

1998 Annual Report

M I C H I G A N



Pulp & Paper Pollution Prevention Program

A Partnership
Between the
Michigan Pulp &
Paper Environmental
Council and
the Michigan
Department of
Environmental
Quality

DEQ
Michigan Department of
Environmental Quality

 Michigan
Pulp & Paper
Environmental Council

M I C H I G A N



**Pulp &
Paper
Pollution
Prevention
Program**

"I commend the major mills in Michigan for voluntarily committing to short and long term pollution prevention goals," said DEQ Director Russell Harding. "The forest products industry is to be applauded for taking a leadership role in this effort."

1st Annual Report DEQ Press Release, July 10, 1997

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This report is printed with MPPEC funds.



INTRODUCTION

The Michigan Pulp and Paper Pollution Prevention Program (P5) is designed to encourage the incorporation of pollution prevention activities at pulp and paper mills in Michigan. The P5 is managed in partnership between the Michigan Department of Environment Quality (DEQ), Environmental Assistance Division and Michigan Pulp and Paper Environmental Council (MPPEC).

P5 is a cooperative effort that recognizes the pulp and paper industry's commitment to reduce the environmental impact of its operations and, in many cases, go beyond federal and state requirements. By participating in P5, mills make a voluntary pledge to further enhance the environment and their respective communities through increased pollution prevention efforts. P5 participants are shown on the map below.

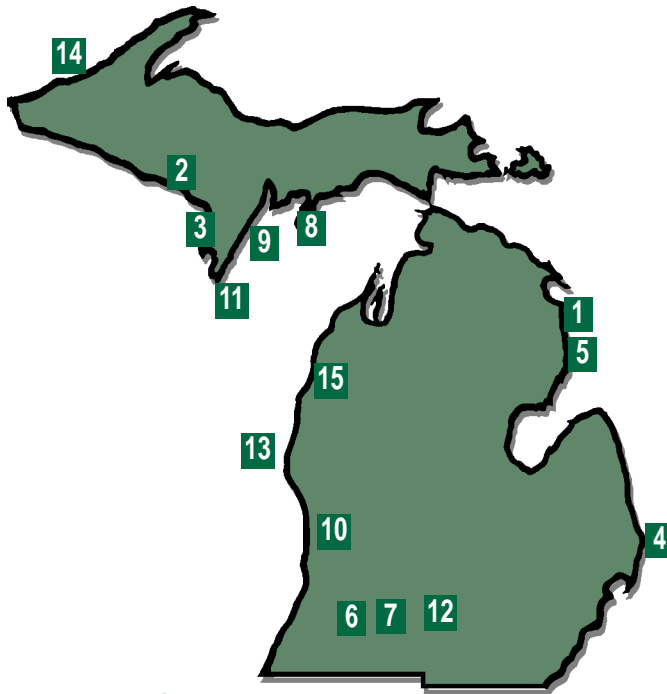
The P5 Partnership is multimedia in scope, encompassing the management of air emissions, wastewater discharges, solid and hazardous waste generation, and other areas of potential environmental

impact. The Partnership recognizes that pollution prevention is an economical and technically practical method for enhancing environmental quality and business sustainability.

This **Second Annual Report** highlights the progress made by the P5 members to reduce emissions and discharges through the implementation of pollution prevention technologies. The report presents the following:

- elements of the P5 program
- participants' historical emission trends
- progress on short term, industry-wide P5 goals for 1997
- progress on current and new long term goals
- industry-wide P5 short term goals for 1998

The appendix of this report includes the individual mill commitments and policy statements developed for this partnership, a review of student intern studies performed at five mills and a compendium of individual mill P2 information.



P5 MEMBER MILLS

- | | | |
|--|---|--|
| 1. ABT co, Inc., Alpena | 6. Fort James Corporation, Kalamazoo | 11. Menominee Paper Company |
| 2. Champion International Corporation, Quinnesec | 7. Georgia-Pacific Corporation, Kalamazoo | 12. Rock-Tenn Company, Battle Creek |
| 3. Consolidated Papers, Inc. Niagara Division (Dickinson County) | 8. Manistique Papers, Inc., Manistique | 13. SAPPI Company, Muskegon |
| 4. EB Eddy Paper, Port Huron | 9. Mead Corporation, Escanaba | 14. Stone Container Corporation, Ontonagon |
| 5. Fletcher Paper, Alpena | 10. Menasha Corporation, Otsego | 15. Tenneco Packaging, Filer City |

PULP AND PAPER INDUSTRY IN MICHIGAN

The pulp and paper industry contributes significantly to Michigan's economy. The industry utilizes Michigan's vast renewable forest resources that currently cover 53 percent of Michigan's total land area, or 19.3 million acres. A wide range of products are produced by the pulp and paper industry including envelopes, printing/writing paper, paperboard containers, boxes, and sanitary paper products. The industry in Michigan means the following to a sustainable economy¹ :

PAPER FACTS

- employment 21,000
- annual payroll \$800 million
- annual value added \$2 billion
- annual production (7th nationally)
 - paper and paperboard 3.4 million tons
 - wood pulp 1.3 million tons
- recovered paper consumption 1.6 million tons
(4th nationally)
- number of mills 39

Environmentally, the mills are also an important driver. According to one environmental indicator, the Toxic Release Inventory (TRI), in 1996 the industry ranked 3rd in the state for total releases.² Water usage and treatment, residuals management and air emissions are all areas for improvement acknowledged by the industry.

Since 1996, fifteen mills in Michigan, representing almost 75 percent of the total pulp and paper production in the state, have made a commitment to environmental improvement by joining the P5 partnership. We continue to seek new members each year.

ABOUT THE P5

The P5 is a voluntary program that identifies environmental substances of concern and establishes priorities and goals for the reduction of their use, generation, discharge, or emission. P5 utilizes the waste minimization hierarchy of source reduction as the preferred method followed by recycling, reuse, treatment/control, and disposal, including actions implemented in response to regulations. Environmental impact and economic and technical practicality are central to the determination of pollution prevention activities selected for this program. Technology transfer and identifying and addressing regulatory impediments to pollution prevention are also integral parts of P5.

The overall goal of this initiative is environmental improvement in concert with sustainable economic growth.

P5 DEFINITION OF POLLUTION PREVENTION

For the purposes of this program, pollution prevention includes any type of activity which reduces the amount of waste and/or pollution released into the environment. It is recognized that these activities should be technically and economically practical. Pollution prevention means the use of source reduction techniques in order to reduce risk to human health and/or the environment. Pollution prevention also includes reuse and environmentally sound recycling and waste reduction techniques. Pollution prevention avoids cross-media transfer of waste and/or pollutants. It addresses all types of waste and environmental releases to the air, water, and land.



¹American Forest & Paper Association (AF&PA)... Michigan Forest and Paper Industries Economic Impact Statement, 1997.
²1996 Toxic Chemical Release Inventory, Staff Analysis, Michigan Department of Environmental Quality, June 1998.

P5 KEY ELEMENTS FOR PARTICIPATION:

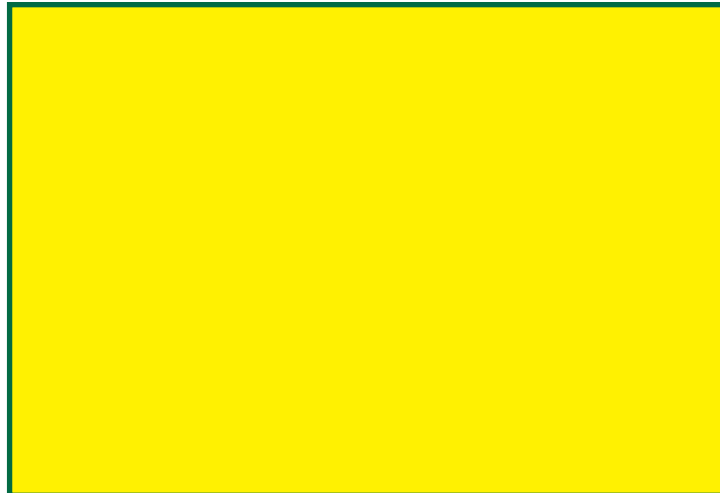
- **Commitment to P5 by a responsible company official.** This written commitment is reviewed and renewed on an annual basis by each participating mill.
- **Development of a written pollution prevention policy.** A pollution prevention policy can include the following elements:
 - Adoption of the P5 definition of pollution prevention;
 - Active mill management support for pollution prevention activities;
 - Integration of pollution prevention into the mill's routine activities;
 - Communication of the pollution prevention policy to employees;
 - Incorporation of the pollution prevention policy into the mill's environmental management system.
- **Establishment of mill specific pollution prevention goals.** The P5 goal selection should be based on 5 criteria:
 - Potential environmental impacts;
 - Future regulated substances;
 - Aesthetic considerations;
 - Volume or quantity of release;
 - Amenable to pollution prevention techniques.
- **Record keeping on pollution prevention activities.** Records are maintained by the participants to track progress related to mill-specific and industry-wide P5 goals.
- **Annual reporting.** Each participant submits information annually for inclusion in the annual report. This information includes the following:
 - Recommitment to P5;
 - Progress towards meeting established pollution prevention goals;
 - Update of existing and/or establishment of new mill-specific goals;
 - Identification of technology transfer opportunities and barriers to pollution prevention.
- **Promotion of non-proprietary technology transfer.** The Partners recognize the benefits of sharing experiences related to pollution prevention activities. This non-proprietary technology transfer is promoted through the development of case studies, education and outreach activities.

HISTORICAL PERSPECTIVE (TRENDS)

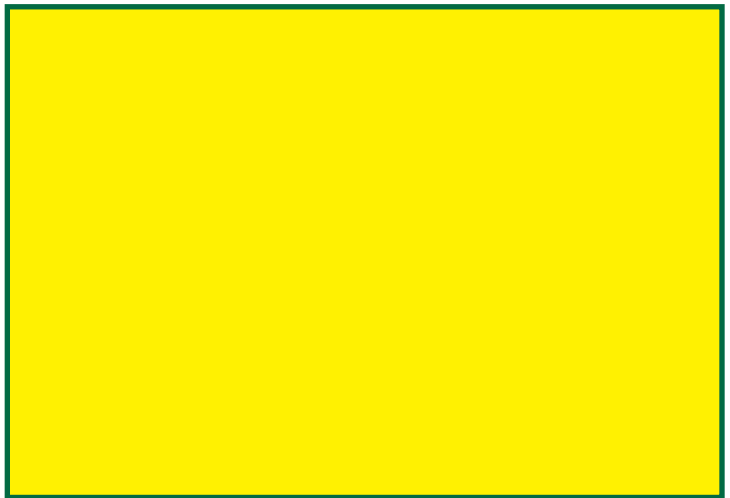
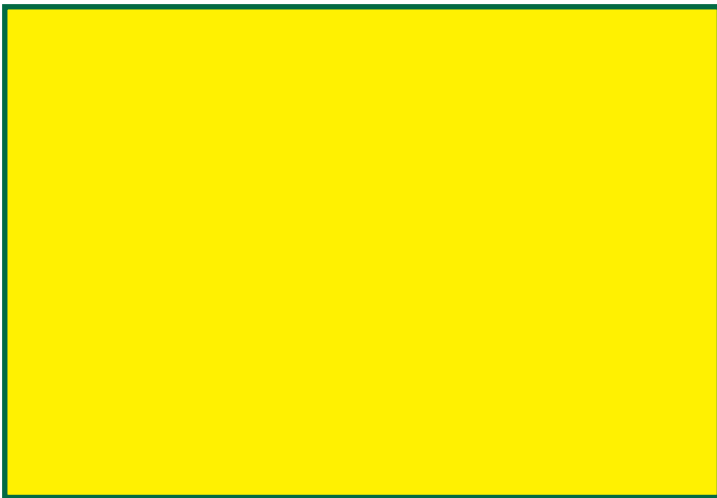
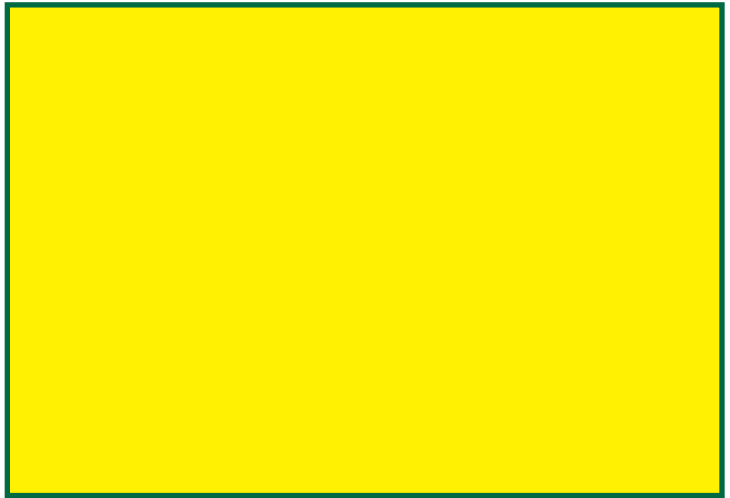
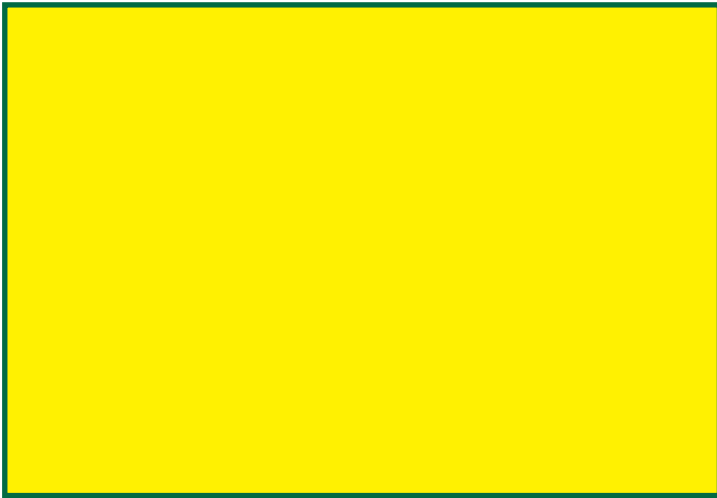
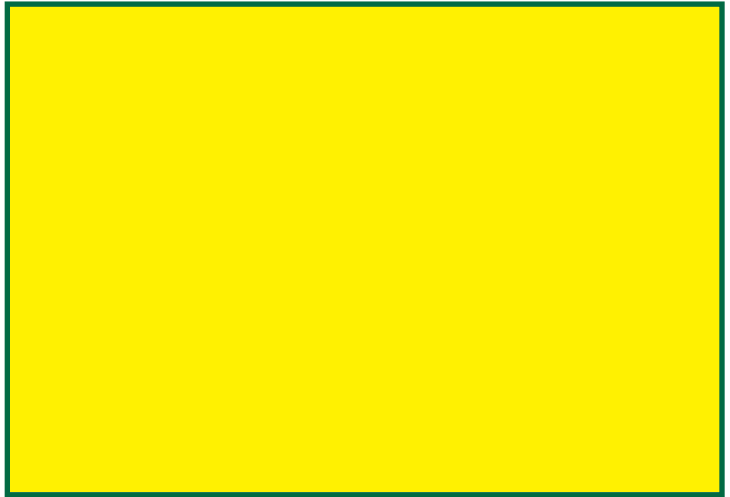
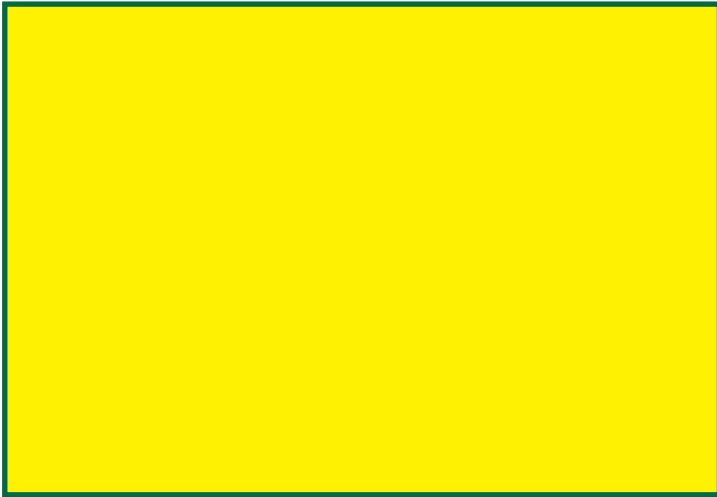
Participating mills have submitted emissions data to update the cumulative environmental trends for the industry. The data covers the years 1987 through 1996. This data was compared, supplemented, and confirmed using existing DEQ data bases (Air Quality Division (AQD) Emissions Inventory, Toxic Release Inventory, Hazardous Waste Inventory, and National Pollution Discharge Elimination System (NPDES)/Wastewater reports). A summary of compiled historical data is provided in the appendix of this report.

The figures on the accompanying page provide historical emissions trends for the period 1987 through 1996 (prior to the P5 goal implementation in 1997). In general, the data shows improvement in environmental performance. During this period, production increased by 30 percent. At the same time, although combined air and water discharges stayed essentially the same, these discharges decreased by 29 percent on a production basis. Also as expressed on a normalized basis (per ton of production), the following occurred: hazardous waste generation decreased by 94 percent; total air emissions decreased by 8 percent, and total wastewater discharges decreased by 52 percent.

Solid waste landfilled, expressed on a production basis, remained essentially the same during this 10 year period. The actual tonnage of solid waste generated increased due in part to the increased production of recycled paper. As a consequence the P5 participants continue to pursue beneficial reuse and reduction of landfilled materials including sludge, ash and mill refuse.



TRENDS



GOALS

GOAL DEVELOPMENT

Each year, participating mills commit to short and long term goals that are quantitative or qualitative in nature. Participants use Areas of Focus as guidance in developing mill-specific pollution prevention goals. The following Areas of Focus have been identified as opportunities for pollution prevention:

- **Nonylphenol Ethoxylate**
- **Mercury**
- **PCBs**
- **Chlorine**
- **Recycling**
- **Environmental Management Systems**
- **Water Usage**
- **Solid Waste Reduction to Landfill**
- **Hazardous Waste Generation**
- **Air Emission Reductions**
- **Expand P5 Participation**

Mill-specific quantitative goals are consolidated into overall P5 goals for the purpose of reporting program results. Each selected P5 quantitative goal reflects a summation of individual mill goals for that parameter or activity.

Qualitative goals from some participants include efforts such as enhanced environmental training, outreach activities, and commitments for further P2 projects and programs. Some participating mills have provided reports on their P2 efforts, which are included in the Appendix.

PROGRESS ON GOALS

The short term goals that were set for the 1997 P5 Partnership and the resulting reductions are illustrated in the table below. The reduction goals were to be achieved through the specific implementation of pollution prevention techniques. These reductions are considered permanent and were, with one exception, met or exceeded. Of particular note, for carbon monoxide, which is a by-product of combustion, the reduction goal was exceeded by over 250 tons. Further, the BOD reduction goal, through better water management, was exceeded by 25 tons. The generation of hazardous waste, largely a result of product substitution, was reduced

by 26 tons. Over 56,000 tons of solid waste (approximately 220,000 cubic yards) was diverted from landfills through the beneficial use of mill sludge and refuse.

In addition to the achievement on the short term goals, early progress was reported on goals set for 2001. While reportable reductions were not expected until 2001, some early implementation did yield reportable reductions. Continued reductions will be tracked through the long term goal report. See the corresponding table, "Long Term Goals 2-5 years," for specifics.

1997 SHORT TERM (1 YEAR) GOAL ACCOMPLISHMENTS

The following P5 goals represent the reduction commitment and actual reductions achieved through P2 efforts for 1997.

| TARGET AREA | PROJECTED REDUCTIONS | ACTUAL REDUCTIONS |
|--------------------------------------|----------------------|-------------------|
| AIR EMISSIONS | | |
| Carbon Monoxide (CO) | 1900 tons/year | 2155 tons/year |
| Volatile Organic Compounds (VOCs) | 92 tons/year | 245 tons/year |
| WASTEWATER DISCHARGES | | |
| BOD Discharged in Effluent | 50 tons/year | 75 tons/year |
| Solids Discharged in Effluent | 12 tons/year | 16 tons/year |
| HAZARDOUS MATERIALS | | |
| Hazardous Waste Generation | 9 tons/year | 26 tons/year |
| PCB Transformer Removal | 12 units | 15 units |
| SOLID WASTE LANDFILLED | | |
| Boiler Ash Generation | 5,800 tons/year | not achieved |
| Beneficial Use of Sludge | 20,000 tons/year | 50,669 tons/year |
| Utilization/Recycling of Mill Refuse | 300 tons/year | 5988 tons/year |

The P5 participants are proud of the successful implementation of the program and the reduction achievements attained in this first year of the program.

1998 COMMITMENTS SHORT TERM (1 YEAR) GOAL

The following P5 goals represent the reduction commitments to be achieved through P2 efforts during 1998.

| TARGET AREAS | PROJECTED REDUCTIONS |
|--|----------------------|
| AIR EMISSIONS | |
| Methanol | 13 tons/year |
| Volatile Organic Compounds (VOCs, excluding methanol) | 12 tons/year |
| WASTEWATER DISCHARGES | |
| Water Use (wastewater volume) | 105 Mgal/year |
| Solids Loading to Treatment | 1,075 tons/year |
| HAZARDOUS MATERIALS | |
| Chlorine Use | 6 tons/year |
| Zinc in Sludge | 0.5 tons/year |
| PCB Transformer Removal | 3 units |
| SOLID WASTE LANDFILLED | |
| Beneficial Use of Sludge | 8,500 tons/year |
| Utilization/Recycling of Mill Refuse | 1,000 tons/year |

NEW SHORT TERM GOAL COMMITMENTS

For the 1998 P5 commitment year, each of the 15 P5 mills submitted new P2 goals. The table on the left shows the combined 1998 short term goals for improvement in air emissions, wastewater discharges, hazardous materials, and solid waste landfilled. These goals reflect the experience and knowledge gained through the first year's goal implementation process and target some of the Areas of Focus.

GOALS AND EARLY PROGRESS LONG TERM GOALS (2 - 5 YEARS)

The following P5 goals represents the reduction commitment for the years 1997 through 2002. Early reductions achieved due to P2 efforts, as of 12/97, are reported as progress.

| TARGET AREAS | COMMITMENT YEAR | | PROGRESS BY: |
|--|-------------------------------|-----------------|-----------------|
| DATE | 97 | 98 | 12/97 |
| | (due by 2001) | (due by 2002) | |
| AIR EMISSIONS | | | |
| Sulfur Dioxide (SO ₂) | 800 tons/year | | |
| Nitrogen Oxides (NO _x) | 350 tons/year | | |
| Carbon Monoxide (CO) | 125 tons/year | | |
| Particulate (TSP and PM ₁₀) | 120 tons/year | | |
| Hydrochloric Acid (HCl) | 90 tons/year | | |
| Sulfuric Acid (H ₂ SO ₄) | 10 tons/year | | |
| Chloroform | 9 tons/year | | 12.5 tons/year |
| Ammonia | 5 tons/year | | 3 tons/year |
| WASTEWATER DISCHARGES | | | |
| BOD and Solids | see note ³ | | |
| AOX in Effluent | 120 tons/year ⁴ | | |
| Water Use (wastewater vol.) | | 50 Mgal/year | |
| HAZARDOUS MATERIALS | | | |
| Hazardous Waste Generation | 5 tons/year | | 0.76 tons/year |
| Chlorine Usage | 8,100 tons/year | | 200 tons/year |
| PCB Transformer Removal | 2 units | | 1 unit |
| SOLID WASTE LANDFILLED | | | |
| Beneficial Use of Boiler Ash | 3,900 tons/year | 5,000 tons/year | |
| Beneficial Use of Sludge | 10,100 tons/year ⁵ | | |
| Beneficial Use/Recycling of Pulp Mill Rejects | 15,300 tons/year | | 2,645 tons/year |

NEW LONG TERM GOAL COMMITMENTS

The long term goals for 2002 completion are included on the table to the right. These goals cover P5 implementation activities in the area of water use reduction and the beneficial use of boiler ash occur between 1999 and 2002.

³ Long term wastewater discharge goals reflect reductions in loading to and discharge from the treatment plant. These goals are not readily quantifiable for this report.

⁴ The First Annual P5 Report states the AOX goal as 20 tons/year, which is a typographical error. The correct amount is 120 tons/year.

⁵ The First Annual P5 Report states the beneficial use of goal for sludge to be 26,900 tons/year. However, a subsequent review determined that this value was incorrect, largely because some of the amount had been reported as a wet weight (water weight included). Dry weight is a much better measure of operating efficiency in terms of solids losses from pulping and paper making operations, and the goal expressed entirely on a dry weight basis is what is shown above.

P5 SPECIAL EFFORTS

INTERNSHIP PROGRAM

During the summer of 1997, five mills participated in a pollution prevention internship program sponsored by the Partnership. Five students from Michigan universities were hired as interns at the mills to research P2 opportunities. Their projects included studying Best Management Practices, wastewater treatment options, Environmental Management Systems, waste minimization alternatives, and pollutant reduction assessment. A summary of the intern projects is located in the Appendix.

OUTREACH

DEQ Staff and P5 members were active in 1997 promoting the benefits of joining the Partnership. During the year, representatives from mills, public agencies, and academia from states, provinces and other countries have requested information on how the partnership was formed, as well as what P2 initiatives were committed to by the mills. The Michigan experience has been shared with the States of Maine, Washington, and Oregon, who have expressed interest in exploring the formation of similar programs. The NCASI regional meeting, September 1997, provided an excellent conduit for sharing information on the P5 and intern program. Further, the industry gained new P2 ideas based on what others are doing throughout the country.

P2 REGULATORY INTEGRATION (NPE STUDY)

P5 supports the concept that voluntary P2 should be used as the preferred alternative to regulation in achieving future environmental improvements. As an example, MPPEC entered into an agreement with Great Lakes Environmental Assessment Section (GLEAS) of DEQ, to study nonylphenol ethoxylate (NPE) discharges from the pulp and paper industry. This study will be expanded during 1998 through a grant from the Michigan Great Lakes Protection Fund to identify specific opportunities for NPE product substitution and technology transfer of the results to the industry. (In the 1997 P5 Annual Report, NPE was identified as an Area of Focus, resulting in qualitative NPE goals for 1998.)

MPPEC TECH TRANSFER

The MPPEC meets bi-monthly to discuss environmental issues relevant to the industry. The agenda for each meeting includes time for discussion on P5 updates. Discussion topics consist of P2 projects, P2 guidance, policy development and other issues. MPPEC meetings also provide opportunities for mill representatives, agency staff, and pulp and paper technical provider experts to discuss P2 applications. In September 1997, a special meeting was held for five P5 interns to present and discuss mill P2 case studies.

DATA QA/QC

Quality assurance and control of the data for the P5 is critical to the integrity of the program. The data is used to report trends and goal progress, and to guide mills in their selection of P2 goals. As noted earlier, historical data on waste generation and environmental releases is submitted by participants under P5. This data is compared against existing databases of the DEQ. In the summer of 1997, a meeting was held between NCASI and DEQ to review the data comparison procedures and results. The quality assurance work is an ongoing effort.



ABOUT THE PARTNERS

MDEQ Environmental Assistance Division (EAD): The EAD provides nonregulatory environmental services to industry, business organizations and the public. It oversees information and assistance programs leading to improvement in environmental quality through an emphasis on pollution prevention. EAD primary program areas are in education and outreach, financial assistance, pollution prevention and technical assistance.

Michigan Pulp and Paper Environmental Council (MPPEC): MPPEC is an association that represents Michigan member mills on environmental issues affecting the industry.

ACKNOWLEDGMENTS

NCASI: National Council of the Paper Industry for Air and Stream Improvement (NCASI) is an environmental technical organization that has been associated with the pulp, paper and wood products industry for over 50 years. NCASI's role in P5 is to consolidate the individual facility goals into industry wide goals for this report as well as maintain the historical environmental database on the participating facilities. To assist in this, each participating facility's specific data and goals were submitted to NCASI for processing.

U.S. Environmental Protection Agency: Department of Environmental Quality staff and resources have been provided for development and implementation of P5 through a two-year Pollution Prevention Incentives for States (PPIS) U.S. EPA grant. The grant provided a set-aside for research and technology transfer. This fund was utilized by the Partnership for the establishment of 5 internship positions in 5 of the P5 mills. The grant funds are matched in kind by state contributions.

The Partnership would also like to acknowledge the **Michigan Manufacturers Association** for the use of their facility for MPPEC and P5 meetings.

For more information about the partnership, contact Wendy Fitzner, Michigan Department of Environmental Quality, Environmental Assistance Division, P.O. Box 48909-7957, 517-373-8798 or 1-800-662-9278, or contact the Michigan Pulp and Paper Environmental Council, Suite 187, 2843 East Grand River, East Lansing, MI 48823.



SUMMARY OF COMPILED HISTORICAL DATA

| Production (Tons) | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Market Pulp | 312,670 | 316,469 | 358,736 | 351,705 | 293,235 | 307,273 | 284,725 | 345,806 | 329,536 | 326,089 |
| Paper | 1,403,674 | 1,449,766 | 1,403,579 | 1,547,618 | 1,724,567 | 1,848,320 | 1,979,166 | 2,014,112 | 2,086,254 | 2,314,430 |
| Paperboard | 1,000,426 | 996,800 | 1,016,271 | 1,025,675 | 1,024,118 | 1,053,609 | 1,171,078 | 1,245,482 | 1,200,569 | 896,577 |
| Total | 2,716,770 | 2,763,035 | 2,778,586 | 2,924,998 | 3,041,920 | 3,209,202 | 3,434,969 | 3,605,400 | 3,616,359 | 3,537,097 |
| Air Emissions - Combustion | | | | | | | | | | |
| Criteria Air Pollutants (lbs) | 43,340,003 | 47,004,122 | 44,762,942 | 73,569,926 | 68,531,804 | 72,747,260 | 78,344,823 | 79,542,771 | 72,985,490 | 72,881,477 |
| Criteria Air Pollutants (lbs/ton) | 31.05 | 28.16 | 27.03 | 26.29 | 23.38 | 22.67 | 22.81 | 22.06 | 20.18 | 20.60 |
| Other Emissions (lbs) | 3,057,386 | 3,078,991 | 3,630,214 | 3,977,902 | 3,495,445 | 3,845,387 | 4,458,572 | 4,716,999 | 4,177,833 | 4,968,221 |
| Other Emissions (lbs/ton) | 1.31 | 1.37 | 1.52 | 1.54 | 1.29 | 1.43 | 1.54 | 1.35 | 1.20 | 1.40 |
| Total (lbs) | 46,397,389 | 50,083,113 | 48,393,156 | 77,547,828 | 72,027,249 | 76,592,647 | 82,803,395 | 84,259,770 | 77,163,324 | 77,849,698 |
| Total (lbs/ton) | 19.90 | 19.69 | 19.00 | 27.71 | 24.57 | 23.87 | 24.11 | 23.37 | 21.34 | 22.01 |
| Air Emissions - Process | | | | | | | | | | |
| Criteria Air Pollutants (lbs) | 16,244,890 | 16,317,014 | 16,790,035 | 23,652,477 | 20,149,707 | 11,788,629 | 11,591,095 | 11,274,311 | 9,807,212 | 10,683,996 |
| Criteria Air Pollutants (lbs/ton) | 17.17 | 17.07 | 17.44 | 15.46 | 12.21 | 5.67 | 4.46 | 3.87 | 3.30 | 3.22 |
| Other Emissions (lbs) | 3,235,510 | 2,316,327 | 1,810,389 | 2,210,554 | 2,677,633 | 3,409,888 | 3,705,269 | 3,415,351 | 3,337,781 | 2,830,911 |
| Other Emissions (lbs/ton) | 1.91 | 1.09 | 0.96 | 0.99 | 1.25 | 1.39 | 1.30 | 1.06 | 1.07 | 0.93 |
| Total (lbs) | 19,480,400 | 18,633,341 | 18,600,424 | 25,863,031 | 22,827,340 | 15,198,517 | 15,296,364 | 14,689,662 | 13,144,993 | 13,514,909 |
| Total (lbs/ton) | 8.35 | 7.33 | 7.30 | 9.24 | 7.79 | 4.74 | 4.45 | 4.07 | 3.63 | 3.82 |
| Total Air Emissions | | | | | | | | | | |
| Total (lbs) | 65,877,789 | 68,716,454 | 66,993,580 | 103,410,859 | 94,854,589 | 91,791,164 | 98,099,759 | 98,949,431 | 90,308,316 | 91,364,607 |
| Total (lbs/ton) | 28.25 | 27.02 | 26.31 | 36.95 | 32.35 | 28.60 | 28.56 | 27.44 | 24.97 | 25.83 |
| Wastewater - Direct | | | | | | | | | | |
| BOD/TSS (lbs) | 15,055,040 | 14,812,569 | 14,916,094 | 20,474,074 | 18,876,866 | 17,473,954 | 17,460,519 | 18,257,164 | 17,089,710 | 19,548,850 |
| BOD/TSS (lbs/ton) | 12.55 | 11.51 | 7.62 | 8.45 | 7.42 | 6.39 | 6.10 | 6.13 | 5.79 | 7.05 |
| Other Discharges (lbs) | 1,431,596 | 536,673 | 1,430,677 | 1,081,335 | 1,164,219 | 1,105,636 | 1,269,271 | 1,284,442 | 1,372,620 | 1,609,619 |
| Other Discharges (lbs/ton) | 0.66 | 0.24 | 0.64 | 0.45 | 0.46 | 0.41 | 0.48 | 0.47 | 0.49 | 0.53 |
| Total (lbs) | 16,486,635 | 15,349,242 | 16,346,771 | 21,555,409 | 20,041,085 | 18,579,590 | 18,729,790 | 19,541,606 | 18,462,330 | 21,158,469 |
| Total (lbs/ton) | 7.47 | 6.88 | 6.93 | 8.22 | 7.30 | 6.31 | 6.54 | 6.56 | 5.76 | 6.97 |
| Wastewater - Indirect | | | | | | | | | | |
| BOD/TSS (lbs) | 92,019,409 | 124,492,216 | 93,151,684 | 85,722,794 | 73,373,782 | 66,202,652 | 58,856,698 | 64,960,645 | 64,416,948 | 60,679,947 |
| BOD/TSS (lbs/ton) | 390.16 | 526.38 | 180.23 | 135.34 | 116.25 | 107.27 | 98.06 | 82.37 | 78.85 | 76.88 |
| Other Discharges (lbs) | 2,612,383 | 1,723,506 | 1,726,957 | 1,571,804 | 1,712,810 | 2,032,328 | 1,325,246 | 4,192,451 | 4,708,369 | 4,077,983 |
| Other Discharges (lbs/ton) | 12.30 | 7.96 | 4.22 | 3.12 | 3.24 | 5.51 | 3.61 | 6.36 | 8.73 | 15.67 |
| Total (lbs) | 94,631,792 | 126,215,722 | 94,878,641 | 87,294,598 | 75,086,592 | 68,234,980 | 60,181,944 | 69,153,096 | 69,125,317 | 64,757,930 |
| Total (lbs/ton) | 401.23 | 533.67 | 183.57 | 137.82 | 118.96 | 110.56 | 100.27 | 87.68 | 84.61 | 82.05 |
| Total Wastewater Discharges | | | | | | | | | | |
| Total (lbs) | 111,118,427 | 141,564,964 | 111,225,412 | 108,850,007 | 95,127,677 | 86,814,570 | 78,911,734 | 88,694,702 | 87,587,647 | 85,916,399 |
| Total (lbs/ton) | 50.36 | 63.49 | 44.03 | 37.21 | 31.27 | 27.05 | 22.97 | 24.60 | 24.22 | 24.29 |
| Combined Air & Water | | | | | | | | | | |
| Total (lbs) | 178,260,967 | 211,759,185 | 179,998,611 | 212,260,866 | 189,982,266 | 178,605,733 | 177,011,493 | 187,644,133 | 177,895,963 | 177,281,006 |
| Total (lbs/ton) | 70.93 | 78.99 | 64.14 | 72.57 | 62.45 | 55.65 | 51.53 | 52.05 | 49.19 | 50.12 |
| Solid Waste (landfilled) | | | | | | | | | | |
| Wastewater Sludge (tons) | 74,825 | 106,466 | 107,549 | 123,843 | 296,668 | 282,190 | 275,877 | 309,314 | 252,536 | 235,396 |
| Boiler Ash (tons) | 82,357 | 84,064 | 121,545 | 131,828 | 101,831 | 87,911 | 155,096 | 157,685 | 161,842 | 199,185 |
| General Trash (tons) | 30,000 | 33,018 | 41,040 | 38,601 | 38,782 | 45,242 | 91,477 | 83,693 | 105,434 | 79,412 |
| Wood Waste (tons) | 12,501 | 10,298 | 10,607 | 11,365 | 11,594 | 18,473 | 24,150 | 39,027 | 37,557 | 23,928 |
| Other Wastes (tons) | 24,444 | 34,886 | 38,633 | 37,231 | 35,000 | 30,420 | 31,693 | 29,810 | 38,600 | 27,117 |
| Total (tons) | 224,127 | 268,732 | 319,374 | 342,868 | 483,874 | 464,236 | 578,292 | 619,530 | 595,969 | 565,038 |
| Total (tons/ton) | 0.15 | 0.15 | 0.17 | 0.19 | 0.17 | 0.15 | 0.17 | 0.18 | 0.16 | 0.16 |
| Hazardous Waste (generated) | | | | | | | | | | |
| Corrosive (lbs) | 175,254 | 28,965 | 85,645 | 15,460 | 4,035 | 16,908 | 2,950 | 17,868 | 11,508 | 43,821 |
| Ignitable (lbs) | 208,538 | 27,950 | 47,595 | 106,270 | 156,918 | 234,915 | 123,344 | 90,520 | 69,815 | 41,436 |
| RCRA Listed (lbs) | 890 | 513 | 1,479 | 1,757 | 4,389 | 7,663 | 9,580 | 17,962 | 8,298 | 5,670 |
| Reactive (lbs) | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 210 | 0 | 0 |
| TCLP Toxic (lbs) | 761 | 0 | 50 | 6,400 | 2,580 | 11,966 | 33,450 | 37,536 | 88,926 | 13,331 |
| Total (lbs) | 385,443 | 57,428 | 134,769 | 129,887 | 167,922 | 271,477 | 169,324 | 164,096 | 178,547 | 104,258 |
| Total (lbs/ton) | 0.52 | 0.08 | 0.11 | 0.10 | 0.08 | 0.10 | 0.05 | 0.05 | 0.05 | 0.03 |

Historical data are based on available information that has been generated from a combination of monitoring data (direct measurement), mass balance calculations, published emission factors, and other methods such as engineering calculations or best engineering judgment. There were data gaps for some substances at some facilities, particularly for the earlier years (e.g., the 1980s). Hence, the lack of data in the earlier years may mean that any reductions achieved since 1987 have been underestimated. For data expressed on a production basis (e.g., lb/ton), only the production from mills that reported a value for that substance(s) was employed in the calculation. Emission factors, EPA/DEQ reporting requirements, analytical quantification limits, and other bases for estimates may change periodically. For these and other reasons, the data may be subject to change.

Because of the ongoing quality assurance review and the availability of additional information, changes have been made to the database since the first P5 annual report was issued. These include the following changes:

- TSS data for one facility were added for all years.
- Carbon monoxide data for two facilities were added for the years 1990 and later.
- Indirect wastewater amounts for 1987 and 1988

expressed on a production basis were adjusted to properly account for the correct production during those years.

- Wastewater COD and color data, which previously were included under "Other Discharges," were removed from the database.
- Sludge amounts from a few facilities that had been reported on a wet-weight basis were adjusted to be dry weight for all years.

Chemical oxygen demand (COD) is not legally required to be measured, but it is measured by several of the direct discharge mills for their own purposes (e.g., process control of the treatment plant). COD is a redundant parameter since the mills routinely measure and report BOD, and BOD is a better indicator of the oxygen demand that organic compounds exert as they biodegrade in a river or lake.

Only a few mills measure color, and no mill is legally required to do so. For those few mills whose effluent color might be of concern in some settings, the rivers to which they discharge are naturally highly colored. Additionally, color is "quantified" into a mass value by comparison to a platinum-cobalt standard, and the quality so determined is not a true mass.

Although a mill should be lauded for making improvements in the mechanical dewatering of its

sludge, the intent was to have dry weights of sludge be reported. Dry weight is a much better measure of solids losses from pulping and paper making operations; the loss of solids is of interest as a measure of operational efficiency.

EXPLANATION OF TERMS

Combustion - Refers to the burning of fuels in boilers to generate power for use in pulp and paper production.

Process - Refers to production equipment and processes, such as a paper machine or a kraft lime kiln.

Criteria Air Pollutants - This group includes carbon monoxide, nitrogen oxides, sulfur dioxide, PM10 (particulate matter smaller than 10 microns in diameter), and volatile organic compounds.

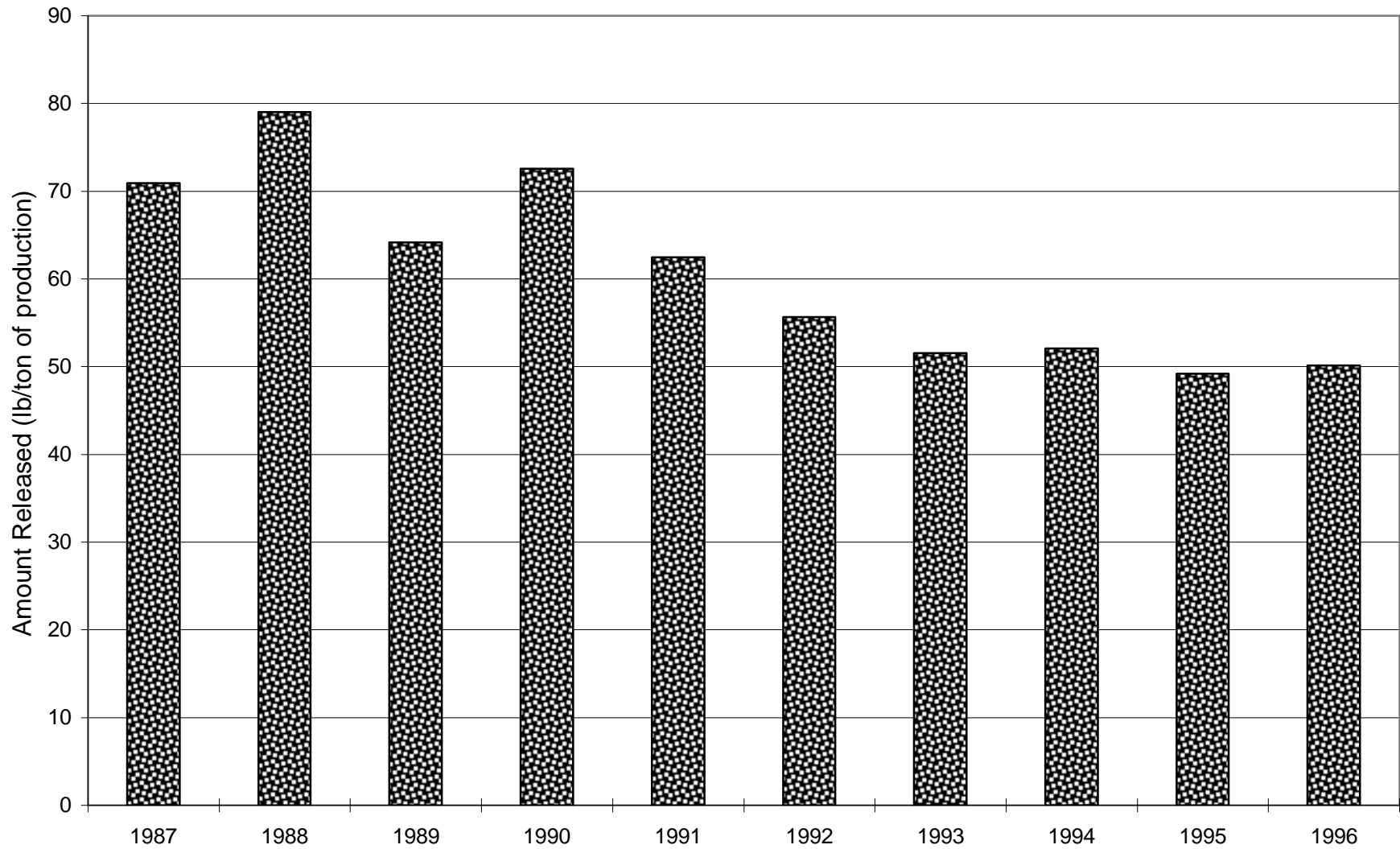
Direct Discharge - Refers to wastewater which is treated by a mill and then discharged to a natural water body such as a river.

Indirect Discharge - Refers to wastewater which, usually after partial treatment at the mill, is discharged to a municipal treatment plant for further treatment. Values in the table do not reflect the additional treatment provided by the municipality.

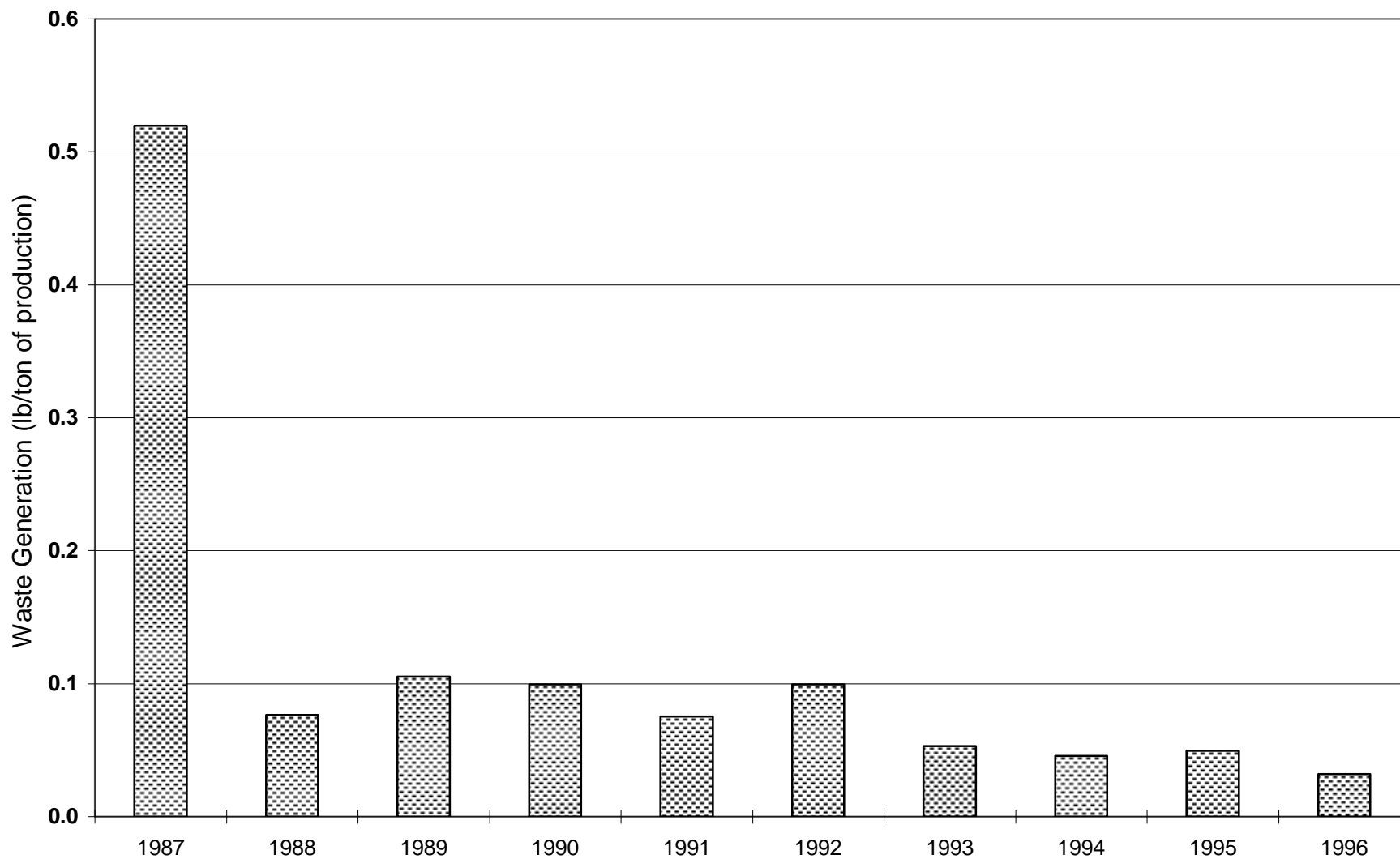
BOD - Biochemical oxygen demand, a measure of the biodegradable organic matter present in wastewater.

TSS - Total suspended solids. **Hazardous Waste** - The terms RCRA listed, corrosive, ignitable, reactive, and TCLP toxic are categories of hazardous waste defined by USEPA based on properties of the waste.

Substances Released Combined Air and Water



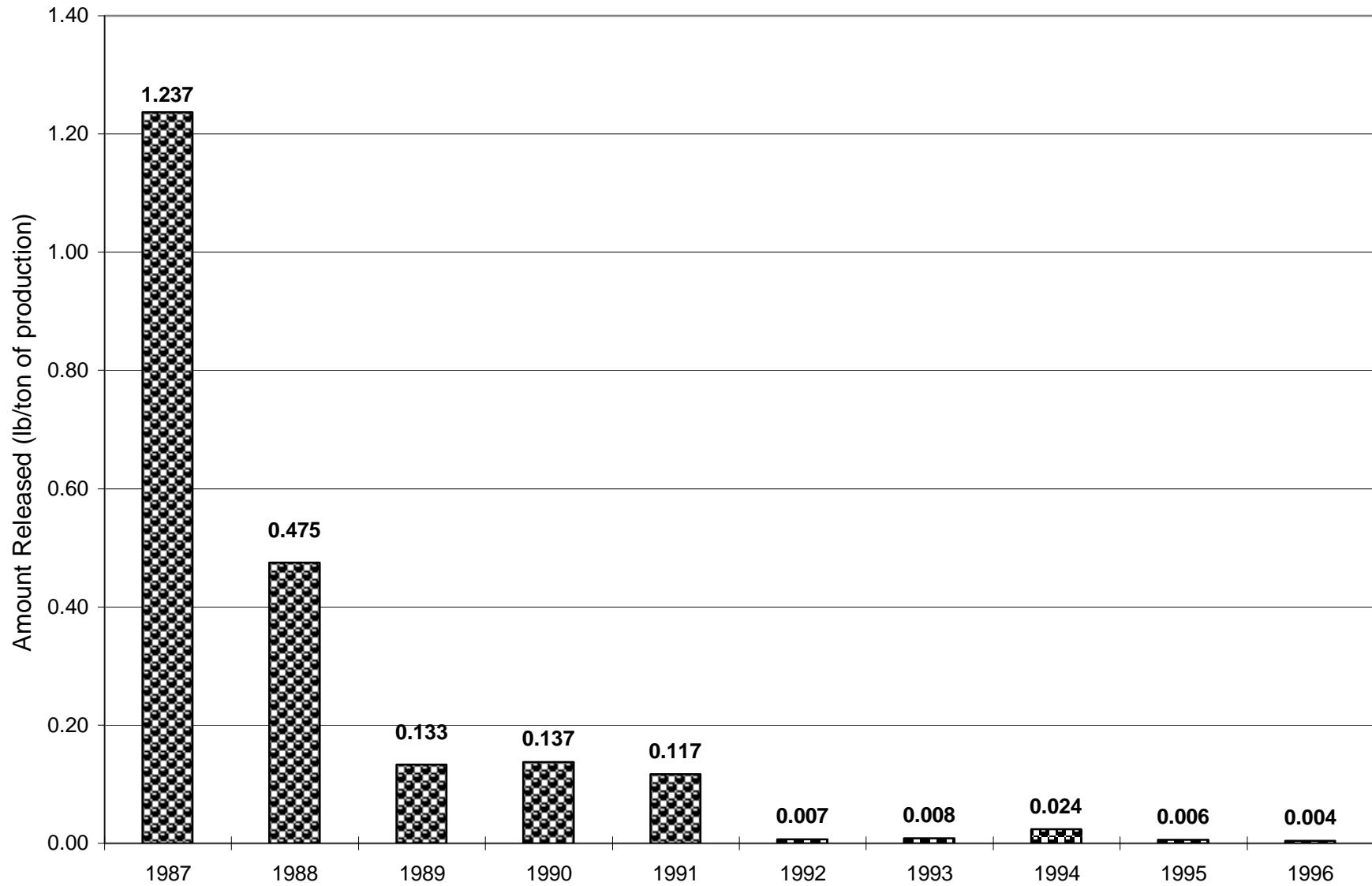
Hazardous Waste Generation



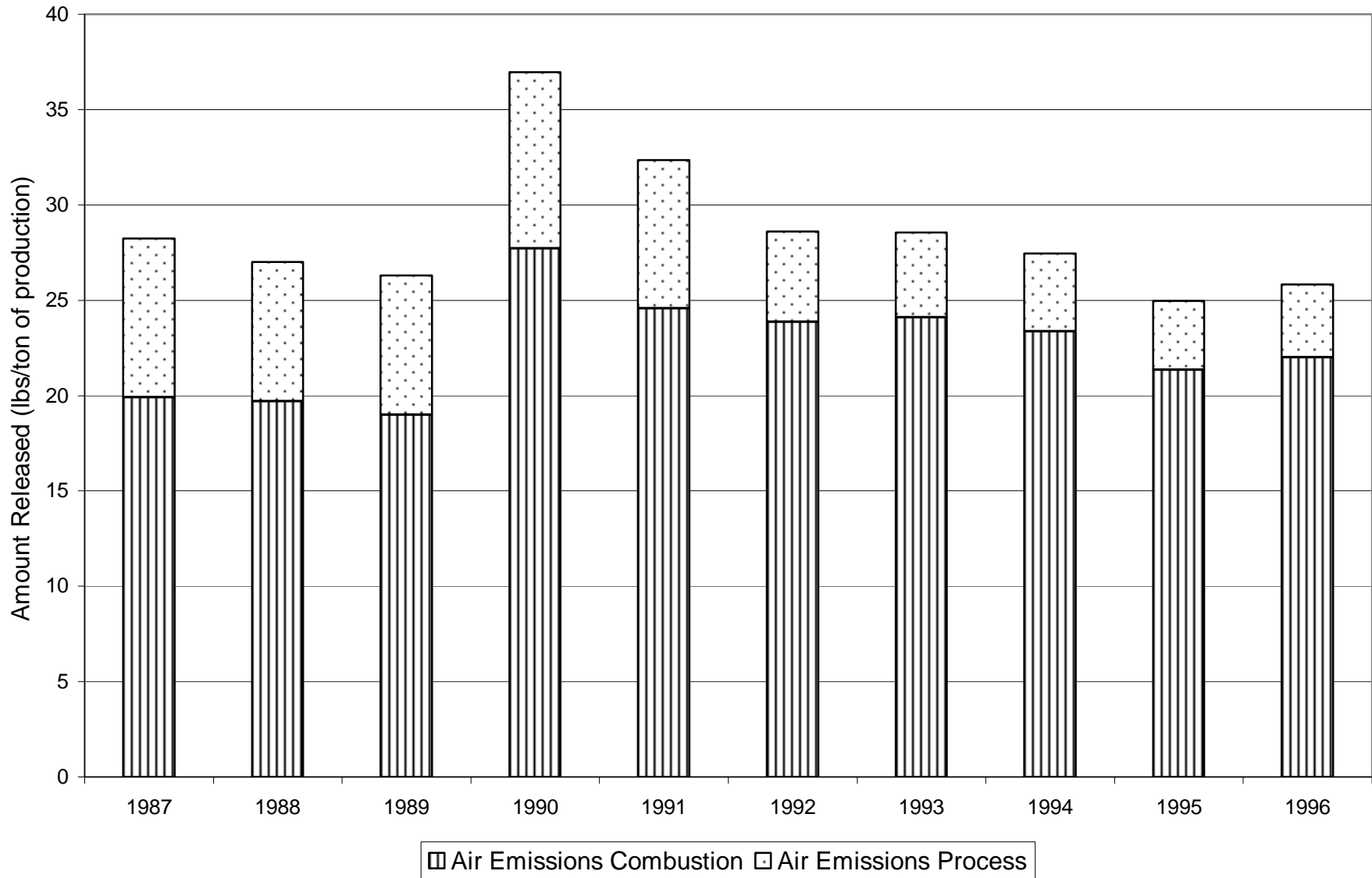
Wastewater Volume Combined Direct and Indirect Flows



Chlorine Released in Air and Water



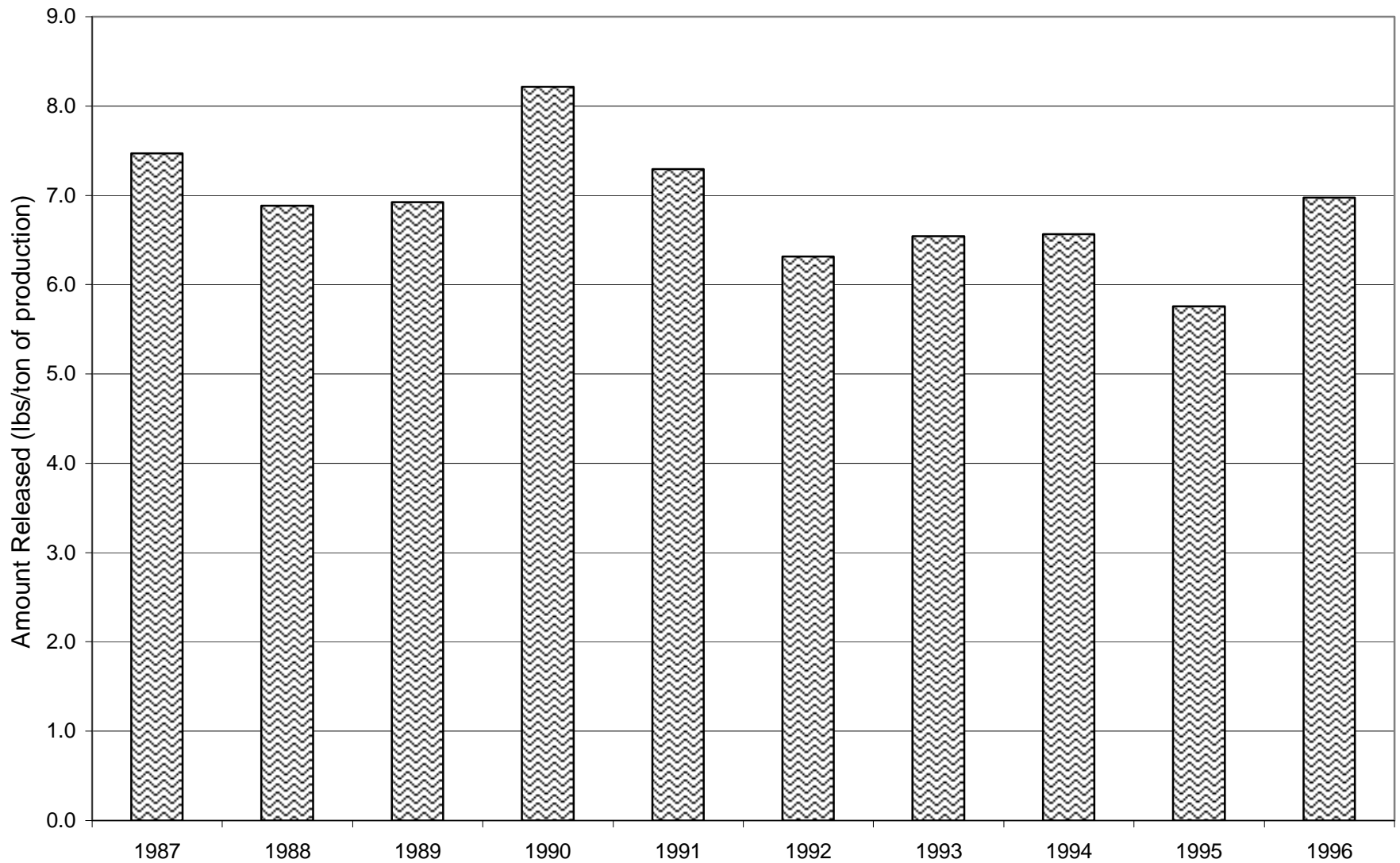
Substances Released to the Air Combustion and Process Sources



Release of BOD,TSS, and Nutrients in Wastewater Direct Discharges



Substances Released in Wastewater after On-Site Treatment Direct Discharges



Substances Released to Municipal Treatment Indirect Discharges

