from toxic discharges can be identified and controlled. Options under this alternative affect SIUs and POTWs.

In option 4.1, SIUs would be required to perform more extensive self-monitoring, testing their effluents more frequently and for more toxic constituents than is currently required (SIUs are currently only required to self-monitor semi-annually for pollutants addressed in the control mechanism). In addition, SIUs would be explicitly required to test their effluents for whole effluent toxicity and ignitability.

Such an increase in SIU monitoring would be warranted by evidence, discussed throughout previous chapters, that neither industries nor POTWs fully know what is in industrial discharges to municipal sewers. Such testing would allow POTWs, States, and EPA Regions to make effective regulatory decisions to control toxic pollutants (e.g., through permitting, local limits development, and enforcement).

Option 4.2 would require pretreatment POTWs to engage in system-wide monitoring of plant wastestreams (influent, effluent, and sludge), which would give municipalities and their regulators more complete knowledge of system conditions, impacts, and contamination from toxic discharges. Increases in sampling frequency would ensure more accurate data for removal credits and local limits development activities, and would support other program implementation and enforcement activities. Toxicity testing would be mandated more often than the once per 5 years specified in the DSS regulations (40 *CFR* 122.21 [j] (l)), and would provide more reliable data on POTW effluent toxicity in light of the high variability associated with industrial discharges, POTW influent, and POTW removal processes. Results would be used to adopt more effective toxic control strategies, as well as to regulate POTW discharges in NPDES permits. Such changes could be implemented through NPDES permit requirements without any regulatory/statutory changes. Indeed, EPA Regions and States have required some POTWs to monitor more frequently (including toxicity monitoring) than is prescribed by the rules.

The final monitoring option, 4.3, would require POTWs to engage in mandatory ambient environmental monitoring for all media affected by releases from POTWs. POTWs frequently have significant effects on their receiving environments. This option would improve knowledge and documentation of changes across media from POTW operations. While surface water monitoring occurs at some POTWs on sensitive receiving streams or under special circumstances (e.g., 301[h] POTWs), it is rare. POTW monitoring of other media and releases is extremely unusual. Such an option presumes that information at the POTW, State, and Federal level on the environmental impacts associated with pretreatment POTWs is inadequate to support such critical decisionmaking for local limits development and industrial and municipal permitting, among other activities. This option could be linked to the development of environmental criteria (option 3.1), to environmental permitting (option 3.2), or to the corrective action option (3.3). Alternatively, environmental monitoring could serve as a stand-alone option to heighten POTWs' awareness of their environmental effects.

A common thread in all monitoring options under alternative 4 is that the National Pretreatment Program lacks comprehensive data on industrial and municipal toxic discharges sufficient to identify problems, monitor progress, ensure compliance, and evaluate program effectiveness with a high degree of reliability. The options within the monitoring regulatory alternative vary with respect to the nature and source of the monitoring information desired concerning the quality of influent, effluent, and sludge, and the POTW's environmental impact. A final monitoring regulatory decision could carry forward one or all of the options presented.

Options 4.1 and 4.2 are currently required in reduced form under the pretreatment and NPDES programs. The frequency of monitoring events included in these options could be adjusted as necessary to achieve the appropriate staging of sampling events to meet all regulatory objectives. Option 4.3 is not mandatory at the Federal level except for 301(h) POTWs, although some States may require environmental monitoring at POTWs. There is precedent for such environmental assessments under the CWA, as in the monitoring requirements for municipalities exempt from secondary treatment under 301(h). Any or all of these options could also require reporting monitoring results to control or approval authorities as appropriate.

8.2.5 Alternative 5: Shift Administrative Responsibilities in the National Pretreatment Program

Alternative 5 contains two possible administrative changes for the National Pretreatment Program. Both options represent dramatic departures from the current role played by local authorities (POTWs) in the program. Option 5.1 would transfer certain program responsibilities, such as development of local limits and program enforcement, from municipalities to approval authorities (approved States and EPA Regions). Municipalities might retain identification, monitoring, and permitting responsibilities. This realignment of responsibilities would draw on the greater technical expertise and resources at the approval authority level, and would provide insulation from local political pressures.

Option 5.2 is a more absolute variant of option 5.1, calling for the transfer of all pretreatment program responsibilities from municipalities to States and EPA. In essence, control of toxic discharges from indirect dischargers would be accomplished by the same agencies now issuing NPDES permits for direct dischargers.

Option 5.2 would require no changes to State-run pretreatment programs under 40 *CFR* 403.10(e). This option would be supported by evidence that POTWs were not effective regulators of industrial waste dischargers or, alternatively, that State-run pretreatment programs and regional regulation of categorical industries in nonpretreatment cities had been particularly successful.

Obviously, option 5.2 would be mutually exclusive with much of alternative 2, which stresses improvement of local controls. Otherwise, consideration of alternative 5 and all the other alternatives can proceed independently.

8.3 EVALUATION OF STATUTORY/REGULATORY ALTERNATIVES FOR THE PRETREATMENT PROGRAM

This section provides a summary evaluation of the five principal statutory/regulatory alternatives described in Section 8.2. The evaluation is accomplished by means of a qualitative and quantitative assessment of each alternative and its respective options. Tables 8-5 and 8-6 serve as an organizational framework and guideposts for the discussion.

In evaluating the options, the following factors need to be considered: (1) the cost of the effort to the private and public sector, (2) the pollutant reductions and environmental results achieved, and (3) the practicality of implementing the alternatives. These factors are

Table 8-5. Qualitative Assessment of Pretreatment Alternatives

Alternative (Statutory [S] or Regulatory [R])	Purpose	Parties Affected	Type of Change(s)	Evidence Supporting Alternative	Applicability to CWA Goals/Effects on Sludge	Benefits	Drawbacks
1. ENHANCE NATIONAL PRETREATMENT STANDARDS							
1.1 New Categorical Standards (R)	Provide new technology-based pretreatment standards for unregulated industries	304(m) industries, other categories	New regulatory standard revised for at least 10 industries; CIU compliance; additional pollutant standards for some categories	• Some industrial categories not currently regulated contribute significant toxics • Some regulated categories discharge more pollutants than are regulated, particularly organics	• Reduction in toxic discharges • Reduction in CIU toxic loadings • Progress toward zero discharge • Improvement in water uses • Improvement in sludge quality	• Consistency • Defensibility	• Resource intensive • Time consuming
1.2 Pollution Prevention in Categorical Standards (S)*	Incorporate pollution prevention as basis of numerical limits in categorical standards	Selected categorical industries	Potential regulatory revision of categorical standards; CIU compliance	• 24 of 30 categorical industries known to have pollution prevention techniques available • 13 of 17 noncategorical industries known to have pollutant prevention techniques available • Many priority and nonpriority pollutants present in effluent/sludge • Current mass-based categorical standards consistent with pollution prevention philosophy	• Results in progress toward zero discharge goals • Should be at least as protective of sludge and water quality	• Consistent with EPA's pollution prevention initiative • Cost impacts to IUs may be low • Innovative	• May increase Federal intervention into production processes
1.3 Nondomestic Pretreatment Standards (R)	Issue consistent concentration-based pollutant standards applicable to all nondomestic users regardless of industry	All nondomestic users	Promulgation of pollutant-specific standards to supplement categorical standards; nondomestic IU compliance	• Commercial dischargers much greater in number than CIUs or SIUs • At many municipalities, uncontrolled nondomestic toxics contribute more than SIUs/CIUs	• Broader toxics reductions across all nondomestic sources, thus water quality and sludge benefits	• Most uniform • Much easier for POTW to use	• Controversial technical basis • Expensive to develop • Potentially inequitable • Requires development of new basis for standard • Would replace known mechanism (categorical standards) with an unknown

* Options addressing pollution prevention and zero discharge can be considered under current statutory requirements but cannot be selected as the basis for BAT unless determined to be the best available treatment economically achievable.

Table 8-5. Qualitative Assessment of Pretreatment Alternatives (continued)

Alternative (Statutory [S] or Regulatory [R])	Purpose	Parties Affected	Type of Change(s)	Evidence Supporting Alternative	Applicability to CWA Goals/Effects on Sludge	Benefits	Drawbacks
1. Enhance National Pretreatment Standards (continued)							
1.4 Zero Discharge Categorical Standards (S)*	Eliminate discharge of persistent toxics posing high risks	Select categorical industries	Regulatory revision to categorical standards; CIU compliance	• Potential for environmental impacts associated with persistent toxics • Persistent toxics still being discharged to POTWs; frequent occurrence in effluent/sludge	• Full attainment of CWA goal for select pollutants and IUs • Distinct support for fishable/swimmable and toxic objectives given pollutant focus • Most aggressive approach for metals reduction in sludge	• Promotes pollution prevention • Technology forcing	• Technical basis for definition of persistence • Issue of practicality • IU cost
1.5 Domestic Waste Controls (S)**	Control toxic wastes in domestic wastewaters	Households connected to POTW with high loadings of domestic toxics	New regulations banning product use; discontinuance or reduction of domestic use	• Analyses in this report indicate exceedance of maximum contaminant levels based on domestic loadings alone • Some POTWs approach or exceed allowable headworks loadings for some pollutants based on domestic loadings • Households can be significant contributors of such pollutants as copper, zinc, lead, pesticides, solvents	• Broadest source reduction for toxics • Sludge improvement at cities with high domestic pollutant loads	• Another pollution prevention initiative • Potentially more cost-effective than additional IU controls • Linkage with local solid waste management efforts • Could provide for more industry expansion/less drastic required IU reductions	• May be more appropriate at local level • Requires ready access to other disposal options • Difficult to enforce
2. Improve/Restrict Site-Specific Discharge Standards							
2.1 Limit Removal Credits to Biodegradable Pollutants (R)	Allow removal credits only where true removal actually occurs	13 POTWs with approved removal credits (now void); prospectively, all pretreatment POTWs	New restrictive provisions in revised removal credits regulation	• 91% of removal credit applications are for pollutants for which "removal" means partitioning to sludge	• Promotes zero discharge of problem pollutants • Reduces loadings to sludge of persistent pollutants	• Limits removal credits to those that are technically defensible	• Would limit availability of removal credits • May result in increased cost to industry • May result in additional loadings to industrial sludge as a result of additional pretreatment

** Product use bans could be accomplished under TSCA.

Table 8-5. Qualitative Assessment of Pretreatment Alternatives (continued)

Alternative (Statutory [S] or Regulatory [R])	Purpose	Parties Affected	Type of Change(s)	Evidence Supporting Alternative	Applicability to CWA Goals/Effects on Sludge	Benefits	Drawbacks
2. IMPROVE/RESTRICT SITE-SPECIFIC DISCHARGE STANDARDS (CONTINUED)							
2.2 Stiffen Removal Demonstrations (R)	Guarantee that consistent removal is occurring before granting removal credits	Removal credit applicants	New monitoring requirements in revised removal credits regulation; decrease in applications	• POTW removal is highly variable • Current removal demonstration requirements may be inadequate to ensure POTW attainment	• Would reduce toxic discharges • No effect on sludge since removal could be to sludge	• Accounts for variability of POTW removal	• May increase POTW application costs • May limit availability of removal credits
2.3 Establish Mandatory Local Limits Procedures (R)	Provide concrete regulations governing development of acceptable local limits	All pretreatment POTWs	Modification to pretreatment regulations; POTW revision of inadequate local limits	• Current regulations provide no specific criteria; guidance only • POTWs use wide range of methods to identify and develop limits for pollutants of concern • All potential pollutants of concern not consistently identified or regulated by POTWs	• Would reduce toxics in effluent and sludge through tighter and more prevalent limits		
2.4 Local Limits to Address All Environmental Criteria (R)	Expand environmental objectives to be attained by local limits	All pretreatment POTWs	Modification to pretreatment regulations; POTW revision of inadequate local limits	• Current limits only have to address pass through, interference, and specific prohibitions • Few NPDES toxic limits, so pass through and interference often not relevant • Air quality and worker health and safety may be impaired at POTWs	• Would reduce all toxics releases; establishes potential for more limiting criteria (e.g., worker health/safety) • Would strengthen sludge improvement as basis for LL	• Multimedia protection	• May increase POTW costs to develop in some cases
3. ENHANCE ENVIRONMENTAL CONTROLS ON POTWs							
3.1 Publish additional Environmental Criteria for All Affected Media (R)	Establish environmental criteria for pretreatment program performance	Pretreatment POTWs, States, and EPA	Extensive scientific and regulatory efforts to issue comprehensive water quality, sludge, sediment, air quality criteria	• Effects of POTW discharges are across all media • Currently, POTWs are essentially unregulated at the Federal level for air, ground water, sediment • Insufficient permit limits and environmental criteria have not led to protective local limits	• Would provide environmental thresholds for meeting CWA objectives (e.g., WQ, sludge)	• Criteria pivotal to controlling direct dischargers • Promotes consistency • Clarifies objectives	• Speed with which States adopt criteria as standard • Time needed to develop criteria

Table 8-5. Qualitative Assessment of Pretreatment Alternatives (continued)

Alternative (Statutory [S] or Regulatory [R])	Purpose	Parties Affected	Type of Change(s)	Evidence Supporting Alternative	Applicability to CWA Goals/Effects on Sludge	Benefits	Drawbacks
3. Enhance Environmental Controls on POTWs (Continued)							
3.2 Mandatory Toxic Limits in Pretreatment POTW Permits (R)	Establish limits in NPDES permits to protect all media affected by POTW discharges	Pretreatment POTWs; indirectly IUs	Modification of NPDES pretreatment regulations to require toxic limits; extensive standards promulgation by States; extensive permitting effort by Regions/States; revision of local limits by POTWs; additional loadings reductions by IUs	• Few pretreatment POTWs have toxic limits in NPDES permits, even for surface water • Local limits infrequently based on protective limits	• Would provide precise measures of CWA objectives for each plant	• Clarifies objectives and provides consistency for POTW's implementation of local limits • More protective if based on protective water/sludge standards	• Significant intergovernment undertaking • In many cases, would not prevent increased loadings unless State water/sludge standards improved
3.3 Corrective Action at POTWs With Environmental Problems(S)	Require cleanup of past releases posing environmental hazards	Unknown subset of pretreatment POTWs	Modification of pretreatment regulations to incorporate corrective action; monitoring/ audits to identify problem POTWs	• Sediment contamination has been demonstrated downstream from pretreatment POTWs • Addresses potential of ground-water contamination caused by POTW releases	• Would dictate that actions impairing goals of CWA be redressed (e.g., fish-kills, stream toxicity) • Focus could include environmental damage associated with disposal of contaminated sludge	• Correct imputs of past releases • Heighten perception of effect of current toxic releases	• Cleanups potentially very costly • Difficulty in determining responsible parties' (e.g., contaminated sediments)
4. Expand Monitoring							
4.1 Expand IU Monitoring (R)	Provide more information on industrial discharges and effects	All SIUs	Regulatory increase in frequency and type of monitoring; increases in IU sampling/ analysis	• IUs monitored only for regulated pollutants, although they often discharge large quantities of other pollutants, including nonpriorities • Only 28 of 716 IUs in NC required to monitor for organics; may be even fewer elsewhere	• Improved knowledge of toxic discharges would lead to more effective controls	• Consistency among all CIUs and SIUs • Data could be used to support National Pretreatment Standards (Alternative 1) • Deterrent value • Aids POTWs in permitting/local limits	• Increased costs for IU monitoring • Reduced incentive for approval authority to identify SIUs

Table 8-5. Qualitative Assessment of Pretreatment Alternatives (continued)

Alternative (Statutory [S] or Regulatory [R])	Purpose	Parties Affected	Type of Change(s)	Evidence Supporting Alternative	Applicability to CWA Goals/Effects on Sludge	Benefits	Drawbacks
4. Expand Monitoring (Continued)							
4.2 Expand POTW Wastestream Monitoring (R)	Provide better knowledge of toxics in POTW wastestreams	Pretreatment POTWs	Regulatory increase in frequency and type of monitoring; increases in POTW sampling/ analysis	• Less than half of pretreatment POTWs required to monitor for any toxics; more do, but results not always available to oversight authorities • Concentration in POTW influent/effluent/sludge are variable, but EPA/State/POTW decisions are often based on occasional one-time scans	• Improved knowledge would enable regulators to determine toxic sources in sludge and effluent • Toxicity testing is a strong tool in preventing toxics in toxic amounts	• Required with option 3.2 • Deterrent value • Better identification of pollutants of concern • Improved operation and maintenance • Would facilitate development and revision of categorical standards	• Cost
4.3 Require POTW Ambient Monitoring (R)	Determine environmental impacts of pretreatment POTWs	Pretreatment POTWs	First time regulation required for ambient monitoring; extensive POTW environmental monitoring	• <1% of POTWs collect ambient data	• Ambient data would determine attainment of environmental objectives (e.g., fishable/swimmable) • Data would also enable assessment of long term impacts of sludge disposal	• Key to alternative 3 • Deterrent value • Oversight/ compliance value • Makes need for pretreatment clearer • Would allow targeting of problem POTWs/ pollutants • Could show tangible results of regulatory actions	• Cost • Technical difficulty in designing monitoring requirements • No current means of managing data at national level
5. Shift Administrative Burdens Responsibilities							
5.1 Shift Select Responsibilities From Control Authorities to Approval Authorities (R)	Ease regulatory burdens on POTWs and access Federal/ State resources	Pretreatment POTWs, States, EPA Regions	Modification of pretreatment regulations to change delineation of responsibilities; lessening of municipal duties; increase in Federal/State responsibilities	• POTW implementation/ enforcement widely inconsistent • Some technical deficiencies at some POTWs	Not Applicable	• Consistency • Equity • Distances regulators from local political, economic pressures	• Distances regulators from site-specific data • More coordination required • Resource burden on EPA/States

Table 8-5. Qualitative Assessment of Pretreatment Alternatives (continued)

Alternative (Statutory [S] or Regulatory [R])	Purpose	Parties Affected	Type of Change(s)	Evidence Supporting Alternative	Applicability to CWA Goals/Effects on Sludge	Benefits	Drawbacks
5. SHIFT ADMINISTRATIVE BURDENS RESPONSIBILITIES (CONTINUED)							
5.2 Centralize Pretreatment Responsibilities (S)	Streamline regulatory responsibilities under pretreatment program	Pretreatment POTWs; approved States	Regulatory revision to transfer all program responsibilities to approved States/EPA Regions	• POTW implementation/ enforcement widely inconsistent • Some technical deficiencies at some POTWs	Not Applicable	• Consistency • Comparability between directs and indirects • Fewer regulators • Distances regulators from local political, economic pressures	• Lack of local expertise • Resource burden on EPA/States • Distances regulators from site-specific data

Table 8-6. Quantitative Assessment of Pretreatment Alternatives[1]

Alternative	Size of Affected Universe: IUs	Size of Affected Universe: POTWs	Assumptions	IU and POTW Compliance Costs: Cost Range	IU and POTW Compliance Costs: Total Cost	Federal and State Costs	Results Anticipated
1. Enhance Pretreatment Standards							
1.1 New Categorical Standards/Revision of Others	731,000 IUs (93% in machinery, manufacturing, and rebuilding)	N/A	25-50% of IUs will need to reduce loadings 19 industrial categories to be reviewed, both "new" and those meriting revision	~$4,780 annually (weighted average)	$880 million-$1.7 billion	$8-$12 million per guideline "on average"; $37-$107 million overall	~51.6 million tons reduced 183,000-365,000 IUs would be required to retrofit
1.2 Pollution Prevention in Categorical Standards	~10,000	N/A	Pollutant reductions ranging from 10 to 90% in three industries	None assumed; possible cost savings	None assumed; possible cost savings	$300-$500 thousand per guideline; $5.7 to $9.5 million overall	~11-12 million lbs. Dependent on industry and constituents Reduction on pollutants to all media
1.3 Nondomestic Pretreatment Standards	30,000 SIUs; could be expanded to other IUs	N/A	Pollutant specific standards issued for approximately 5-15 "persistent" pollutants as a supplement to existing guidelines	Unknown	Unknown	$500 to $750 thousand per pollutant for an ecological study Cost guideline unknown	Greater than 4.5 million lbs. reduced Significant reductions in persistent metals, cyanides, and solvents Affects all industrial categories

1 The costs presented in this table and the accompanying appendix are presented as rough estimates. This analysis was not conceived, and should not be used, as a costing analysis conducted in compliance with Executive Order 12291. Costs were, in large part, developed on the basis of professional judgments drawn from surrogate data. Unless otherwise noted, costs represent one-time costs.

Table 8-6. Quantitative Assessment of Pretreatment Alternatives[1] (continued)

Alternative	Size of Affected Universe: IUs	Size of Affected Universe: POTWs	Assumptions	IU and POTW Compliance Costs: Cost Range	IU and POTW Compliance Costs: Total Cost	Federal and State Costs	Results Anticipated
1.4 Zero Discharge Categorical Standards	30,000 SIUs; could be extended to other IUs	N/A	Zero discharge of from 5 to 15 persistent pollutants	Expect extensive plant closure and some job loss	Unknown	>$37-$107 million range, but unknown	Reductions of approximately 4.5 million lbs. of persistent toxics
1.5 Domestic Hazardous Waste Control Programs	N/A	2,330	All local pretreatment programs will need to establish permanent household waste programs Corrosion control costs and lead pipe replacement costs not included; attributable to another rulemaking	~$2.50 per lb. collected ~$.37-$1.10 per capita served	$40-$119 million	Negligible; dependent on extent of technical assistance and training	Dependent on participation rates and success of TSCA product bans, if implemented ~500 drinking water systems installing corrosion control; ~230 will require lead pipe replacement
2. Improve/Restrict Toxic Discharge Standards							
2.1 Restrict Removal Credits Availability to Biodegradable Pollutants	Unknown ≥ 100 IUs	Unknown	Credits no longer available for metals	≥ 2.5 times current sampling and analyses costs	~$14,000 per applicant	≤150 workhours per review	Reduced interest in obtaining removal credits Fewer toxic pollutants released to environment from POTWs

The costs presented in this table and the accompanying appendix are presented as rough estimates. This analysis was not conceived, and should not be used, as a costing analysis conducted in compliance with Executive Order 12291. Costs were, in large part, developed on the basis of professional judgments drawn from surrogate data. Unless otherwise noted, costs represent one-time costs.

Table 8-6. Quantitative Assessment of Pretreatment Alternatives[1] (continued)

Alternative	Size of Affected Universe: IUs	Size of Affected Universe: POTWs	Assumptions	IU and POTW Compliance Costs: Cost Range	IU and POTW Compliance Costs: Total Cost	Federal and State Costs	Results Anticipated
2.2 Require More Rigorous Testing for Removal Credits	Unknown	Un-known		≥ 2.5 times current sampling and analyses costs	Unknown without knowing number of applicants	≤ 150 workhours per review	Reduced interest in obtaining removal credits Fewer removal credits granted Fewer toxic pollutants released to environment from POTWs
2.3 Codify Local Limits Guidance	≤30,000 SIUs	2,330	~33% of local limits are technically based Other programs currently incurring no costs	<200-300 work hours	<$15.6 - $23.4 million	Two EPA work years to promulgate regulations; no additional review costs expected	Local limits development is enhanced
2.4 Broaden Media of Concern for Local Limits Development		2,330	0% of current limits provide comprehensive coverage	~50 workhours per POTW	~$6 million	See options 3.1 and 3.2	Enhanced protection of water quality, sludge quality, worker health and safety
3. Enhance Environmental Controls on POTWS							
3.1 Publish Additional Environmental Criteria for All Affected Media	N/A	N/A	No net impact with regard to resources over the long term; current program activities are accelerated	Not calculated for reason given under Assumptions column	Not calculated for reason given under Assumptions column	Not calculated for reason given under Assumptions column	Acceleration in standards development spurs writing of water quality-based permits

[1] The costs presented in this table and the accompanying appendix are presented as rough estimates. This analysis was not conceived, and should not be used, as a costing analysis conducted in compliance with Executive Order 12291. Costs were, in large part, developed on the basis of professional judgments drawn from surrogate data. Unless otherwise noted, costs represent one-time costs.

Table 8-6. Quantitative Assessment of Pretreatment Alternatives[1] (continued)

Alternative	Size of Affected Universe: IUs	Size of Affected Universe: POTWs	Assumptions	IU and POTW Compliance Costs: Cost Range	IU and POTW Compliance Costs: Total Cost	Federal and State Costs	Results Anticipated
3.2 Inclusion of Toxic Limits in POTW Permits For All Wastestreams	N/A	2,330	All 2,330 affected have multimedia permits Cost of a single permit is at least as great as developing water quality-based permit	Wastestream monitoring costs would be same as those for option 4.2	Wastestream monitoring costs would be same as those for option 4.2	~60 workyears in permitting plus cost of standards development and wasteload allocations Cost of wasteload allocations by discharge situation, ranging up to 5 full workyears	Mass reduction in pollutants discharged and cross-media transfer Increased pursuit of local limits Better local limits
3.3 Require Corrective Action of POTW	N/A	2,330	Cost of sludge permitting is minimal; costs not included All POTWs receive environmental assessments Major costs of cleanup	Unknown but likely in millions	Unknown but likely in millions	200 workyears for initial assessments; additional costs unknown	Cleanup of past releases to surface water, sediment, ground water
4. Expand Pretreatment Monitoring							
4.1 SIU Monitoring							Better understanding of SNC rates
Effluent Monitoring	30,000	N/A	Monitor 4x annually	$21 - $153 million			60,000 to 120,000 sampling
					$35 - $227 million	N/A	
Prohibited Discharge	30,000	N/A	Monitor 4x annually	$2.7 million			Accelerate source reduction/recycling
Toxicity Testing	30,000		Monitor 2x annually	$12 - $72 million			Improved deterrence

[1] The costs presented in this table and the accompanying appendix are presented as rough estimates. This analysis was not conceived, and should not be used, as a costing analysis conducted in compliance with Executive Order 12291. Costs were, in large part, developed on the basis of professional judgments drawn from surrogate data. Unless otherwise noted, costs represent one-time costs.

Table 8-6. Quantitative Assessment of Pretreatment Alternatives[1] (continued)

Alternative	Size of Affected Universe		Assumptions	IU and POTW Compliance Costs		Federal and State Costs	Results Anticipated
	IUs	POTWs		Cost Range	Total Cost		
4.2 POTW Wastestream Monitoring Increased Influent, Effluent, and Sludge Monitoring	N/A	2,330	No pretreatment POTWS currently meet this sampling rigor	$63 - $124 million	$65 - $135 million	N/A	25,000 additional influent, effluent sludge tests Improved deterrence Better data
Effluent Toxicity Monitoring	N/A	2,330	Semiannual testing Range reflects acute versus chronic tests	$1.9 - $11.2 million			
4.3 POTW Ambient Monitoring Surface Water	N/A	2,330	Seasonal sampling	$19.5 - $39 million	$19.5 - $39 million	Review costs	Over 8,000 sampling events New data on community impact of POTW treatment processes
Air	N/A	2,330	Seasonal sampling of headworks aeration basin	$76 - $130 million	N/A	Review costs	
Ground Water	N/A	2,330	Annual testing Unlikely that POTWs have wells in place, but cost of design/installation does not appear in total cost column	Designing/ installing well system costs $12,400 Annual testing of $9,100	≥$21 million	Review costs	Increased recognition of impact of POTWs on ground water

[1] The costs presented in this table and the accompanying appendix are presented as rough estimates. This analysis was not conceived, and should not be used, as a costing analysis conducted in compliance with Executive Order 12291. Costs were, in large part, developed on the basis of professional judgments drawn from surrogate data. Unless otherwise noted, costs represent one-time costs.

Table 8-6. Quantitative Assessment of Pretreatment Alternatives[1] (continued)

	Size of Affected Universe			IU and POTW Compliance Costs			
5. Shift Administrative Responsibilities							
5.1 Shift Some Responsibilities From POTWs		2,330		Program resources shift between levels of government	N/A	Represents a shift of responsibility; no change in overall program costs expected	
5.2 Centralize Program		2,330		No net impacts	N/A	Represents a shift of responsibility; no change in overall program costs expected	

[1] The costs presented in this table and the accompanying appendix are presented as rough estimates. This analysis was not conceived, and should not be used, as a costing analysis conducted in compliance with Executive Order 12291. Costs were, in large part, developed on the basis of professional judgments drawn from surrogate data. Unless otherwise noted, costs represent one-time costs.

reflected in Tables 8-5 and 8-6, Appendix D, and the following narrative. A short description of Tables 8-5 and 8-6 appears below. Following these descriptions, five separate subsections corresponding to the five statutory/regulatory alternatives provide a more explicit explanation of the results summarized in Tables 8-5 and 8-6.

Table 8-5 provides a qualitative assessment of the alternatives (and associated options) in summary form. It lists the options, their purposes, affected parties, types of change expected, evidence supporting the alternatives, applicability to CWA goals, effects on sludge, benefits, and drawbacks.

Table 8-6 provides quantitative information, to the extent available, on each alternative (and associated options). In addition to identifying the size of the affected universe, it lists basic assumptions for the quantitative analysis; estimated costs (often expressed in ranges) to industrial users, the POTW, and Federal and State governments; and results that may accrue by adopting each of the options. The quantitative estimates provided here are intended to give a relative sense of the magnitude of change to be expected under a given option. To estimate the quantitative impacts of each alternative (and option) accurately, a much more rigorous analysis than was attempted here would need to be accomplished. Appendix D summarizes the basis for each quantitative estimate given in Table 8-6.

8.3.1 Evaluation of Alternative 1: Enhance National Pretreatment Standards

This alternative encompasses five optional strategies that would reduce toxic loadings through the promulgation of categorical pretreatment standards. Each option implies the need for EPA to promulgate categorical standards, for industrial users to comply with those standards, and for pretreatment POTWs to ensure industrial user compliance with those standards. EPA promulgates categorical standards in cases where specified industrial sources discharge significant loadings. Where sources do not present a concern at the national level, EPA may issue guidance to assist POTW operators and NPDES permit writers in fashioning control requirements.

The five options were (1) developing new and revised categorical standards, (2) incorporating pollution prevention technologies into categorical standards, where practicable, (3) establishing pollutant-specific effluent standards for persistent pollutants covering all significant users, (4) incorporating zero discharge standards for persistent pollutants that pose high risks into categorical standards, and (5) prohibiting the discharge of certain products/substances from households to sewers.

The Office of Water is undertaking, or has recently undertaken, initial studies for the development or revision of several categorical standards. The following steps generally occur in standards development: (1) writing a preliminary data summary, (2) developing and analyzing an industry survey, (3) conducting sampling and analysis, and (4) preparing the categorical standard rulemaking record, including options selection. In general, decisions usually are made to proceed or not to proceed with a complete rulemaking effort after the data summary is finished.

Preliminary data summaries vary in cost but can be completed for approximately $200,000 each, or $3.8 million for the 19 industries. Steps 2 through 4 are far more variable in cost. Industry surveys are estimated to cost from $300,000 to $2.5 million, sampling from $2 to $6 million, and guidelines development from $1 to $2 million for each industrial category. Assuming 10 industrial categories are carried through the entire process and 9 more through the preliminary data summary phase, a total cost estimate for categorical standards development ranges from $37 million to $107 million. Associated industrial user compliance costs range from $880 million to $1,700 million. It is estimated that these industries currently discharge approximately 68.9 million pounds annually and that additional controls may yield reductions from 50 to 75 percent, or 30 to 51.6 million pounds. EPA is unable to attach a monetary value to the benefit of these loadings reductions.

Option 1.2 calls for categorical standards mandating pollution prevention (as practicable) and Option 1.3 would require zero discharge requirements for persistent pollutants. The standards development process currently considers both pollution prevention techniques and zero discharge as viable control options. Indeed, categorical standards for three prominent industrial categories are based on pollution prevention techniques: iron and steel (flow reduction); organic chemicals, plastics, and synthetic fibers (in-plant process controls); and petroleum refining (flow reduction). However, the statute does not provide for preferential selection of either pollution prevention or zero discharge options, although either pollution prevention techniques or zero discharge may be selected as the basis of the effluent limitation if available and economically achievable. Even where pollution prevention or zero discharge are not the basis for selection of effluent limitations, any single industrial user may use such techniques to meet the prescribed limitations.

As explained in Chapter 3, EPA's Pollution Prevention Information Clearinghouse includes case studies of voluntary pollution prevention techniques available in 36 separate industrial categories. A growing number of industrial users in certain industrial categories, such as metal finishers/electroplaters, are turning to pollution prevention techniques to reduce environmental protection expenditures. Indeed, some electroplaters are now making use of "closed-loop" technologies.

In reviewing existing categorical standards and developing new categorical standards, the Office of Water could establish a policy that pollution prevention techniques constitute an explicit option meriting review within the context of current "cost achievability" requirements of the CWA. The marginal costs of adding such a step to the review process would be marginal compared to the total cost of standards development, perhaps on the order of \$300,000 to \$500,000 per industry reviewed. The additional cost is almost entirely attributable to the need to collect and analyze more detailed data on in-plant production processes and controls. If EPA were to consider pollution prevention techniques for all 19 industries, the total incremental cost would be in an estimated range of \$5.7 to \$9.5 million.

Pollution prevention presumably would result in greater pollutant reductions than those achieved by traditional treatment standards. Moreover, these techniques are also likely to reduce pollutants more cost effectively, especially if multimedia impacts are considered (e.g., extensive use of pollution prevention techniques in the electroplating industry are being driven by the high cost of disposing of RCRA Subtitle C wastewater sludges generated as a result of wastewater treatment). The magnitude of pollutant reductions possible from the use of pollution prevention techniques is estimated at approximately 11 to 12 million pounds, assuming that existing loads can be reduced from 10 to 90 percent in three industrial categories (the pharmaceuticals, electroplating/metal finishing, and machinery manufacturing industries were selected to represent a range of pollution prevention potential among indirect dischargers). Again, EPA is unable to express the monetary value of the benefits from loadings reductions.

Requiring zero discharge of high risk persistent pollutants would reduce industrial user contributions by roughly 4.5 million tons according to Toxic Release Inventory System (TRIS). Persistent pollutants are discharged by essentially all industrial categories. Requiring zero discharge of persistent pollutants from indirect discharges presumably would also logically imply requiring zero discharge from direct discharges, since the nature of the pollutant and the impact on the environment are exactly the same. The costs of a blanket proscriptive option are unknown, but are likely to be high and might involve a significant number of plant closures and unemployment. Certain subcategories in the nonferrous metals, iron and steel cold forming, and battery manufacturing industries have had "no discharge" as a prescribed standard for certain pollutants in the past, but in these instances, such standards were deemed economically achievable.

Pollutant-specific, nondomestic pretreatment standards would represent a significant departure from the current approach for categorical standards development with environmental and administrative benefits of questionable value. Categorical standards are based on what is technologically achievable within an industrial category or subcategory. The concept of developing pollutant-specific standards is at odds with this approach. This option would necessitate development of a water quality basis or other basis for uniform concentration-based standards. Whereas the current effluent limitations concept fashions controls to subcategories based on size, age, and other factors prescribed in the CWA, a pollutant-specific approach would involve prescribing a "blanket" limitation irrespective of available technology and cost. This is counter to the intent of the CWA.

In Chapter 6 of this report, pollutants were classified by a number of different criteria, including persistence. Among the persistent pollutants found to be commonly discharged (as measured by TRIS), 13 (CN, Ni, Cu, Ba, Mn, Pb, An, Cd, Ag, As, Zn, chloroform, 1,1,1-trichloroethylene) have been detected in 26 separate industrial wastestreams. While persistent pollutants do not represent a significant portion of pollutants discharged to POTWs (less than 5 percent of the total volumes discharged to POTWs according to TRIS), they are, nonetheless, important because of the ecological effects they can produce.

The cost of developing a pollutant-specific limitation, while unknown at this point, would likely be equivalent to conducting a major ecological study and a major categorical standard. EPA's recently completed bioaccumulation study cost in the range of $500,000 to $750,000 and 5.5 workyears. The cost of developing an associated guideline is unknown.

Legal challenges could be expected, and resources would need to be expended to meet these challenges, as well as subsequent remand/repair of the standards as necessary. Establishing local limits for pollutants of concern may be a more cost-effective approach to pollutant-specific control. As shown in Table 8-6, developing local limits is relatively inexpensive (on the order of 200 professional hours exclusive of sampling and analysis) and is currently targeted to the toxic metals (i.e., the majority of those pollutants identified as persistent).

Not targeting persistent pollutants in pollutant-specific guidelines does not bar EPA from paying special attention to them in the development or revision of traditional categorical standards. In this way, the same result (additional control of persistent pollutants) could be achieved without the expenditure of additional resources for ecological studies.

While reducing the loadings of pollutant from domestic sources has merit in site-specific circumstances where domestic loadings represent a significant portion of total loadings, national standards directed at controlling domestic sources are probably premature at this time. A national approach would be necessary only if domestic sources precluded a large number of POTWs from meeting environmental objectives. Moreover, establishing an effective domestic source control program could be expensive, as well as extremely difficult to implement and enforce. Permanent hazardous household waste collection programs are facing costs of up to $2.50 per pound collected (or $.37- $1.10 per capita). While national regulations may be premature at this time, EPA and the States can, and should, work with local pretreatment programs to establish effective household hazardous waste programs.

Assuming 175 million persons are served by POTWs in the pretreatment program, EPA estimates the total national cost of a domestic source control program to range from $40 million to $119 million annually. On the other hand, such programs may prove ineffective in reducing toxic loadings to the POTW. High participation rates are difficult to encourage, and more expensive programs will need to be adopted to create interest sufficient to reduce loading significantly. In certain cases, where environmental benefits exceed the costs, outright product bans under the Toxics Substances Control Act could be employed to control discharges of certain toxic pollutants from households by prohibiting their manufacture or use.

A potentially significant source of specific pollutants from domestic sources (e.g., lead, copper, zinc, manganese) soon may be reduced because of EPA's August 1988 proposed rulemaking (40 *FR* 31516) undertaken by EPA to reduce the concentrations of lead in drinking water. As a result of this rulemaking, it is projected that at least 39,800 public drinking water systems will be installing corrosion control, and another 8,300 systems will require lead pipe replacement. For systems serving more than 50,000 persons (the group of systems most likely to be co-located with pretreatment POTWs), it is projected that nearly 500 will be installing corrosion control and that about 230 will require lead pipe replacement. While primarily intended to reduce lead levels in drinking water systems, these actions should lower concentrations of the aforementioned metals in domestic sewage and in releases to environmental media.

8.3.2 Evaluation of Alternative 2: Improve/Restrict Site-Specific Standards

Four separate options were presented coincident with this alternative. The first two options concerned removal credits: Option 2.1 provided for regulations to restrict removal credits to biodegradable pollutants; Option 2.2 provided for the regulations to require more rigorous testing. The next two options concerned local limits: Option 2.3 provided that the current guidance with improvements be promulgated as regulations; Option 2.4 provided that the basis for local limits be expanded to include all media endpoints. Removal credits and local limits are provided to fine tune national standards to meet local, site-specific objectives to protect the plant, sludge quality, water quality, and worker health and safety as well as to prevent redundant treatment. Therefore, both require the POTW authority to be well aware of the effect of toxic pollutants on the ambient environment (see alternative 3: enhance environmental controls on POTWs).

Granting removal credits for transfer, rather than treatment, of pollutants is counter-productive to the intent of EPA's pollution prevention program. A simple evaluation of influent and effluent concentrations of specified pollutants is highly unlikely to represent the removal efficiency for any single pollutant, given the variability in removal efficiencies. Optimally, the sampling regime should be lengthened, with a sufficient number of discrete samples being taken to better account for hydraulic retention times. Thus, removal credit demonstrations should provide much more extensive data than they have in the past, perhaps achieving the 95 percent level of confidence associated with BAT guidelines for direct dischargers.

Requiring sufficiently detailed removal credit demonstrations will involve substantial costs to POTWs. If influent/effluent sampling were required for a complete month, then sampling and analysis costs would increase at least 2.5 times from current costs (12 sampling and analytic events versus 30 events) if credits were restricted to biodegradable pollutants. More extensive testing requirements, such as headworks, aeration basin, and sludge monitoring, may be necessary if removal credits were to be made available for other than biodegradable pollutants and it were decided that removal credits would be available only to the extent of actual treatment in the POTW (rather than transfer to other media).

Removal credit demonstrations also impose a cost for State/EPA officials. Review of removal credit demonstrations can consume workweeks, rather than workdays. Technically, removal demonstrations are similar to local limits and fundamentally different factor variance reviews, which generally consume up to 150 professional hours ($7,500) over a period of a few weeks.

Finally, the actual number of applicants interested in taking advantage of removal credits may not warrant providing for such relief. Thirteen separate control authorities were granted removal credits prior to the 1987 suspension; another 14 applications from control authorities were pending. Together, approximately 150 industrial users benefited by the approval of the removal credits. Discussions with the Association of Municipal Sewerage Authorities regarding this report suggest that POTW interest in seeking removal credits has waned since the early years of the pretreatment program. Should the cost of preparing removal credit applications be increased (beyond the current estimated cost of removal credit preparation of $11,000; approximately half the cost is associated with sampling, the other half with application preparation), or the number of pollutants for which credits are available be decreased, further interest in receiving removal credits would be discouraged.

Options 2.3 and 2.4 provide for an enhancement of local limits. Option 2.3 would call for the establishment of mandatory local limits procedures, based on the codification of the essential elements of *Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program* (EPA, 1987). Option 2.4 would mandate the application of local limits to protect all media endpoints. These two options complement one another.

The local limits program has had its successes, especially since the development of the guidance and attendant training sessions. As described elsewhere in this study, a growing number of pretreatment POTWs have developed environmentally protective, defensible local limits in the last few years. Clearly, guidance can be an effective mechanism for program improvement, especially when accompanied by an intensive training and oversight effort. In addition, POTWs are generally developing limits for more pollutants than appear in their NPDES permits. It is reasonable to assume that if more toxic limits appeared in the POTW's NPDES permit, the POTW would, in turn, develop additional local limits.

Local limits developed in accordance with EPA's guidance (i.e., technically based) can be developed by a POTW for 200 workhours, exclusive of sampling and analysis costs. Development costs may increase as a result of the number of pollutants regulated, criteria under consideration, and permitted industrial users. Thus, should the number of media endpoints considered be increased, the cost would remain reasonable, perhaps running to 250 or 300 hours. The tools to develop local limits are available, and they offer a cost-effective approach toward achieving environmental objectives.

Codifying the guidance could result in expenditures for local limits development up to $15.6 to $23.4 million, assuming that 33 percent of POTWs have already developed local limits based on the guidance. However, these costs do not represent an accurate estimate of true incremental increase in the preparation of local limits, in that POTWs are already required to develop adequate limits. This option merely clarifies the requirement, and pretreatment POTWs are already incurring many of the costs that this option would entail. Expanding the number of media endpoints would not likely increase total estimated costs by more than 25 percent (or about 50 hours) per POTW, including those that already have developed local limits. Thus, up to $6 million in labor costs may be incurred.

The cost of reviewing local limits varies in accordance with the complexity of the submission. Average review costs run from 50 to 80 professional hours, or from $2,500 to $4,000 per review. On a national basis, this amount works out to approximately $6 to $9 million. The cost of reviewing local limits incorporating all media endpoints would most likely fall within this cost estimate range. However, these reviews will be conducted whether or not the guidance is codified; any change would be in the local limits themselves, not the review costs.

8.3.3 Evaluation of Alternative 3: Enhance Environmental Controls at POTWs

The three options involve EPA issuance of environmental criteria, inclusion of toxic limits in POTW permits for all wastestreams, and corrective action requirements for cleanups of past releases from POTWs.

The first and second options are the linchpins of the National Pretreatment Program. The development and application of environmental criteria will encourage POTWs to develop local limits and to initiate pollution prevention and other initiatives for their industrial, commercial, and domestic users. Development of water quality criteria is underway at EPA, and development of sediment quality criteria is at the preliminary stage. Criteria development will only spur limits development to the extent States adopt water quality standards (or EPA promulgates standards for the States) and POTW permit limits are developed to meet those standards. For example, despite the existence of national aquatic life and/or human health criteria and guidance for the priority pollutants, most pretreatment

POTWs do not have limits for those pollutants in their NPDES permits: 32 percent had toxic metal limits; 11 percent had toxic organic limits.

EPA's municipal sludge regulations were proposed on February 6, 1989 (54 *FR* 5746), and are now scheduled for promulgation in early 1992. In the meantime, EPA has mounted an interim permitting strategy that establishes standard conditions and baseline monitoring requirements and, where problems are known or suspected, requires best management practices to abate problems. At this time, the sludge permitting procedure is not expected to increase POTW or permitting authority costs by more than a workday per permit.

In addition, 171 pretreatment POTWs appear on the Agency's 304(l) list and are prime candidates for permit revisions incorporating toxic limits. Workload estimates indicate that each permit should cost the permitting authority from $10,000 to $15,000 (exclusive of model development and wasteload allocation costs and sludge permitting requirements). Expressed in staffing needs, the total workload in writing water quality-based permits for all pretreatment POTWs is 60 workyears (again exclusive of wasteload allocation costs and sludge permitting requirements).

The variability in wasteload allocation costs is a prime factor of concern in developing toxic limits for permittees. In a simple case, a permit writer may use a dilution calculation. In other cases, more sophisticated modeling for a single discharge situation may involve a 6- to 22-week effort. In a still more complex situation, involving multiple dischargers, the wasteload allocation process may involve anywhere from 15 workweeks to 5 full workyears. In most situations, a simple dilution analysis is sufficient, but the more complex situations can realize a significant resource drain. Assuming all POTWs should receive water quality-based permits and each wasteload allocation involved a 6-workweek effort, the total wasteload allocation cost would total approximately 250 workyears.

Requiring cleanup, termed corrective action by the RCRA program and remedial action by the Comprehensive Environmental Response, Compensation, and Liability Act program, at POTWs would involve remediating past releases posing risks to human health and the environment. This cleanup program could be conducted by POTWs in much the same way the process works for the RCRA program (i.e., a cursory review of operations and releases followed, as necessary, by a more comprehensive assessment of those releases, a study plan for remediating those releases, and remediation). A minority of POTWs, those subject to

RCRA permits-by-rule as a condition of receiving hazardous wastes by truck, rail, or dedicated pipeline, are currently subject to this cleanup process.

The first phase of the process, the cursory review of facility operations and potential releases, will cost the permitting authority an estimated $8,000 to $12,000 to conduct (or 4 to 6 workweeks). If all pretreatment POTWs were to receive such assessments, this could absorb on the order of 200 workyears (about two-thirds of the cost associated with developing water quality-based permits). The actual costs of cleanup cannot be estimated at this time. Currently, insufficient information exists on the nature, extent, and significance of contamination that may be associated with releases from POTWs to warrant recommendation of this option. If subsequent environmental data suggest widespread problems at POTWs, a corrective action model may be appropriate.

8.3.4 Evaluation of Alternative 4: Expand Pretreatment Monitoring Requirements

This alternative encompasses three separate options involving the expansion of SIU monitoring requirements, POTW wastestream monitoring requirements, and POTW ambient monitoring requirements. Monitoring for more and better data has two principal objectives: (1) it serves as a basis for further action, and (2) it provides feedback on program progress. In addition, the expansion of monitoring requirements would likely increase compliance by increasing SIU fear of being subject to enforcement actions. All options would involve significant expenditures (from tens to hundreds of millions of dollars) of resources and, therefore, all merit serious scrutiny prior to adoption—including an analysis of whether the environmental benefits to be gained exceed the costs.

A regulatory modification requiring semiannual testing of 30,000 SIU effluents can be an expensive exercise. Three tests (effluent monitoring, toxicity testing, prohibited discharge monitoring) are prescribed to be conducted four times per year, as indicated in Table 8-6. Together, these three tests could result in annual expenditures of between $35.3 and $227 million. Yet, additional monitoring only indirectly results in achieving the goals of the CWA. Conducting priority pollutant scans can cost more than $1,000 per event. A more flexible monitoring approach tailored to the industrial user, increasing the frequency of metals monitoring for some industries and decreasing it for others, may offer more tangible benefits for dollars expended.

The preliminary data summaries prepared by EPA's Office of Water, TRIS data base, and site-specific inspections (e.g., compliance history, pass through, and interference events) all provide basic information that POTWs can use in establishing monitoring requirements (frequency and pollutant coverage) for industrial users.

Under Option 4.2, POTWs would be required to conduct more indepth monitoring (monthly influent/effluent tests, monthly sludge analyses, quarterly effluent toxicity tests) of their wastestreams. The prime objective in requiring increased wastestream monitoring is the effect such action would have on spurring local limits development and assessing compliance with water quality-based permits. This option is compatible with option 3.2, which calls for mandatory toxic limits in pretreatment POTW permits.

The total estimated annual cost of the POTW wastestream monitoring option is estimated within a range of $63 to $124 million, depending on how many pollutants will be analyzed ($200 for a metals analysis versus $1,100 for a priority pollutant scan) per sample and the type of toxicity test ($200 for an acute test, one species versus $1,200 for a battery of chronic tests) selected. The projected cost estimate ranges for this option are similar to the SIU monitoring option ($35.3 to $227 million for IUs versus $65 to $135 million for POTWs), but the benefits to the POTW and receiving environments are more tangible. In addition, this option may underestimate the number of POTWs currently monitoring their wastestreams (and thus overestimate the costs), since many POTWs monitor without reporting results to EPA.

The third option provides that POTWs monitor the ambient environment (water, sediment, ground water, air) as a standard permit condition. Chapter 6 demonstrated that POTW releases can have a deleterious effect on each media endpoint. However, in large part, the data were determined inadequate for a complete national assessment of the effect that toxic discharges from POTWs have on the ambient environment. Generating ambient data can be expensive. As shown in Table 8-6, surface water sampling (biological) could involve an annual cost range of $19.5 to $39 million. Air quality monitoring of the headworks and aeration system involve costs in the range of 3 to 4 times ($76 to $130 million) that of surface water sampling. The cost of ground-water sampling is similarly expensive, especially if ground-water monitoring systems will need to be designed and installed.

While the analyses completed in support of Chapter 6 were not sufficient to develop a complete national assessment, that chapter does conclude that toxic discharges from POTWs are clearly affecting the aquatic environment. Therefore, should POTWs be required to monitor any single medium, that medium should be water. Biological monitoring is an effective means of assessing both water and sediment quality.

The biological monitoring costs provided in Table 8-6 are based on Ohio EPA experience. They assume that an average reference site survey, incorporating fish and macroinvertebrate sampling, costs a total of .03 workyears (62 workhours or $3,100 at $50 per hour).

8.3.5 Evaluation of Alternative 5: Shift Administrative Burdens/Responsibilities in the National Pretreatment Program

Chapter 7 concludes that pretreatment program deficiencies in applying categorical standards, issuing permits, and conducting compliance monitoring can be attributed to technical errors and shortcomings that were relatively common early in the program's history. Five States have chosen to administer a statewide program rather than delegate responsibilities to the local level. There is no indication that these programs have experienced a lesser or greater degree of deficiencies as a result of their administrative structure.

Chapter 7 also concludes that the pretreatment program's fundamental strength is the flexibility that implementation at the local level provides. Indeed, one could argue that whereas the POTW is dedicated to water quality protection and has an established financial structure to fund its activities, State and Federal water quality programs continually compete for resources with other environmental programs. Thus, the POTW authority may be in a more stable financial condition and can offer a more stable organization for day-to-day management of the pretreatment program.

The technical errors that have occurred can be remedied by additional training and guidance. Indeed, recent training efforts, such as those directed at developing local limits, have been well received and have had tangible results.

REFERENCES

U.S. Environmental Protection Agency. 1987. *Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program.* Washington, DC: Office of Water Enforcement and Permits.

9. FINDINGS AND RECOMMENDATIONS

In the preceding chapters, the U.S. Environmental Protection Agency (EPA) presented specific findings pertaining to:

- The sources and amounts of toxic pollutants discharged to publicly owned treatment works (POTWs)
- The extent to which toxic pollutants are removed by secondary treatment plants
- The capability of POTWs to modify national pretreatment standards by developing removal credits and local limits
- The adequacy of data on environmental impacts associated with toxic discharges from POTWs
- The effectiveness of the existing pretreatment program in programmatic and environmental terms
- Evaluation of regulatory alternatives.

Section 9.1 summarizes the findings of this Report to Congress. Recommendations stemming from these findings are discussed in Section 9.2.

9.1 FINDINGS

Major findings from this Report to Congress are presented below. Each finding is derived either from specific analyses conducted for this report or from other recent program reports or data. The findings are organized according to the six substantive chapters of the Report to Congress.

9.1.1 Sources and Amounts of Pollutants Discharged to POTWs

- Sources
  - Nationwide, over 15,000 POTWs receive and treat a total of approximately 34 billion gallons per day of domestic, commercial, and industrial wastewater.
  - A total of 1,542 POTWs (encompassing 2,128 individual municipal wastewater treatment plants) are required to have approved local pretreatment programs. As of March 1990, 1,442 of the 1,542 (94 percent) have approved local programs. Toxic discharges to another 314 POTWs are regulated by State-run pretreatment programs, pursuant to 40 *CFR* 403.10(e), in lieu of local programs. Those POTWs with approved pretreatment programs and those covered by State-run programs receive more than 80 percent of the national wastewater flow discharged to POTWs.
  - EPA estimates that 30,000 significant industrial users (SIUs) discharge to POTWs. This number comprises approximately 11,600 categorical industrial users and 18,400 noncategorical SIUs.

- Several hundred thousand other nondomestic users discharge to wastewater treatment plants across the United States. These facilities include retail and commercial establishments, as well as industries deemed nonsignificant.

- Sources and Types of Industrial Discharges
  - The Domestic Sewage Study (DSS), assuming imposition of and compliance with categorical Pretreatment Standards for Existing Sources (PSES), identified the following industrial categories responsible for the highest loadings of 165 metals and toxic organics to POTWs:

    Metals: Electroplating and metal finishing; industrial and commercial laundries; organic chemicals manufacturing; coal, oil, petroleum products and refining; and pulp and paper mills.

    Organics: Equipment manufacture and assembly; pharmaceutical manufacture; organic chemicals manufacturing; coal, oil, petroleum products and refining; and industrial and commercial laundries.
  - Data from the Toxic Release Inventory System (TRIS) regarding releases of more than 300 listed toxic chemicals showed that more than 5,700 industries estimated discharges of more than 680 million pounds of toxic pollutants to more than 1,700 POTWs in 1988. The industrial categories reporting the largest volume released to POTWs were fertilizer manufacturing, organic chemical manufacturing, dye manufacturing and formulating, pulp and paper mills, food and food by-products processing, and pharmaceutical manufacturing.
  - For the 165 pollutants analyzed in the DSS (plus copper and zinc), annual POTW loadings of toxic pollutants reported in TRIS (159 million pounds) exceed loadings estimated in the DSS (60 million pounds), although the DSS represented more facilities discharging to POTWs.

- Other Potentially Significant Sources
  - Findings for the DSS, TRIS, and EPA's 304(m) plan suggest that commercial and industrial facilities not yet subject to categorical pretreatment standards may discharge significant quantities of toxic pollutants to POTWs. These include machinery manufacturing and rebuilding, industrial and commercial laundries, hazardous waste treatment facilities, and waste reclaimers.
  - Domestic wastewaters may contain considerable amounts of toxic pollutants as a result of the disposal of household hazardous wastes. In some cases, pollutants contributed by drinking water supplies and drinking water conveyance systems may also be significant. Inorganic pollutants present in domestic wastewater include metals, such as copper, iron, lead, and zinc. Organic compounds may include pesticides, plasticizers, coal tar compounds, and chlorinated solvents.
  - While concentrations and loadings of toxic pollutants from domestic sources are typically lower than those from commercial and industrial sources, domestic loadings at specific POTWs may be significant enough to contribute to pass through and interference. Thus, some POTWs have undertaken to reduce domestic contributions through adjustments to treatment of drinking water supplies and through product restrictions, as well as by hazardous household waste collection programs.

- POTWs may also receive significant loadings of toxic pollutants from hauled wastes, landfill leachate, storm water, or cleanup activities associated with RCRA corrective actions, Superfund cleanups, and underground storage tanks.

- Types of Controls
  - Categorical standards and local limits have brought about significant reductions in metals loadings and moderate reductions in toxic organics loadings from regulated industries.

    Metals: Toxic metals pollutant loadings from regulated industries are estimated to be reduced by 95 percent after implementation of PSES. This reduction results in estimated annual loadings of about 14 million pounds (6,500 metric tons).

    Organics: Depending on the data source, toxic organic loadings from regulated industries are estimated to be reduced by approximately 40 to 75 percent after PSES, resulting in annual loadings of approximately 65 million pounds (30,000 metric tons).
  - Planned development of additional categorical standards for such industries as machinery manufacturing and rebuilding, pharmaceutical manufacturing, industrial laundries, paint formulating, and hazardous waste treatment is expected to further reduce loadings of toxic pollutants to POTWs.
  - POTWs and industrial users have demonstrated that they understand pollution prevention and the opportunities it affords to reduce loadings of toxic pollutants. EPA has found that pollution prevention techniques have been used at 36 of the 47 industrial categories evaluated in this report.
  - In 1989, over 600 household hazardous waste collection programs were in place, many of which were coordinated by POTWs. Further reductions in toxic pollutant loadings from nontraditional sources of pollutants, including commercial and domestic sources, may be necessary to obtain the reductions needed to achieve desired environmental standards.

9.1.2 *Extent of Removal of Toxic Pollutants at Secondary Treatment Plants*

- Fate of Toxic Pollutants
  - Toxic pollutants present in the raw sewage entering secondary treatment plants have several fates. Toxic organic pollutants can biodegrade, partition to sewage sludge, volatilize, or remain in the discharge to receiving waters. Metals generally partition to the sewage sludge or remain in the discharge from the POTW.
  - The removal of most toxic pollutants from wastewaters is largely incidental to the treatment of conventional pollutants and should be considered in terms of partitioning among alternative pathways; pollutants may be shifted from one medium to another (to the air through volatilization or sludge through adsorption), as well as destroyed through biodegradation.
- Nature of Pollutant Removals
  - Pollutant removal is calculated from the results of sampling the influent and effluent of a POTW treatment plant.
  - Calculation of removals of toxic pollutants at a POTW must consider that removal of toxics involves several pathways and is variable because of changing conditions

and situations at the POTW (e.g., concentration of the pollutant, POTW operational characteristics, aeration/turbulence, temperature).

- EPA's analyses of priority pollutant removals indicate that removal of efficiencies vary widely from POTW to POTW.
- Removal efficiencies do not appropriately represent POTW variability when expressed as single median values because of variability of observed removals.
- The broad range of removal efficiencies observed underscores the need for using POTW-specific data in making decisions that involve toxic pollutant removals applicable to individual POTWs.

9.1.3 POTW Capability to Revise Pretreatment Standards

- Status of Removal Credits
  - Removal credits are adjustments to categorical pretreatment standards that reflect the removal of a pollutant by a POTW. A POTW may elect to lessen the stringency of a categorical standard where it demonstrates it consistently removes a given pollutant, and maintains compliance with its National Pollutant Discharge Elimination System (NPDES) permit and sludge requirements. The removal credits program has been suspended since 1986. Removal credits will remain unavailable until EPA promulgates sludge requirements pursuant to Section 405 of the Clean Water Act (CWA).
  - When the removal credit program was suspended in 1986, 12 POTWs nationwide had removal credits approved by EPA, and another 15 had removal credit applications pending. The approved removal credits covered 16 pollutants and affected approximately 150 industrial dischargers.
  - Future POTW interest in removal credits, once they are available again, is expected to be low; however, increased regulation of organic pollutants in recently promulgated and forthcoming guidelines may renew interest in removal credits for some organic compounds.
- Assessment of POTW Capability: Removal Credits
  - POTWs generally possess adequate resources and technical expertise to perform the tasks inherent in revising pretreatment standards through removal credits (e.g., monitoring and calculation of revised standards).
  - Most of the pollutants for which removal credits were granted (or for which they have been applied) are metals that do not biodegrade in municipal treatment systems and that are partitioned instead to sludge.
  - While both best available technology economically achievable (BAT) (direct discharge) and PSES (indirect discharge) standards are set such that the applicable technology can meet the limit 99 percent of the time for daily maximum and monthly average limitations, a POTW's demonstration of "consistent" removal for purposes of removal credits does not require the same degree of confidence. Since a POTW pursuing removal credits for its industrial users need only show that it can achieve removal 75 percent of the time, its treatment combined with its industrial users' treatment may be less than that provided by direct dischargers. Additionally, the regulations do not require that POTWs with combined sewers provide treatment consistent with direct dischargers.

- Status of Local Limits
  - Analysis of local limits at 200 POTWs found that 90 percent of POTWs have adopted local limits for one or more toxic pollutants and over 70 percent have adopted local limits for the 10 pollutants listed in EPA guidance as being of highest concern. A much smaller percentage, however, has adopted local limits using a headworks loading or other technical basis. POTWs surveyed by the General Accounting Office were found to impose local limits for an average of 14 toxic pollutants.
  - The most prevalent limits were for copper, cadmium, lead, nickel, zinc, chromium, cyanide, mercury, arsenic, and silver. Only one toxic organic, phenol, was found in the top 20 pollutants regulated in local limits. This organic is controlled by local limits at 49.5 percent of the 200 pretreatment POTWs reviewed.
  - POTWs regulate for many more pollutants in their local limits than they are limited for in their NPDES permits. According to EPA's Permit Compliance System (PCS), only 32 percent of the NPDES permits for pretreatment POTWs issued in 1989 contained any limits for one or more toxic pollutants.
- Assessment of POTW Capability: Local Limits
  - POTWs are generally capable of developing and implementing local limits. Weaknesses observed include the following:
    - In developing local limits, POTWs generally lack site-specific data necessary to calculate treatment plant removals. The current practice of using literature POTW removal data to develop local limits may not accurately reflect treatment plant performance and may result in exceedances of environmental or technical criteria.
    - POTWs often rely on literature data to predict pollutant concentrations that may result in unit process inhibition. These literature inhibition data are based on a limited sample size and may not accurately characterize site-specific conditions. Additionally, these data are available for only a few pollutants and treatment processes.
    - The application of local limits to categorical industries often involves comparisons with the categorical standards to determine which of the limits (local or categorical) are more stringent. Although EPA has provided guidance to address this issue, POTWs continue to have difficulty applying the most stringent standard.
  - POTWs often lack sufficient environmental standards, criteria, or permit conditions to judge the appropriateness of local limits. NPDES permits for two-thirds of the POTWs with pretreatment programs do not contain limits for any toxic pollutants. Of those that do, only a few pollutants are generally limited. In addition, national sludge disposal standards are not yet in place, and most States do not have comprehensive sludge standards. POTWs, therefore, are often without specific environmental criteria and standards upon which limits are to be based.

9.1.4 *Adequacy of Data on the Environmental Effects of Toxic Discharges From POTWs*

- Types of Effects and Pathways
  - Discharges of toxic pollutants from POTWs can impair the quality of receiving environments, including surface water, ground water, and air. In addition, the health and safety of workers at POTWs may be adversely affected.
  - In general, metals pass through treatment plants to surface waters or are partitioned to sludge in roughly equal proportions. Toxic organics that are not biodegraded either volatilize to air or are released to surface waters, with few adsorbing to sludge.
  - Toxic effects vary by pollutant, as well as by receiving medium. Principal effects of concern are lethality, carcinogenicity (causing cancer), teratogenicity (causing developmental abnormalities), or mutagenicity (causing genetic abnormalities). Some compounds discharged from POTWs (PCBs and arsenic) exhibit all of these deleterious effects. Several metals are lethal, teratogenic, and mutagenic but do not cause cancer.
- Extent of Environmental Criteria
  - The lack of comprehensive criteria for all the pollutants discharged to and from POTWs inhibits estimation of the environmental effects of POTW discharges.
  - In addition, the POTWs, States, and EPA do not collect or maintain data that are comprehensive enough to adequately characterize municipal wastestreams or their impacts in receiving environments. Data on POTWs are most comprehensive for discharges to surface water.
- Surface-Water Impacts
  - Eighty percent of POTWs covered by pretreatment programs discharge treated effluent to rivers and streams, 4 percent to lakes, 7 percent to oceans, and 9 percent to other environments, including land, estuaries, and reservoirs.
  - Under the 304(l) program, 254 POTWs (171 pretreatment POTWs) are among the 888 facilities contributing toxic pollutants to stream segments not attaining water quality standards.
  - Of the water bodies States assessed in 1988, States reported that 21 percent of river miles, 21 percent of lake acres, and 19 percent of estuary areas were reported to not be fully meeting use designations as a result of toxic pollutant discharges from all sources.
  - Municipal sources (including both pretreatment and nonpretreatment cities) are reported as second in importance (behind agriculture) in causing use nonattainment.
  - Limited toxics monitoring data, including ambient stream data for pretreatment POTWs, indicate a high probability that pretreatment POTW discharges of toxic pollutants are affecting receiving waters. For example, nearly 53 percent report concentrations that would exceed chronic water quality criteria; 20 percent of the discharges of copper, cyanide, cadmium, PCBs, silver, and lead cause exceedances of chronic criteria. While these projected exceedances do not necessarily lead to actual toxic effects at a particular POTW and receiving stream, they suggest that concentrations are sufficiently high to warrant toxic limits in NPDES permits.

- Toxicity testing results from one EPA Region indicate that 17 percent of the acute tests exceeded EPA's Criterion Maximum Concentration. Chronic test exceedances were even higher.

- Ground-Water Impacts
  - The most significant potential cause of ground-water contamination by POTWs is disposal of sewage sludge, although empirically this has rarely been a problem. Forty-two percent of all municipal sewage sludge is beneficially used in land application, 22 percent is disposed of in landfills, 14 percent by incineration, 6 percent through distribution and marketing, 5 percent by ocean disposal, and 2 percent by other practices. Roughly three-quarters of sludge is used or disposed of in land-based practices.
  - In the Lagoon Study, EPA found that there is a low potential for ground-water contamination from municipal wastewater lagoons, but that lagoons with industrial discharges may be potential sources of ground-water contamination.
  - Pollutants under consideration for regulation in EPA's proposed Sludge Technical Criteria were detected at high frequency in the National Sewage Sludge Survey (NSSS). Of the 34 pollutants for which limits have been proposed, 11 were detected more than 50 percent of the time.
  - Pollutants under consideration for regulation in EPA's proposed Part 503 regulations for sludge use and disposal were detected at high frequency in the NSSS. Mean concentrations of certain toxic metals (arsenic, cadmium, copper, lead, molybdenum, nickel, and zinc) found in sludge in the NSSS suggest that some POTWs may be precluded from certain beneficial use or disposal practices unless they can reduce loadings through additional pretreatment.

- Air/Worker Health and Safety Impacts
  - Little is known about the extent and effects of air emissions from POTWs. The DSS estimated that 0.1 percent of the mass of national emissions of volatile organic compounds may come from POTWs. Twenty-seven POTWs nationally are reported to emit over 100 tons per year of Clean Air Act criteria pollutants.
  - Of the 2,414 disabling injuries reported at wastewater treatment plants, a small percentage may be caused by discharges to POTWs: 2.4 percent involved respiratory injuries, 5.1 percent irritation from exposure to chemicals, and 1.6 percent chemical burns, all effects that may be attributed to industrial wastes.

9.1.5 Effectiveness of the National Pretreatment Program

- Program Scope
  - The pretreatment program has targeted the appropriate POTWs for control of nondomestic sources. Of more than 15,000 POTWs in the Nation, pretreatment program requirements are being implemented by 1,442 local control authorities at 2,015 treatment plants and by five States at 314 plants. Another 100 local programs, covering 113 plants, are being developed. These pretreatment programs and their POTWs are collectively responsible for more than 82 percent of the Nation's municipal wastewater treatment capacity, and they receive the vast majority of all industrial discharges to POTWs in the United States.
  - Virtually all the POTWs reported in TRIS to be receiving over 1 million pounds of toxic chemicals are covered by programs. Evaluation of various data sources (e.g.,

TRIS, NEEDS, 304(l) data) may enable EPA to target additional POTWs for development of local pretreatment programs.

- Categorical and other industrial users discharge more toxic pollutants, particularly toxic organics, than are regulated by either categorical standards or local limits.

* Implementation Status
  - Measurements of the level of programmatic implementation of local programs indicate that local implementation is well underway. Ninety-four percent (totaling 1,442) of required local pretreatment programs have been approved. Twenty-seven States have approved State pretreatment programs. Specific programmatic implementation issues will require more attention, such as the need for POTWs to develop technically based local limits and to adequately enforce all pretreatment standards and requirements.
  - PCS indicates that 84 percent of SIUs have been issued control mechanisms, and 90 percent of SIUs have been inspected under local programs.
  - Estimates of industrial noncompliance range from 10 percent (PCS), to 17 percent (International Joint Commission), to 41 percent (General Accounting Office). This is higher than the corresponding SNC rate for direct dischargers.
  - EPA Regions and States have performed extensive oversight of local pretreatment programs, having performed more than 3,600 audits and inspections at 1,328 POTWs in the last 5 years.
  - To assist POTWs and States in implementing the pretreatment program, EPA has released 37 guidance manuals and conducts 46 workshops and seminars per year.
  - One of the pretreatment program's key strengths is implementation at the local level, which provides the flexibility necessary to respond to site-specific conditions. In general, locally implemented programs have been found to regulate more noncategorical industries than State-run programs. In contrast to State-run programs, local programs have developed and implemented site-specific local limits to prevent pass through and interference and have conducted more frequent monitoring of industries to assess compliance.
  - The decentralized local approach has, however, resulted in instances of incomplete or inconsistent implementation of local pretreatment programs. As many as 40 percent of the approved local pretreatment programs need to improve at least one key area of implementation (e.g., issuance of industrial user control mechanisms, development of local limits, enforcement).

* Environmental Results
  - The lack of comprehensive environmental data makes it difficult to evaluate the program's effectiveness in achieving the goals of the CWA. However, evidence from various data sources suggests that the pretreatment program has resulted in significant reductions in the discharge of toxic pollutants to POTWs and from POTWs to the environment.
  - Many POTWs report significant declines in concentrations and loadings of toxic pollutants in influent, effluent, and sludge associated with implementation of pretreatment programs. These decreases have reduced operational problems and have improved the quality of receiving waters and sludges.

9.1.6 Alternative Regulatory Strategies for Pretreatment

- The overall regulatory framework for control of toxic discharges to POTWs appears to provide suitable mechanisms to address environmental concerns.
- EPA considered five alternative strategies that might be appropriate: (1) enhancement of national pretreatment categorical standards, (2) improvement of site-specific standards and modifications, (3) better environmental controls on POTWs, (4) improved monitoring, and (5) a shift of administrative responsibilities.
- Regulatory improvements were found desirable in three of the five areas: enhancing pretreatment standards, improving site-specific standards, and enhancing environmental controls on POTWs. Section 9.2 provides more detail concerning these improvements.
- The benefits to be derived for each action have not been quantified in monetary terms.

9.2 RECOMMENDATIONS

From the major findings in this Report to Congress, EPA recommends the following approaches, none of which will require statutory changes, to further reduce the environmental impacts associated with toxic discharges to and from POTWs:

- Continue to promulgate national categorical pretreatment standards and stress the adoption of cost-effective pollution prevention and domestic wastewater controls wherever feasible.
- Improve local pretreatment standards (both removal credits and local limits) to further reduce toxic loadings and to ensure the integrity of POTW collection systems.
- Improve the scientific basis of pretreatment controls, and provide better benchmarks for pretreatment program performance, by establishing comprehensive standards and criteria for all media affected by POTW discharges.

Aspects of these broad recommendations are more fully explained below. It should be noted that EPA is currently undertaking many regulatory development and program implementation activities envisioned by these recommendations. These recommendations do not comprise entirely new initiatives, but are intended to complement ongoing water pollution control efforts by municipalities, States, and the EPA.

Recommendation One: Enhance National Categorical Pretreatment Standards

- Continue to develop new and revised categorical standards in accordance with EPA's plan developed under 304(m), and continue to review new pollutants, particularly those nonpriority pollutants now known to pose significant environmental risks, for inclusion in categorical standards. Where final standards are not necessary on a national basis, issue guidance to POTWs on problem pollutants and control options.
- Continue to consider cost-effective pollution prevention techniques as the basis for categorical standards where such techniques offer the best available technology economically achievable (BAT).
- Reexamine the removal credit requirements of the General Pretreatment Regulations (§403.7) in light of the findings of this report. Further topics for examination might include the definition of consistent removal, monitoring requirements, types of compounds for which removal credits are and are not available, the use of data from similar POTWs, and specific conditions for inclusion in the NPDES permit once removal credits are approved.

Recommendation Two: Improve Local Pretreatment Standards

- Promote opportunities for use of cost-effective pollution prevention tools in industrial user permitting, local limits development, spill control, and inspections to reduce nondomestic loadings of toxic pollutants. Encourage market forces and industrial user input into the process of developing and allocating POTW local limits.
- Promote domestic hazardous waste programs and other opportunities to reduce discharges of pollutants from domestic sources.
- Consider revising the local limits requirements in the General Pretreatment Regulations (§403.5) to address methods for determining pollutants of concern, use of actual monitoring data instead of default or literature values, the basis of limits, and other issues.
- Consider developing additional local limits guidance for high-risk nonconservative organic pollutants (e.g., volatile organic compounds).
- Assess the degree to which corrosion control programs and pipe replacement programs completed in response to Safe Drinking Water Act requirements may reduce concentrations of metals in municipal wastewaters.

Recommendation Three: Improve Scientific Basis of Pretreatment Controls

- Continue to emphasize with EPA Regions and States the need for water quality-based NPDES permits for pretreatment POTWs.
- Continue to train permit writers in methods for incorporating water quality-based limits and sludge requirements in NPDES permits.
- Target pretreatment POTWs for additional monitoring and reporting, in order to ascertain the need for additional toxics control, based on data showing actual or reasonable potential for problems. Target additional POTWs for development of local pretreatment programs based on these same data sources.

- Establish measures for assessing the environmental effectiveness (e.g., improved water quality and sludge quality) of local pretreatment programs. Incorporate these measures into ongoing implementation activities (such as audits, PCIs, or POTW annual reports).
- Continue to develop water quality and sludge quality standards.
- Issue guidance to States emphasizing the need to develop water quality standards and wasteload allocations for toxics of concern. Provide technical assistance as necessary.
- Continue aggressive enforcement of pretreatment standards and requirements at the local, State, and Federal levels.

ABBREVIATIONS AND ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AMSA	Association of Metropolitan Sewerage Agencies
BAT	Best Available Technology Economically Achievable
BPJ	Best Professional Judgement
BMR	Baseline Monitoring Report
BPT	Best Practicable Technology
BOD	Biochemical Oxygen Demand
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
CIU	Categorical Industrial User
CWA	Clean Water Act
DSS	Domestic Sewage Study
EPA	U.S. Environmental Protection Agency
GAO	General Accounting Office
IDLH	Immediately dangerous to life and health
ITD	Industrial Technology Division (EPA Office of Water Regulations and Standards)
IU	Industrial User
mgd	Million gallons per day
MISA	Municipal Industrial Strategy for Abatement
NEDS	National Emissions Data System
NIOSH	National Institute of Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NSSS	National Sewage Sludge Survey
NURP	National Urban Runoff Program
ORD	Office of Research and Development
OSHA	Occupational Safety and Health Administration
OWEP	Office of Water Enforcement and Permits (EPA)
PASS	Pretreatment Audit Summary System
PCS	Permit Compliance System
POTW	Publicly Owned Treatment Works

ABBREVIATIONS AND ACRONYMS (CONTINUED)

PPIC	Pollution Prevention Information Clearinghouse
PSES	Pretreatment Standards for Existing Sources
RCRA	Resource Conservation and Recovery Act
RIA	Regulatory Impact Analysis
RNC	Reportable Non-Compliance
SDWA	Safe Drinking Water Act
SIU	Significant Industrial User
SNC	Significant Non-Compliance
SS	Suspended Solids
STORET	Storage and Retrieval Data Base
SU	Standard Units
TDS	Total Dissolved Solids
TOC	Toxic Organic Compounds
TTO	Total Toxic Organics
TRIS	Toxic Release Inventory System
TSCA	Toxic Substances Control Act
TSD	Treatment, storage, and disposal operations
TSS	Total Suspended Solids
TTO	Total Toxic Organics
TWA	Time Weighted Average
UST	Underground Storage Tank
WERL	Wastewater Engineering Research Laboratory (EPA)
WET	Whole Effluent Toxicity
WPCF	Water Pollution Control Federation
WWTP	Wastewater Treatment Plant

GLOSSARY

Acclimated - A term introduced in the Domestic Sewage Study to characterize removals achieved by activated sludge treatment plants that have a consistent influent wastewater feed of each pollutant at 500 parts per billion.

Activated Sludge Process - A (secondary) biological treatment process consisting of an aeration tank(s) where oxygen is supplied to maintain dissolved oxygen levels, followed by a clarifier that provides for the removal of solids.

Allowable Headworks Loading - The maximum pollutant loading that may be received at the headworks of a specific treatment works calculated to ensure the prevention of interference or pass through from that pollutant.

Approval Authority - The regulatory agency (the Director in an NPDES State with an approved State pretreatment program and the appropriate Regional Administrator in a non-NPDES State or without an approved State pretreatment program) that is responsible for overseeing and enforcing the development and implementation of the POTW's local pretreatment program. (40 *CFR* 403.3[c])

Approved Pretreatment Program - A program administered by a POTW that meets the criteria established in the General Pretreatment Regulations and that has been approved by the approval authority. (40 *CFR* 403.3 [d])

Baseline Monitoring Report (BMR) - A report submitted by categorical industrial users within 180 days after the effective date of an applicable categorical standard indicating the compliance status of the user with the categorical standard. (40 *CFR* 403.129[b])

Best Available Technology (BAT) - A level of technology represented by a higher level of wastewater treatment technology than required by Best Practicable Technology (BPT). BAT is based on the best (state of the art) control and treatment measures that have been developed or are capable of being developed within the appropriate industrial category.

Biochemical Oxygen Demand (BOD) - The rate at which microorganisms use the oxygen in water or wastewater while stabilizing decomposable organic matter under aerobic conditions. BOD measurements are used as a measure of the organic strength of wastewater.

Categorical Industrial User - An industrial facility subject to regulation by a national categorical pretreatment standard established by EPA.

Categorical Standards - Pollutant discharge standards that apply to users in specific industrial categories determined to be the most significant sources of toxic pollutants discharged to the Nation's treatment works. These standards are based on the best technology available to treat the pollutants of concern resulting from the regulated processes. Categorical pretreatment standards are published by industrial category, each as a separate regulation. All firms regulated by a particular category are required to comply with these standards, regardless of where they are located in the United States.

Chemical Abstracts Services - A registry of over 10 million different chemical substances.

Clarifier - A wastewater treatment unit designed to remove settlable solids.

Comminuters - Devices used to cut wastewater solids to a width of 1/4 to 3/4 inches without removing them from the wastewater.

Conservative Pollutants - Pollutants that are not biodegraded or volatilized at a wastewater treatment works.

Control Authority - A POTW with an approved POTW pretreatment program, or the approval authority if the POTW does not have an approved POTW pretreatment program. (40 *CFR* 403.12[a])

Conventional Pollutants - Biochemical oxygen demand, total suspended solids, fecal coliform, pH, and oil and grease.

Decile - Each of the 10 equal divisions of an ordered number set. (Ten percent of the values lies within each division.)

Domestic Sewage Study (DSS) ***(Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works [February 1986])*** - This report evaluated the impacts of waste discharged to POTWs as a result of the Domestic Sewage Exclusion.

Environmental Protection Agency (EPA) - A regulatory agency established by the U.S. Congress to administer the Nation's environmental laws. (Section 122.2 of the Clean Water Act)

Fundamentally Different Factor (FDF) Variances - A modification of a categorical pretreatment standard that may be granted by EPA when an industry or interested party demonstrates that factors exist in its process that were not considered in the development of the standard. (40 *CFR* 403.13).

40-POTW Study - Also known as *The Fate of Priority Pollutants in Publicly Owned Treatment Works* (EPA 440/1-82/303) September 1982.

47-POTW Study - A data base compiled for this report by EPA from readily available information on pollutant removals at 47 POTWs.

GAGE Survey - A file containing data on river flows organized by STORET reach and segment.

Grit Chamber - A wastewater treatment unit designed to remove inert solids from wastewater based on differential settling rates of the wastewater solids and the flow and velocity of the wastewater.

Hazardous Waste - Section 1004(5) of the Resource Conservation and Recovery Act (RCRA) defines hazardous waste as "a solid waste, or combination of solid wastes, which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may:

(A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating irreversible, illness; or

(B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed." (40 *CFR* 261.3)

Hazardous Waste Data Management System (HWDMS) - A data base maintained by the Office of Solid Waste to track the permit, compliance, and enforcement status of RCRA hazardous wastehandlers. The data base contains information for more than 90,000 facilities, which are classified as hazardous waste generators; transporters; treatment, storage, and/or disposal (TSD) facilities; or nonregulated facilities.

Hydraulic Detention Time - The hydraulic detention time of a particular vessel at a particular flow may be defined as the flow per unit time divided by the volume of the vessel.

Indirect Discharge - The introduction of pollutants from any nondomestic source into a POTW. (40 *CFR* 403.3[g])

Industrial User - An industrial user is any source of indirect discharge. (40 *CFR* 403.3 [u])

Interference - A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

(A) Inhibits or disrupts the POTW, its treatment process or operations, or its sludge processes, use or disposal; and

(B) Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to Subtitle D of SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act. (40 *CFR* 403.3[i]).

Lagoons/Stabilization Ponds - Simple basins commonly surrounded by earthen dikes that provide treatment for wastewater through settling and stabilization.

Local Limits - National pollutant discharge limits developed and enforced by the POTW for specific pollutants of concern to its system to ensure compliance with the prohibited discharge standards. (40 *CFR* 403.5[c])

Municipal Industrial Strategy for Abatement (MISA) Study - A study of 37 Canadian STPs conducted to provide influent and effluent monitoring data to support the development of monitoring regulations.

National Pollutant Discharge Elimination System (NPDES) - The national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318, and 405 of CWA. (Section 122.2)

National Pretreatment Program - The program administered and implemented by EPA (and approved States) as a subset of the National Pollutant Discharge Elimination System

(NPDES) program to control discharges of pollutants by industrial and commercial facilities to POTWs.

National Pretreatment Standard - Any regulation containing pollutant discharge limits promulgated by the EPA in accordance with Section 307 of the Clean Water Act, which applies to industrial users. This term includes prohibited discharge standards, categorical standards, and local limits. (40 *CFR* 403.3 [j])

National Sewage Sludge Study (NSSS) - A study conducted in 1988 that included sampling visits to a variety of POTWs. Sewage sludge samples were collected after final processing in an effort to identify the presence and level of toxic pollutants contained in municipal sewage sludge.

NEEDS 1988 - An access data base from the biennial NEEDS Survey to estimate the cost of construction needed by U.S. POTWs.

NEEDS Survey - A biannual assessment of the total cost to the Nation of bringing all facilities into compliance with the goal of the Clean Water Act to provide a minimum of secondary wastewater treatment.

NRDC Consent Decree - A settlement agreement that ended litigation over the toxics control provisions of the 1972 Federal Water Pollution Control Act (FWPCA) Amendments ([NRDC v. Train, 8ERC2120 [D.D.C. 1976], modified March 1979, October 1982, August 1983, January 1984, July 1984, and January 1985). This agreement required EPA to promulgate technology-based standards addressing 65 compounds or classes of compounds for 21 industrial categories. This list of toxic pollutants was adopted by Congress in the 1977 Clean Water Act Amendments.

Pass Through - A discharge that exits the POTW into waters of the United States in quantities or concentrations that, alone or in conjunction with a discharge or discharges from other sources, causes a violation of any requirement of the POTW's NPDES permit, including an increase in the magnitude or duration of the violation. (40 *CFR* 403.3[n])

Permit Compliance System (PCS) - A data base used to track information for all NPDES permitted facilities. This information includes facility data, discharge data, compliance schedule requirements, enforcement activities, and compliance status. A subset of this system, the Pretreatment Program Enforcement Tracking System (PPETS), tracks pretreatment program implementation information for all municipal facilities with approved pretreatment programs.

PRELIM - An EPA computer program designed to assist POTWs in developing technically based local limits.

Pretreatment - The reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a POTW. The reduction or alteration may be obtained by physical, chemical, or biological processes, process changes, or by other means, except that dilution may not be used to substitute for treatment. Appropriate pretreatment technology includes control equipment, such as equalization tanks or facilities, for protection against surges or slug loadings that might interfere with or otherwise be incompatible with the POTW. (40 *CFR* 403.3[q])

Pretreatment Audit Summary System (PASS) - An EPA data base designed specifically to track information obtained during EPA and/or State audits and inspections of local pretreatment programs.

Pretreatment Implementation Review Task Force (PIRT) - A task force established by EPA in 1984 to review the implementation status of the National Pretreatment Program and to provide the Agency with recommendations for improving the program.

Pretreatment Standards for Existing Sources (PSES) - Categorical standards and requirements applicable to industrial sources that began construction prior to the publication of the proposed pretreatment standards for that industrial category. (See individual categorical standards in 40 *CFR* Parts 405-471 for specific dates.)

Primary Treatment - The removal of wastewater solids through sedimentation.

Priority Pollutant - A list of pollutants originally developed during negotiations between the National Resources Defense Council (NRDC) and EPA and incorporated as a part of a settlement agreement that ended litigation over the toxics control provisions of the 1972 Federal Water Pollution Control Act (FWPCA) Amendments (NRDC v. Train, 8ERC2120 [D.D.C. 1976], modified, March 1979, October 1982, August 1983, January 1984, and January 1985). The settlement agreement is commonly referred to as the "NRDC Consent Decree." This list, containing 65 compounds or classes of compounds, including 129 toxic pollutants (and subsequently amended to 126 pollutants), was adopted by Congress in the 1977 Clean Water Act Amendments. (40 *CFR* 403, Appendix B)

Prohibited Discharge Standards - Discharge standards established by EPA, including general and specific prohibitions. The **general prohibitions** prohibit pass through and interference. The **specific prohibitions** are intended to protect the treatment works and its operations by prohibiting the discharge of pollutants that will interfere with or pass through the treatment works. In particular, they prohibit pollutants that:

(A) Create a fire or explosion hazard in the sewers or treatment works, specifically including those with a closed-cup flashpoint of greater than 140°F (60°C)

(B) Are corrosive (with a pH lower than 5.0)

(C) Are solid or viscous in amounts that will cause obstruction to the flow to and/or in the treatment works, resulting in interference

(D) Are petroleum oil, nonbiodegradable cutting oil, or mineral oil products in amounts that will cause interference or pass through

(E) Have a flow rate or concentration that will cause interference

(F) Increase the temperature of the wastewater entering the treatment works to greater than 104°F (40°C)

(G) Have a fume toxicity in a quantity that may cause acute worker health and safety problems. (40 *CFR* 403.5)

Publicly Owned Treatment Works (POTW) - A treatment works, as defined by Section 212 of the Clean Water Act, that is owned by a State or municipality (as defined by Section 501[4] of the Act). This definition includes any devices and systems used in the storage, treatment, recycling, and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes, and other conveyances only if they convey wastewater to a POTW treatment plant. The term also means the municipality as defined in Section 502(4) of the Act, which has jurisdiction over the indirect discharges and discharges from such a treatment works. (Section 403.3[o])

Removal - The amount by which a pollutant in the influent of the treatment works is reduced by the treatment processes prior to its discharge by the treatment works. (403.7[a][i])

Removal Credit - A revision to a discharge limit for an industrial user subject to a categorical pretreatment standard for a particular pollutant discharged to a particular treatment works based on that treatment works' ability to remove the pollutant to a degree significantly greater than that considered in the development of the standard. The POTW must apply to the approval authority for authorization to grant a removal credit to its affected industrial users. Such authorization will only be granted where the POTW can demonstrate that the revised discharge limit will not endanger its compliance with all applicable requirements, including water quality standards, NPDES permit conditions, and sludge reuse and/or disposal requirements. (40 *CFR* 403.7)

Reportable Non-Compliance (RNC) - Criteria developed by OWEP that are used to evaluate local program implementation and that provide the framework for the definition of reportable noncompliance. The criteria should be used by EPA Regions and approved States to report POTW noncompliance with pretreatment requirements on the QNCR (Quarterly Noncompliance Report). The criteria are:

- POTW establishment of insignificant user control mechanisms
- POTW compliance monitoring and inspections
- POTW enforcement or pretreatment standards and reporting requirements
- POTW reporting to the approval authority
- Other POTW implementation requirements.

Screening - A preliminary wastewater treatment unit found at or near the headworks of the treatment works that consists of parallel bars or gratings with uniform spacing designed to remove larger debris and solids from the wastewater.

Secondary Sedimentation - A function of the secondary clarifier that is designed to remove the biomass from the wastestream, thereby allowing for recycling and wasting of solids.

Secondary Treatment - Treatment processes, including activated sludge, trickling filters, and lagoon systems, that are designed to break down pollutants in the wastewater through biochemical processes. The level of treatment required for secondary treatment is defined in 40 *CFR* Part 133.

Significant Industrial User (SIU) - Any industrial user that meets any of the following criteria:

(A) Is subject to categorical pretreatment standards

(B) Discharges an average of 25,000 gallons or more per day of process wastewater to the treatment works

(C) Contributes a process wastestream that makes up 5 percent or more of the hydraulic or organic capacity of the treatment works

(D) Is determined by the POTW to have a reasonable potential for adversely affecting the treatment works' operation or for violating any pretreatment standard or requirement. (40 *CFR* 403.3[t])

Significant Non-Compliance (SNC) - Criteria used by control and approval authorities to identify important violations and/or patterns of noncompliance. These criteria are used to establish enforcement priorities and comply with special reporting requirements. An industrial user is in significant non-compliance if its violation meets one or more of the following criteria: (A) Chronic violations of wastewater discharge limits, defined here as those in which 66 percent or more of all of the measurements taken during a 6-month period exceed (by any magnitude) the daily maximum limit or the average limit for the same pollutant parameter; (B) Technical Review Criteria (TRC) violations, defined here as those in which 33 percent or more of all of the measurements for each pollutant parameter taken during a 6-month period equal or exceed the product of the daily maximum limit or the average limit multiplied by the applicable TRC; (C) Any other violation of a pretreatment effluent limit (daily maximum or longer term average) that the Control Authority determines has caused, alone or in combination with other discharges, interference or pass through (including endangering the health of the POTW personnel or the general public); (D) Any discharge of a pollutant that has caused imminent endangerment to human health, welfare, or to the environment or has resulted in the POTW's exercise of its emergency authority under paragraph (f)(1)(vi)(B) of this section to halt or prevent such a discharge; (E) Failure to meet, within 90 days after the schedule date, a compliance schedule milestone contained in a local control mechanism or enforcement order for starting construction, completing construction, or attaining final compliance; (F) Failure to provide, within 30 days after the due date, required reports, such as baseline monitoring reports, periodic self-monitoring reports, and reports on compliance with compliance schedules; (G) Failure to accurately report noncompliance; (H) Any other violation or group of violations that the Control Authority determines will adversely affect the operation or implementation of the local pretreatment program.

Solvent Recycling Industry (SRI) - Commercial facilities that recycle spent solvents resulting from manufacturing processes or cleaning operations located at other sites. SRI facilities do not include recovery operations that are an integral part of a main process, such as solvent refining or vegetable oil manufacturing, and they do not include operations added on to a process, such as surface coating industries that reclaim spent solvents reused onsite.

STORET (Storage and Retrieval Data Base) - A data base that includes water-related environmental data for all 50 States.

Total Toxic Organics (TTO) - Total toxic organics, which is the summation of all quantifiable values greater than 0.01 milligrams per liter for a long list of toxic pollutants identified under individual categorical standards.

Toxic Pollutant - For purposes of this report, any pollutant, including any pollutant listed as toxic under Section 307(a)(1) of the Clean Water Act (priority pollutants) and other pollutants as reported by the various data sources used in this report.

Toxic Release Inventory System (TRIS) - Established under Section 313 of the 1986 Emergency Planning and Community Right to Know Act, TRIS is a data source used to identify toxic pollutants being discharged by industrial and commercial sources into the environment, including discharges to POTWs.

Trickling Filter - A secondary treatment process consisting of a bed of coarse inert materials (natural or synthetic) over which the primary clarifier effluent is uniformly distributed. The inert materials provide a surface for the growth of biomass that treats the wastewater.

Used Oil Reclamation and Re-Refining Industry - Consists of approximately 68 used oil recycling businesses. The industry can be subdivided into two facility classes based on the sophistication of the processing technology and the purity of the product.

Whole Effluent Toxicity (WET) - The aggregate toxic effect of an effluent measured directly by a toxicity test. (40 *CFR* 122.21 [j])