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Great Lakes Water Quality Board: Report on Great Lakes Water Quality 1982 to the International Joint Commission

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November 1982
Windsor, Ontario

INTERNATIONAL JOINT COMMISSION

GREAT LAKES WATER QUALITY BOARD

November 1982

International Joint Commission
Canada and United States

Commissioners:

The Great Lakes Water Quality Board hereby submits its 1982 report to the International Joint Commission.

V. V. Adamkus
Chairman
United States Section

H. L. Ferguson
Chairman
Canadian Section

Preface

The Water Quality Board is the principal advisor to the International Joint Commission regarding the environmental quality of the Great Lakes ecosystem. The 1978 Great Lakes Water Quality Agreement directs the Water Quality Board to "advise the Commission on the progress and effectiveness of ... programs" to "restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem." The Agreement further directs the Board to "identify deficiencies in the scope and funding of such programs and evaluate the adequacy and compatability of results", and to "examine the appropriateness of such programs in the light of present and future socio-economic imperatives".

In fulfillment of its Agreement responsibilities, the Water Quality Board submits this 1982 report to the International Joint Commission.

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1. Introduction

The 1982 Report of the Water Quality Board to the International Joint Commission is an update of the Board's 1981 Report. As such, this year's report focusses on selected items under the Agreement of significant change and brings these to the Commission's attention. In addition, the Board is pleased to submit its evaluation of the adequacy of remedial measures currently in place or proposed to correct the environmental problems of the 18 Class "A" areas of concern identified in last year's report. This evaluation was undertaken by the Board in recognition of the Commission's expressed concern of the persistence of these pollution problems reported to the Commission since 1974.

The Great Lakes System is immense geographically and diverse in development. Its water quality is managed by eight states, one province, and two federal governments. Since the first Canada-U.S. Great Lakes Water Quality Agreement was signed in April 1972, a large amount of money has been expended in protecting these lakes, and much progress has been made by the jurisdictions to abate existing pollution problems and to prevent new problems.

These successes and accomplishments are acknowledged and commended, but this year's Water Quality Board report does not dwell on successes. It is a report primarily about remaining problems and about the adequacy of programs in the jurisdictions to deal with them, and this report should be read in that context. The emphasis is on the 18 Class "A" areas of concern reported in 1981.

This year's report:

1. Updates eutrophication and selected toxic contaminants issues from a whole-lake perspective (Chapter 3).

2. Summarizes both the environmental quality within specific areas of concern and the remedial measures taken in response to the identified problems (Chapter 4). The detailed background material presented in the Appendix, bound within the covers of this report, has been updated from that presented in 1981. The Water Quality Board has critically evaluated the specific information about present and proposed remedial programs to correct the significant environmental degradation for the 18 Class "A" areas of concern. The evaluation was conducted, so that the Board may advise the International Joint Commission whether environmental problems can and will be solved and beneficial uses restored in a timely manner.

3. Outlines a course of action, whereby the Water Quality Board can assist the Parties in implementing the specific program-oriented toxic substances recommendations presented in the 1981 Board report

(Chapter 5). Emphasis is on the development of lists of substances for which inventory information, characteristics information, or environmental measurements is required.

4. Describes developments in programs to control municipal and industrial inputs of phosphorus, and the status of detergent phosphorus limitations (Chapter 6).

5. Describes progress of the Parties toward fulfilling their obligations as set forth in the 1978 Agreement (Chapter 7).

6. Summarizes specific activities which the Board has undertaken in carrying out its responsibility to assist the Commission under the relevant sections of the Agreement (Chapter 8).

Two additional reports provide support for the 1982 report of the Board:

1. "A Review of the Pollution Abatement Programs Relating to the Petroleum Refinery Industry in the Great Lakes Basin." Report by the Petroleum Refinery Point Source Task Force to the Water Quality Programs Committee of the Water Quality Board, November 1982.

2. "1982 Annual Report. Committee on the Assessment of Human Health Effects of Great Lakes Water Quality". A report presented jointly to the Water Quality Board and the Science Advisory Board, November 1982.

2. Executive Summary

This 1982 Water Quality Board Report is an update of the Board's 1981 comprehensive report on Great Lakes water quality. This report brings to the Commission's attention related items of significant change in the environmental quality of the Great Lakes, as well as in the programs and measures undertaken by the Parties in response to the requirements of the Canada-U.S. Great Lakes Water Quality Agreement.

As an update status report, this year's report builds upon the comprehensive report submitted to the Commission in November 1981. In last year's report, the Board:

1. Described the environmental quality of the Great Lakes for the principal issues of eutrophication and persistent toxic substances.

2. Summarized the environmental quality for site-specific areas of concern within the basin.

3. Presented a detailed evaluation of toxic substances control programs for the basin.

4. Detailed phosphorus inputs and controls for municipal and industrial point sources and for nonpoint land runoff.

5. Described progress toward fulfillment of the obligations and requirements of the 1978 Agreement.

ENVIRONMENTAL QUALITY OF THE GREAT LAKES

NUTRIENT ENRICHMENT

Tributary inputs of phosphorus to the Great Lakes have not changed appreciably over the past five years, but the loading of phosphorus from municipal and industrial point sources continues to decline. Continued monitoring will establish whether expected ecological responses are occurring in the Great Lakes in response to reduced phosphorus loads.

TOXAPHENE

The presence of the family of substances called toxaphene has been confirmed in lake trout from Lake Superior and Lake Michigan. At the present time, however, there is insufficient information to establish whether toxaphene, at the concentrations reported, constitutes a threat to human health and the environment of the Great Lakes. Therefore, in order to conduct a hazard or a risk assessment for toxaphene, and in order to establish whether any further action is warranted, the Board requests that the Commission encourage the Parties to continue to exchange information on environmental and human health effects, on quantities and locations of use, on analytical

methodology, and on atmospheric transport. The last point is particularly important, since long-range transport is clearly indicated by the presence of toxaphene in lake trout from a land-locked lake on Isle Royale in Lake Superior.

In response to concern in the United States about the presence and persistence of toxaphene, especially in the Great Lakes ecosystem, the U.S. Environmental Protection Agency recently announced its intention to strictly regulate the use of toxaphene, as required by legislation passed by Congress in October 1982. In Ontario, the use of toxaphene is minimal and is strictly controlled.

AREAS OF CONCERN

In its first Biennial Report under the 1978 Agreement, the International Joint Commission, in June 1982, expressed concern regarding the persistence of some localized pollution problems reported annually by the Water Quality Board since 1974. In light of that concern, the Board evaluated the adequacy of remedial measures in place or proposed for the 18 significant Class "A" areas of concern identified in last year's report. The purpose of this evaluation was to report on the nature of pollution problems in those areas and to determine the overall adequacy, in the Board's view, of the remedial measures currently in operation or proposed for those areas. In conducting this evaluation, the Board assessed information on the environmental conditions of these areas and information on remedial measures provided by the responsible jurisdiction.

Table 1 summarizes, for each Class "A" area of concern, the sources of pollution, the environmental problems and consequences, and the remedial measures information which the Board used to conduct its evaluation. Details are given in Chapter 4 and in the Appendix.

Based on its evaluation, the Board reached one of the following conclusions for each type of problem in each area of concern:

1. Remedial measures currently in operation will resolve the identified environmental problems and restore beneficial uses over the near term (5 to 10 years).

2. Remedial measures currently in operation will not resolve the identified problems and restore uses over the near term:

   A. However, additional programs and measures have been imposed, and these will be adequate and timely.

   B. Additional programs and measures have been imposed, and environmental problems will eventually be resolved and uses restored. However, there is a long lag time between completion and operation of the remedial measures and the response of the environmental system.

   C. Even though all reasonable remedial measures have been or are being taken, it is doubtful whether the environmental problems will be completely resolved and uses restored.

TABLE 1
EVALUATION OF REMEDIAL MEASURES IN CLASS "A" AREAS OF CONCERN

Key for Water Quality Board evaluation:

1. Remedial measures currently in operation will resolve the identified environmental problems and restore beneficial uses over the near term (5 to 10 years).
2. Remedial measures currently in operation will not resolve the identified problems and restore uses over the near term; however,
   - A. Additional programs and measures have been imposed, and these will be adequate and timely.
   - B. Additional programs and measures have been imposed, and environmental problems will eventually be resolved and uses restored. However, there is a long lag time between completion and operation of the remedial measures and the response of the environmental system.
   - C. Even though all reasonable remedial measures have been or are being taken, it is doubtful whether the environmental problems will be completely resolved and uses restored.
   - D. There are apparently no firm programs additionally planned that will resolve problems and restore uses.
3. Insufficient information has been received or is available in order to make a reasonable judgement as to whether control measures are adequate, or to decide when such measures may be required.

AREA OF CONCERN	SOURCES	ENVIRONMENTAL PROBLEMS AND CONSEQUENCES	REMEDIAL MEASURES	BOARD EVALUATION ADEQUACY OF REMEDIAL MEASURES
1. Fox River and Southern Green Bay, Wisconsin	Municipal and industrial discharges, in-place pollutants	Water enriched with phosphorus and ammonia. Depressed dissolved oxygen levels. Sediment contaminated with nutrients, oxygen-consuming materials, heavy metals, and PCB. Fishery impaired by PCB and industrial organic chemicals.	Municipal and industrial controls in place to reduce inputs of phosphorus, oxygen-consuming organic materials, and solids. Discharges generally met permit requirements. Waste load allocations being established for BOD, ammonia, solids. Resolution expected of BOD-related dissolved oxygen and ammonia problems. Toxics production-use inventory prepared; industrial effluent analysis required as part of NPDES permit reissuance to define presence of toxic substances; trend-monitoring program for selected toxics; PCB hot-spot identification study.	2B - Municipal and industrial discharges and in-place pollutants 2D - Toxic pollutants
2. Milwaukee Estuary, Wisconsin	Municipal discharges, combined sewer overflows, in-place pollutants, leaching from landfill	Sediment polluted with nutrients, oxygen-consuming materials, and heavy metals. Fishery impaired by PCB, DDT, industrial and agricultural chemicals. Water violations for metals and ammonia; PCB, DDT, chlordane, and dieldrin present in some discharges. Beach closures resulting from elevated coliform levels.	Present municipal facilities provide phosphorus removal and meet secondary requirements. Milwaukee Master Facilities Plan approved to upgrade conveyance, storage, and treatment facilities. Industrial pretreatment program under development.	2B
3. Waukegan, Illinois	In-place pollutant	Sediment, water, and fish contaminated with PCB. Fish consumption advisory in place. Dredging and navigation restricted.	Industrial release of PCB substantially reduced. Litigation in progress to resolve in-place contamination.	2D - Programs subject to outcome of litigation
4. Grand Calumet River and Indiana Harbor Ship Canal, Indiana	Municipal and industrial discharges, combined sewer overflows, industrial waste disposal sites, in-place pollutants	Harbor sediment severely polluted with nutrients, oxygen-consuming materials, heavy metals; also present - organic chemicals associated with heavy industry. Dredging and navigation restricted. Virtually no fish present; those found are contaminated with PCB, agricultural and industrial organic chemicals. Few macroinvertebrates, since sediment habitat consists of oily silt and sludge. Water violations for numerous substances. Beach closures resulting from elevated coliform levels. Adjacent nearshore area of Lake Michigan adversely impacted.	East Chicago STP not in compliance with NPDES permit, enforcement action in progress. Facility contributes to elevated coliform levels; no influent pretreatment to reduce phenols; ammonia pretreatment requirement not met; no facilities to reduce ammonia. New municipal facilities under construction at Gary. Industrial discharges in compliance with NPDES requirements for conventional pollutants; permits being reviewed to determine need for limits on toxics. New wasteload allocations to be established for municipal and industrial dischargers. No plans to eliminate wet-weather combined sewer overflows. Landfill abatement effected as release information becomes available. Indiana water quality standards established to achieve selected uses only.	2C - River and harbor 3 - Impact on adjacent nearshore area of Lake Michigan.
5. St. Marys River, Michigan and Ontario	Municipal and industrial discharges, combined sewer overflows, in-place pollutants	Sediment polluted with iron, zinc, phenol, and cyanide; benthic fauna impaired. Confined disposal required for dredged material. Phenol violations in water extend across international boundary; ammonia and cyanide violations. Recreational uses restricted, resulting from bacterial contamination.	Second phase of municipal sewage treatment program, when operational, will protect shoreline recreational uses. Control order for Algoma Steel outlines phased effluent loading reduction requirements; action will eliminate transboundary phenol problems. Natural physical and biochemical processes expected to reduce sediment contamination and help restore healthy benthic fauna.	1 - Sources in Michigan 2B - Sources in Ontario

6. Saginaw River System and Saginaw Bay, Michigan	In-place pollutants, industrial waste disposal sites, nonpoint land runoff	Eutrophication aggravated by cultural enrichment from past municipal and present nonpoint phosphorus loads. Nutrients, sediments, and turbidity from nonpoint land runoff impact trophic state, fish habitat, dissolved oxygen levels, and result in siltation of drainage canals and navigation channel. Sediment contaminated with PCB and PBB. Fishery impacted by PCB, PBB, and dioxin; consumption advisories or bans in effect.	Municipal and industrial control programs generally in place for phosphorus and for conventional pollutants; phosphorus load reductions has led to reduced chlorophyll levels, reduced algal densities, and fewer undesirable algae; taste and odor problems no longer reported. Toxics: effluent limitations, remedial dredging, and site cleanup on a case-by-case basis; adequacy of control measures needs to be established. Major nonpoint source demonstration program currently underway.	1 - Municipal discharges 2D - Nonpoint land runoff 3 - In-place pollutants, industrial sources of toxic substances.
7. St. Clair River, Ontario and Michigan	Municipal and industrial discharges, combined sewer overflows, in-place pollutants	Sediment contaminated by PCB, mercury, other heavy metals; confined disposal required for dredged material and recovery of benthic fauna impeded. Fishery impacted by mercury and PCB; consumption advisories in effect. Local recreational use limited by bacterial contamination. Phenol violations in water.	Remedial measures being implemented and regulatory actions being taken at area industrial discharges. Bacterial contamination problem will be addressed by sewer separation programs. Study completed to establish presence and distribution of organic substances in ecosystem and identify sources; may lead to additional controls, if warranted. Natural river processes contributing to restoration of ecosystem.	1 - Sources in Michigan 2B - Sources in Ontario
8. Detroit River, Michigan and Ontario	Municipal and industrial discharges, combined sewer overflows, direct land runoff	Sediment contaminated with PCB and mercury; confined disposal required. Benthic community disrupted downstream of Rouge River. Fishery impacted by mercury and PCB; consumption advisories in effect. Recreational activities are restricted by elevated bacterial levels. Water violations for phenol, iron, conductivity.	Municipal and industrial discharges generally meet effluent and load requirements for phosphorus and for conventional pollutants; water quality improvements noted in western basin of Lake Erie. Measures planned or completed to abate combined sewer overflows on Canadian side and in Ecorse River Basin; overflows also reduced at Detroit, but no plan to further reduce these or direct land runoff into river. Studies planned to establish presence and distribution of organic pollutants in sediment. Hazardous waste disposal sites cleaned up as identified.	2A - Sources in Ontario 1 - Municipal and industrial sources in Michigan, combined sewer overflows in Ecorse River Basin 2C - In-place pollutants 2D - Combined sewer overflows and direct land runoff in Michigan
9. Rouge River, Michigan	In-place pollutants, combined sewer overflows	Sediment severely degraded. Few fish in river. Water violations for coliform, phenol, iron, conductivity	Industrial dischargers in substantial compliance with NPDES permit requirements. Studies on combined sewer overflows nearing completion.	2D
10. Raisin River, Michigan	In-place pollutants	Sediment severely degraded with conventional and oxygen-consuming materials. Fishery impacted by PCB and industrial and agricultural organic chemicals. Water violations for dissolved oxygen, fecal coliform, heavy metals, and conductivity.	All major dischargers in substantial compliance with NPDES permit requirements. Potential industrial sources of toxic substances being sought.	3
11. Maumee River, Ohio	In-place pollutants, nonpoint land runoff	Excess nutrients and sediments from land runoff. Sediment contaminated with conventional and oxygen-consuming materials and heavy metals. Fishery impacted by PCB and industrial and agricultural organic chemicals. Water violations for dissolved oxygen, fecal coliform, heavy metals, and conductivity.	Municipal and industrial dischargers generally meet NPDES permit requirements for phosphorus removal, secondary treatment, conventional pollutants, and/or identified toxic substances. Acute, static bioassay tests performed to establish toxicity of discharges; other toxics control programs under development. Numerous no-till and associated soil conservation demonstration programs in place. Natural processes should contribute to system restoration.	1 - Municipal discharges 2B - nonpoint land runoff, industrial discharges, and in-place pollutants 2D - Combined sewer overflows
12. Black River, Ohio	Muncipal discharges, in-place pollutants, waste disposal sites	Sediment contaminated with conventional and oxygen-consuming materials, nutrients, and metals. Fishery impacted by PCB and industrial organic chemicals. Water violations for nutrients, dissolved oxygen, coliform, cyanide, heavy metals, and conductivity.	Elyria STP-industrial pretreatment program planned. Amherst STP-consent decree to achieve advanced secondary limits. U.S. Steel - remedial program to meet best available treatment requirement. Waste load allocations planned. Two hazardous waste disposal sites cleaned up. Natural processes should contribute to system restoration.	2B

13. Cayahoga River, (Cleveland), Ohio	Municipal and industrial discharges, combined sewer overflows, urban land runoff, waste disposal sites, in-place pollutants	Fishery impacted by depressed dissolved oxygen levels, elevated dissolved solids and ammonia, and polluted sediment. Sediment contaminated with conventional and oxygen-consuming materials, nutrients, heavy metals, and PCB; confined disposal required for dredged material.	Akron STP-system upgrading will improve treatment and reduce combined sewer overflows. Cleveland STP's - 2 of 3 facilities meet phosphorus limitations; construction for other requirements is in progress. Two interceptor systems, when completed, will substantially reduce combined sewer overflows. Industrial facilities in compliance with requirements for conventional and toxic pollutants; reviews being conducted to identify need for additional toxics control. Several hazardous waste disposal sites identified, closed, and/or cleaned up.	2C
14. Ashtabula River, Ohio	Municipal and industrial discharges, in-place pollutants, waste disposal sites	Sediment contaminated with conventional and oxygen-consuming materials, heavy metals, and industrial chlorinated organic substances; confined disposal of dredged material required, and navigation restricted. Fishery impacted by PCB and industrial organic chemicals. Water violations for fecal coliform, heavy metals, and conductivity.	Ashtabula STP-plant improvements will eliminate fecal coliform violations; additional tests to be conducted to establish toxicity of effluent. Industries on Field's Brook have installed treatment facilities to abate conventional and toxic pollutants; studies and evaluations being conducted to establish need for additional toxics controls. Several waste disposal sites cleaned up or under review. Dredging to remove contaminated sediment under way for Ashtabula River and under study for Field's Brook.	2B
15. Buffalo River, New York	Municipal and industrial discharges, combined sewer overflows, in-place pollutants, waste disposal sites	Sediment severely contaminated with conventional pollutants, heavy metals, industrial organic chemicals, PCB, and pesticides; benthic macroinvertebrate population severely impaired, and confined disposal of dredged material required. Water violations for dissolved oxygen, fecal coliform, heavy metals, and conductivity.	Buffalo STP-corrective action underway to ensure compliance with SPDES requirements; application under development for approval of pretreatment program, in order to abate toxics in influent. Construction program to address combined sewer overflows scheduled to begin in 1984. Lackawanna (C) STP - Construction to lead to phosphorus removal and secondary treatment; no pretreatment program deemed necessary. Industrial and pretreatment discharge limits being developed based on best professional judgement.	2B Municipal and industrial discharges 2D - Combined sewer overflows and in-place pollutants
16. Niagara River, New York and Ontario	Municipal and industrial discharges, in-place pollutants, waste disposal sites	Sediment severely contaminated with conventional pollutants, heavy metals, PCB, industrial and agricultural organic chemicals; benthic fauna severely disrupted, and confined disposal of dredged material required. Fishery impacted by PCB, mercury, industrial and agricultural organic chemicals. Water violations for fecal coliform, heavy metals, and several organic substances.	Niagara River Toxics Regulatory Program to address major municipal and industrial discharges, active and abandoned hazardous waste disposal sites; toxic limits and discharge permits to be established for identified sources. Litigation in progress for several prime polluters. Niagara Falls (C) STP - facilities to be completed to remove toxic substances; preliminary steps being taken to develop pretreatment program; diversion project to be constructed. Industrial and pretreatment discharge limits being developed based on best professional judgement.	1 - Sources in Ontario 2B - Sources in New York
17. Hamilton Harbour, Ontario	Industrial discharges, in-place pollutants	Sediment contaminated with nutrients, PCB, and heavy metals; confined disposal of dredged material required. Depressed dissolved oxygen levels from municipal and industrial discharges, polluted sediments, and algal decay limit harbor as a fish habitat. Water violations for nutrients, cyanide, phenol, iron, zinc, and conductivity. Diminished aesthetic quality and poor water quality deter broader recreational use of harbor.	Stelco and Dofasco - remedial works under construction to eliminate exceedences of load limitations. Hamilton STP - meets operational and phosphorus removal requirements. A water management study is underway to determine further possible remedial measures.	2B - Industrial discharges 2C - In-place pollutants
18. St. Lawrence River, (Cornwall, Ontario - Massena, New York)	Municipal and industrial discharges, combined sewer overflows, in-place pollutants	Sediment contaminated with nutrients, heavy metals, oil and grease, and PCB. Fishery impacted by mercury and PCB; consumption and sale restrictions or advisories exist. Water violations for PCB, heavy metals, and several organic substances. Some restrictions on recreational use exist downstream of Cornwall because of bacterial contamination.	Several discharge violations noted for municipal and industrial dischargers; remedial works under construction to control conventional pollutants, but not phosphorus on New York side. Some controls in place for PCB. Controls for other toxics under consideration, including pretreatment requirements. Controls on municipal sources of bacterial contamination are under development by Ontario and the City of Cornwall. The industrial contributor to the bacterial problem is also to be brought under control.	2B

D. There are apparently no firm programs additionally planned that will resolve problems and restore uses.

3. Insufficient information has been received or is available in order to make a reasonable judgement as to whether control measures are adequate, or to decide when such measures may be required.

Overall, the Board found that in the majority of the areas of concern, the programs currently in place are not adequate to solve the environmental problems identified; however, in most instances, further measures are in the process of implementation which, when completed, may resolve the problems. In these cases, the Board noted that, while a recovery is likely, it will be over a longer period of time, up to a decade.

As a result of this evaluation, the Board reached a number of conclusions regarding the general state of development of a variety of remedial measures.

MUNICIPAL AND INDUSTRIAL DISCHARGES

The Water Quality Board concludes that municipal and industrial wastewater treatment facilities presently in operation, and those which will become operational over the next five years, should effectively control the discharge of "conventional" pollutants, metals, and "conventional" toxic substances. However, municipal and industrial waste treatment facilities are generally inadequate for the Grand Calumet River/Indiana Harbor Canal area. In addition, industrial pretreatment programs are required for municipal facilities in the Black River, Ohio; the Buffalo River, New York; the Niagara River, New York; and the St. Lawrence River at Cornwall, Ontario and Massena, New York. Proper pretreatment of industrial waste would enable improved treatment by municipal facilities.

The Water Quality Board also notes the shift in the nature of the problem from "conventional" pollutants to persistent toxic substances. Most of the unresolved pollutant discharge problems are now associated with persistent toxic substances. Legislative and regulatory initiatives have been mounted in both the United States and Canada to identify and control the release of persistent toxic substances from municipal and industrial facilities. For the most part, efforts have been conducted on a facility-by-facility or a substance-by-substance basis. The remedial measures implemented to date are generally not adequate; however, in many cases, further measures are being implemented which, when completed, should effectively control the release of these substances in most Class "A" areas of concern.

Numerous ongoing studies and data-gathering programs have been initiated in response to problems associated with persistent toxic substances; these necessary activities, if continued, should lead to such firm program requirements as standards, regulations, and effluent limitations and, ultimately, the control of persistent toxic substances in a cost-effective manner. Such measures are particularly needed for the Grand Calumet River/Indiana Harbor Canal; the Buffalo River, New York; and the Niagara River, New York.

WASTE DISPOSAL SITES

Toxic substances from unsecured waste disposal sites contribute to problems in six Class "A" areas of concern: the Grand Calumet River/Indiana Harbor Canal area; the Black River, the Cuyahoga River, and the Ashtabula River, Ohio; the Niagara River, New York; and the St. Lawrence River at Massena, New York. Problems are being addressed on a case-by-case basis. Monies available through the Comprehensive Environmental Response, Compensation and Liability Act (Superfund) have been utilized to clean up waste disposal sites on the Cuyahoga River and the Ashtabula River, and may be used at other sites in the United States.

Governments are also devoting particular attention to comprehensive planning for the siting, design, construction, and operation of new waste treatment and disposal facilities, emphasizing public understanding of the necessity for secure treatment and disposal facilities.

COMBINED SEWER OVERFLOWS AND URBAN LAND RUNOFF

Combined sewer overflows and urban land runoff contribute a wide variety of pollutants directly to the receiving water in several Class "A" areas of concern; however, in many cases, the magnitude and the significance of these contributions are not well documented or understood.

In response to identified pollution problems, construction programs are underway at the Milwaukee Estuary, Wisconsin and on the Detroit River (Canadian side and the Ecorse River Basin, Michigan). A major program is also underway at Chicago, Illinois which will eliminate direct and indirect overflows and runoff into Lake Michigan. A construction program will begin for the Buffalo River, when funds become available in 1984. The total cost of the above projects is several billion dollars, and construction schedules stretch over many years.

Because of the costs associated with remedial programs, comprehensive studies and planning have been or will be initiated to define the problems caused by combined sewer overflows, and the costs and the benefits to be derived from controls in six areas of concern: the St. Marys River at Sault Ste. Marie, Ontario; the St. Clair River at Sarnia, Ontario; the Rouge River, Michigan; the Maumee River, Ohio; Hamilton Harbour, Ontario; and the St. Lawrence River at Cornwall, Ontario.

Restoration of the Grand Calumet River/Indiana Harbor Canal and the Detroit River at the City of Detroit, Michigan might also require remedial measures to control or abate combined sewer overflows and/or urban land runoff. The City of Detroit has concluded that, although pollutant loads to the Detroit River from combined sewer overflows could be reduced, no significant improvement in water quality would result. Any load reductions and improvements would be masked by direct surface runoff from the City of Detroit and by combined sewer overflows in the Rouge River Basin. Municipalities along the Grand Calumet River/Indiana Harbor Canal have completed combined sewer overflow studies and are forwarding reports to the State of Indiana for review and recommendations for action.

AGRICULTURAL LAND RUNOFF

Agricultural land runoff contributes to environmental problems in many tributaries to the Great Lakes, including two of the 18 Class "A" areas of concern: the Saginaw River Basin/Saginaw Bay, Michigan and the Maumee River Basin, Ohio. Programs to demonstrate cost-effective measures to reduce agricultural land runoff are continuing in the Saginaw River Basin and in the Maumee River Basin, as well as in other areas within the Great Lakes Basin, including Wisconsin (the Wisconsin Fund Program); the Saline River Valley, Michigan; the Sandusky River Basin, Ohio; and the Thames River Basin (Stratford/Avon River Environmental Management Project), the Grand River Basin, and the Simcoe-Couchiching Basin, Ontario. In order to ensure adequate protection of the water in these basins, as well as the waters of the lakes themselves, funding must be provided in order to ensure that the present studies and control programs are continued and expanded.

IN-PLACE POLLUTANTS

In 17 of 18 areas of concern, in-place pollutants are contributing to the degraded state of these locations. In the three major connecting channels designated as areas of concern, natural processes will eventually restore the benthos. Natural processes will eventually restore the ecosystem in the connecting channels. However, for harbors, embayments, and estuaries, these processes will occur only slowly, if at all, and it is doubtful whether the Grand Calumet River/Indiana Harbor Canal; the Rouge River and the Raisin River, Michigan; the Maumee River, the Cuyahoga River, and the Ashtabula River, Ohio; the Buffalo River, New York; and Hamilton Harbour, Ontario will be fully restored to the quality levels called for in the 1978 Great Lakes Water Quality Agreement.

Even with implementation of all practical remedial measures, some areas will remain degraded because the sediments are contaminated as a result of past pollution. The Board will report to the Commission next year on the nature and extent of these problems and their implications to the full realization of the Agreement requirements.

TOXIC SUBSTANCES

In its 1981 report, the Water Quality Board presented 16 program-oriented recommendations which, when implemented, will not only permit an orderly resolution or abatement of threats to human health and the environment posed by toxic substances, but will also allow for a more effective and efficient use of Great Lakes resources. The Commission endorsed the recommendations and commended them to the Parties.

Because of the urgency to proceed, the Board is assisting the Parties and the Great Lakes jurisdictions, to facilitate their efforts to implement the recommendations. The Board's Toxic Substances Committee is developing priority lists of substances for which additional information is required, so that proper hazard and risk assessments can be conducted and sound decisions made regarding control measures. The priority lists will be presented to the Water Quality Board in 1983.

A clearinghouse of sources of inventory and characteristics information is being established and will be operated out of the Commission's Great Lakes Regional Office. The clearinghouse will be operational in 1983.

On behalf of the Water Quality Board, the Regional Office is also updating the list of substances identified as present in the Great Lakes ecosystem.

PHOSPHORUS INPUTS AND CONTROLS

Removal of phosphorus at municipal treatment plants, in conjunction with limitations on the phosphorus content of laundry detergents, has resulted in dramatic reductions in the loadings of phosphorus to the Great Lakes, especially Lake Erie and Lake Ontario. Canada has achieved the municipal phosphorus loading goal specified in the 1972 Agreement for Lake Erie, and the United States is close to the target (Figure 1). Both countries are close to achieving their respective goals for Lake Ontario (Figure 2). Facilities in the Lake Michigan Basin in 1981 discharged with a flow-weighted effluent phosphorus concentration of 0.84 mg/L, which is better than the proposed Agreement goal of 1.0 mg/L.

Three major sewage treatment plants met and bettered the 1.0 mg/L concentration for the first time in 1981: Detroit Metro, Rochester Frank Van Lare, and Syracuse Metro. However, six major plants still had not achieved this concentration: Cleveland Southerly, Cleveland Westerly, Akron, Buffalo, Niagara Falls, and Hamilton. In addition, two other plants have been added to the list since last year's report: Wayne County Wyandotte and Toronto Humber exceeded the effluent target in 1981.

A number of other facilities have not yet achieved the desired level of phosphorus removal, and the schedules for completion of facilities have had to be extended. For other facilities, there are no compliance dates, due to low funding priorities for construction. Also, New York does not require phosphorus removal for facilities discharging into the St. Lawrence River Basin.

The Water Quality Board urges that phosphorus removal facilities be completed at all municipal facilities at the earliest possible date. If all municipal facilities in the Great Lakes Basin presently discharging phosphorus at a concentration greater than 1.0 mg/L were to meet this limit, the annual phosphorus load to the basin would be reduced by a further 1,300 tonnes.

Ohio and Pennsylvania have had no limitations on the content of phosphorus in laundry detergents. In 1982, Wisconsin's three-year detergent phosphorus ban expired. The Water Quality Board reaffirms its position that the imposition of detergent phosphorus limitations, by all jurisdictions in areas which can contribute to the phosphorus loadings to the Great Lakes, is an important and effective means of reducing the rate of eutrophication of the Great Lakes.

AGREEMENT PROGRESS

Environmental problems identified and reported on in the late 1960's and early 1970's were primarily associated with pollutants discharged from municipal and industrial plants. Both Canada and the United States developed legislation, regulatory programs, and remedial measures in response to these problems.

The planning and construction of the past decade has shown its positive effects. Wastewater treatment facilities are now, or will soon be operational at most municipal and industrial discharges in the Great Lakes Basin. These facilities generally provide for secondary treatment or its equivalent, phosphorus removal if required, and treatment for specific heavy metals and "conventional" toxic substances. More than $7.25 billion has been spent over the past ten years for construction of municipal facilities alone. Positive industrial response to the cleanup effort has also contributed to the effort to restore, preserve, and enhance the Great Lakes; the total expenditure by industry to date cannot be readily estimated but is sizeable.

Remedial programs for municipal and industrial plants will continue, in order to further control discharges of previously identified pollutants, and to respond to more recently identified pollutants, such as persistent toxic substances. The projected U.S. federal expenditure for fiscal years 1983 and 1984 under the municipal Construction Grant Program is $320 million for the Great Lakes Basin. In Canada, the municipal, provincial, and federal governments plan additional expenditures totalling $330 million for municipal facilities in the basin prior to March 1985.

The third Canada-Ontario Agreement was signed in July 1982. The Agreement reaffirms Canada's and Ontario's continuing commitment to the Canada-United States Great Lakes Water Quality Agreement of 1978 and to the programs and remedial measures necessary to preserve, maintain, and improve the quality of the Great Lakes ecosystem.

In 1982, the U.S. Supreme Court refused to consider the Michigan Watercraft Pollution Control Act, thus upholding the decision of the state Supreme Court which validated the law. The Act prohibits the discharge of all sewage from vessels in Michigan waters.

There have been no developments regarding four sections of the 1978 Agreement: hazardous polluting substances (Annex 10), ecosystem integrity (Article IV, Section 3(b)), naturally exempt areas (Article IV, Section 1(e)), and limited use zones (Annex 2).

WATER QUALITY BOARD ACTIVITIES

SURVEILLANCE AND MONITORING

In order to establish whether the Great Lakes International Surveillance Plan (GLISP) was providing the information required to meet the goals of the Agreement (Article VI, Section 1(m) and Annex 11), the Water Quality Board's Surveillance Work Group has conducted an evaluation of GLISP. Results

indicate differences in surveillance and monitoring activities, mainly as a result of resource limitations, changes based on interpretation of historical data, and increasing emphasis on toxics contaminant pollution.

The Board is presently considering a proposal to ensure that the requisite annual binational planning takes place, to provide a basis for allocating sufficient resources to assure implemention of a scientifically sound and cost-efficient surveillance plan.

A task force was formed in 1981 to design and oversee the intensive survey of Lake Superior, scheduled for 1983.

QUALITY ASSURANCE

Annex 11 of the Agreement calls for quality assurance programs in support of Great Lakes surveillance and monitoring activities. The Board's Data Quality Work Group conducted twelve interlaboratory studies during 1981 and 1982, held a workshop for chemists involved with the analysis of phosphorus in water, initiated development of reference materials to meet specific Great Lakes requirements, compiled a listing of archived Great Lakes Basin environmental samples, maintained a listing of analytical methods, and continued efforts to have laboratories implement sufficient intralaboratory quality control programs.

PETROLEUM REFINERY TASK FORCE

In 1977, the Water Quality Board reported on progress within the petroleum refinery industry to reduce pollutant discharges to the Great Lakes. Because of significant progress by that industry since that report and because of increased interest in toxic substances, the Board established a Petroleum Refinery Point Source Task Force to report on these considerations. The specific conclusions and recommendations of the Task Force are presented in Chapter 8 of this report. Details of the study are presented in the report of the Task Force to the Board, "A Review of the Pollution Abatement Programs Relating to the Petroleum Refinery Industry in the Great Lakes Basin."

3. Environmental Quality of the Great Lakes - Update

Surveillance and monitoring programs are conducted on each of the Great Lakes, in order to establish the degree to which jurisdictional pollution control requirements are being met, to determine compliance with the general and specific objectives given in Articles III and IV and in Annex 1 of the Agreement, to provide information for measuring local and whole lake response to control measures, and to identify emerging problems.

In its 1981 report and in its Appendix, "Great Lakes Surveillance," the Water Quality Board presented comprehensive information describing in detail the environmental quality of the open waters, the nearshore areas, and the connecting channels. The intention of this chapter is to present only significant developments in the environmental quality of the open waters of the Great Lakes, since the report one year ago. The eutrophication issue is updated, and selected toxic substances issues are highlighted. The next detailed report will be prepared in 1983.

Information collected during the past year as part of nearshore and connecting channel surveillance and monitoring programs has been incorporated, as appropriate, into the discussions on areas of concern, presented in Chapter 4 and in the Appendix.

NUTRIENT ENRICHMENT

Results from the Great Lakes International Surveillance Plan indicate that total tributary phosphorus loadings to the five Great Lakes have not changed appreciably during the last five years. However, a significant decline in municipal and industrial phosphorus loadings to the Great Lakes has occurred since the mid-1970's (see Table 2 on page 50). Continued monitoring is required to establish the effect of load reductions on phosphorus concentrations in the water of each lake, and to document expected ecological responses. For example, the concentration of total phosphorus in the open waters of Lake Ontario has declined; this may be a reflection of lower inputs from the Niagara River, the major source of nutrients to the lake.

Declines have also been noted for spring phosphorus concentrations along the Canadian nearshore of Lake Ontario from the Niagara River to Kingston. Results obtained from the Ontario Ministry of the Environment indicate that 1981 average phosphorus concentrations were well below the stable plateau of the previous four years.

The dramatic ecosystem response to phosphorus load reductions to Saginaw Bay is described in detail in the Appendix (page 103).

As point source phosphorus loadings are reduced, the contribution from nonpoint sources becomes more important. For example, in 1976, municipal point sources accounted for 38% of the phosphorus load to Lake Erie. When municipal control programs are fully implemented, municipal inputs will

contribute only about 20% of the load. Nonpoint sources, primarily runoff from agricultural land in the western basin, will account for over 60% of the phosphorus load. If the to-be-confirmed target load given in Annex 3 of the 1978 Agreement is to be achieved, programs to reduce the nonpoint source loading to the lake will need to be implemented.

CONTAMINANTS

TOXAPHENE

In 1976 the Upper Lakes Reference Group reported to the Commission that toxaphene was detected in lake trout collected in 1974 from Lake Superior and the Straits of Mackinac. The levels reported were between 0.1 and 1.0 mg/kg on a whole fish basis. Last year the Board reported to the Commission that concentrations of approximately 3 mg/kg were recorded in lake trout from Siskiwit Lake, a land-locked lake on Isle Royale, Lake Superior. More recently, the Department of Fisheries and Oceans Canada and the U.S. Fish and Wildlife Service Laboratories in Columbia, Missouri and Ann Arbor, Michigan reported that the concentration of toxaphene or toxaphene-like substances in lake trout, caught from Lake Superior and Lake Michigan between 1977 and 1980 and analyzed in 1982, ranged from 0.4 to 10.9 mg/kg on a whole fish basis. Surveillance activities are underway to determine if toxaphene is present in fish from the other Great Lakes.

The information presently available about toxaphene in the Great Lakes ecosystem is inconclusive. The number of samples analyzed is small and the data are limited to one fish species from only a few locations in the two lakes. In addition, the data are subject to high variability because of the limitations of analytical methodology.

Toxaphene is a complex mixture of toxic compounds produced by the chlorination of camphene which is itself a chemical mixture obtained as a by-product of turpentine distillation. Technical grade toxaphene consists of about 170 different chlorinated camphenes, 20 to 40 of which have been detected in Great Lakes fish tissue. Toxaphene has been used both as a pesticide and a herbicide. Toxaphene was widely used in association with cotton and sunflower agriculture, notably in the southern United States, the Dakotas, and in California; direct use of the chemical compound within the U.S. portion of the Great Lakes Basin was minimal compared to its nationwide usage. In Ontario, permits are issued to use toxaphene only as a livestock insecticide. These permits are issued only to licenced veterinarians. Only one permit was issued in 1981, and only three issued for 1982 (through September). Within the basin there is no known toxaphene production, but there are several formulators/distributors in Ohio and Minnesota. The environmental data in combination with the geographical use statistics implicate long-range transport through the atmosphere as the most likely pathway for lakewide contamination.

Although there is an Agreement objective for toxaphene in water (0.008 µg/L, for the protection of aquatic life), there is no objective for fish tissue concentration. The U.S. Food and Drug Administration action level for toxaphene in edible portions of fish is 5 mg/kg. The values reported to date are for whole fish and are higher than would be expected for analysis of edible portions. Although the information available to date is inconclusive,

nevertheless, the presence of toxaphene in lake trout from Lake Superior and Lake Michigan is clearly cause for concern.

In response to concern in the United States about the presence and persistence of toxaphene, especially in the Great Lakes ecosystem, the U.S. Environmental Protection Agency recently announced its intention to cancel most uses of toxaphene, as required by legislation passed by Congress in October 1982. The only major permitted use would be for the control of scabies on cattle and sheep.

The Water Quality Board is advising the Commission about the presence of toxaphene in lake trout from Lake Superior and Lake Michigan and about the action which the United States has taken. At the present time, there is insufficient information to establish whether toxaphene, at the concentrations reported, constitutes a threat to human health and the environment of the Great Lakes. In order to conduct a hazard or a risk assessment for toxaphene, and in order to establish whether any further action is warranted, the Board requests that the Commission encourage the Parties to continue to exchange information on environmental and human health effects, on quantities and locations of use, on analytical methodology, and on atmospheric transport. The last point is particularly important, since long-range transport is clearly indicated.

CHLORINATED DIOXINS

Chlorinated dioxin pollution has previously been reported to the Commission and remains of concern to the Water Quality Board. Chlorinated dioxins consist of about 75 different chemical compounds, of which 2,3,7,8-TCDD is the most toxic. 2,3,7,8-TCDD is formed as a by-product in the manufacture of 2,4,5-trichlorophenol, which was produced in the Great Lakes Basin and used for the manufacture of some phenoxy herbicides, including 2,4,5-T (trichlorophenoxy acetic acid). Environmental problems associated with 2,3,7,8-TCDD are the result of past disposal of wastes associated with the production of 2,4,5-trichlorophenol. There are two notable "hot spots" for this toxic chemical, namely the Niagara and the Saginaw River Basins. Point source discharges and/or chemical disposal sites are the probable sources of this contaminant.

Other chlorinated dioxins are formed in the combustion of certain chemical compounds by a process not fully understood. This would implicate the atmosphere as a potential medium for dispersal of these substances. The sources, degradation, and dispersal of these substances are presently under study in both Canada and the United States.

Data obtained from the Ontario Ministry of Environment's 1981 sport fish survey on edible portions of fish confirm that 2,3,7,8-TCDD levels exceed the Canadian federal advisory limit (20 ng/kg) for human consumption in large lake trout from the western basin of Lake Ontario. Other species tested by Ontario in 1980 from Lake Ontario, Lake Erie, Lake Huron, and Lake Superior do not exceed this advisory level and, in most cases, 2,3,7,8-TCDD was below the detection level. Data from the New York Department of Environmental Conservation indicate that edible portions of lake trout, chinook and coho salmon, rainbow and brown trout, and white perch from Lake Ontario generally exceed the state advisory limit (10 ng/kg) for human consumption. These data

are corroborated by analyses performed by the Columbia, Missouri laboratory of the U.S. Fish and Wildlife Service.

Results from the Ontario Ministry of the Environment's 1981 spottail shiner program confirm that former waste disposal operations along the Niagara River are measurable sources of 2,3,7,8-TCDD to the river and thence to Lake Ontario, a conclusion supported by recent studies conducted by the New York Department of Environmental Conservation and the Columbia laboratory of the U.S. Fish and Wildlife Service.

4. Areas of Concern

INTRODUCTION

In 1981, the Water Quality Board identified and described environmental degradation in 39 site-specific areas of concern in the Great Lakes Basin. These areas were divided into two classes:

1. Class "A" - those areas exhibiting significant environmental degradation and severe impairment of beneficial uses; 18 Class "A" areas were identified.

2. Class "B" - those areas exhibiting environmental degradation and possible impairment of beneficial uses; 21 Class "B" areas were identified.

All available environmental data - fish, sediment, and water - were used to identify, evaluate, and classify each area of concern from a technical perspective; the specific procedure followed and the factors considered by the Board are given in the Appendix.

This year, the Board undertook an evaluation of remedial measures for the 18 Class "A" areas of concern to determine if they would correct the environmental problems.

To conduct this evaluation, the Water Quality Board requested the jurisdictions to update information which had been presented in last year's report: environmental data, causes of the environmental problems, and present remedial programs. Each jurisdiction also provided the Board with additional, specific information about present and proposed remedial programs. The Board evaluated this information, in order to determine whether environmental problems could be solved and beneficial uses restored. The Board considered:

1. The nature of the environmental problem.

2. The nature of the remedial programs in place or planned.

3. The schedule to initiate or complete these programs.

4. Factors which would preclude timely and satisfactory resolution of the problem and restoration of uses, including cost, technical considerations, and further definition of the issue.

5. Expected date by which the problems would be resolved and uses restored.

Based on its evaluation, the Board reached one of the following conclusions for each area of concern:

1. Remedial measures currently in operation will resolve the identified environmental problems and restore beneficial uses over the near term (5 to 10 years).

2. Remedial measures currently in operation will not resolve the identified problems and restore uses over the near term:

   A. However, additional programs and measures have been imposed, and these will be adequate and timely.

   B. Additional programs and measures have been imposed, and environmental problems will eventually be resolved and uses restored. However, there is a long lag time between completion and operation of the remedial measures and the response of the environmental system.

   C. Even though all reasonable remedial measures have been or are being taken, it is doubtful whether the environmental problems will be completely resolved and uses restored.

   D. There are apparently no firm programs additionally planned that will resolve problems and restore uses.

3. Insufficient information has been received or is available in order to make a reasonable judgement as to whether control measures are adequate, or to decide when such measures may be required.

The specific guidelines to evaluate the technical data and to evaluate remedial measures for each Class "A" area of concern are given in the Appendix, along with relevant data and information and the sources of these data and information.

To better understand the Board's findings, knowledge of the types and sources of pollutants is required. Pollutants can be considered in four broad categories:

1. "Conventional" pollutants - a term which includes nutrients, substances which consume oxygen upon decomposition, materials which produce an oily or a sludge deposit on the bottom, and bacteria. Conventional pollutants include phosphorus, nitrogen, chemical oxygen demand, biochemical oxygen demand, oil and grease, volatile solids, and total and fecal coliform.

2. Metals - including mercury, lead, zinc, iron, and cadmium.

3. "Conventional" toxic substances - including phenol, cyanide, ammonia, and chlorine.

4. Toxic substances - complex organic chemicals, usually chlorinated, which can persist and can bioaccumulate.

Many varied problems result from the release of pollutants into the ecosystem. Nutrient enrichment can stimulate excess aquatic growth, resulting

in taste and odor problems in drinking water, altered fish habitat and changes in species, and restricted recreational use of water and beaches.

Excess aquatic growth and oxygen-consuming pollutants can depress the dissolved oxygen level in the water, further affecting the fishery.

Waste discharges or silt, which can blanket the sediment, disrupt the benthic community. Since other aquatic species depend on the benthos as a food source, the aquatic community is disrupted.

Several metals and some "conventional" toxic substances, e.g. cyanide, are directly lethal to fish and other aquatic life. Others, e.g. phenol, can taint fish flesh, and still others, e.g. mercury, can result in harm to man when he consumes fish which contain them.

Many toxic substances can produce adverse environmental and human health effects. Such substances can derive from both agricultural and industrial sources. Familiar chemicals are PCB, DDT, dioxin, and mirex. However, for many other toxic substances, at the concentration at which they are present in the Great Lakes ecosystem, the environmental and human health effects are not sufficiently well understood. A conservative stance is generally considered appropriate for these substances.

Sources of pollutants fall into six general categories: municipal and industrial discharges, waste disposal sites, combined sewer overflows, urban land runoff, agriculatural land runoff, and in-place pollutants.

GENERIC CONSIDERATIONS

In conducting the evaluations of remedial measures in specific areas of concern, the Board identified a number of shortcomings of a general nature common to most of the remedial efforts. These common factors are discussed below in relation to the types of pollutants identified with the environmental problems manifest in each area of concern.

From these common factors, the Board has drawn general conclusions about the efficacy of remedial programs in general and specific measures in particular to abate identified pollution and to ensure future protection of the Great Lakes ecosystem.

MUNICIPAL AND INDUSTRIAL DISCHARGES

Many regulatory initiatives over the past decade were designed to control the discharge of "conventional" pollutants, metals, and "conventional" toxic substances. Wastewater treatment facilities are now operational, or will soon be operational at most municipal and industrial sources in the Great Lakes Basin. More than $7.25 billion has been spent over the past ten years for construction of municipal facilities alone. Municipal facilities generally provide for secondary treatment or equivalent and phosphorus removal if required. Pretreatment requirements have been developed in many cases so that municipal facilities can effectively treat industrial wastes.

The Water Quality Board concludes that those facilities presently in operation, and those which will become operational within the next five years should, collectively, abate the discharge of "conventional" pollutants, metals, and "conventional" toxic substances.

The Board notes several exceptions, however, where progress is not satisfactory: facilities will not become operational within the next five years, or no remedial measures are planned. Municipal and industrial waste treatment facilities are generally inadequate for the Grand Calumet River/Indiana Harbor Canal area, and additional industrial pre-treatment programs are required for facilities in the Black River, Ohio; the Buffalo River, New York; the Niagara River, New York; and the Cornwall, Ontario-Massena, New York area of the St. Lawrence River.

The Board notes that many programs and measures have been implemented to identify and control the release of toxic substances from municipal and industrial facilities. Notable among these are:

1. Efforts to systematically identify sources of toxic substances, e.g. Michigan's Critical Materials Register which, based upon consideration of environmental and human health effects, has identified substances for which production and use information is required; Wisconsin's development of a production and use inventory of toxic substances for the lower Fox River; New York's industrial chemicals use survey, which helps direct the state's monitoring program; and Ontario's hazardous contaminants program, which has identified chemicals requiring further evaluation in terms of environmental and human health effects and exposure potential.

2. Requirements to test effluents to establish the presence and effects of toxic substances.

3. Effluent limitations based on best available treatment and/or on best professional judgement.

4. Development of industrial pre-treatment programs for toxic substances.

For the most part, efforts to control the release of toxic substances are conducted on a facility-by-facility or a substance-by-substance basis; a comprehensive management strategy, although closer than it was five years ago, as reflected by the above activities, is not yet a reality. The Board encourages continuation of ongoing studies and data-gathering programs. These are necessary activities which should lead to such firm program requirements as standards, regulations, and effluent limitations. The Board is nonetheless concerned that, without a comprehensive management strategy, toxic substances in the Great Lakes ecosystem cannot be controlled in a cost-effective manner. This is especially true for such severely polluted areas as the Grand Calumet River/Indiana Harbor Canal; the Buffalo River, New York; and the Niagara River, New York.

The approaches followed by both the United States and Canada allow for development of control strategies for all pollutants, including toxic substances, discharged directly from municipal and industrial facilities into the receiving water. The basis for control in the United States is the NPDES

permit system, developed under the Clean Water Act. The NPDES permit details pollution control requirements and compliance schedules for each discharger. Effluent limitations are based upon national technology-based guidelines and, where necessary, on water quality standards. In Ontario, effluent limitations are specified as required in Certificates of Approval or Control Orders.

The Board notes a legislative disparity in the United States. Legislation in some states, e.g. New York and Michigan, allows imposition of effluent limitations and pre-treatment regulations more strict than those mandated by the federal government. However, laws in other states, e.g. Wisconsin, mandate that state requirements must comply with and not exceed federal requirements; exceptions are permitted where federal requirements have not been promulgated. However, if requirements more stringent than existing federal limitations and regulations were required, the state could not implement them.

Some industries discharge their wastes to municipal sewerage systems. Requirements have been developed for treatment of these wastes prior to their discharge, in order to protect municipal facilities and to ensure that the wastes receive adequate treatment. Pretreatment programs are generally in place for conventional pollutants, and are in various stages of development for toxic substances.

In Canada, a model "By-Law to Control Industrial Waste Discharges to Municipal Sewers" was prepared several years ago by a joint committee of the Ontario Ministry of the Environment and the Ontario Municipal Engineers Association. The model bylaw suggests permissible concentrations for constituents of industrial waste, based on known toxicities or potential adverse effects at the municipal facility. Application of the model bylaw by municipalities is discretionary, and is tailored to the local problems identified.

In June 1978, the U.S. Environmental Protection Agency published "General Pretreatment Regulations for Existing and New Sources of Pollution." The regulations provide for national pretreatment standards and include general discharge prohibitions for certain nondomestic wastes as well as standards applicable to specific industrial categories.

WASTE DISPOSAL SITES

Toxic substances from hazardous waste disposal sites have, or have the potential to adversely affect several areas of the Great Lakes ecosystem, notably the Grand Calumet River/Indiana Harbor Canal; the Black River, the Cuyahoga River, and the Ashtabula River, Ohio; the Niagara River, New York and Ontario; and the St. Lawrence River at Massena, New York. These sites have been addressed on a case-by-case basis. Clean-up, if required, has been effected through voluntary measures by site owners, court orders and, in the United States, by funds made available through the Comprehensive Environmental Response, Compensation and Liability Act ("Superfund"). These efforts are indicative of the implementation of a comprehensive control strategy for existing waste disposal sites.

In Ontario, hazardous waste disposal sites which have the potential to adversely affect the ecosystem have been identified by the province. Needed remedial measures have been undertaken by municipalities and industries or by

the province. Legislation is also being considered to address the matter of liability which can arise during the active operating phase of hazardous waste disposal sites.

Both Canada and the United States are devoting particular attention to the siting, design, construction, and operation of new waste treatment and disposal facilities in order to ensure that there are no adverse impacts on ecosystem quality. These comprehensive programs also emphasize public understanding of the necessity for secure treatment and disposal facilities.

COMBINED SEWER OVERFLOWS AND URBAN LAND RUNOFF

Combined sewer overflows and urban land runoff contribute nutrients, bacteria, and untreated waste directly into the receiving water. The problems associated with these discharges vary greatly from one location to another and, in some cases, use impairment may not exist. Measures to partially correct problems arising from these sources have been or are being implemented at several municipalities in the Great Lakes Basin. The Board notes that construction programs are underway on the Milwaukee Estuary, Wisconsin and on the Detroit River (Canadian side and the Ecorse River basin in Michigan). A construction program will begin for the Buffalo River, when funds become available in 1984. However, these measures are expensive; planning and construction schedules for complete resolution of the problems stretch over many years, and are dependent on the level of funding available.

The Board also notes the studies and planning under way on the St. Marys River at Sault Ste. Marie, Ontario; the St. Clair River at Sarnia, Ontario; the Rouge River, Michigan; the Maumee River, Ohio; Hamilton Harbour, Ontario; and the St. Lawrence River at Cornwall, Ontario. These efforts will consider the extent of the problems resulting from combined sewer overflows, the benefits to be derived from controls, the control options which are available, and the costs involved. The Board trusts that these studies and planning will lead to appropriate control programs.

The City of Detroit has concluded from a recently completed study that, although pollutant loads to the Detroit River from combined sewer overflows could be reduced, no significant improvement in water quality would result. Any load reductions and improvements would be masked by direct surface runoff from the City of Detroit and by combined sewer overflows in the Rouge River Basin.

Municipalities along the Grand Calumet River/Indiana Harbor Canal have completed combined sewer overflow studies and are forwarding reports to the State of Indiana for review and recommendations for action.

The December 14, 1981 amendments to the U.S. Clean Water Act address funding for combined sewer overflow programs. Section 2 of the act defines categories which are eligible for funding under the Construction Grants Program; combined sewer overflows are not listed. However, Section 5 allows the governor of a state to specifically request the Administrator of the U.S. Environmental Protection Agency to fund a combined sewer overflow project,

provided that the state certifies that correction of a combined sewer overflow problem is a major priority for that state. The above changes are effective October 1, 1984.

Beginning October 1, 1982, the Administrator will have available an additional $200 million per fiscal year specifically for marine bays and estuaries, including those in the Great Lakes Basin, which are subject to lower water quality because of combined sewer overflows. These monies are to be considered like a construction grant appropriation. Grants will be used as deemed appropriate by the Administrator, upon demonstration of water quality benefits by the governor of a state.

The 1982 Canada-Ontario Agreement provides resources, until March 1985, for the construction of municipal waste collection and treatment facilities in the Great Lakes Basin. Funding is shared among the municipal, provincial, and federal governments. The correction of problems related to combined sewer overflows is addressed by this Agreement, insofar as the funding relates to construction of sanitary sewers.

AGRICULTURAL LAND RUNOFF

Agricultural land runoff contributes to environmental problems in many tributaries to the Great Lakes, including two of the eighteen Class "A" areas of concern: the Saginaw River Basin/Saginaw Bay, Michigan and the Maumee River Basin, Ohio. The Water Quality Board notes the number and diversity of programs in the Maumee River Basin to demonstrate the effectiveness of no-till and associated soil conservation techniques to control this source of pollution. The Board strongly urges the continuation of these programs, both to improve the water quality in the river basin as well as in the western basin of Lake Erie.

The Water Quality Board also notes the major demonstration program underway in the Saginaw River Basin/Saginaw Bay area. The Board believes that adequate protection of Saginaw Bay can only be achieved through the implementation of nonpoint source control measures.

IN-PLACE POLLUTANTS

The Water Quality Board, in its review and evaluation of Class "A" areas of concern, has concluded that, in general, remedial programs presently in place or proposed will significantly improve ecosystem quality in the Great Lakes Basin. However, even with the completion and satisfactory operation of remedial works, environmental problems will remain, because of the presence of in-place pollutants. For several areas of concern, natural processes will eventually restore the area ecosystem. This is especially true for the connecting channels, where contaminanted sediment will eventually be transported downstream, deposited, buried with clean sediment, and effectively isolated from the remainder of the ecosystem.

However, for harbors, embayments, and estuaries, these processes will occur only slowly, if at all. Remedial measures, such as dredging, will have only limited beneficial effect. It is, therefore, doubtful whether certain of the areas of concern will be fully restored to the quality levels called for

in the Agreement and to support all beneficial uses, even with implementation of all reasonable remedial measures.

The principal reasons are modification of land use patterns in the drainage basin, especially through industrial and urban development, and modification of the geometry of the water body through construction of bulkheads and loading docks and through deep-channel dredging. These hydrological changes have imposed additional constraints on the assimilative capacity of these waters.

The Class "A" areas particularly affected are the Grand Calumet River/ Indiana Harbor Canal area; the Rouge River and the Raisin River, Michigan; the Maumee River, the Cuyahoga River, and the Ashtabula River, Ohio; the Buffalo River, New York; and Hamilton Harbour, Ontario.

The Board urges further study to determine to what extent the environmental quality of these areas can be restored and whether the remainder of the Great Lakes can be adequately protected. Evaluations for each of the abovementioned areas of concern should also consider alternative measures to deal with in-place pollutants, technological and fiscal limitations, social and economic implications, and public opinion. The goals of these studies and evaluations are to establish whether the requirements and obligations of the Agreement can be met and adequate protection of the Great Lakes achieved.

EVALUATION OF REMEDIAL PROGRAMS

Table 1 on page 5 summarizes the Board's evaluation of the adequacy of remedial programs to correct environmental problems for the 18 Class "A" areas of concern. More detailed statements of the Board's evaluation and of the environmental issues are presented in the pages following. Details regarding the environmental data and the remedial programs, as submitted by the jurisdictions, are given in the Appendix.

FOX RIVER AND SOUTHERN GREEN BAY, WISCONSIN

ISSUE

Southern Green Bay has historic eutrophication problems. Although municipal and industrial facilities generally meet the 1.0 mg/L phosphorus effluent limitation, the additional stress on the system as a result of these discharges have not been determined with any certainty. The phosphorus budget and dynamics of Green Bay is being studied, including the relation of phosphorus to phytoplankton growth and the effects of phytoplankton and oxygen-consuming organic substances on dissolved oxygen levels.

Dissolved oxygen levels in the lower Fox River have improved considerably since 1972, as a result of installation of wastewater treatment facilities.

The potential for ammonia toxicity problems is thought to exist near the mouth of the river and for some distance out into the bay. No problems, however, have been documented to date.

Sediments in the Fox River and near the river mouth in Green Bay are heavily polluted with conventional contaminants and heavy metals, including: volatile solids, chemical oxygen demand, total Kjeldahl nitrogen, phosphorus, ammonia, oil and grease, lead, zinc, and mercury. PCB and DDT are also present.

The area fishery continues to improve in amount and diversity but is still impaired. Concentrations of PCB in fish flesh routinely exceed the U.S. FDA action level. Low or trace levels of industrial chemicals, pesticides, and their breakdown products, including pentachlorobenzene, α-lindane, DDT, hexachlorobenzene, nonachlor, pyridine carboxamide, and tri-, tetra-, and pentachlorophenol are also present.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that the remedial works now in operation are not adequate to fully resolve the identified environmental problems resulting from municipal and industrial discharges (Evaluation = 2B). However, the Board recognizes that major improvements in the water quality of the lower Fox River have been achieved over the past 10 years as a result of Wisconsin's pollution control programs.

For control of conventional pollutant parameters, facilities are now in place on the lower Fox River between Lake Winnebago and the DePere Dam, and are planned for the sector between the DePere Dam and the mouth at Green Bay. All controls should be fully installed and in operation on or before January 1, 1985. Municipalities and industries have responded to the discharge requirements with no significant delinquencies in meeting construction schedules and discharge permit requirements. The works will consist of wastewater treatment for industrial and municipal dischargers sufficient to implement the waste load allocation requirements and to meet water quality standards even during periods of low flow and high temperature. Operation of the facilities will also solve the BOD-related dissolved oxygen and ammonia problems of the lower Fox River and Green Bay.

The Board also concludes that there are no firm program requirements apparent for the control of many of the toxic pollutant parameters. However, the Board recognizes that there are insufficient data currently available with which to design such requirements. The Board also notes Wisconsin's efforts to develop the necessary information bases for assessment and control (Evaluation = 2D).

Based on the information available, it is expected that problems associated with pollutants in the sediment will be resolved over the longer term (Evaluation = 2B).

MILWAUKEE ESTUARY, WISCONSIN

ISSUE

The Milwaukee Estuary, including Milwaukee Harbor and inflowing tributaries (Milwaukee River, Menomonee River, and Kinnickinnic River), contain heavily polluted sediments, contaminated fish, and degraded water.

Current water quality problems are primarily related to combined sewer overflows and in-place pollutants.

Sediments contain high levels of conventional pollutants and heavy metals, including oil and grease, chemical oxygen demand, total Kjeldahl nitrogen, total phosphorus, lead, zinc, cadmium, and copper. PCB, DDT, and chlordane are also present in some sediments.

Most fish samples contain PCB in excess of the U.S. FDA action level of 5.0 mg/kg (maximum 88 mg/kg). DDT levels in some fish (maximum 2.98 mg/kg) exceed the Agreement objective of 1.0 mg/kg. Also present at low or trace levels are hexachlorobenzene, α- and γ-lindane, cis- and trans-chlordane, dieldrin, trans-nonachlor, and mercury.

Water samples from Milwaukee Harbor exceed the Agreement objectives for conductivity, ammonia, zinc, cadmium, mercury, lead, and copper. PCB, dieldrin, and DDT have been detected in some area discharges.

Bacterial counts increase as a result of combined sewer overflows after heavy rainfall, and area beaches are subject to closure.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that remedial works currently in operation will not resolve identified environmental problems in the Milwaukee Estuary; however, Wisconsin and the courts have imposed a schedule and additional measures which will resolve the municipal and combined sewer overflow related problems (Evaluation = 2B). These additional works will consist of those facilities set forth in the approval of the Master Facilities Plan issued in June 1981. These include additional treatment capabilities at existing facilities and combined sewer overflow detention and treatment. The court-ordered schedule for installing and placing these controls into operation is given in the Appendix. A pretreatment program is also under development to reduce the industrial impact on sludge and on treatment plant effluent quality.

A firm implementation schedule, which will result in meeting water quality standards in the Milwaukee Estuary, and which could include removal of in-place pollutants, currently exists in the Dane County court order. An intensive study to determine the appropriate means to achieve the water quality standards is currently underway (Evaluation = 2B).

WAUKEGAN HARBOR, ILLINOIS

ISSUE

The sediments in Waukegan Harbor and in the North Ditch are grossly contaminated with PCB (maximum concentration 500,000 mg/kg). PCB is also present in water (concentrations up to several μg/L) and in fish (maximum average concentration 77.4 mg/kg); the U.S. FDA action level for PCB in fish is 5.0 mg/kg. Signs have been posted warning the public not to eat fish caught in the harbor.

Because of restrictions on the dredging and disposal of contaminated sediments, restrictions have been imposed on navigation.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that remedial works currently in operation are not adequate and any proposed measures are subject to the outcome of litigation. Hence, the Board cannot evaluate the effectiveness of such measures at this time (Evaluation = 2D).

GRAND CALUMET RIVER AND INDIANA HARBOR CANAL, INDIANA

ISSUE

All sediments in the lower portion of the Grand Calumet River and Indiana Harbor Canal are heavily polluted for all conventional pollutants and for heavy metals; the concentrations are among the highest in the Great Lakes System. Sediments also have high levels of organic chemicals associated with heavy industry. Consequently, restrictions on the dredging and disposal of contaminated sediments have resulted in restrictions on dredging for navigation.

Fish are not generally found in the River or Canal: the area fishery is virtually nonexistent. When found, the fish are small and in poor physical condition. The fish are contaminated with PCB, α-lindane, hexachlorobenzene, pentachloranoisole, cis-nonachlor, cis- and trans-chlordane, oxychlordane, DDD, DDE, and dieldrin.

Very few macroinvertebrates are present, since their habitat - the bottom sediments in the River and Canal - are oily silt and sludge.

Water samples exceed Agreement objectives for copper, lead, selenium, iron, zinc, ammonia, mercury, phenol, and conductivity; and exceed Indiana standards for ammonia, cyanide, phenol, phosphorus, chloride, fluoride, mercury, and oil and grease. PCB was also measurable in the water column.

Outflow from the Grand Calumet River and Indiana Harbor Canal also has an adverse environmental impact on the adjacent nearshore of Lake Michigan. Elevated concentrations or violations have been reported for cadmium, phenol, and ammonia; and phosphorus, chloride, and sulphate concentrations appear to be increasing.

Elevated bacteriological levels occur after rainfall as a result of combined sewer overflows to the Grand Calumet River. East Chicago may also contribute by the discharge of inadequately treated sewage. Consequently, recreational use of the water is restricted: Hammond Lake Front Park is permanently closed, and Jerose Park, in East Chicago, was closed during 1981.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that remedial measures currently in place will not resolve the identified environmental problems in the Grand Calumet River and Indiana Harbor Ship Canal. Additional measures are in the process of being implemented at several of the municipal and industrial

facilities in the area; although these measures will reduce pollutant loads, they will not be adequate to resolve the environmental problems. At one sewage treatment plant, there has been only limited progress to upgrade wastewater treatment facilities and to provide pretreatment; enforcement action is pending and agreement is being sought on an abatement compliance schedule.

Action is being taken against industrial waste landfills as information becomes available.

There are no plans to address in-place pollutants.

Since the drainage basin is heavily developed, and since there is little natural flow, it is doubtful whether the environmental problems will ever be completely resolved. The State of Indiana has proposed to designate these waters as suitable for only certain, restricted uses (Evaluation = 2C).

In addition, insufficient information is available to conclude whether present and proposed water quality standards and effluent limitations will ensure protection of the adjacent waters of Lake Michigan and the achievement of the Agreement objectives in these waters (Evaluation = 3).

ST. MARYS RIVER, MICHIGAN AND ONTARIO

ISSUE

Sediments along the Ontario shoreline of the St. Marys River, downstream of the industrialized section of Sault Ste. Marie, contain high levels of iron, zinc, phenol, cyanide, and oil; the benthic fauna are impaired. Ontario has placed restrictions on the disposal of dredged materials.

Phenol concentrations in excess of the Agreement objective extend across the international boundary. Ammonia levels exceed the Agreement objective, and cyanide levels exceed the Ontario objective.

Bacteriological contamination from sewer system overflows along the Sault Ste. Marie, Ontario waterfront and from the Sault Ste. Marie, Ontario sewage treatment plant has restricted recreational use in some areas.

Mercury contamination in larger sizes of certain fish species has resulted in consumption advisories; the former contamination sources were, however, upstream in Lake Superior.

WATER QUALITY EVALUATION

The Water Quality Board concludes that the remedial measures currently in place along the Ontario side of the St. Marys River are not adequate to resolve current environmental problems. Additional measures being imposed by Ontario are expected to correct the transboundary phenolics problem by 1987. Further measures for the control of local bacteria and other identified problems are to be put in place and in operation by 1988. Through these programs and through natural physical and biochemical processes, improvement in benthic fauna is expected over the longer term (Evaluation = 2B).

The Water Quality Board concludes that remedial measures currently in place along the Michigan side of th^ St. Marys River are adequate to ensure protection of the river ecosystem (Evaluation = 1).

SAGINAW RIVER SYSTEM AND SAGINAW BAY, MICHIGAN

ISSUE

Historically, eutrophication has been a pronounced water quality problem in Saginaw Bay. In fact, due to its hydrology, eutrophication may always be characteristic of the bay. The total phosphorus load to Saginaw Bay from the Saginaw River decreased from 1044 t/a in 1974 to 409 t/a in 1979. This decrease is due to phosphorus removal efforts by municipal treatment plants, the detergent phosphorus ban in Michigan, and reduced tributary flow rates. The municipal phosphorus loads in 1979, 1980, and 1981 were 211, 220, and 232 t/a, respectively. This slight increase is due in part to an increase in the number of facilities reported, an increase in the total flow treated, and to poor performance by one or more of the municipal facilities; nonetheless, the point source phosphorus load to Saginaw Bay appears to have stabilized. This overall load reduction and the attendant improvements in water quality in Saginaw Bay since the early 1970's have resulted is a marked decrease in the number of taste and odor complaints from communities getting drinking water from the bay.

The total phosphorus load to Saginaw Bay from the Saginaw River increased, however, in 1980 from the load reported for 1979. This increase is primarily due to higher tributary flow and nonpoint land runoff. The impact of this increase on water quality in Saginaw Bay is not known.

Runoff from agricultural land in the basin contributes suspended solids, nutrients, organic matter, and pathogenic organisms to Saginaw Bay. Siltation and associated turbidity degrades fish habitat, fills surface drainage ways, and fills the main navigation channel from the bay into the Saginaw River. The nutrient and organic matter contributed by agricultural activities adversely affects the dissolved oxygen level in the Saginaw River. Loadings from agricultural sources vary substantially from year to year, depending on the amount of rainfall and whether major rainfall events occur before crops have grown sufficiently to protect the soil.

Sediments in the Saginaw River contain elevated levels of PCB, in excess of U.S. EPA's dredge disposal guidelines. Sediments in the Pine River are contaminated with PBB.

Fish from Saginaw Bay, the Saginaw River, and its tributaries contain PCB and chlorinated dioxins in excess of the U.S. FDA guidelines. Fish from the Pine River contain PBB. Fish consumption bans are in effect for portions of the area rivers, and a fish consumption advisory is in effect for Saginaw Bay.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that programs to control phosphorus from municipal discharges are adequate (Evaluation = 1), and notes that there is a nonpoint source control demonstration project in operation; however, there are no firm requirements in place or planned to continue control of excessive nonpoint phosphorus loadings from tributaries (Evaluation = 2D).

The Board further concludes that remedial works currently in operation are inadequate to resolve toxic contamination problems principally associated with industrial discharges. Additional studies have been instituted to confirm the adequacy of control measures for chlorinated hydrocarbons and to establish the impacts, if any, on Saginaw Bay of contamination problems in tributaries to the bay (Evaluation = 3).

Dredging has been carried out at some locations to remove contaminated sediments. Studies are underway to determine the feasibility and benefits of removing contaminated sediments at other locations (Evaluation = 3).

ST. CLAIR RIVER, ONTARIO AND MICHIGAN

ISSUE

Sediment at several locations along the Ontario shoreline of the St. Clair River remains contaminated with PCB, mercury, lead, chromium, copper, and zinc at levels in excess of the Ontario guidelines for open-water disposal, necessitating confined disposal of dredged materials from maintenance navigation projects. Mercury levels are, however, considerably reduced from levels recorded in the early 1970's.

A marked improvement in the biological community of the river sediment has occurred over the past decade. Residual sediment contamination does, however, slow the recovery of the benthic fauna, adjacent to and downstream of the petroleum and petrochemical complex in Sarnia and Moore Township.

Although mercury levels have also declined markedly in fish, consumption advisories issued by Michigan and Ontario remain in effect, primarily for larger fish. Advisories are also in effect for some fish species because of elevated PCB levels. Fish tainting is still occasionally reported in areas close to industrial sources.

The Agreement objective for phenol in water is exceeded along the Canadian shore, and fecal coliform levels exceed the provincial objective. Bacterial contamination from combined sewer overflows limits local recreational use.

WATER QUALITY EVALUATION

The Water Quality Board concludes that remedial measures currently in place on the Michigan side of the St. Clair River are adequate to ensure protection of the river system (Evaluation = 1).

The Board concludes that remedial measures currently in place on the Ontario side of the St. Clair River are not adequate at this time. The Board notes that, with regard to mercury contamination. remedial measures were taken in the early 1970's. Levels of mercury in fish have declined markedly, and a continued but more gradual decrease is expected through natural processes. The Board notes that Ontario is requiring further remedial measures of Polysar Corporation to address phenolic compounds. The province expects improvements in river water quality as a result. Further, to alleviate the bacterial contamination problem at Sarnia, the province is actively seeking an effective remedial measure under the municipal sewer separation program (Evaluation = 2B).

of these sources could afford a greater measure of protection and improvement to the water quality of the Detroit River and the western basin of Lake Erie. The City of Detroit has concluded that, although pollutant loads to the Detroit River from combined sewer overflows could be reduced, no significant improvement in water quality would result. Any load reductions and improvements would be masked by direct surface runoff from the City of Detroit and by combined sewer overflows in the Rouge River Basin. There are no additional programs planned at the present time to address these sources (Evaluation = 2D).

Sediments in the Detroit River may continue to be a source of contamination; however, it is not clear whether broad-scale dredging is a viable remedial option. Natural physical and biochemical processes are expected to reduce the contaminant levels and lead to re-establishment of a healthy benthic fauna community (Evaluation = 2C).

ROUGE RIVER, MICHIGAN

ISSUE

The Rouge River, a tributary to the Detroit River, drains a heavily developed industrial area. Historical data show severe degradation of the sediment. Significant control measures have been implemented; however, the river remains seriously impacted by combined sewer overflows and contaminated sediments. Fecal coliform, phenol, iron, and total dissolved solids concentrations in water exceed the Agreement objectives.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that control measures currently in place are not adequate to resolve environmental problems in the Rouge River Basin. The major problems are the result of combined sewer overflows. A major study on combined sewer overflows has been completed and other studies are still in progress. Based on the information available, and considering the benefits to be derived and the costs involved, the court has concluded that measures to correct combined sewer overflows in the Rouge River Basin are not warranted at this time (Evaluation = 2D).

RAISIN RIVER, MICHIGAN

ISSUE

The Raisin River drains a heavily industrialized area south of Detroit. Existing water quality problems result to a great extent from contaminated sediments, which are heavily polluted with volatile solids, oil and grease, and metals; chemical oxygen demand is high.

Fish are contaminated with PCB and other persistent organic compounds.

The Agreement objectives were violated for dissolved oxygen, conductivity, fecal coliform, and several heavy metals in water. The Michigan standard for pH was also violated.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that there are no programs planned to resolve problems associated with contaminated sediment. Further evaluation is necessary to determine whether dredging is a feasible alternative for the removal of in-place pollutants (Evaluation = 3).

MAUMEE RIVER, OHIO

ISSUE

The Maumee River carries a heavy load of soil and nutrients, resulting from agricultural land runoff, to the western basin of Lake Erie. Sediments in the lower Maumee River and in Toledo Harbor are heavily polluted with such conventional pollutants as volatile solids and chemical oxygen demand, and with metals, as a result of past municipal and industrial discharges. Contamination has, however, been decreasing with time as a result of pollution control efforts. Sediments in the outer harbor are less heavily polluted.

The area fishery is impaired. PCB levels in fish exceed the U.S. FDA action level. Several industrial chemicals and pesticides are also present in fish tissue.

The Agreement objectives for dissolved oxygen, conductivity, fecal coliforms, and several heavy metals are also exceeded for water samples from the mouth of the Maumee River.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that the remedial measures currently in operation to control municipal sources of pollution are adequate (Evaluation = 1).

Programs to control nonpoint sources of pollution within the Basin, which are more significant than point sources, are not adequate. While there are major and intensive nonpoint source control demonstration projects on going, the Board notes that these efforts rely on voluntary participation, and the long term acceptance of these programs is unknown (Evaluation = 2B).

Problems related to combined sewer overflows are under study and evaluation. No date is projected for combined sewer overflow controls due to insufficient data on programs and lack of funding (Evaluation = 2D).

Program requirements to control toxic contaminants from industrial sources are being developed. Expected implementation is 1985/86 (Evaluation = 2D).

With the implementation of remedial programs to decrease pollutant loads from both point and nonpoint sources, the natural processes of attrition should remove contaminants from the sediments and fish over the next five to ten years (Evaluation - 2B). However, because of the natural chemistry of the water in the drainage basin and because of existing land use patterns, the water quality in the estuary may never meet all Agreement objectives.

BLACK RIVER, OHIO

ISSUE

Sediments in the lower Black River are heavily polluted with such conventional contaminants as volatile solids, chemical oxygen demand, and oil and grease; nutrients; and metals.

The area fishery is impaired. PCB levels in fish exceed the U.S. FDA action guideline. Several chemicals of industrial origin are also present in fish tissue.

Concentrations in water samples violated Agreement objectives or Ohio EPA water quality standards for nutrients, dissolved oxygen, fecal coliforms, conductivity, cyanide, and several heavy metals.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that the remedial programs in operation are not now adequate; however, the remedial programs under way for municipal and industrial facilities in the area should result in adequate controls of the discharges of wastewater into the river by mid-1986. Because of in-place pollutants, an additional 5 to 10 years will be required for natural processes to correct the environmental problems (Evaluation = 2B). However, the natural chemistry of the drainage area for the Black River and current land use patterns may preclude the river water from attaining all the Agreement objectives. Surveys have been conducted to assess what water uses can be achieved for the area.

CUYAHOGA RIVER (CLEVELAND), OHIO

ISSUE

Few fish are able to survive in the lower Cuyahoga River and in Cleveland Harbor because of depressed dissolved oxygen levels, elevated levels of dissolved solids and ammonia, and polluted bottom sediments.

Sediments are heavily contaminated with such conventional pollutants as volatile solids, chemical oxygen demand, total Kjeldahl nitrogen, and oil and grease; with heavy metals; and with PCB. Although sediment quality has improved with time, dredged materials must be disposed of in confined areas.

Concentrations in water samples exceeded Agreement objectives and/or Ohio standards for dissolved oxygen, ammonia, conductivity, phenol, fecal coliform, and several heavy metals.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that current remedial measures are not adequate. However, major programs to control municipal and industrial discharges, combined sewer overflows, and urban land runoff are underway and should all be in place by 1990. These measures will significantly improve ecosystem quality in the area. They include major construction at municipal treatment plants in Akron and Cleveland. Two large interceptor programs are

under construction or planned. Wastewater treatment systems have been installed at major industries in the area, for the control of conventional and toxic pollutants; the facilities are being reviewed to identify whether additional controls are required for toxic substances. Several hazardous waste disposal sites have been identified, closed, and/or cleaned up.

However, there is inadequate information available to determine what water quality the current remedial programs will permit. In light of the natural chemistry of the drainage basin, the current intensive land use, and the greatly modified geometry of the navigation section of the river, it is unlikely that the water quality in the river will ever meet the Agreement objectives (Evaluation = 2C).

ASHTABULA RIVER, OHIO

ISSUE

Fish from the lower Ashtabula River, the harbor area, and inflowing tributaries are contaminated with complex organic substances of industrial origin. For several of the compounds, the human health effects are not known. A U.S. FDA action level exists only for PCB; concentrations in fish exceeded this level.

Heavy sediment contamination with conventional pollutants (volatile solids, total Kjeldahl nitrogen, chemical oxygen demand, and oil and grease), heavy metals, and chlorinated organics necessitates confined disposal for dredged materials. Restrictions on dredging have also resulted in restrictions on navigation.

Water samples collected at the mouth of the harbor exceeded the Agreement objectives for conductivity, fecal coliforms, and several heavy metals.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that the remedial works now in operation have significantly improved the ecosystem quality of the Ashtabula River. However, these measures are not adequate to completely resolve the environmental problems related to industrial discharges, hazardous waste sites, and in-place pollutants (sediment). The Board notes that there are investigations underway to address some of these issues. Although firm program requirements have not yet been developed, such measures, when implemented would restore ecosystem quality, although natural attrition will take some time (Evaluation = 2B).

The Board also notes that Field's Brook, a tributary to the Ashtabula River, is a priority site of the "Superfund" program. This is the only site at which "Superfund" monies have been considered for the removal of contaminated sediments from a stream. The Board will closely follow the progress of this activity.

BUFFALO RIVER, NEW YORK

ISSUE

The lower Buffalo River, which drains a heavily populated and highly industrialized basin, and the Buffalo waterfront are very severely polluted.

Almost all sediments are heavily contaminated with conventional pollutants (including nutrients, volatile solids, and oil and grease) and with heavy metals. Many sediments are also contaminated with high concentrations of organic substances primarily of industrial origin. Nine potential or positive carcinogens and eight organic substances having a potential for chronic aquatic toxicity were identified. Each was present at at least one sampling location and at a concentration of at least 5 mg/kg; the concentrations of some substances exceeded 50 mg/kg. PCB and pesticides are also present.

Because of the multiplicity and the concentrations of carcinogens, toxins, heavy metals, and conventional pollutants present, the macroinvertebrate population is severely impaired.

In water samples, the Agreement objectives were exceeded for dissolved oxygen, conductivity, fecal coliform, and several heavy metals.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that remedial measures currently in place will not resolve identified problems in the Buffalo River. However, additional programs are being implemented, notably at the Buffalo and the Lackawanna municipal treatment facilities. These additional measures should be operational by 1985. Significant improvement in ecosystem quality in the area is expected by 1990 (Evaluation = 2B).

There are currently no firm remedial programs to address in-place pollutants. Funds to address combined sewer overflows are expected to be approved in 1984 (Evaluation = 2D).

NIAGARA RIVER, NEW YORK AND ONTARIO

ISSUE

Water, sediment, and fish from the Tonawanda Channel of the Upper Niagara River are severely contaminated. The lower Niagara River also exhibits extensive contamination.

Almost all sediments from the Tonawanda Channel are heavily contaminated with conventional pollutants, heavy metals, and PCB in excess of acceptable concentrations for open-water disposal of dredged materials. Many sediments are also contaminated with high concentrations of other organic substances primarily from industrial sources. Nine potential or positive carcinogens and eight organic substances having a potential for chronic aquatic toxicity were identified. Each was present at at least one sampling location and at a concentration of at least 5 mg/kg; the concentrations of some substances exceeded 50 mg/kg.

Sediments from the lower Niagara River generally exceeded acceptable levels for heavy metals.

A number of organic compounds have also been identified in sediment and water samples taken from the river near industrial landfills.

Numerous organic chemicals of industrial or agricultural origin have been identified in fish. For those substances for which U.S. Food and Drug Administration action levels or Canadian federal consumption guidelines have been established, concentrations are such that most fish are suitable for unrestricted consumption. Advisories are in place for larger specimens of American eel and coho salmon, because of elevated levels of PCB and mirex; although found in the lower Niagara River, these species are generally resident in Lake Ontario.

Agreement or Ontario objectives were exceeded in some water samples for PCB, aldrin/dieldrin, DDT, endrin, phenolics, heptachlor/heptachlor epoxide, endosulfan, fecal and total coliform, and several heavy metals. Most of the observed exceedences were in the Tonawanda Channel and in the lower Niagara River.

The benthic fauna is disrupted in the Tonawanda Channel and in the lower Niagara River. Toxicity was a limiting factor along the shoreline of the upper Niagara River and was also a problem in the lower Niagara River.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that the remedial programs currently in operation for the U.S. side of the Niagara River are not adequate to resolve environmental problems identified in the river. The Board notes, however, that remedial actions taken primarily by the U.S. EPA and the New York Department of Environmental Conservation have increased over the past few years. Specifically the Board recognizes the U.S. Niagara River Agenda (clean-up plan) and the binational Canada-U.S. Niagara River Toxics Committee work, which is currently taking place. Specific efforts of the Canadian agencies in monitoring the ambient environmental conditions of the river are also noted. While the Board is of the opinion that jurisdictions responsible have placed high priority in cleaning up the environmental degradation of the Niagara River, it recognizes that recovery of the Niagara River ecosystem will take a sustained effort. The Board will continue to track the progress of the responsible jurisdictions in implementing the acquired remedial measures to alleviate these problems (Evaluation = 2B).

The Board concludes that remedial measures currently in operation on the Canadian side of the Niagara River are adequate (Evaluation = 1).

HAMILTON HARBOUR, ONTARIO

ISSUE

Contaminants in sediments from several portions of Hamilton Harbour exceed the provincial guideline for open water disposal of dredged materials for nutrients, several heavy metals, and PCB. The greatest contamination is in

the area adjacent to municipal and industrial discharge sites and in the deep water central basin. Organochlorine pesticides have also been detected in sediments. Dredged material is disposed of in confined areas.

Agreement or provincial water quality objectives are exceeded for total dissolved solids, zinc, ammonia, phosphorus, iron, cyanide, and phenol. Localized impairment from phenols and cyanide is especially apparent in the area adjacent to the steel mills on the south shore.

Oxygen demand from municipal and industrial discharges, sediments, and algal decay depress hypolimnetic dissolved oxygen levels, especially in the summer, thereby limiting the suitability of the major part of the harbor as a fish habitat.

Aesthetic quality is diminished by poor water clarity and color, as a result of high levels of suspended solids, chlorophyll, and dissolved organics, thereby deterring broader recreational use of the harbor.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that remedial measures currently in operation are not adequate to resolve the environmental problems in Hamilton Harbour. The Board notes that the province has imposed further remedial measures on major industrial dischargers with regard to phenols, cyanide, and suspended solids (Evaluation = 2B); a further strategy is under development by the Ontario Ministry of the Environment for in-place pollutants (Evaluation = 2C).

ST. LAWRENCE RIVER (CORNWALL, ONTARIO - MASSENA, NEW YORK)

ISSUE

Elevated mercury and PCB levels in larger sizes of some fish species continue to necessitate advisories or restrictions on the consumption and commercial sale of these fish. However, the prospects are for declining levels as the impact of controls which are in place or planned is felt. The mercury problem is residual in nature. Some reduction of PCB levels in forage fish has occurred over the last three years, in response to initial controls on Massena-area industrial sources.

Elevated fecal and total coliform levels have resulted in recreational use restrictions at some beaches downstream of Cornwall. There are also localized violations on both sides of the river for some Agreement or jurisdictional objectives including phosphorus, total phenolics, certain heavy metals, PCB, and two organochlorine pesticides.

Contaminants in sediments collected from the mouth of the Grasse River, at Massena, and along the Cornwall, Ontario waterfront exceed jurisdictional guidelines for open water disposal of dredged materials for nutrients, heavy metals, oil and grease, and/or PCB. This contamination is primarily residual.

WATER QUALITY BOARD EVALUATION

The Water Quality Board concludes that remedial works currently in place are not adequate to resolve the principal problem of PCB contamination in fish and sediments. While the Board notes that both the U.S. and Canada have programs underway or planned for control of municipal and industrial discharges by 1985, it also notes that the effects on fish and sediments from previous PCB discharges will probably continue for some time beyond that date (Evaluation = 2B).

5. Toxic Substances

INTRODUCTION

Through the 1978 Great Lakes Water Quality Agreement, the Governments of the United States and Canada agreed to control or prevent the input of toxic substances into the Great Lakes ecosystem, and to rehabilitate those portions of the Great Lakes already degraded by toxic contamination. Annex 12 of the Agreement spells out specific programs and measures which, when developed and implemented, would virtually eliminate the entry of toxic substances into the Great Lakes ecosystem and thereby accomplish these goals of the Agreement.

In 1980 the Water Quality Board established a Toxic Substances Committee for the purpose of evaluating jurisdictional toxic substances control programs and activities responding to the Agreement. Based on this comprehensive evaluation, the Board, in its 1981 report, made 16 program-oriented recommendations which address nine work objectives:

1. Priority Lists. Identify those chemicals of greatest concern, about which basic information is required.

2. Information Clearinghouse. Identify inventories of chemicals of concern, specific to the Great Lakes Basin, and identify compilations of data of the biological and human health effects of toxic substances.

3. Screening Tests. Develop and evaluate tools to assess the impact or the potential for impact of toxic substances.

4. Surveillance, Monitoring, and Research Programs. Support and coordinate these programs, to ensure that the necessary information is obtained and the requirements of the Agreement are met.

5. Ecosystem Studies. Establish the transport, fate, and effects of ambient levels of toxic substances.

6. Atmospheric Programs. Study atmospheric deposition and develop a strategy to control this pathway of contamination.

7. Hazard and Risk Assessment. Develop reliable methods to assess the hazards and risks posed by toxic substances in the Great Lakes Basin.

8. Control Programs. Provide continuing support in order to solve problems posed by toxic substances in the Great Lakes Basin.

9. Hazardous Waste. Develop a common definition, and develop compatible programs to ensure safe transport and disposal.

Consistent with the recommendation of the International Joint Commission, in its First Biennial Report to the Parties in June 1982, the Water Quality Board directed its Toxic Substances Committee to assist the jurisdictions in implementing these recommendations in three top-priority work areas:

1. Priority Lists of Toxic Substances in the Great Lakes Basin

2. Information Clearinghouse

3. Chemical Substances Present in the Great Lakes Ecosystem

Activities within these major work areas are planned to be completed by November 1983.

PRIORITY LISTS OF TOXIC SUBSTANCES IN THE GREAT LAKES BASIN

A major component in the toxic substances management system is assessment of the hazard and/or the risk posed by the substance to human health and the environment.

The Toxic Substances Committee has concluded that, for many substances, there is not enough information with which to conduct a hazard or a risk assessment, much less, on which to base a control program. For instance, of 381 substances identified in the Great Lakes Basin environment, the Human Health Effects Committee reported in 1981 that 292 of these did not have sufficient biological or human health effects information to evaluate their potential impact on human health. Furthermore, it is surmised that many hundreds of potentially hazardous substances are manufactured or used in the Great Lakes Basin and have not as yet been released or detected in the environment. A need exists to identify such substances and the sites where they are manufactured and used. Toward providing an adequate information base so that assessments and subsequent decisions on controls can be made in a cost-effective manner, the Toxic Substances Committee developed three recommendations, which were presented in the Water Quality Board's 1981 report to the Interntional Joint Commission:

1. Develop a priority list of toxic substances of significance for the Great Lakes Basin for which characteristics data should be gathered, using agreed-upon test guidelines.

2. Prepare a single priority list of toxic substances in the Great Lakes Basin for which inventory data must be developed, rank these substances according to their potential environmental and human health effects, and periodically update the list and the ranking.

3. Develop a joint priority list for toxic substances that require immediate environmental measurements.

The most pragmatic scheme to generate the three priority lists incorporates some type of screening and ranking process.

Information on the characteristics of substances manufactured or used in the Great Lakes Basin or found in the Basin's ecosystem is a logical starting point in the development of the three priority lists. The characteristics of

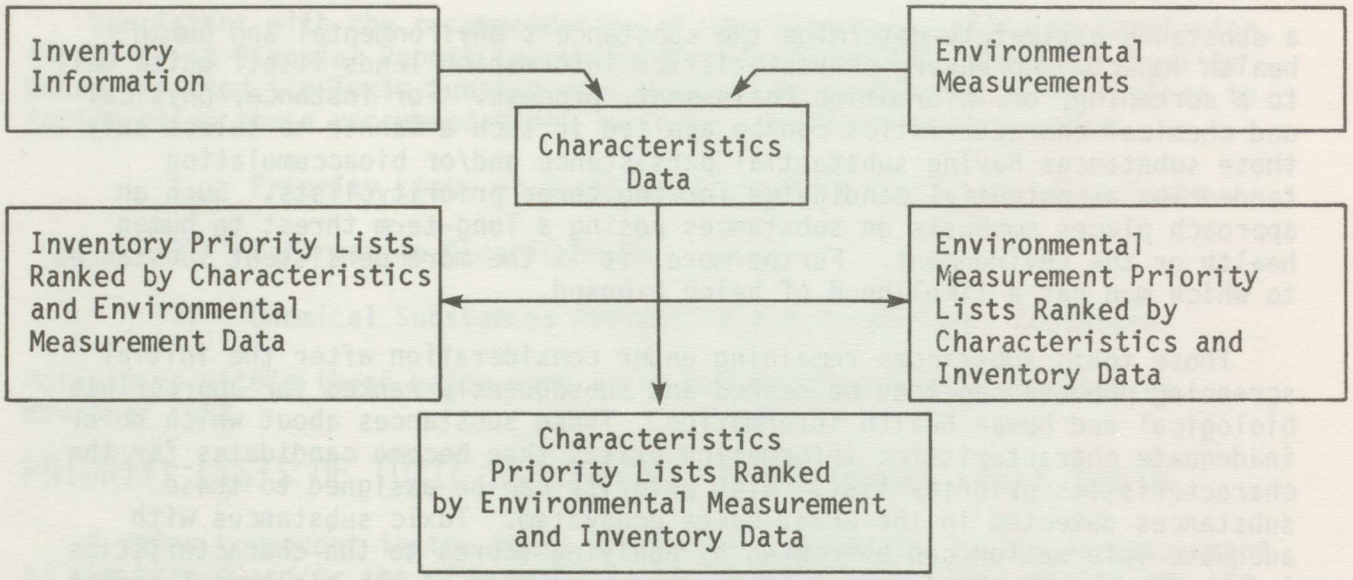
a substance ultimately determine the substance's environmental and human health impact. Moreover, characteristics information lends itself quite well to a screening, or information refinement, process. For instance, physical and chemical characteristics can be applied in such a manner to select only those substances having substantial persistence and/or bioaccumulation tendencies as potential candidates for the three priority lists. Such an approach places emphasis on substances posing a long-term threat to human health or the environment. Furthermore, it is the more persistent substances to which man has a likelihood of being exposed.

Those toxic substances remaining under consideration after the initial screening process can then be scored and subsequently ranked for appropriate biological and human health information. Those substances about which no or inadequate characteristics information exists then become candidates for the characteristics priority list. High priority can be assigned to those substances detected in the Great Lakes ecosystem. Toxic substances with adequate information can be ranked by applying scores to the characteristics information on the basis of the types and magnitude of the biological effect. These substances can then be re-ranked by the quantity of the substance manufactured and/or used in the Great Lakes Basin. The top-ranked substances would in turn comprise the inventory priority list for which specific information on the sites of manufacture, use, and storage should be sought. If no or inadequate inventory information exists for a particular substance, the substance becomes a possible candidate for a second inventory priority list, ranked by the scoring obtained from the characteristics evaluation. Inventory information can then be sought on the top-ranked chemicals on this second inventory priority list.

The environmental measurement priority lists can subsequently be generated from the two priority lists ranked for characteristics and inventory information. In this part of the process, emphasis will be placed on those substances which have been previously detected in the Great Lakes Basin ecosystem. Separate environmental measurement priority lists can then be developed for various ecosystem compartments (fish, water, sediments, or air) as well as geographic locations or drainage basins.

In this proposed scheme, the three types of priority lists and their development are clearly interrelated. For example, in order to determine which substances are included on an environmental measurement priority list, it is necessary first to rank potential candidates, utilizing characteristics and inventory information. If a substance is found in the Great Lakes Basin ecosystem, such as a pesticide in fish, the priority assigned to gathering additional environmental data becomes dependent upon the characteristics and inventories of the pesticide in comparison with other substances recently detected in the Great Lakes Basin ecosystem.

The inter-dependency of the three information bases relative to the generation of the priority lists can be shown in the figure below. Each of the priority lists - characteristics, inventory, or environmental measurements - are produced from the consideration of data available in the other two information bases. The practical relationship among these priority lists, as depicted below, is actually cyclical in nature. Increasingly refined information on any one of the priority lists will be generated from data in the complementary lists.



In accordance with the Commission's Recommendation No. 5, in its First Biennial Report, June 1982, the Water Quality Board has directed that the priority list of chemicals of concern, developed by the Human Health Effects Committee, serve as the starting point for this iterative, or cyclical process. Subsequent to the initiation of this exercise, it is anticipated that the jurisdictions will establish and utilize this process on a permanent basis.

By November 1983, the Toxic Substances Committee expects to have developed and applied the necessary methodologies to produce the three types of toxic substances priority lists for the Great Lakes. A special work group of the Toxic Substances Committee will coordinate the efforts of all the state, provincial, and federal participants and provide technical guidance and assistance to the jurisdictions during the initial exercise through this process. The Water Quality Board intends this activity to complement the continuing toxic substances control activities of each Great Lakes jurisdiction by providing an international, basin-wide perspective to the control of toxic substances.

The Toxic Substances Committee is convinced that this approach will provide a comprehensive, organized toxic substance information base for joint or cooperative action, economical information exchange, cost-effective research work, and improved program priority setting by all the Great Lakes jurisdictions. This process can be an essential basis for a truly integrated toxic substances management system in the Great Lakes Basin.

INFORMATION CLEARINGHOUSE

Inventory and characteristics information are essential for hazard and risk assessment and for other activities related to the control of toxic substances. The more information which is available to the user, the better the quality and the utility of the assessments which are conducted. What information is available, however, and where might it be obtained? Much of the information has been assembled into published reports or onto computerized data management systems. In order to publicize these sources and systems and

the information which each contains, the Water Quality Board recommended in its 1981 report that the Parties "establish a centralized mechanism to identify all inventory-related activities within the Great Lakes Basin," and "establish a centralized mechanism to identify major compilations of characteristics-related data within the Great Lakes Basin."

Under the direction of the Toxic Substances Committee, a single-purpose work group will establish within one year a central computerized clearinghouse, taking cognizance of the needs of data users and existing information sources. Each information source will be described in sufficient detail, so that users readily know the content and accessibility of each. Information from the clearinghouse will be available as a computer printout. Once established, the clearinghouse will be operated out of the Commission's Regional Office in direct cooperation with the jurisdictions.

CHEMICAL SUBSTANCES PRESENT IN THE GREAT LAKES ECOSYSTEM

Information about the presence and distribution of chemical substances in the Great Lakes ecosystem is essential, in order to assess the hazard and the risk posed by these substances and to formulate programs and measures to protect both human health and the Great Lakes resource. Two previously published reports compiled relevant information:

1. "Status Report on the Persistent Toxic Pollutants in the Lake Ontario Basin," Water Quality Board, December 13, 1976.

2. "Status Report on Organic and Heavy Metal Contaminants in the Lakes Erie, Michigan, Huron and Superior Basins," Water Quality Board, July 1978.

Since the preparation of these two reports, more chemical substances have been identified, and more specific information is required in order to effectively protect human health and the environment. For this reason, recent information about substances identified in the Great Lakes ecosystem is being compiled, and an update of the abovenoted reports is being prepared by the Commission's Great Lakes Regional Office, with direction from the committees and groups of both the Water Quality Board and the Science Advisory Board. The format will be more convenient and informative for the user.

CONCLUSION

As indicated above, the Water Quality Board made a number of other recommendations for the Parties to begin to address during 1983. The Water Quality Board, through its Toxic Substances Committee will coordinate and monitor activities relative to these recommendations. Progress reports will be prepared and incorporated into the 1983 report of the Water Quality Board.

6. Phosphorus Inputs and Controls

Phosphorus control is required under several sections of the 1978 Great Lakes Water Quality Agreement to address pollution from municipal sources (Article VI, Section 1(a)), pollution from industrial sources (Article VI, Section 1(b)), eutrophication (Article VI, Section 1(d) and Annex 3), and pollution from agricultural, forestry, and other land use activities (Article VI, Section 1(e)). Phosphorus control activities conducted in response to Agreement requirements are summarized below.

PHOSPHORUS CONTROL REQUIREMENTS

Annex 3 of the 1978 Agreement proposes target phosphorus loads, establishment of load allocations and compliance schedules, and details specific measures to control phosphorus inputs to the Great Lakes. These requirements are, however, subject to confirmation by the Parties. A proposed addendum to Annex 3 remains under official review within the respective governments.

PHOSPHORUS REMOVAL AT MUNICIPAL TREATMENT PLANTS - (ARTICLE VI, SECTION 1 (A))

Since 1972, Canada and the United States have spent or committed more than $7.25 billion for municipal wastewater treatment facilities in the Great Lakes Basin; a principal goal of these programs is phosphorus removal capability. Removal of phosphorus at municipal treatment plants, in conjunction with limitations on the phosphorus content of laundry detergents, has resulted in dramatic reductions in the municipal phosphorus loadings, especially to the Lower Great Lakes (Table 2 and Figures 1 and 2).

As part of an effort to update and improve the U.S. municipal phosphorus loading record, U.S. EPA, GLNPO and the IJC Regional Office undertook a review of the annual loading data on file for U.S. municipal wastewater treatment plants. Omissions and inconsistencies in the historical data base were corrected for each discharger. Similar problems have not been encountered for Ontario data. The improved data base for municipal point source discharges is now complete and should be considered the most accurate historical record to date. Copies of the historical and current annual loading data base are available from the Regional Office.

Table 3 lists the eight largest sewage treatment plants (over 100,000 m^3/d or 25 MGD) in the Lower Lakes Basin which, in 1981, did not achieve an average phosphorus effluent concentration of 1.0 mg/L. The 1981 loading for each of these facilities is also presented in the table, along with the expected load if the phosphorus concentration in their effluents were 1.0 mg/L. The expected date to achieve the effluent goal and the status of activities at each facility are also noted in Table 3. The Board is pleased to report that three major treatment plants previously included in a similar list for 1980, the Detroit Metro, Rochester Frank Van Lare, and Syracuse Metro

TABLE 2

REPORTED MUNICIPAL PHOSPHORUS LOADS IN THE GREAT LAKES BASIN[1]

(tonnes per year)

LAKE BASIN	1972 LOAD ESTIMATE	PHOSPHORUS LOADINGS							EXPECTED LOAD[2] AT 1 mg/L	LOAD[3] OVER 1 mg/L
		1975	1976	1977	1978	1979	1980[4]	1981[5]		
SUPERIOR										
United States		224	222	154	142	83	94	72	78	-8
Canada		62	71	108	97	124	109	100	31	69
MICHIGAN										
United States		2,361	2,373	1,716	1,347	1,224	1,047	933	1,108	-175
HURON										
United States		414	370	340	273	227	232	242	188	54
Canada		210	208	217	222	217	194	223	106	117
ERIE										
United States	13,870	6,719	5,578	6,147	5,252	4,000	3,288	2,633	2,187	446
Canada	1,390	232	262	259	228	234	212	214	240	-26
ONTARIO										
United States	4,750	1,847	1,815	2,089	1,761	1,788	1,555	1,182	760	422
Canada	5,110	2,373	1,266	1,000	967	1,110	972	1,012	905	107
ST. LAWRENCE RIVER										
United States		37	58	50	59	47	86	131	-[6]	-
Canada		123	89	129	128	118	76	88	52	36

[1]Phosphorus loadings for 1975 through 1981 are reported for sewage treatment plants discharging directly to the lakes and for all indirect dischargers over 3,800 m^3/d (1 MGD) in the U.S. and over 4,500 m^3/d (1 MIGD) in Canada.

[2]Expected load with municipalities at 1.0 mg/L "P", calculated using 1981 flow data. 1.0 mg/L is presently an Agreement requirement only for Lake Erie, Lake Ontario, and the international portion of the St. Lawrence River.

[3]Excess - Reported loading for 1981 minus calculated loading if effluent concentration were 1 mg/L.

[4]Canadian data are for calendar year 1980; U.S. data are for water year 1980 (October 1, 1979 - September 30, 1980).

[5]Canadian data are for calendar year 1981; U.S. data are for water year 1981 (October 1, 1980 - September 30, 1981).

[6]New York does not require phosphorus removal for municipal facilities discharging in the St. Lawrence River Basin.

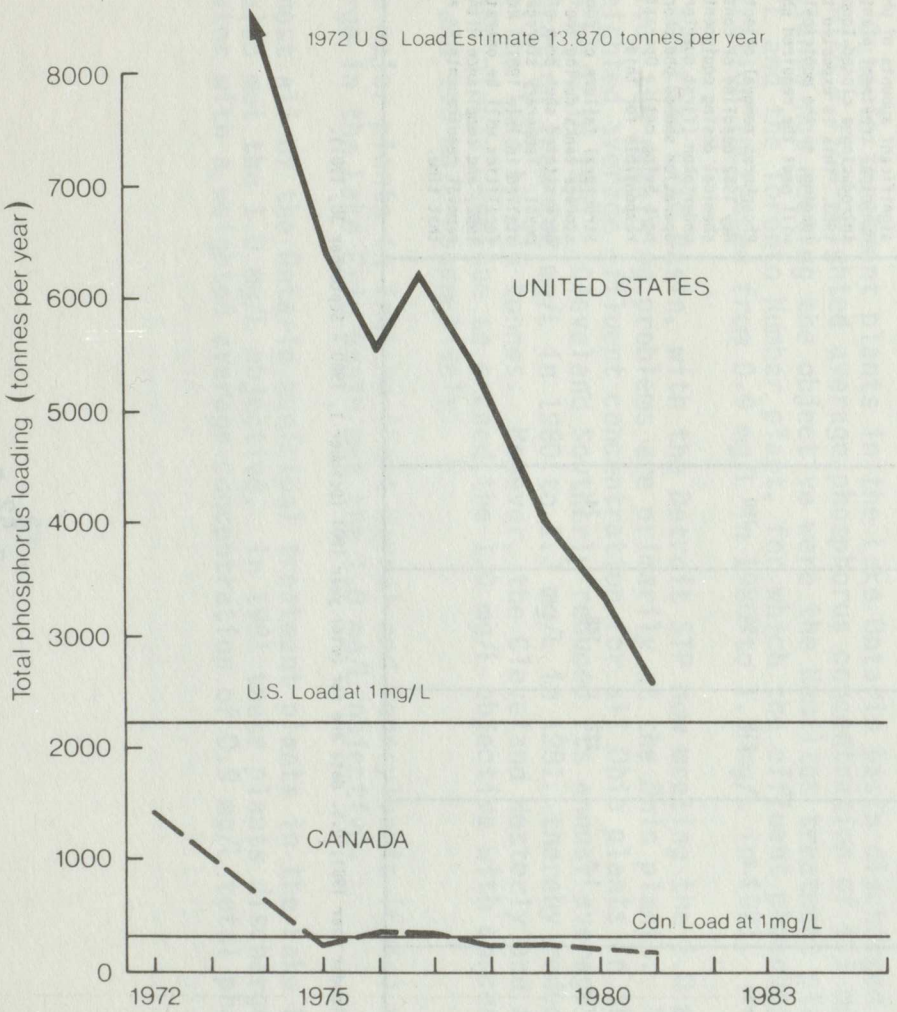


Figure 1 Lake Erie municipal phosphorus loads.

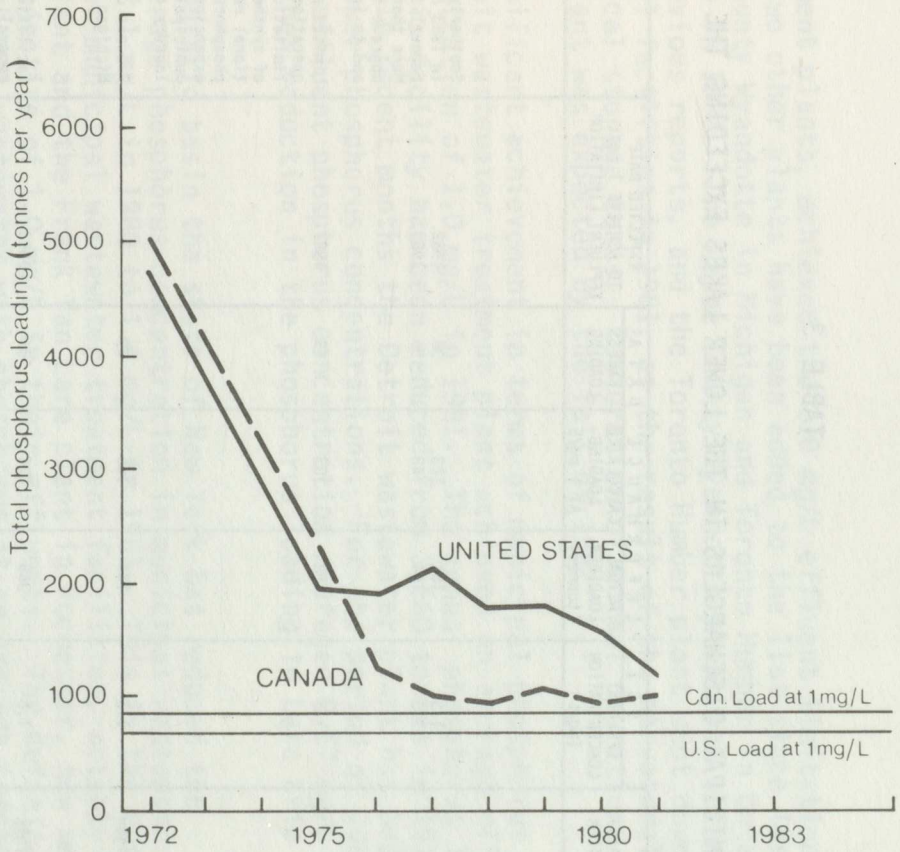


Figure 2 Lake Ontario municipal phosphorus loads.

TABLE 3

MAJOR MUNICIPAL DISCHARGERS IN THE LOWER LAKES EXCEEDING THE 1 MG/L TARGET

FACILITY	JURIS-DICTION	1981 PERFORMANCE DATA				EXPECTED DATE TO ACHIEVE 1 mg/L EFFLUENT LIMITATION	REMARKS
		EFFLUENT CONCENTRATION (mg/L)	ACTUAL LOADING[a] (tonnes)	CALCULATED LOADING AT 1 mg/L	EXCESS LOADING		
LAKE ERIE							
Cleveland	Ohio						
- Southerly STP		1.3	161	123	38	1982	Southerly STP expected to achieve 1.0 mg/L in 1983 due to improved suspended solids removal.
- Westerly STP		3.0	144	48	96	1983	More than $410 million spent to date to upgrade treatment and collection systems and to install phosphorus controls.
Akron STP	Ohio	1.5	152	103	49	1982	Limited phosphorus control presently in operation at facility. 1.0 mg/L effluent limitation met in spring 1981 through use of synthetic polymer coagulant. Additional renovations under way to improve phosphorus removal. Additional sewers and expansion also planned. Further, municipal ordinance limits phosphorus in laundry detergents.
Wayne County Wyandotte	Michigan	1.3	134	105	29	-	Process control problems under review with Michigan DNR.
LAKE ONTARIO							
Buffalo STP	New York	1.6	359	225	134	1983	Facilities in place for phosphorus removal. However, limitations in sludge digestion capacity preclude full operation of these facilities. Corrective measures currently under way.
Niagara Falls STP	New York	1.5	126	86	40	1983	One industry currently discharging significant amounts of phosphorus to the municipal treatment plant will be introducing a closed-loop process in early 1983. This is expected to reduce excess loading, so the municipal plant effluent will meet the required phosphorus limit.
Hamilton STP	Ontario	2.2	216	96	120	-	Phosphorus removal objectives to be met by May 1982 deadline or construction of chemical dosing equipment will be undertaken (first quarter of 1982 operation showed phosphorus removal to 1.0 mg/L being met). Operational changes were responsible for this.
Toronto Humber STP	Ontario	1.5	222	148	74	-	Structural failure of concrete chemical storage tanks during the summer of 1981 necessitated shut-down of phosphorus removal. Temporary storage tanks were installed in late 1981. New storage facilities will be operational by fall 1982, and compliance with phosphorus removal requirements is anticipated at that time.

[a]Canadian data are for calendar year 1981; U.S. data are for water year 1981 (October 1, 1980 - September 30, 1981).

wastewater treatment plants, achieved the 1.0 mg/L effluent limitation in 1981. However, two other plants have been added to the list since last year's report: Wayne County Wyandotte in Michigan and Toronto Humber in Ontario were not in compliance in 1981. The Wayne County Wyandotte plant had been overlooked in previous reports, and the Toronto Humber plant shut down its phosphorus removal facilities in 1981, as the result of the structural failure of concrete chemical storage tanks. Restoration of normal operations at the Toronto Humber plant was expected by the fall of 1982.

The most significant achievement in terms of municipal phosphorus control is that the Detroit wastewater treatment plant achieved an average effluent phosphorus concentration of 1.0 mg/L in 1981. The annual phosphorus load to Lake Erie from this facility has been reduced from 3,660 tonnes in 1975 to 940 tonnes in 1981. In recent months the Detroit wastewater plant has been achieving even lower phosphorus concentrations. For the period of June 1981 to July 1982 the effluent phosphorus concentration averaged 0.57 mg/L which represents a further reduction in the phosphorus loading to Lake Erie of 405 tonnes per year.

In the Lake Ontario basin the state of New York has reduced the flow-weighted average phosphorus concentration in municipal wastewater discharged from 2.1 mg/L in 1980 to 1.6 mg/L in 1981. This is the result of some of the larger municipal wastewater treatment facilities, notably the Syracuse Metro Plant and the Frank Van Lare plant in Rochester, now meeting the phosphorus objective of 1.0 mg/L in their effluents. The Buffalo STP continues to discharge wastewater with phosphorus at an average concentration above 1.0 mg/L although it has been reduced from 2.1 mg/L in 1980 to 1.6 mg/L in 1981.

The Ontario treatment plants in the Lake Ontario basin discharged treated sewage with a flow-weighted average phosphorus concentration of 1.1 mg/L. The major plants not meeting the objective were the Hamilton treatment plant at 2.2 mg/L and the Toronto Humber plant, for which the effluent phosphorus concentration increased from 0.9 mg/L in 1980 to 1.5 mg/L in 1981.

In the Lake Erie Basin, with the Detroit STP now meeting the 1.0 mg/L objective, the remaining problems are primarily at the Ohio plants. The flow-weighted average effluent concentration for all Ohio plants in the basin was 1.4 mg/L in 1981. Cleveland Southerly reduced its annual average effluent concentration from 2.2 mg/L in 1980 to 1.3 mg/L in 1981, thereby reducing the load to the lake by 145 tonnes. However, the Cleveland Westerly and Akron treatment plants continue to exceed the 1.0 mg/L objective with concentrations of 3.0 and 1.5 mg/L respectively.

The major plants in Indiana (Fort Wayne) and Pennsylvania (Erie) which discharge in the Lake Erie Basin met the 1.0 mg/L objective.

Almost all of the Ontario municipal treatment plants in the Lake Erie basin also met the 1.0 mg/L objective. In 1981 these plants discharged wastewater with a weighted average concentration of 0.9 mg/L total phosphorus.

The Board observes that many other municipal facilities have previously achieved the desired effluent goal. Together, these efforts have resulted in the virtual achievement of an average phosphorus effluent limitation of 1.0 mg/L at all municipal treatment facilities in the Lower Lakes Basin, as called for in the 1972 Agreement.

The Board notes, however, that a number of facilities have not yet achieved the desired level of phosphorus removal and that schedules for completion of facilities have been extended. There are also several facilities in the United States which have no identifiable compliance dates due to low funding priorities for construction. The Board urges the jurisdictions to place special emphasis on completing their programs for municipal phosphorus control at the earliest possible date. Where feasible, interim measures for temporary chemical feed systems and temporary alternative sludge disposal methods should be used until capital construction projects are completed.

The Board also notes that none of the five New York municipal facilities discharging to the St. Lawrence River Basin limit phosphorus in the effluent. The New York Department of Environmental Conservation has deemed that phosphorus loadings from these facilities will not affect water quality. Only the statewide ban on phosphorus in detergents limits the phosphorus load. Four of the five facilities discharged more than 3,800 m^3/d (1 MGD) in 1981.

The municipal phosphorus loadings to the Upper Great Lakes have also been reduced by jurisdictional programs not yet specifically required in the Agreement.

The Lake Michigan Basin is noteworthy in that, on average, municipal facilities in that area discharged wastewater with a flow-weighted average effluent phosphorus concentration of 0.84 mg/L. However, several major municipal facilities are discharging with an average effluent concentration greater than 1.0 mg/L, for example, Grand Rapids, Michigan at 1.6 mg/L and Kalamazoo, Michigan at 3.0 mg/L. A further load reduction of more than 130 tonnes per year could be achieved if these plants reduced their effluent concentration to 1.0 mg/L.

Phosphorus loading information for all individual municipal wastewater treatment plants discharging directly to the Great Lakes and those discharging more than one million gallons per day to tributaries can be obtained from the IJC Great Lakes Regional Office, Windsor, Ontario. The "1981 Municipal and Industrial Phosphorus Loadings to the Great Lakes" report includes computer printouts listing the annual phosphorus loads discharged by each plant from 1975 through 1981 and summary tables by lake and jurisdiction.

INDUSTRIAL PHOSPHORUS INPUTS - ARTICLE VI, SECTION 1 (B))

Phosphorus loadings from industrial sources generally constitute only a small portion of the point source phosphorus load to the Great Lakes. The major exceptions are the lower Fox River, Wisconsin, where pulp and paper manufacturing facilities discharged 75 tonnes of phosphorus in 1981, which is half the total point source phosphorus load to Green Bay; and Thunder Bay,

Ontario, where industries discharged 80.7 tonnes in 1980, compared to a municipal loading of 102 tonnes.

A decrease of 37 tonnes of phosphorus should be noted for the 1980 pulp and paper load reported for the Fox River. Appleton Papers, Inc., upon reviewing the Board's 1981 Report, conducted an in-house review and discovered use of improper analytical procedures and reporting errors which resulted in the previously reported higher loading value.

The combined municipal and industrial phosphorus loads for Green Bay in 1981 was 150 tonnes. This loading was a 22% net decrease in total phosphorus load from 1980. The municipal component dropped by 29 tonnes, while the industrial load dropped by 14 tonnes from the previous year.

Details on other significant industrial dischargers of phosphorus to the Great Lakes are provided in the report, "1981 Municipal and Industrial Phosphorus Loadings to the Great Lakes".

DETERGENT PHOSPHORUS LIMITATIONS

Limitations on the phosphorus content of laundry detergents have contributed to reductions in phosphorus loadings to each of the Great Lakes. Canada has established a federal limit of 2.2% on the content of phosphorus in laundry detergents. Minnesota, Michigan, Indiana, and New York each have a state limit of 0.5%. The City of Chicago also has a limit of 0.5%, thereby including most of the Illinois portion of the Great Lakes Basin. Ohio, Pennsylvania, and Wisconsin presently have no limitations.

Wisconsin's three year old detergent phosphorus ban expired July 1, 1982 due to the failure of the Wisconsin General Assembly to extend the measure. The original legislation contained a sunset provision which required a review of the efficacy of the limitations and subsequent legislative extension. Future legislative action on a ban is uncertain.

The Water Quality Board reaffirms its position that the imposition of detergent phosphorus limitations, by all jurisdictions in areas which can contribute to the phosphorus loadings to the Great Lakes, is an important and effective means of reducing the rate of eutrophication of the Great Lakes. The Board further notes that as progress continues to be made in the control of point sources of phosphorus, particularly from municipal wastewater treatment plants, attention should be given to a better understanding of the contributions of nonpoint sources of phosphorus. Specifically, there is need to better define the magnitude of the contributions from combined sewer overflows, wastewater treatment plant bypasses, agricultural and urban runoff, and atmospheric deposition, which are currently poorly quantified, and to assess their impact on phosphorus concentrations and water quality in the Great Lakes.

7. Agreement Progress

Through the signing of the 1978 Great Lakes Water Quality Agreement, the Parties obligated themselves to various programs, measures, and other activities to effect the restoration, preservation, and enhancement of the Great Lakes ecosystem. In its 1981 report, and in Appendix III to that report, the Water Quality Board reported on the progress of the Parties toward fulfilling their commitments. The Board's report described numerous programs and measures which the Great Lakes jurisdictions had undertaken. The intention of this chapter is to update the Agreement progress information presented in last year's report. Therefore, only significant developments and major changes are presented here.

In its 1981 report, the Water Quality Board also identified four sections of the Agreement for which there has been little or no formal action by the Parties. The Board notes again this year that there have been no developments with respect to hazardous polluting substances (Annex 10), ecosystem integrity (Article IV, Section 3(b)), naturally exempt areas (Article IV, Section 1(e)), and limited use zones (Annex 2).

IMPLEMENTATION OF AGREEMENT - ARTICLE XI

On July 12, 1982 the third Canada-Ontario Great Lakes Water Quality Agreement was signed by representatives of the federal and provincial governments. Canada and Ontario entered into their first cooperative agreement in 1971 and signed a revised Canada-Ontario Agreement in 1976. The signing of the 1982 Agreement formalizes the joint commitment by Canada and Ontario to continue to preserve, maintain, and improve where necessary the quality of the boundary waters. The 1982 Agreement reaffirms the intentions of Canada and Ontario to continue and jointly share in the cost of pollution control and surveillance programs on the Great Lakes.

The 1982 Agreement renews existing obligations and reflects the 1978 Canada-United States Great Lakes Water Quality Agreement by placing a greater emphasis on the control of toxic substances and pollution from diffuse sources, such as urban and agricultural runoff. It also provides for the continuation of Canada's cost-shared Great Lakes surveillance program, the continuation of the phosphorus-control program started in 1971, and a one-time federal grant of $65 million for construction of municipal sewage works in the Great Lakes basin over the period 1982-1985.

POINT SOURCE COMPLIANCE - ARTICLE VI, SECTION I

FINANCIAL RESOURCES FOR MUNICIPAL WASTEWATER TREATMENT FACILITIES

Municipal facilities are to be constructed to provide levels of treatment consistent with the achievement of the phosphorus requirements and the general and specific objectives of the Agreement. Since 1972, Canada and the United States have spent or committed more than $7.25 billion for construction of

municipal wastewater treatment facilities in the Great Lakes Basin (Table 4). These facilities generally provide for secondary treatment or equivalent, phosphorus removal if required, and additional treatment in order to protect the ecosystem from other identified pollutants.

In the United States, funding for municipal facilities is shared by the municipal, state, and federal governments. In 1981, $436 million in federal and state funds was spent in the Great Lakes Basin. The projected federal expenditure for fiscal years 1983 and 1984 under the Construction Grant Program will be approximately $320 million.

In Canada, the provision of financial resources for the construction of municipal waste collection and treatment facilities has also been shared amongst the municipal, provincial, and federal governments.

The signing of the revised Canada-Ontario Agreement on July 12, 1982, reaffirms financial participation by the three levels of government until March 1985. In addition to the $65 million federal money, Ontario will provide up to $125 million, and municipal governments will provide $140 million, for a projected total of $330 million to continue the clean up of municipal sewage discharges in the Great Lakes Basin.

INDUSTRIAL WASTEWATER TREATMENT OR CONTROL REQUIREMENTS

The Canada-United States Agreement of 1978 calls for "establishment of waste treatment or control requirements expressed as effluent limitations . . . for all industrial plants" in order to meet the general and specific objectives and the other control requirements of the Agreement.

In the United States, the development of remedial programs and discharge limitations for municipal and industrial point source dischargers is based on a combination of national technology-based standards and on applicable water quality standards. To date, these standards have only been applied to traditional sewage parameters and to such toxic substances as heavy metals, cyanide, and phenols via revised NPDES permits.

The U.S. Environmental Protection Agency plans to issue comprehensive regulations to control toxic pollutants discharged in wastewater from facilities in 34 industrial categories. Regulations have been issued to date for only five: iron and steel facilities, inorganic chemical plants, manufacturers of timber products, textile mills, and electroplating operations.

The regulations set effluent limits, to be achieved through the use of graduated levels of technology specified in the U.S. Clean Water Act; industries have until July 1, 1984 to comply with best available technology requirements. The regulations also include new source performance standards, applicable to new industrial facilities, and pretreatment requirements, applicable to existing and future plants that discharge wastewater into publicly owned sewage treatment facilities.

Regulations have not yet been promulgated for the remaining 29 industrial categories, but control of toxic pollutants is required now. Lacking these federal regulations, permit development is proceeding, in some cases, on the basis of best professional judgement, as determined independently among the

TABLE 4

FUNDS COMMITTED FOR MUNICIPAL SEWERAGE CONSTRUCTION
IN THE GREAT LAKES BASIN
(in millions of dollars)

YEAR	CAPITAL COMMITMENTS FOR SEWERAGE WORKS IN ONTARIO BY ALL LEVELS OF GOVERNMENT[1]	OBLIGATED STATE AND FEDERAL FUNDS IN THE UNITED STATES [2]
1971	57	370
1972	66	313
1973	138	419
1974	103	509
1975	112	950
1976	174	429
1977	150	716
1978	191	618
1979	200	456
1980	180	499
1981	165	436
TOTAL	1,536	5,715

[1]Figures represent total capital commitments for treatment plants and interceptor sewers.

[2]Figures represent total United States eligible project costs with federal grant approval through December 31, 1981.

jurisdictions. Similarly, non-specific water quality standards have resulted in conservative criteria being applied as a constraint against the effluent limits evolving from best professional judgement.

This process has the potential to create inequities among the discharge limits developed by the jurisdictions using best professional judgement, and could also establish limits which exceed those derived from water quality criteria.

In Canada, the Canada-Ontario Agreement provides for establishment of specific industrial effluent limitations to be in operation by December 1983, requirements for substantial elimination of persistent toxic substances, requirements for product control of toxic substances, and related enforcement programs. Additional requirements embrace thermal discharges, industrial waste pretreatment, and radioactivity.

POLLUTION FROM SHIPPING ACTIVITIES - ARTICLE VI, SECTIONS I(f) AND (i) AND ANNEXES 4,5,6, AND 9

Since the last report on this item representatives of the United States and Canadian Coast Guards, together with other interested agencies, held a Joint Meeting on Progress towards Achievement of the Objectives established by the Great Lakes Water Quality Agreement of 1978. The meeting was held June 1-2, 1982, at Toronto, Ontario. The report of this meeting has been forwarded to the International Joint Commission.

DISCHARGES OF OIL AND HAZARDOUS POLLUTING SUBSTANCES

Annex 4 stipulates the adoption of programs and compatible regulations to prevent discharges of harmful quantities of oil and hazardous polluting substances from vessels. A proposed amendment to the Canadian Pollutant Substances Regulations has been prepared and is being circulated to the industry, public, and other interested agencies for comment. Subject to the approval of this amendment, the Canadian regulations will cover all of the hazardous polluting substances listed in Appendix 1 to Annex 10 of the Agreement.

Following the implementation of this amendment, both the U.S. and Canadian Coast Guards will have regulations and programs that give effect to the general objectives set forth in Annex 4.

DISCHARGES OF VESSEL WASTES

Annex 5 stipulates that compatible regulations be adopted to govern the discharge of garbage, sewage, and waste water from vessels. Both Coast Guard services have undertaken projects in an attempt to resolve the problems which gave rise to the unsatisfactory results obtained from sample tests on installed marine sanitation devices. Further study will be undertaken, and it is proposed that a meeting be held in November 1982 in an effort to conclude the issues associated with the regulation and control of sewage pollution from vessels operating in the Great Lakes.

The U.S. Supreme Court has determined that the Michigan Watercraft Pollution Control Act, which prohibits discharge of all sewage from vessels in Michigan waters, is not pre-empted by the federal Clean Water Act. The court also found that the federal act does not violate Admiralty or Equal Protection Clauses by delegating authority to states to "completely prohibit discharge from all vessels of any sewage, whether treated or not." The court further concluded that international navigation treaties for the Great Lakes do not conflict with either the federal or state water law.

POLLUTION FROM SHIPPING SOURCES

Annex 6 calls for the Canadian Coast Guard and the United States Coast Guard to review services, systems, programs, recommendations, standards, and regulations relating to shipping activities in order to maintain or improve Great Lakes water quality. The two Coast Guards continue to hold informal meetings at the operational level to review rules and regulations covering navigation equipment, and ship communication systems. These areas of mutual concern are continually being updated.

JOINT CONTINGENCY PLAN

Annex 9 calls for the maintenance of the "Joint Canada-United States Marine Pollution Contingency Plan for the Great Lakes (CANUSLAK)", adopted by the Parties on June 24, 1974. The St. Lawrence River supplement to the Plan is now complete, and the Detroit-St. Clair River supplement is undergoing major changes. This will be completed by October 1982.

The Joint Contingency Plan is currently undergoing its first major revision. Considerable progress has been made. It is expected that the Plan will be able to stand for a number of years without further major revision.

POLLUTION FROM ONSHORE AND OFFSHORE FACILITIES - ARTICLE VI, SECTION 1(h) AND ANNEX 8

The Agreement calls for the Parties to abate and control pollution from onshore and offshore facilities, including prevention of discharges of harmful quantities of oil and hazardous polluting substances.

The U.S. Army Corps of Engineers conducted a review in regard to drilling for gas beneath the U.S. portion of Lake Erie. The Corps concluded "that development of U.S. Lake Erie natural gas resources can be accomplished in an environmentally acceptable manner". This conclusion "is not a recommendation to develop the natural gas resources . . . but rather is . . . strictly related to whether or not the means exist to accomplish such development in an environmentally acceptable manner. . . . All future permit applications for gas development . . . will be judged on their own merits and site specific environmental effects and will be subject to review under provisions of the National Environmental Policy Act of 1969 and Corps of Engineers Regulations."

SURVEILLANCE AND MONITORING - ANNEX 11

The following major surveillance and monitoring activities have recently been carried out in accordance with the 1978 Agreement.

Lake Ontario - A two-year intensive survey was conducted in 1981 and 1982. Due to water quality problems resulting from inadequate control of toxic substances present in the Niagara River, an effort greater than that anticipated in the Great Lakes International Surveillance Plan (GLISP) has been expended. Programs to monitor contaminants in biota and wildlife from the open lake and the nearshore areas have continued.

Lake Erie - Data analysis, synthesis, and report preparation based on the 1978/79 intensive survey are proceeding. Annual collections for open lake water quality and for contaminants in fish and wildlife were completed for 1980/81 and continued in 1982. Nearshore studies of the Ontario coastline of Lake Erie were completed at the planned level of intensity.

Lake Huron - Data analysis, synthesis, and report preparation based on the 1980 intensive survey are proceeding. Nearshore studies along the Ontario coastline of Lake Huron were completed. Open lake collections for contaminants of fish and wildlife have continued.

Lake Superior - A task force to plan for the 1983 intensive survey was formed in 1981. Open lake collections for contaminants of fish and wildlife have continued.

Lake Michigan - An Executive Summary report based on the 1976 intensive survey was issued in 1982. Open lake collections for contaminants in fish and wildlife have continued.

UTILIZATION OF AGREEMENT OBJECTIVES - ARTICLES III AND IV AND ANNEX I

Water Quality Agreement objectives describe the minimum desired levels of water quality which are to be maintained or achieved for the waters of the Great Lakes. Objectives are the major basis for measuring progress to restore, preserve, and enhance these waters. Article III presents the general objectives which the Parties have adopted, and Article IV and Annex 1 set forth the specific objectives.

Water quality standards and other regulatory requirements provide the legally enforceable basis within each jurisdiction to achieve or maintain a prescribed level of water quality. Article V, Section 1 states that:

> Water quality standards and other regulatory requirements of the Parties shall be consistent with the achievement of the General and Specific Objectives. The Parties shall use their best efforts to ensure that water quality standards and other regulatory requirements of the State and Provincial Governments shall similarly be consistent with the achievement of these Objectives.

CANADA

In the 1976 and the 1982 Canada-Ontario Agreements on Great Lakes Water Quality, Canada and Ontario agreed to adopt the Agreement objectives as the minimal basis for establishing water quality standards for the boundary waters of the Great Lakes. Further, objectives would be the basis for designing and

assessing pollution abatement programs in the Great Lakes. Using these objectives as the minimum goal for Great Lakes water quality, appropriate effluent limitations for new and expanded facilities are being incorporated into Certificates of Approval and, for existing dischargers, into formal programs and control orders.

UNITED STATES

The Clean Water Act grants EPA responsibility for ensuring that each state considers both the Agreement objectives and water quality criteria in the review of state standards; the more stringent should be considered for Great Lakes waters. Water quality criteria are outlined in "Quality Criteria for Water 1976" (Red Book). "Ambient Water Quality Criteria for Pollutants" (1980) contains more recent information for 64 pollutants and, as such, supercedes much of the Red Book. Research and development of criteria for other pollutants is continuing.

Amendments to the Federal Water Pollution Control Act (PL 97-117), passed in 1981, require states to review and revise their surface water quality standards by December 1984 or forfeit eligibility for water treatment facility construction grants.

Each state conducts a technical evaluation of its standards; EPA concurrently reviews any proposed revisions. Proposed revisions are then distributed for public review, public hearings are held, and further revisions made in response to public comment. Before final adoption by the state, the proposed revised standards are subjected to a legal, legislative, or administrative review. After adoption, the standards are submitted to EPA for final approval. If they are not acceptable, EPA can promulgate standards either wholly or in part for that state.

U.S. EPA is moving toward development of site-specific water quality standards for priority water bodies, including the Great Lakes. Proposed regulations (40CFR120, Draft, Water Quality Standards Regulation) governing the process to revise the standards would require the states to perform a three-stage evaluation and analysis: use attainability, incremental benefit/cost, and site-specific water quality standards.

Table 5 summarizes the current status to revise water quality standards in each state.

TABLE 5

STATUS OF STATE WATER QUALITY STANDARDS

STATE	STATUS
Minnesota	Comprehensive standards revisions were adopted, effective January 1981, and approved by EPA on July 24, 1981. Reclassification of 23 stream segments were adopted, effective December 1, 1981, and approved by EPA on May 12, 1982.
Wisconsin	The last major revisions became effective on September 1, 1981. These revisions included removal of dissolved oxygen variances on portions of the Lower Fox River and were based upon new modeling procedures. These revisions were approved by EPA on March 23, 1982. Wisconsin is initiating a general review of its standards with the objective of updating several portions.
Illinois	Standards last revised in 1973 and 1974, and partial revisions were made in May 1979. No comprehensive revisions are currently proposed. Individual standards are reviewed on a continuing basis. State is currently reviewing fecal coliform standards and combined sewer overflow control.
Indiana	Standards last revised in May 1978 and approved by EPA on October 31, 1980 except for portions addressing general use waterways. The state is currently considering a limited stream use designation system and other revisions to their stream standards.
Michigan	Standards last revised in 1973. Hearings on new revisions are currently in progress. The state is considering changes in its general toxicity water quality standard and formal adoption of toxicant control protocols.
Ohio	EPA promulgated standards for Ohio on November 28, 1980. However, due to procedural errors in the basis for promulgation, the Federal rule was withdrawn, effective July 7, 1982. The Ohio Environmental Board of Review recently vacated the state's 1978 water quality standards, leaving Ohio without standards. Ohio EPA appealed the Board's ruling, and the Appeals Court granted a stay of the Board order, pending the hearing on the issue. Ohio is continuing to review standards on a site-specific basis. As part of that process, on January 18, 1982, Ohio adopted revisions in the Fields Brook water quality standard for total dissolved solids. This revision is currently under review by EPA.
Pennsylvania	Revised standards adopted August 1979, effective October 1979. EPA approved revisions in January 1981. Technical review of standards currently being conducted. Adoption of revised standards expected in 1985.
New York	Standards last revised in 1974. Public hearings on revisions were held in 1978 and public meetings were held in 1980. As per the 1981 amendments to the Federal Water Pollution Control Act (PL 97-117), states must review and revise their water quality standards by December 1984. New York's projected completion date is 1984.

8. Water Quality Board Activities

The Board highlights in this chapter the more significant of its activities in carrying out its responsibilities in assisting the Commission under the relevant sections of the Agreement.

PETROLEUM REFINING INDUSTRY - ARTICLE VI, SECTION I(b)

In 1977, the Water Quality Board reported on progress within the petroleum refinery industry to reduce pollutant discharges to the Great Lakes. Because of significant progress by that industry since that report and because of increased interest in toxic substances, the Board established a Petroleum Refinery Point Source Task Force to report on these considerations.

The Board has received the Task Force's report, "A Review of Pollution Abatement Programs Relating to the Petroleum Refinery Industry in the Great Lakes Basin". The Task Force's findings, conclusions, and recommendations are summarized below. The Board wishes to make this report available to the International Joint Commission and to the public at the present time, but it is the Board's intention to review the report prior to tendering specific advice to the Commission.

FINDINGS

There are 15 petroleum refineries discharging their effluents directly into the waters of the Great Lakes Basin; two refineries discharge to municipal sewer systems. The Task Force's report only addresses the former, since the latter receive treatment at municipal facilities.

Petroleum refineries discharge to five areas of concern: Grand Calumet River and Indiana Harbor Ship Canal, Indiana; Saginaw River System and Saginaw Bay, Michigan; St. Clair River System, Ontario-Michigan; Maumee River, Ohio; and St. Louis River, Minnesota-Wisconsin. The report discusses each of the refineries located in these areas, but the Task Force noted that the individual impact of a refinery discharging to an area of concern cannot be evaluated without consideration of other dischargers that may also have impacts. One means of accomplishing this evaluation is the waste load allocation procedure which includes, as a prerequisite, a waste load characterization of the effluent dischargers. Such a procedure is being applied by Indiana in the Grand Calumet River and Indiana Harbor Ship Canal and it includes the refinery located there.

All agencies within the Great Lakes Basin have developed pollution abatement programs for the petroleum refinery industry consistent with the requirements of their individual water quality objectives. All jurisdictions regulate oil and grease, ammonia, suspended solids, and phenol for this

industry. Additional restrictions have been added in some areas. Meeting these requirements has resulted in marked improvement in the quality of the effluents discharged into the Great Lakes.

Since production at Great Lakes refineries has been variable, and since a number of refineries have closed, the quantities of pollutants discharged by this industry were reported by the Task Force on a "per unit of production" as well as on a total load basis. Significant decreases in conventional pollutants were reported since 1976.

Each jurisdiction carries out a compliance enforcement program. The status of compliance for each refinery in 1980 is reported. Specific problems and remedial actions at these refineries are discussed. Consistent violations of specific limits set by the jurisdictions are referred for action.

Although requirements in Canada and the United States are different, compliance usually results in similar pollution control equipment being installed.

Many toxic pollutants are significantly reduced by the biological waste treatment systems usually employed at refineries. Screening for individual pollutants by the agencies and the industry is continuing, but these efforts are hampered somewhat by limitations of analytical methods.

CONCLUSIONS AND RECOMMENDATIONS

The Task Force reviewed the progress made by the petroleum refining industry to reduce its pollutant discharges in response to pollution abatement programs. Based on the present evaluation, it was the opinion of the Task Force that the jurisdictional programs as they relate to the petroleum refining industry are adequate to meet the general program requirements of Article VI, Section 1(b) of the 1978 Agreement.

A significant improvement in the quality of wastewater being discharged from Canadian and United States refineries has been observed since 1976. This improvement has occurred both on a basis of total load and on a basis of loading per unit of crude oil processed, and is a result of efforts by the industry to meet the applicable requirements imposed by the jurisdictions. This improvement has been achieved primarily by upgrading treatment facilities and by improved water management.

Overall, the petroleum refining sector generally meets the discharge requirements imposed by the jurisdictions. However, the majority of the refineries do have occasional incidents for one or two parameters, and a few have frequent instances of exceeding these requirements. Therefore, the Task Force recommended to the Board that:

1. *Refineries experiencing difficulties in meeting effluent requirements improve the operation of their existing wastewater treatment facilities, continue to optimize and upgrade these facilities, and incorporate process modernization techniques, including improved water management and recycling of process waste.*

There has been a 10% reduction in crude oil processed in the 1976-1981 period in the Great Lakes Basin. Depending on demand and economic climate, an additional reduction in crude processing may take place during the next several years, but this reduction is not expected to have a major impact on refinery waste loadings to the Great Lakes.

All refineries discharging to the Great Lakes Basin have treatment facilities which include biological wastewater treatment systems. Studies on the petroleum refinery industry have shown that a well operated biological treatment system significantly reduces conventional pollutants as well as many toxic substances present in refinery wastewater. However, the treated effluent from refineries still contains certain toxic organic and metal substances at very low concentrations. Therefore, the Task Force recommended to the Board that:

2. *The long-term impact of some of the persistent toxic substances in the refinery effluent discharges be determined in any water quality and/or chronic toxicity studies being conducted, particularly in the areas of concern.*

Routine monitoring for most toxic substances is not a jurisdictional requirement. The information base for most toxic substances in refinery effluents has been generated from the industry as a whole and is not specific to the refineries in the Great Lakes Basin. It is expected that the effluent characteristics for the refineries in the basin would be similar to those surveyed. Therefore, the Task Force recommended to the Board that:

3. *Refineries discharging into the Great Lakes Basin be encouraged to characterize their effluent for the most significant toxic substances by periodic monitoring.*

4. *The jurisdictions modify their existing requirements if these studies indicate that previously unknown adverse effects exist, particularly in the areas of concern due to refinery effluents.*

A detailed comparison of jurisdictional requirements for pollutants discharged by the industry was not addressed as it would have involved a detailed refinery-by-refinery comparison. Both countries have adopted similar strategies for controlling water pollution from the petroleum refining sector. It was the opinion of the Task Force that major differences do not exist, as supported by the installation of similar pollution control technology.

The Task Force considered the quantities of wastewaters being generated by the re-refineries in the basin. The chemical characteristics of effluent data were not readily available; however, the process water component of these wastewaters is known to be very small in volume, and the re-refiners generally discharge to municipal wastewater treatment plants. No attempt was made to review the limited data available to the Task Force.

Petroleum refineries are not significant contributers of phosphorus loading to the Great Lakes Basin. Phosphorus is added to promote the biological activity in biological waste treatment systems and, subsequently, most of this phosphorus is consumed by the biomass which accumulates in the sludge.

The individual impact of a refinery discharging to an area of concern cannot be evaluated without the consideration of other dischargers in the area. Therefore, the Task Force recommended to the Board that:

5. *Problems identified in areas of concern be addressed by a waste load characterization procedure, in order to determine the relative magnitude of the refineries' contributions, and specific problems be corrected on a case-by-case basis such as by using a waste load allocation procedure or other means.*

Many refineries in the Great Lakes Basin have recently shut down or will do so in the near future. Therefore, the Task Force recommended to the Board that:

6. *The jurisdictions examine the procedures for plant closing and determine their adequacy.*

The refinery effluent treatment systems currently in use are sophisticated and require well trained personnel to run at maximum efficiency. Most states with refineries in the Great Lakes basin require certified operators to control these systems. Therefore, the Task Force recommended to the Board that:

7. *Ohio and Ontario investigate the benefit of, and the need for a certified wastewater treatment plant operator program for the industry.*

Adequate analytical protocols exist for the conventional pollutants and for many non-conventional ones. However, meaningful comparison of data on trace organic contaminants is hampered by the lack of uniform procedures for analysis, especially for volatile organics. Therefore, the Task Force recommended to the Board that:

8. *Additional efforts be made to standardize and improve analytical protocols used by the jurisdictions in testing for the presence of organic compounds, particularly in industrial effluents.*

Petroleum refineries generally do not have specific requirements to minimize the environmental impacts of thermal discharges in the Great Lakes Basin. One refinery in Ohio has thermal control requirements because of local site-specific conditions.

There are no requirements specific to refineries to minimize the adverse environmental impact of water intakes. Refineries are not the most significant users of water, when compared to other industrial sectors.

SURVEILLANCE AND MONITORING - ARTICLE VI, SECTION I(m) AND ANNEX 11

BACKGROUND

The Great Lakes International Surveillance Plan (GLISP) was developed under the auspices of the Water Quality Board as a framework within which Great Lakes surveillance and monitoring programs would be conducted in order to meet the goals set forth in Annex 11 of the 1978 Water Quality Agreement. The Agreement states four goals:

1. To assess compliance with pollution control requirements.

2. To determine achievement of the general and specific objectives given in Articles III and IV and in Annex 1.

3. To provide information for measuring local and whole lake responses to control measures.

4. To identify emerging problems.

REVIEW OF GREAT LAKES INTERNATIONAL SURVEILLANCE PLAN

In order to establish whether GLISP was providing the information required to meet the Agreement goals, the Water Quality Programs Committee, on behalf of the Water Quality Board, directed the Surveillance Work Group to conduct an evaluation of GLISP. Each program component was reviewed by compiling information about what specific surveillance and monitoring activities have been accomplished compared to what was required in GLISP. The Surveillance Work Group was also asked to provide reasons for identified differences in implementation and to recommend appropriate modifications to correct the situation.

Results from that review indicate that there are differences in surveillance and monitoring activities when compared to GLISP, and that these variances have resulted mainly from resource limitations, changes based on interpretation of historical data, and changes in emphasis from eutrophication to contaminant pollution.

The downward trend in financial resources contributed by the United States has forced the states to continually review their programs based on jurisdictional priorities. Since the goals and priorities of jurisdictional surveillance often differ from those of the Agreement, some states have reduced or eliminated efforts in certain components of GLISP.

The ebbing of state involvement has not been uniform, and this has resulted in a varied effect on GLISP-related activities, especially evident in the monitoring of tributaries, water intakes, beaches, and nearshore water quality. In conjunction with reduced state involvement, the demands on U.S. federal agencies have increased accordingly and at a time of decreasing budget allocations and personnel.

Under the auspices of GLISP, Canada and the United States have amassed a vast storehouse of information relevant to the Agreement. Some changes, additions, or reduced efforts to components in GLISP have been made, based on the interpretations of this information base. All changes made to GLISP should be based on existing data, with full binational considerations, and not unilaterally based on fiscal policies.

The main focus of the original 1972 Great Lakes Water Quality Agreement was on eutrophication: its causes, prevention, and monitoring. Since that Agreement, increasingly more attention has been focussed on contaminant pollution. The open lake programs to collect fish and herring gulls for contaminant analyses have continued relatively unmodified since their inception. However, there have been increased efforts in other ecosystem components to include biota, sediment, and water column contaminant pollution; these have commanded an increased amount of effort and funding. However, these efforts have been somewhat variable and relatively uncoordinated from a binational perspective.

If GLISP has a major fault, it is in its failure to provide a mechanism to ensure up-front binational planning crucial to identifying the level of commitment required to satisfy obligations under the 1978 Agreement. The Board is presently considering a proposal to ensure that the requisite annual binational planning takes place, to provide a basis for allocating sufficient fiscal resources to assure implementation of a cost-efficient and scientifically sound surveillance plan.

SUMMARY OF QUALITY ASSURANCE

Annex 11 of the Agreement calls for quality assurance programs in support of Great Lakes surveillance and monitoring activities. These programs include standard sampling and analytical methodology, inter-laboratory comparisons, and compatible data management. Proper quality assurance programs permit valid assessment of surveillance and monitoring data and strengthen the evaluations and conclusions which are derived from these data. In order to help provide environmental data of sufficient quality to meet the surveillance and monitoring requirements of the Agreement, the Water Quality Board established a Data Quality Work Group.

During 1981 and 1982, the Work Group conducted 12 interlaboratory studies, held a chemists' meeting on phosphorus analysis of water, initiated development of standard reference materials to meet specific Great Lakes requirements, compiled a listing of archived Great Lakes Basin environmental samples, maintained a listing of analytical methods used by Great Lakes laboratories, and continued its efforts to have laboratories implement sufficient intralaboratory quality control programs. A brief description of these activities follows.

INTERLABORATORY STUDIES

To determine if Great Lakes laboratories produce comparable results, the Work Group conducted 12 interlaboratory studies: four for phosphorus in water, three for metals in water, three for major ions in water, one for

organochlorine pesticides and PCB in fish, and one for metals in fish. Aqueous samples were prepared from natural waters from a variety of sources and from standard solutions. Fish samples were prepared as homogenates.

Most laboratories performed well. However, round robins have identified laboratories which produce biased or erratic results, as well as laboratories using analytical methods inadequate to quantify ambient concentrations of substances. The need for an ongoing round robin program has also been demonstrated, since good past performance can unknowingly be lost without external performance evaluation.

Due to some laboratories demonstrating an inability to measure pesticides and metals in environmental samples, associated data were excluded from use by the Technical Assessment Team in preparing its report on the Lake Erie Intensive Study. For these laboratories inadequate quality assurance programs were in place.

ANALYTICAL CHEMISTS' MEETING ON PHOSPHORUS DETERMINATION

Laboratories providing much of the Great Lakes phosphorus data have compared well in interlaboratory studies. However, some laboratories have continued to demonstrate an inability to adequately quantify phosphorus in samples at the interlaboratory test levels. Due to the difficulties displayed by some laboratories, a meeting of chemists who analyze phosphorus in water was held in May 1981. The goals of the meeting were to catalyze improved performance on analysis for total phosphorus in water up to the level currently achieved by the best participating laboratories, to exchange ideas on intralaboratory quality control, and to emphasize the need to provide accurate data to characterize water quality in the Great Lakes.

For those laboratories demonstrating poor performance, the most common problems identified were insufficient calibration procedures, inappropriate choice of analytical range, and turnover in personnel. In a few cases, insufficient regard for quality control was demonstrated and inadequate quality assurance protocols were used.

ANALYTICAL METHODS DOCUMENTATION AND REVIEW

A description of the methods used by participants in the interlaboratory studies is maintained on file at the Great Lakes Regional Office of the International Joint Commission. In specific cases, methods have been reviewed for their appropriateness, and changes have been suggested.

REFERENCE MATERIAL

Various bulk environmental samples are being collected, analytically verified, and stored for future use on behalf of the Work Group at the Canada Centre for Inland Waters. These reference materials will be used over several interlaboratory studies, providing a history of sample storage integrity, coupled with a running record of laboratories' performances on similar samples over time.

ENVIRONMENTAL SAMPLE ARCHIVE - SPECIMEN BANKING

Annex 12 of the Agreement calls for specimen banking. Specimen banking is essential to Great Lakes research, monitoring, and surveillance. The importance of such collections is illustrated through re-analysis of past samples, thereby providing information from the past on heretofore undetected residues. Such banking has been invaluable in establishing and following, over time, residue levels for mirex and chlorinated dioxins.

The Work Group has surveyed who has archived environmental samples.

INTRALABORATORY QUALITY CONTROL AND REPORTING LOW LEVEL RESULTS

The Work Group believes that all data obtained by a laboratory should be reported, unless an errant result is established rather than merely suspected. Analysts must not discriminate on individual data points, since they are virtually certain to be combined into data sets for interpretation.

The Work Groups' discussions on these issues have been reformatted and are being presently considered for adoption as a Standard Practice within ASTM Committee D-19 on water.

REVIEW AND REVISION OF OBJECTIVES

As an ongoing activity, the Aquatic Ecosystem Objectives Committee of the Science Advisory Board reviews the specific objectives in the Agreement, in response to Article IV, Section 2. That Committee is also investigating the feasibility of scientifically defensible objectives to protect beneficial uses from the combined effects of pollutants (Article IV, Section 3(a)).

POLLUTION FROM DREDGING ACTIVITIES - ARTICLE VI, SEC. I(g) AND ANNEX 7

Annex 7 of the 1978 Agreement assigned many of the considerations about dredging to a Dredging Subcommittee, under the auspices of the Water Quality Board. In January 1982, the Subcommittee published, "Guidelines and Register for Evaluation of Great Lakes Dredging Projects." The report summarizes existing dredging policies and practices, Great Lakes dredging activities, and proposed guidelines for evaluation of dredging projects. The report also provides detailed data about Great Lakes dredging projects conducted during 1975-1979.

Detailed dredging information has been compiled for 1980 and 1981 and is available at the Commission's Regional Office. The Subcommittee is also evaluating the practicality of the proposed guidelines, as applied to dredging and disposal activities at Toronto and Toledo Harbors. A contract study is under way to place dredging into an ecosystem perspective. Reports will be provided to the Water Quality Board in 1983.

NONPOINT SOURCE CONTROL TASK FORCE - ARTICLE VI, SECTION I(e)

The Water Quality Board established a Nonpoint Source Control Task Force in 1982. The Task Force will review the nature and extent of nonpoint control programs currently being undertaken by the Great Lakes jurisdictions, in response to the issues raised by the Pollution from Land Use Activities

Reference Group in its 1978 report to the Commission; the need for nonpoint source control programs for areas of concern, noted by the Board in Chapter 4; and the mandate given in the Agreement.

The Task Force will report to the Board in 1983. Their report will provide a basis for further Board evaluation on nonpoint management plans and control activities.

MUNICIPAL ABATEMENT PROGRAMS TASK FORCE

The Water Quality Programs Committee has established a Task Force for the Review of Municipal Abatement Programs. The Task Force is to review the effectiveness of the current municipal effluent control programs for conventional pollutants, phosphorus, and toxic substances by examining individual wastewater treatment systems, including sludge management. The Task Force will review in detail the contribution of municipal sources to the Great Lakes phosphorus budget. A final report is to be prepared for the 1983 Board Report.

1983 REPORT OF THE GREAT LAKES WATER QUALITY BOARD

In 1983, the Water Quality Board will prepare a comprehensive report on the status of the Great Lakes ecosystem and of programs being implemented by the Parties in meeting their commitment under the 1978 Agreement to restore, maintain, and enhance the integrity of the Great Lakes Basin ecosystem.

Regarding environmental conditions in the Great Lakes, the Board will report on:

1. The intensive surveys conducted in 1978/79 for Lake Erie and in 1980 for Lake Huron.

2. The nutrient enrichment status of the Great Lakes and their response to phosphorus controls.

3. Changes in concentrations of toxic substances of concern in biota, sediments, and water.

4. Major changes on the status of areas of concern or remedial programs.

5. The nature and extent of problems associated with pollutants in place in the sediment.

6. The intensive surveillance survey planned for 1983 for Lake Superior.

Regarding toxic substances, the Board will:

1. Provide a report on toxic substances which have been identified in various compartments in the Great Lakes ecosystem. This report will update reports prepared in 1976 and 1978.

2. Report on the development of the clearinghouse of existing sources of inventory and characteristics information.

3. Report on the priority lists which are to be developed for substances which are of concern because of possible human health or environmental impacts; substances for which additional characteristics information (e.g. toxicity, persistence, mutagenicity) is required; substances for which inventory information (production and use) is needed; and substances for which additional surveillance and monitoring is required, in order to establish their presence or absence in the Great Lakes or to provide information required to estimate exposure and assess risk.

4. Comment on the status of the contaminant problems in the Niagara River and efforts to resolve them.

Regarding phosphorus loading and controls, the Board will report:

1. Changes in total phosphorus loads to the Great Lakes over past ten years.

2. Status of compliance with phosphorus control requirements.

Regarding Agreement progress, the Board will:

1. Present a summary of compliance of municipal and industrial dischargers with jurisdictional pollution control requirements.

2. Present a comprehensive analysis of municipal abatement programs.

3. Review nonpoint source control programs which are being implemented.

4. Review the U.S. and Canadian Coast Guards' report on pollution from shipping activities.

5. Present recommendations regarding options for disposal of dredged material.

6. Present an analysis of the impacts of dredging activities on the Lake Erie ecosystem and an assessment of their significance compared to other activities and sources of pollution.

Appendix
Areas of Concern

INTRODUCTION

DEFINITION

An area of concern is identified when an Agreement objective or a jurisdictional standard, criterion, or guideline has been exceeded.

PROCEDURE

To identify, evaluate, and classify each area of concern from a technical perspective, all available environmental data - fish, sediment, and water - are used to provide as complete a description as possible. The 1978 Agreement objectives, along with jurisdictional standards, criteria, and guidelines, provide the basis for review and evaluation of these data. To the extent possible, the Board has established the human and environmental significance of the observed ecosystem quality. The Board has also established a cause-effect relationship between observed environmental conditions and the sources of environmental insult. This leads to a description of regulatory and remedial measures which have been implemented in response to the degraded environmental conditions in each area of concern.

Detailed information about present and proposed remedial programs is then evaluated, in order to decide whether environmental problems can be solved and beneficial uses restored.

DESCRIPTION OF CONCERN

In order to provide as complete a description and evaluation of all potential areas of concern, the following have been considered to the extent necessary and possible:

1. Compilation of surveillance and monitoring data for fish and other biota, sediment, water column, and air, in order to develop a description of present and historical conditions.

2. Comparison of these data with Agreement objectives and jurisdictional values in order to establish and substantiate duration and extent of any violations. Values for sediment and fish are given in Tables 6 and 7, respectively. Agreement objectives and jurisdictional values for water are presented where appropriate in the discussion of specific areas below.

3. Discussion of potential and observed environmental and human health effects and uses affected.

4. Information about biological community structure, e.g. types, relative abundance, and absolute abundance of benthos and fish. Consideration of how the community structure reflects and is a consequence of observed ecosystem quality and anthropogenic inputs. Discussion about the direction in which the community structure might

TABLE 6

GUIDELINES FOR CLASSIFICATION OF GREAT LAKES SEDIMENTS

(Concentrations in mg/kg dry weight)

	U. S. E P A			ONTARIO M O E
	NONPOLLUTED	MODERATELY POLLUTED	HEAVILY POLLUTED	
Volatile Solids	<50,000	50,000-80,000	>80,000	60,000
Chemical Oxygen Demand	<40,000	40,000-80,000	>80,000	50,000
Total Kjeldahl Nitrogen	<1,000	1,000- 2,000	>2,000	2,000
Oil and Greese	<1,000	1,000- 2,000	>2,000	1,500
Lead	<40	40- 60	>60	50
Zinc	<90	90- 200	>200	100
Mercury	<1	-	>1	0.3
Polychlorinated Biphenyl	<1	1- 10	>10	0.05
Ammonia	<75	75- 200	>200	100
Cyanide	<0.10	0.10- 0.25	>0.25	0.1
Phosphorus	<420	420- 650	>650	1,000
Iron	<17,000	17,000-25,000	>25,000	10,000
Nickel	<60	20- 50	>50	25
Manganese	<300	300- 500	>500	-
Arsenic	<3	3- 8	>8	8
Cadmium	-	-	>6	1
Chromium	<25	25- 75	>75	25
Barium	<20	20- 60	>60	-
Copper	<25	25- 50	>50	25

Discussion of the applicability and limitations of these guidelines is found in the report of the Dredging Subcommittee, "Guidelines and Register for Evaluation of Great Lakes Dredging Projects", 1982. The U.S. EPA guidelines are from the report, "Guidelines for Pollutional Classification of Great Lakes Harbor Sediments".

TABLE 7

MAXIMUM CONTAMINANT LEVELS IN FISH
(Concentrations in mg/kg wet weight)

PARAMETER	AGREEMENT OBJECTIVE (Edible portion)	U.S. FDA ACTION LEVEL (Edible portion)[b]	CANADA HEALTH PROTECTION GUIDELINE (Edible portion)
Aldrin/Dieldrin	0.3	0.3	-
DDT and Metabolites	1.0[a]	5.0	5.0
Endrin	0.3	0.3	-
Heptachlor/Heptachlor Epoxide	0.3	0.3	-
Lindane	0.3	0.3	-
Mirex	Substantially Absent	0.1	0.1[a]
Polychlorinated Biphenyls	0.1[a]	5.0	2.0[a]
Kepone	-	0.3	-
Mercury	0.5[a]	1.0	0.5
Toxaphene	-	5.0	-
2,3,7,8-TCDD (Dioxin)	-	0.00005	0.00002

a. Whole fish
b. Fillet with skin.

shift, and why, as a consequence of changes in ecosystem quality and in loadings.

5. Causes of violations. Specific point source dischargers and/or nonpoint inputs (including land runoff and the atmosphere) are named along with the loadings of substances for which violations are observed. If a violation is the result, in whole or in part, of a natural phenomenon, this is noted.

6. Remedial or corrective measures. Controls presently in place are described. These are evaluated to determine their present ability to control the release of a particular substance, the correctability of the problem, any modifications or additional measures required, and the probable cost. Observed and/or projected changes in ecosystem quality are described.

Consideration of the above information provides a common basis for selecting and evaluating areas of concern. This approach also establishes a comparable depth and breadth to the data base required to substantiate a concern.

EVALUATION OF ENVIRONMENTAL INFORMATION

Through consideration of the above information, the Water Quality Board prioritized areas of concern into two classes:

1. A Class "A" designation is assigned to those areas exhibiting significant environmental degradation, where impairment of beneficial uses is severe.

2. A Class "B" desingation is assigned to those areas exhibiting environmental degradation, where uses may be impaired.

The Board employed a set of guidelines to evaluate, from a technical perspective, available information for each area of concern, in order to prioritize that concern. The initial questions asked were:

1. Are one or more Agreement objectives or jurisdictional values violated?

2. Are values exceeded for a significant number of parameters? Which ones?

3. For each parameter, is the violation persistent over a number of repeat observations?

4. How many samples were taken? Over what period of time and what geographic area?

5. Is the value for each parameter exceeded by a significant amount?

6. How old are the data? Are such data still relevant?

A positive response to most of these questions would suggest a Class "A" or a Class "B" classification. A negative response would suggest that no further evaluation is required at the present time.

To further rank the relative severity of a problem, additional questions were considered:

7. Is a use impacted? Which one or ones?

8. Is the violation related to current discharges or historic accumulation?

9. Are there any transboundary implications?

If the responses were positive, then a Class "A" classification would be suggested.

Through consideration of available technical information, and through application of its professional judgement to help identify where the most severe problems exist, the Water Quality Board identified and reported on 18 Class "A" and 21 Class "B" areas of concern in its 1981 report. These 39 areas of concern are given in Table 8.

EVALUATION OF REMEDIAL PROGRAM INFORMATION

In this report, the Water Quality Board has evaluated specific information about present and proposed remedial programs, in order to decide whether environmental problems could be solved and beneficial uses restored. The Board considered:

1. The nature of the environmental problem.

2. The nature of the remedial programs in place or planned.

3. The schedule to initiate or complete these programs.

4. Factors which would preclude timely and satisfactory resolution of the problem and restoration of uses, including costs, technical considerations, and further definition of the issue.

5. Expected date by which the problems would be resolved and uses restored.

Based on its evaluation, the Board reached one of the following conclusions for each area of concern:

1. Remedial measures currently in operation will resolve the identified environmental problems and restore beneficial uses over the near term (5 to 10 years).

2. Remedial measures currently in operation will not resolve the identified problems and restore uses over the near term:

TABLE 8

CLASS "A" AND CLASS "B" AREAS OF CONCERN

CLASS "A"	CLASS "B"
LAKE SUPERIOR BASIN	
None	St. Louis River, Minnesota Thunder Bay, Ontario Nipigon Bay, Ontario Jackfish Bay, Ontario Peninsula Harbour, Ontario
LAKE MICHIGAN BASIN	
Fox River/Southern Green Bay, Wisconsin Milwaukee Estuary, Wisconsin Waukegan Harbor, Illinois Grand Calumet River and Indiana Harbor Canal, Indiana	Manistique River, Michigan Menominee River, Michigan-Wisconsin Sheboygan, Wisconsin Muskegon, Michigan White Lake, Montague, Michigan
LAKE HURON BASIN	
St. Marys River, Michigan and Ontario Saginaw River System and Saginaw Bay, Michigan	Spanish River Mouth, Ontario Penetang Bay to Sturgeon Bay, Ontario Collingwood, Ontario
LAKE ERIE BASIN	
St. Clair River, Ontario and Michigan Detroit River, Michigan and Ontario Rouge River, Michigan Raisin River, Michigan Maumee River, Ohio Black River, Ohio Cuyahoga River (Cleveland), Ohio Ashtabula River, Ohio	Clinton River, Michigan Wheatley Harbour, Ontario
LAKE ONTARIO BASIN	
Buffalo River, New York Niagara River, New York and Ontario Hamilton Harbour, Ontario	Eighteen Mile Creek, New York Rochester Embayment, New York Oswego River, New York Toronto Waterfront, Ontario Port Hope, Ontario Bay of Quinte, Ontario
ST. LAWRENCE RIVER	
Cornwall, Ontario-Massena, New York	None

A. However, additional programs and measures have been imposed, and these will be adequate and timely.

B. Additional programs and measures have been imposed, and environmental problems will eventually be resolved and uses restored. However, there is a long lag time between completion and operation of the remedial measures and the response of the environmental system.

C. Even though all reasonable remedial measures have been or are being taken, it is doubtful whether the environmental problems will be completely resolved and uses restored.

D. There are apparently no firm programs additionally planned that will resolve problems and restore uses.

3. Insufficient information has been received or is available in order to make a reasonable judgement as to whether control measures are adequate, or to decide when such measures may be required.

Presented below is information describing the environmental quality, discharges, and remedial measures for each Class "A" area of concern. This information has been updated and expanded from the material presented in Appendix II of the Board's 1981 report. Also presented below is the Board's evaluation of present and proposed remedial programs, and conclusions about whether and when environmental problems will be solved and beneficial uses restored.

The sources of information are given also below for each area of concern; the reader is referred to these for additional details. In general, the fish data for U.S. areas of concern were obtained from records compiled by EPA's Great Lakes National Program Office in Chicago. The sediment data for these areas were drawn primarily from reports prepared by the U.S. Army Corps of Engineers or by EPA; these reports are available through EPA's Great Lakes National Program Office. The U.S. water data are from STORET. The summaries of environmental data for Canadian areas of concern were provided by the Ontario Ministry of the Environment, Toronto. In addition, several jurisdictions have published special reports describing aspects of these areas in detail.

Information about Class "B" areas of concern is given in the Board's 1981 report. The Board has also compiled available information about other areas in the Great Lakes; this information is maintained at the Commission's Great Lakes Regional Office. These other areas are also being kept under close scrutiny and, where appropriate, the Board encourages the development of information to establish the nature and extent of uses impacted by discharges or by conditions existing within these areas.

FOX RIVER AND SOUTHERN GREEN BAY, WISCONSIN

ENVIRONMENTAL DATA

SEDIMENT

The sediments of the lower Fox River and the navigation channel leading out into Green Bay were examined in an intensive 1977 survey. Sediments in the river were grossly polluted, with high concentrations of volatile solids, chemical oxygen demand, total Kjeldahl nitrogen, oil and grease, mercury, phosphorus, lead, zinc, and ammonia. The sediments were also contaminated with PCB in excess of 10 mg/kg. Pollutant levels in sediments decrease away from the river mouth; at the end of the navigation channel, about 16 km from the river mouth, sediments are classified as unpolluted.

In the 1980 and 1981 sampling of sediments in the lower Fox River, all samples continued to show elevated levels of PCB - in the 4 to 6 mg/kg range - but down substantially from the greater than 10 mg/kg levels in 1977. The highest value was found at Highway 29 bridge in the city of Green Bay, 2.9 km above the river's mouth. DDT was also found at this location in the sediments and at another site closer to the bay itself.

FISH

Fish collected both upstream and at the mouth of the Fox River in 1978 and 1979 were analyzed for more than 20 metals and organic substances. Levels of PCB routinely exceed the U.S. FDA action level of 5.0 mg/kg; the maximum reported level is 90 mg/kg. DDT and mercury levels were below the FDA action level. Traces of pentachlorobenzene, α-BHC, HCB, nonachlor, pyridine carboxamide, tri-, tetra-, and pentachlorophenol, copper, and chromium have been reported.

PCB levels exceed the 5.0 mg/kg FDA action level in 18 of 30 fish samples collected from other tributaries to Green Bay: Duck Creek, Little Suamico River, Oconto River, Peshtigo River, Pensaukee River, Big Suamico River, and Red River. Subsequent sediment sampling, however, showed no detectable sources of PCB on these tributaries. Investigations also showed that the fish had migrated into the streams from the bay.

Fish sampling in 1980 in the 11.7 km sector below the DePere Dam found 8 of the 9 samples exceeding the PCB action level. PCB levels decreased above the dam with only one sample exceeding the action limit. In 1981, 9 of the 11 fish samples on the lower Fox River exceeded the PCB action level.

WATER

Five automatic monitoring stations are located in the 64.4 km (40.0 miles) stretch of the lower Fox River between the outlet of Lake Winnebago and the stream's mouth at Green Bay. These stations have been operational since 1971. They are polled hourly by computers providing electronically sensed data on four or five parameters including dissolved oxygen, pH, temperature, and specific conductivity. The data are stored directly in the computer for later statistical comparison and/or printed out on the teletype. Stations can be contacted manually at other times.

Additionally, since 1959 a monitoring station has been maintained near the mouth in the DePere-Green Bay section where samples are collected monthly for a broader range of chemical testing. Fish, sediment, and biological sampling is done routinely at the station too, but at less frequent intervals.

There is a series of dams in the lower Fox River but negligible storage capacity below Lake Winnebago. Tributary inflow to the Fox River in this section is of little significance. A stream flow gauging station is located at Rapid Croche Dam, near the mid-point of the lower Fox River section, and its flow is considered applicable throughout the stream sector. For 84 years of stream flow records through the 1980 water year, the average flow was 117 cubic metres per second (4,163 cubic feet per second) and the most recent determination of $Q_{7,10}$ (minimum 7 days flow in 10 years) is 27 m^3/s (950 ft^3/s).

Generally the worst stream conditions at the automatic monitoring stations have been found at Rapid Croche Dam. For comparison, data at that station for the month of August are shown for 1972, 1980, and 1981. The base year, 1972, was chosen because there was little advanced wastewater treatment along the Fox River at that time and flow and temperatures were similar to those in 1981.

RAPID CROCHE DAM - AUGUST MONITORING DATA

				Change	
	1972	1980	1981	1980 to 1981	1972 to 1981
Max. Daily Ave. D.O. (mg/L)	2.46	8.48	9.80	1.32	7.34
Min. Daily Ave. D.O. (mg/L)	0.00	6.63	4.43	-2.20	4.43
Ave. Monthly D.O. (mg/L)	0.74	7.73	7.74	0.01	7.00
Ave. Monthly Temp. (^0F)	76.2	75.0	76.5	1.5	0.3
Ave. Monthly pH	7.82	9.10	8.50	-0.6	0.68
Ave. Monthly Flow (ft^3/s)	2,334	3,804	2,046	-1,758	-283
Min. Daily Fow (ft^3/s)	1,335	1,598	1,556	-42	221

Total phosphorus analysis was conducted on the monthly samples collected in the Green Bay-DePere area. For calendar years 1972, 1980, and 1981 the respective total phosphorus averages were 0.20, 0.19, and 0.14 mg/L.

Ammonia can be detrimental to water quality in different ways. In its decomposition and stabilization, each part of ammonia requires 4.44 parts of oxygen for conversion to the end products of nitrates and water and, in so doing, can remove sizeable amounts of the water's dissolved oxygen. This stabilization of the nitrogeneous materials does not start to take place until most of the carbonaceous material is oxidized. Extensive mathematical modelling of the lower Fox River from the outlet of Lake Winnebago to the DePere Dam - 64.4 km to 11.7 km from the mouth - does not show that a significant problem exists or is likely. Studies of the downstream portion from the DePere Dam and in southern Green Bay are continuing.

Ammonia is toxic at fairly low levels. As the pH increase, the ammonium/ammonia equilibrium is shifted further toward higher concentrations of the latter. Algal activity can contribute to pH increases. Although no toxic problems have been observed, it is believed there is a potential for such near the mouth of the Fox River and for some distance out into Green Bay.

Nitrogen and phosphorus are considered as key nutrients in the eutrophication of a body of water. Nitrogen as ammonium, ammonia, and nitrates is directly utilizable by aquatic plants and algae, and eutrophic growths can result. Both Lake Winnebago and southern Green Bay have historic eutrophication problems, and the additional impacts from industrial and municipal discharges have not been determined with any certainty.

Significant sources of ammonium discharges occur in the Lower Fox River. Monthly average effluent concentrations of ammonium from municipal installations are about 15 mg/L at Appleton, 10 to 15 mg/L at Heart of the Valley, and 35 to 55 mg/L at Green Bay. Levels of 10 to 30 mg/L at Ford Howard Paper, Green Bay; 3 to 200 mg/L at Nicolet Paper, DePere; and 5 to 40 mg/L at Consolidated Papers, Appleton make up the list of significant industrial discharges of ammonia to the Fox River.

CAUSES AND REMEDIAL MEASURES

The lower Fox River has the largest concentration of pulp and paper facilities in the Great Lakes Basin. Sixteen mills discharge treated wastes directly to the Fox River while five other mills route all of their wastewaters to local municipalities for treatment and subsequent discharge to the same stream. Over the past decade, the industry has made significant reductions in their discharge of suspended solids and BOD as noted in the 1981 report of the Pulp and Paper Task Force to the Water Quality Board.

Municipal discharges are the second most significant source of pollutants on the lower Fox River. Besides handling all domestic wastes from their jurisdictions, the seven major municipal treatment systems treat the total wastewater loads from 5 pulp and paper mills (some of the waste streams from other mills provide their own treatment), and essentially all wastes from other wet industries such as those involved in meat, milk, and vegetable processing. All these municipalities provide phosphorus removal and, with the exception of Appleton, which was under construction, were meeting the 1.0 mg/L phosphorus discharge requirement. The 1981 average total phosphorus discharge for Appleton was 1.4 mg/L. The flow-weighted average for the other 6 dischargers was 0.55 mg/L.

A study to determine the phosphorus budget and dynamics for Green Bay, its relation to phytoplankton growth, and how the phytoplankton affects the oxygen resources versus the effects from organic loading is underway by investigators at Michigan Technological University, Houghton, Michigan.

Dischargers must meet permit requirements and are required to provide detailed records of treatment plant performance. For the 16 pulp and paper mills, this means a daily record of treatment plant performance and stream loadings. The mills have increased production by about 50% in the past 10 years. The population served by the municipal treatment plants has at least equalled the 7% county-wide gain shown in the 1970 and 1980 censuses and totals an estimated 240,000 to 250,000 people. The Wisconsin Department of Natural Resources' Lake Michigan District Office, Green Bay, has a team of experienced professionals on operation and maintenance to ensure that treatment plant performance continues at a high level.

LOWER FOX RIVER POLLUTIONAL LOADINGS
(Kilograms per day)

	1972	1980	1981	Percent Change 1980 to 1981	Percent Change 1972 to 1981
Pulp and Paper					
BOD	122,420	15,300	13,782	-9.9	-88.7
Suspended Solids	97,500	16,775	15,223	-9.3	-84.4
Municipal					
BOD	17,547	6,275	5,436	-13.4	-69.0
Suspended Solids	17,376	6,041	4,857	-19.6	-72.0
Combined					
BOD	139,967	21,575	19,218	-10.9	-86.3
Suspended Solids	114,876	22,816	20,080	-12.0	-82.5

The 1981 records show that Consolidated Papers at Appleton and Appleton Papers discharged average phosphorus concentrations of 3.8 and 1.1 mg/L respectively. These are above the Agreement goal of 1.0 mg/L. Phosphorus in these cases may be from excesses used in the wastewater treatment process.

Three of the pulp and paper mills on the lower Fox River recycle paper that may contain PCBs: Wisconsin Tissue, Bergstrom Paper Company, and Fort Howard Paper Company. High removal of PCB with the treatment plant sludges is likely, although an effluent sample from the Fort Howard mill was found to contain 4.0 ug/L. Paper recycling operations are specifically exempted by state law from restrictions on the use of PCB-containing materials.

The Wisconsin Department of Natural Resources has established the total maximum daily loadings of BOD which can be assimilated in the Fox River above the DePere Dam and still maintain state water quality standards for fish protection. These allowable loadings have been established for varying conditions of river flow and temperature in three separate reaches of the river. This assimilative capacity has been allocated, through the permit process, to the various dischargers in each reach. The allocation for each individual discharger is proportional to the quantity of BOD which would be allowed under the categorical effluent standards program.

Wasteload allocations will be in effect on July 1, 1983 for most of the lower Fox River and are under development for the point sources in the DePere-Green Bay sector. Waste load allocations, including ammonia restrictions, for the entire lower Fox River will become effective January 1, 1985. Facilities for treating BOD and suspended solids are essentially in full operation now. The use of highly efficient wastewater treatment technology has resulted in current discharges from the pulp and paper mills to be less than one-half the quantity permitted under the categorical treatment standards. (The combined permit averages for BOD and suspended solids - 35,646 and 51,113 kg/d, respectively - compares to the 13,782 and 15,223 kg/d actually discharged by the pulp and paper mills in this stream section.) Further reductions called for by waste load allocations are expected to be achieved by reduced production and waste storage. It also appears that substantial ammonia reductions could be attained by changing industrial production methods. This will likely be explored in lieu of treatment.

Ammonia concentrations in the effluents from facilities at Heart of the Valley and Appleton are probably in line with what would be expected for the type of treatment and a municipal waste. The Consolidated and the Fort Howard plants both have biological type treatment units which require nutrient additions, including ammonia. High ammonium readings at Nicolet Paper are from problems associated with an ammonia-based coating process. The Green Bay Metro Plant receives high strength ammonium wastes from the Proctor and Gamble ammonium bisulfite pulping operations at their Fox River Mill; and from the use of ammonia to neutralize wastes at the James River Paper Mill, formerly American Can Company.

Consolidated Papers at Appleton will permanently discontinue operations by October 1, 1982. Nicolet Paper's recent discharge permit gives them until July 1, 1984 to correct their ammonia problem. Fort Howard Paper and the Green Bay metropolitan facility are in the DePere-Green Bay section of the lower Fox River which is under study and mathematical modelling. This section is tentatively scheduled to be subject to waste load allocations, including temperature/flow/ammonia requirements, if necessary, by January 1, 1985.

Emphasis is also being given to control of toxic materials released by the pulp and paper making processes. As part of their reapplication for reissued WPDES permits, individual mills were required to analyze their effluents for the U.S. EPA list of priority pollutants. They were also asked to assess their pulp and papermaking processes to determine the potential sources of toxic contaminants in the wastewater. Permit applications and other information sources were reviewed for deleterious concentrations of toxic pollutants. Although specific limitations on toxic pollutants were not placed in permits (ammonia limitations were, however, included in some cases), some mills are required to conduct additional monitoring, including bioassays, to more clearly define the presence of toxic substances in their effluents. In addition, the Wisconsin Department of Natural Resources is initiating a trend monitoring program for selected toxic substances and a PCB "hot-spot" identification study on the river. Inventory studies (e.g. Sullivan and Delfino's 1982 report, "A Select Inventory of Chemicals Used in Wisconsin's Lower Fox River Basin") are helpful in designing such monitoring programs.

ASSESSMENT

A big improvement has been made in the water quality of the lower Fox River in the past 10 years, and all waste discharges are now essentially in compliance with their permit requirements. When the wasteload allocations are in effect for the DePere-Green Bay dischargers, tentatively scheduled for January 1, 1985, water quality standards should consistently be met with respect to dissolved oxygen and suspended solids. Reduced production and waste storage, rather than treatment are expected to be the principal ways in meeting waste load allocations during periods of low stream flows and high temperatures.

Wisconsin has prohibited the use of dieldrin and DDT and the manufacture and most uses of PCB. Point sources of these can be eliminated as they are identified but diffuse sources will persist in the environment for some time. The Wisconsin Department of Natural Resources is continuing an active program for the identification and control of toxic substances.

INFORMATION SOURCES

For specific information regarding the lower Fox River and Southern Green Bay, please refer to the following reports:

1. Sullivan, J.R. and Delfino, J.J., "A Select Inventory of Chemicals Used in Wisconsin's Lower Fox River Basin." University of Wisconsin Sea Grant Institute WIS-SG-82-238, March 1982, Madison, WI.

2. Christianson, R., "Wisconsin's Approach to Developing Waste Load Allocations", J. Water Poll. Contr. Fed., Vol. 51, No. 3, March 1979, pp. 630-635.

3. "Waste Load Allocated Water Quality Related Effluent Limitations." Wisconsin Department of Natural Resources Regulations, Chapter NR212, Wisconsin Administrative Code, Register, No. 309, September 1981.

Additional specific information about the lower Fox River and southern Green Bay can be obtained from the files and reports of the Wisconsin Department of Natural Resources, P.O. Box 7921, Madison, Wisconsin 53707.

Five stations on the lower Fox River are automatically polled hourly for temperature, dissolved oxygen, pH, and conductance. This information is routinely summarized on a monthly basis for averages, maxima, and minima, as well as stream flow. The data may also be displayed graphically by day, week, month, or year. Contact: Bruce Fenske, Water Quality Evaluation Section.

The ambient monitoring station in the DePere-Green Bay section of the lower Fox River is part of the statewide monitoring network and is sampled monthly for chemical parameters and about annually for fish and benthos. The network has been operational since 1961 and data collected have been published through 1980. Contact: Carol Tiegs, Water Quality Evaluation Section.

Mathematical modelling of the lower Fox River is under the immediate direction of Dale Patterson, Water Quality Evaluation Section. He and Mike Llewelyn, Water Quality Planning, with staff assistance from the Municipal and Industrial Wastewater Sections, generally guide wasteload allocations.

Additional general information about both the lower Fox River and southern Green Bay and the Milwaukee Estuary can also be obtained from the Wisconsin Department of Natural Resources.

Municipal and industrial loading information was obtained from monthly discharge monitoring reports submitted by the industries and the municipalities. The loadings are usually based on the arithmetic average of daily counts. An annual summary of pulp and paper mill discharges is made, showing the daily averages by month and year, together with the average discharges called for in the WPDES discharge permit. Contacts: Paul Didier, Chief, Industrial Wastewater Section, and Chuck Ledin, Municipal Wastewater Section.

Information about toxic substances in fish was extracted from the annual reports of the Coastal Zone Project. A bibliography of toxic substances reports published by the Wisconsin Department of Natural Resources has also been prepared. Contact: Tom Sheffy.

The Department's Bureau of Water Quality Management has prepared a list of major research, survey, and investigative activities for the period July 1, 1980 through June 30, 1982. A bibliography of water quality reports published by the Department has also been prepared. Contact: F.H. Schraufnagel.

The U.S. Geological Survey prepares an annual report showing daily average stream flows at principal gauging stations, with physical and chemical data also collected for streams and rivers in Wisconsin.

MILWAUKEE ESTUARY, WISCONSIN

ENVIRONMENTAL DATA

SEDIMENT

Surveys conducted in 1973 and in 1980 reveal that the sediments in Milwaukee Harbor are heavily polluted, according to EPA's "Guidelines". The sediments contain high levels of oil and grease, chemical oxygen demand, total Kjeldahl nitrogen, total phosphorus, lead, zinc, cadmium, and copper. The 1980 surveys also showed portions of the estuary to have PCB levels in excess of 50 mg/kg.

Further 1980 and 1981 sampling was reported in the October 1981 Departmental publication to Coastal Zone Management on the Toxic Substances Survey project. This report indicated that sediment contamination in the Milwaukee River can be divided into 3 reaches. The first, between the mouth and Hampton Avenue, shows an average PCB sediment level of 9.60 mg/kg. The second, from Silver Spring Drive to County Highway C below Grafton, shows an average PCB level of 0.28 mg/kg. A sediment sample from Cedar Creek, which flows into the Milwaukee River below County C, showed a PCB level of 0.73 mg/kg below the Cedarburg sewage treatment plant. In the third reach, above Grafton, PCB levels were below detection limits.

Detectable levels of DDT (0.19 mg/kg average) were confined to the reach from the mouth to Silver Spring Drive. Four sediment samples from the Woolen Mills impoundment at West Bend shows this area to be a low-level source of PCB, DDT, and chlordane. Average values for these residues were 0.28, 0.13, and 0.04 mg/kg, respectively. Dieldrin was not detected in any sample.

The other two rivers draining the Milwaukee metropolitan basin also displayed measurable amounts of sediment contamination. PCB was identified in the Menomonee River sediment from Highway 100 downstream to its mouth. Three samples were taken in the Kinnickinnic River between Kinnickinnic Avenue and Jackson Park; elevated levels of PCB were found in all three with the highest nearest the mouth. Chlordane (0.02 mg/kg) was found at Kinnickinnic Avenue.

FISH

Fish collected in 1978 and 1979 surveys by the Wisconsin Department of Natural Resources were found to be heavily contaminated with PCB; the maximum observed level is 88 mg/kg; the FDA action level is 5.0 mg/kg. DDT in some fish exceeds the Agreement objective of 1.0 mg/kg; the maximum observed level is 2.98 mg/kg. Also present in the fish at trace levels or present but not quantified are hexachlorobenzene, α- and γ-BHC, cis- and trans-chlordane, dieldrin, trans-nonachlor, mercury, copper, and chromium.

The 1981 Toxic Substances Survey report showed that all 11 fish samples from the three rivers in 1980 exceeded the PCB action level, with a range of 8.6 to 88.0 mg/kg. One sample from the Kinnickinnic River exceeded the chlordane action level. The 1981 extensive sampling of the Milwaukee River fish revealed a PCB problem area extending from the mouth upstream to Grafton. Fifteen of the 23 samples in this area exceeded the PCB action level with a range of 5 to 49 mg/kg. Fish from the Kinnickinnic River in 1981 continued to show PCB values above acceptable levels.

WATER

Water samples collected in 1976 from Milwaukee Harbor exceed the Agreement objectives for conductivity, ammonia, zinc, cadmium, mercury, lead, and copper. Note: Little new water quality data are available for the Milwaukee Harbor at this time. The current harbor/estuary study is generating considerable data, but it is mainly for design purposes, has not been adequately analyzed to date, and toxics coverage probably is minimal.

PCB (1.0 µg/L) was detected in the final effluent to the Milwaukee River at the Saukville sewage treatment plant. Dieldrin (0.1 µg/L) and DDT (0.89 µg/L) were detected in the Butler storm sewer discharge to the Menomonee River at 124th Street and Villard Avenue. More intensive sampling is required to determine the exact sources of these microcontaminants.

Dieldrin and DDT were also detected in the leachate from the Woolen Mills landfill at West Bend. Two samples were taken, one of which showed dieldrin (0.07 µg/L) and both of which showed DDT (0.73 µg/L average).

The Milwaukee Health Department has found that bacterial counts increase at area beaches as a result of combined sewer overflows after heavy rainfall. Beaches are therefore subject to a two-day closure, as a precautionary measure, whenever rainfall exceed 0.60 inches. In 1981, South Shore Park was closed 3 times for a total of 7 days, out of a 68-day swimming season.

CAUSES AND REMEDIAL MEASURES

The Milwaukee Estuary is heavily developed and highly industrialized. However, the current water quality problems are primarily related to combined sewer overflows and in-place pollutants. The combined sewer effluents contain significant amounts of heavy metals in addition to the normal oxygen-demanding materials, oil, and nutrients. In June 1981, the Milwaukee Metropolitan Sewerage District obtained approval of a comprehensive Master Facilities Plan for upgrading its facilities to meet federal and state clean water laws. The Milwaukee Water Pollution Abatement Program is estimated to cost $1.6 billion in 1982 dollars. Over $300 million in work has already been completed or is under contract. Following are the court-ordered deadlines for completing the initial plan elements:

1. July 1, 1982 for meeting treatment standards during dry weather periods.

2. July 1, 1983 for completion of relief sewers.

3. July 1, 1986 for elimination of wet-weather bypassing in the separated sewer area.

4. July 1, 1993 for correction of the combined sewer overflow problem, if sufficient grant funds are available. If they are not, minimum expenditures of $13 million (in 1976 dollars) per year until the combined sewer overflow project is completed.

The current treatment facilities have highly efficient phosphorus removal systems and consistently meet secondary treatment requirements during dry weather periods. The Milwaukee Metropolitan Sewerage District is presently developing a pretreatment control program to help reduce the industrial impact on sludge and on treatment plant effluent quality.

A pretreatment standard for cadmium has been enacted by the Sewerage District. As a result, pretreatment installed by one industry has reduced the cadmium content of Milwaukee's sludge product, Milorganite, to one-half of previous levels. Standards have been developed, and are undergoing public review for zinc, nickel, copper, and lead.

The primary rationale for these pretreatment standards is to reduce the metals content in sludge and thus extend the site life for land applications. An additional advantage of pretreatment is the removal of toxic and gross pollutants that would otherwise discharge to surface waters during periods of combined sewer overflows. In accordance with Milwaukee's WPDES permit, the Sanitary District must have an approved pretreatment program by July 1, 1983.

Due to high levels of PCB found in fish native to the estuary and its tributaries, U.S. EPA conducted a special sediment survey in 1980. The results showed that, overall, the contamination level in the inner harbor area was lower than expected. Investigations under the Toxic Substances Control Act were conducted by U.S. EPA to identify the potential sources of the PCB "hot spots".

The Milwaukee Metropolitan Sewerage Commission is conducting a comprehensive study of the harbor/estuary to establish the level of pollution abatement needed for the combined sewer overflows. The study completion date is scheduled for December 1984. Pollution abatement for the combined sewer overflows is anticipated to rely on conveyance and storage facilities to intercept flows that would otherwise spill and store these flows until capacity is available at the treatment plants. The results of the study will determine the amount of storage volume needed. Additional planning efforts will then determine costs. These costs, in addition to the provisions of the court order Milwaukee is under, will determine the length of time required to complete the abatement works. While the study is being conducted, overflows from the separated sewer area and treatment plant deficiencies are being corrected.

ASSESSMENT

Some of the contaminants in the Milwaukee Harbor and lower parts of the Milwaukee, Kinnickinnic, and Menomonee Rivers are also found upstream. Indications are that diffuse sources or discontinued operations are or were involved. Wisconsin banned the use of dieldrin and DDT in the late 1960's

and, effective July 1, 1977, with some exemptions, prohibited the manufacture and purchase for use of substances containing PCB. Although the Wisconsin Department of Natural Resources continues to seek upstream sources to eliminate, these contaminants could persist in the aquatic environment for some time.

Also, with the correction of sewage overflows and treatment plant deficiencies, the Milwaukee Estuary problem will continue as a major pollution problem until the combined sewer overflows in the metropolitan area can be addressed. Complying with the court ordered clean-up of the combined sewer overflows and possibly the implementation of measures to mitigate the in-place pollutants, should eliminate the area of concern. This is a costly undertaking, and completing installation of the facilities in a reasonable amount of time, 10 to 12 years, will rely on funding at the level of $20 million (1982 dollars) per year in local funds and $20 million (1982 dollars) per year in state aid from the newly created Combined Sewer Overflow Fund.

The schedule to resolve the environmental problems should be nearly identical to the schedule to place the controls into operation, although some lag might be expected, depending on the specific problem involved. It should be noted that, although the final date for the combined sewer overflow problem correction is July 1, 1993, work is proceeding and the problem is not 100 percent uncorrected until that time.

INFORMATION SOURCES

For specific information regarding the Milwaukee Estuary, please refer to the report, "Study Design for the Milwaukee Harbor Estuary Comprehensive Water Resources Planning Program," prepared by the Southeastern Wisconsin Regional Planning Commission (SEWRPC) in September 1981.

The interests of the state of Wisconsin and its Department of Natural Resources, insofar as the court stipulation, agreements, and follow-up on progress is concerned, are handled by Jay Hochmuth, Special Assistant for Milwaukee Metropolitan Environmental Affairs.

General information sources are given at the end of the presentation for the lower Fox River and southern Green Bay.

WAUKEGAN HARBOR, ILLINOIS

ENVIRONMENTAL DATA

Data obtained by U.S. EPA since October 1978 were subject to a protective order issued by the court at the request of Outboard Marine Corporation. The order was lifted in mid-June 1981. These data are now available from U.S. EPA, Region V, Chicago.

SEDIMENT

The sediments in Waukegan Harbor and the nearby North Ditch, a tributary to Lake Michigan, are grossly contaminated with PCB. Levels up to 500,000 and 380,000 mg/kg have been found in Slip No. 3 in the harbor and in North Ditch, respectively.

FISH

PCB contaminant levels (whole fish) for samples of fish collected in the harbor over a four year period are listed below:

Date of Collection	Number of Samples	Average Concentration of Total PCB in in Whole Fish (mg/kg)	Number of Samples Exceeding 5 mg/kg U.S. FDA Action Level for Edible Portion of Fish
August 1978	9	18.9	6
May and July 1979	9	29.7	8
September 1980	7	77.4	5
July 1981	4	8.2	1

A 1980 study demonstrated that uncontaminated fish exposed to water from Slip No. 3 for thirty days achieved PCB levels of 20 mg/kg. After an 84-day reacclimation period in open-lake water, the PCB levels did not drop below 8 mg/kg. The U.S. FDA action level for PCB in fish is 5.0 mg/kg.

WATER

PCB levels in water in Waukegan Harbor range from 0.1 µg/L to several µg/L in Slip No. 3.

CAUSES AND REMEDIAL MEASURES

The Outboard Marine Corporation (OMC) has an aluminum die-casting facility located between Waukegan Harbor and the North Ditch, a tributary to Lake Michigan. The facility had purchased 8.4 million pounds of PCB as hydraulic fluids from Monsanto Company between 1959 and 1972, and it is estimated that an additional 1.5 million pounds were purchased between 1954 and 1959. OMC has estimated that as much as 15 to 20% (1.5 to 2.0 million pounds) of these PCB may have been released to the environment. A U.S. EPA consultant estimated in a 1981 report that about 350,000 pounds of PCB remain in the harbor sediments and about 500,000 pounds remain the North Ditch sediments.

Initial actions taken in 1976 by the U.S. EPA and the Illinois EPA were successful in substantially reducing the PCB load from the facility's discharges. However, the residual PCB contamination of sediments and soils in the harbor, North Ditch, and the facility's property continue to impact the surrounding area.

The U.S. EPA and the Illinois EPA filed suit against OMC in 1978 and against Monsanto in 1980 for a remedy to the PCB contamination. Trial is now scheduled for December 1982.

Substantial engineering work on alternative mitigative measures has been done by U.S. EPA in support of the lawsuit as well as for potential government clean up under the Comprehensive Environmental Response, Compensation and Liability Act (Superfund).

The warning signs against consumption of fish caught in the harbor posted by the Lake County Health Department in 1980 remain in place.

The U.S. Army Corps of Engineers has a study underway to identify a suitable disposal site for sediments to be dredged from the federally maintained portions of the harbor. In the meantime, dredging is only being conducted outside of the breakwaters in the entrance channel where accumulated material is uncontaminated, being primarily littoral drift sand from Lake Michigan.

U.S. EPA, which has been pursuing remedies through the lawsuit as well as Superfund, has now decided to concentrate on the lawsuit. Consequently, on May 7, 1982, U.S. EPA withdrew its application to the U.S. Army Corps of Engineers, Chicago District, for the dredge and fill permit under the provision of Section 404 of the Clean Water Act of 1977. The Corps acknowledged the withdrawal of the application and advised the Illinois EPA. This action by U.S. EPA obviates the need of the Illinois EPA to continue work on the water quality certification, required by Section 401 of the Clean Water Act; lacking an active application, no certification is necessary.

The Illinois EPA also has received an application for a permit to construct retaining lagoons and filter systems to receive the dredged material. A review had been completed and comments addressed to U.S. EPA on the facilities. At present the application lies dormant, since the Section 404 dredge and fill permit application was withdrawn.

ASSESSMENT

Since resolution of this environmental problem is the subject of extensive litigation involving several parties, remedial controls and reclamation programs have not been specified as of this date. Therefore, assessment of their adequacy is impossible.

INFORMATION SOURCES

Information about environmental conditions in Waukegan Harbor and about the status of remedial programs may be obtained from:

Great Lakes National Program Office
U.S. Environmental Protection Agency
536 South Clark Street
Chicago, Illinois 60605

Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

GRAND CALUMET RIVER AND INDIANA HARBOR CANAL, INDIANA

ENVIRONMENTAL DATA - RIVER AND CANAL

SEDIMENT

Sediment surveys conducted from 1977 to 1980 confirm that all sediments in

Indiana Harbor Canal and the Grand Calumet River are heavily polluted for all conventional pollutants and heavy metals, and have high levels of organic chemicals associated with heavy industry. The concentrations of pollutants are among the highest reported in the Great Lakes System. Maximum observed concentrations for representative substances are: oil and grease 175,000 mg/kg (17.51%), volatile solids 609,000 mg/kg (60.9%), iron 326,000 mg/kg (32.6%), chemical oxygen demand 415,700 mg/kg (41.57%), total phosphorus 15,000 mg/kg, lead 15,000 mg/kg, zinc 13,000 mg/kg, chromium 2,000 mg/kg, and PCB 89.22 mg/kg.

FISH AND MACROINVERTEBRATES

Fish are observed in the area only occasionally. In 1980, the Indiana Stream Pollution Control Board and U.S. EPA captured several fish from the Indiana Harbor Canal for contaminant analyses: carp (some with fins rotted off), a spotfin shiner, and a yellow perch. Several organic substances were reported as present, including PCB, α-BHC, hexachlorobenzene, pentachloroanisole, cis-nonachlor, cis- and trans-chlordane, oxychlordane, p,p'-DDD, p,p'-DDE, and dieldrin. Based on the total absence of fish in the Canal at other times that collections were attempted, and considering the small size and the condition of the fish that were collected, these fish were likely not indigenous to the area but were washed in during heavy flow periods.

A macroinvertebrate sampling program was carried out in 1979. When recovered, the sampler plates were covered with oily silt and sludge. A few segments which appeared to be portions of oligochaetes were found on the plates, but no other organisms were present.

A 1980 sampling program confirmed the presence of oligochaetes and an extremely small number of other macroinvertebrates.

WATER

Two water surveys conducted in 1978 showed that the Agreement objectives were exceeded for copper, iron, mercury, zinc, ammonia, phenol, and conductivity. The maximum cyanide level was 87 μg/L, and the maximum observed PCB concentration was 17 μg/L.

A water survey conducted by U.S. EPA in 1980 showed that the Agreement objectives were exceeded for copper, lead, selenium, iron, zinc, ammonia, and phenolics. Indiana water quality standards were exceeded for ammonia, cyanide, phenol, total phosphorus, chloride, fluoride, mercury, and oil and grease. The maximum cyanide level was 320 μg/L.

SURVEILLANCE DATA - NEARSHORE LAKE MICHIGAN

Outflow from the Grand Calumet River and Indiana Harbor Canal also has an adverse environmental impact on the adjacent nearshore area of Lake Michigan.

WATER

Based on intensive sampling by the Indiana Stream Pollution Control Board, in cooperation with the Indiana Department of Natural Resources, in 1980 and 1981, elevated concentrations or violations were found for cadmium, phenol,

and ammonia in the nearshore area of Lake Michigan. In addition, phosphorus, chloride, and sulphate concentrations appear to be increasing.

The extent to which the Agreement objective for cadmium (0.2 µg/L) is exceeded is not clear, since the analytical detection limit was 1.0 µg/L. Ninety-one percent (540 out of 596) of the samples were less than the detection limit. How many of these would have been less than 0.2 µg/L is unknown. The Indiana water quality standard for cadmium (10 µg/L) was not, however, exceeded.

Phosphorus concentrations appear to have increased slightly from 1980 to 1981, but are well below the Indiana water quality standards of 0.30 mg/L average and 0.40 mg/L maximum. Chloride and sulphate appear to be increasing but do not exceed Indiana water quality standards (15 mg/L monthly average and 20 mg/L daily maximum, and 26 mg/L monthly average and 50 mg/L daily maximum, respectively).

Violations of bacteriological standards for whole body contact continue periodically following rainfall. The beach at Hammond Lake Front Park remains permanently closed, and the beach at Jerose Park, in East Chicago, was closed during 1981. The four other beaches along the Lake Michigan shoreline in Lake County, Indiana were open for the 1981 season.

FISH

The 1981 annual fish flesh survey near Michigan City, included analysis of the anterior steak of lake trout, ranging from 22 to 32 inches and from 4 through 9 years of age. Violative concentrations were found for PCB, total chlordane, total DDT, and dieldrin. Pollutants not detected were heptachlor, aldrin, p,p'-methoxychlor, o,p'-methoxychlor, and endrin; γ-BHC was detected in only a few fish. All other pollutants checked were below violative concentrations, including mercury, pentachloroanisole, heptachlor epoxide, and hexachlorobenzene.

REMEDIAL MEASURES AND ASSESSMENT

The Grand Calumet River and Indiana Harbor Ship Canal, no more than 13 miles in total length, predominantly consist of treated industrial and municipal wastewater and storm runoff with little, if any, "natural" flow. Recognizing this, as well as other unnatural features of these waterways, the Indiana Stream Pollution Control Board has designated these waters for partial body contact, limited aquatic life, and industrial water supply use only. The Board has established water quality standards and effluent limits to obtain these limited uses, as well as to protect the water quality and higher uses of Lake Michigan. It is doubtful that the river and harbor will ever meet some Agreement objectives and that these waters will be suitable to support all uses.

The major industrial facilities discharging to this watershed were in compliance with their permit requirements in 1980. The permits are being reviewed by the Indiana Department of Health to determine whether additional requirements may be needed for control of toxic substances.

Sulphate and chloride increases are caused by wastewater treatment techniques to reduce cyanide in steel plant discharges and constitute a trade-off, presumably for the better. These increases will continue, accelerated by cyanide reduction wastewater treatment techniques. Whether or not such increases are a significant ecological concern is unknown.

Phenols originate from steel plant and oil refinery discharges but, while exceeding the objective in some areas, do not cause taste problems for Indiana municipal water treatment plants. U.S. Steel and the sole remaining refinery, AMOCO, are meeting best practicable technology limits, and U.S. Steel is close to meeting best available technology limits. Other steel mills, however, discharge their phenolic wastewater to the East Chicago sewerage system, which passes through the treatment plant with little effective treatment.

A special "sweep" of the area by U.S. EPA, Indiana, and local agency staff identified a large number of industrial waste landfills in the northwest Indiana area. Some of these have contaminated seepage and runoff to Indiana Harbor and its tributaries. As information becomes available, U.S. EPA is taking appropriate action under Section 311 of the Clean Water Act to contain these inputs. Where needed, responsible parties are being taken to state and federal courts to ensure that the necessary abatement measures are taken.

The East Chicago wastewater treatment facility was not in compliance with its NPDES permit requirements in 1980, including requirements for phenol and ammonia. Some phenol violations will persist in the receiving water unless the steel companies discharging into the East Chicago sewerage system provide pretreatment. However, existing violations do not affect Indiana water treatment and should not affect Chicago. Recent Indiana Stream Pollution Control Board lake surveys show no concentrations above detection limits (2.0 µg/L) outside Indiana waters.

Ammonia violations occur primarily because the East Chicago wastewater treatment facility receives high ammonia-bearing wastewater from area steel mills. An ammonia effluent limitation has been imposed in the facility's NPDES permit which, if met, should result in the elimination of violations in the nearshore area of Lake Michigan. However, ammonia violations will persist until East Chicago installs and operates ammonia reduction facilities. Their progress in adding the necessary sewerage system improvements through federal/state construction grants appears to be stymied. No forecast of when the ammonia limitation will be met can be made at this time.

Joint enforcement action by Illinois, Indiana, and U.S. EPA is in progress against East Chicago concerning all its permit violations. Several meetings with all parties have been held to reach an agreement. When finalized, a realistic abatement compliance schedule should result.

The Gary Sanitary District was not in compliance with its permit requirements in 1980. New facilities are under construction.

The Cities of Gary, Hammond, and East Chicago have completed combined sewer overflow studies. These will be forwarded to the state for review.

In 1974, Indiana allocated dry weather waste loads for the Grand Calumet River and Indiana Harbor Canal. Indiana water quality standards for the area have been changed since 1977. The river flow has been significantly reduced

since 1975, due to recycling of cooling water by U.S. Steel. Indiana plans to update the 1974 waste load allocations according to the following strategy:

1. The 1983 waste load allocation study will be based on current state water quality standards. New EPA advanced treatment review policy and effluent guidelines for industrial dischargers will be adopted in the study.

2. Projected effluent flows for both municipal and industrial dischargers will be used. The progress of the U.S. Steel recycling plan will be taken into account.

3. The 1983 study will include a seasonal waste load allocation analysis, which was not considered in 1974.

Toxic and conservative waste loads will be evaluated and allocated for at least phenol, cyanide, chloride, sulphate, and phosphorus.

While the Hammond sewage treatment plant met its requirements, a faulty sewer resulted in the bypassing of combined municipal wastes and stormwater. This resulted in extended beach closings along the southern Lake Michigan shoreline in 1980. An emergency $8 million construction program was initiated in the fall of 1980 and completed in May 1981.

Periodic fecal coliform violations at some Lake Michigan bathing beaches are caused by combined sewer overflows to the Grand Calumet River. While dry weather discharges have been and will continue to be eliminated, it is doubtful that wet weather overflows will ever be totally eliminated due to the expense and engineering difficulties involved. East Chicago may also contribute by the discharge of inadequately treated sewage which could be eliminated by better operation and plant improvements. No remedial action is comtemplated other than enforcement of NPDES limits on wastewater treatment plant discharges.

Whether contaminated sediments in the Grand Calumet River, Indiana Harbor Ship Canal, and Indiana Harbor are a sink, or a source for uptake by aquatic organisms, is unknown, even though the sediments appear to effectively remove pollutants from the water column. No remedial action is planned at this time.

The chlordane, PCB, DDT, and dieldrin in most lake trout (those greater than 20 inches or more than 4 years old) caught in the Indiana waters of Lake Michigan are apparently not attributable to municipal and industrial discharges in the area. These pollutants are widespread throughout the entire lake. Federal and/or state remedial measures prohibiting or limiting the use and disposal of these products has already been taken. Until more is known of the sources, uptake mechanisms, and the efficacy and the feasibility of source control (once determined), no remedial measures can be proposed other than the continued issuance of fish advisories.

INFORMATION SOURCES

Additional information about environmental conditions and remedial measures may be obtained from:

Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, Indiana 46206

Great Lakes National Program Office
U.S. Environmental Protection Agency
536 South Clark Street
Chicago, Illinois 60605

ST. MARYS RIVER, MICHIGAN AND ONTARIO

ENVIRONMENTAL DATA

SEDIMENT

The Ontario Ministry of the Environment (MOE) carried out intensive sediment analyses during 1973. The data indicated high levels of iron, zinc, phenol, cyanide, and oil exist in the sediment along the Canadian shore for a distance of 5 km from the Algoma Slip to downstream from the Canadian locks. Elevated levels of PCB (as high as 300 µg/kg) were found in 1974 along the U.S. shore downstream from the locks. The area of contamination extended 2 km from the locks with a maximum width of 300 m. High PCB levels (as high as 120 µg/kg) also existed in the Lake George channel downstream from the Sault Ste. Marie, Ontario sewage treatment plant and in Little Lake George. Restrictions have been placed by Ontario MOE on the disposal of dredged materials.

FISH

The 1982 Ontario Ministry of the Environment and Ministry of Natural Resources publication entitled, "Guide to Eating Ontario Sport Fish", indicated that mercury, PCB, mirex, and DDT in boneless, skinless fillets of dorsal muscle flesh of fish from Lake George are suitable for unrestricted consumption for fish in size up to 26 inches. Species such as northern pike (>26 inches), lake trout (>22 inches), and walleye (>18 inches) show elevated levels of mercury and have consumption advisories. The Canada consumption guideline for mercury is 0.5 mg/kg.

WATER

Discharges from Algoma Steel Corp. Ltd. have contributed to elevated levels of phenols, ammonia, and cyanide in the St. Marys River. Ontario MOE monitored the river quality through 5 cruises during 1981. Phenol levels higher than the Agreement objective (1 µg/L) persisted along the Ontario shoreline of the river down to Little Lake George. Levels ranged from 100 µg/L at 300 m from the Algoma outfall to 5 µg/L at Little Lake George (12 km from the source). Frequent equipment breakdown in the coke oven by-product plant is largely responsible for the elevated levels of phenolic compounds in the river. Free cyanide levels exceeded the provincial objective (5 µg/L) for a relatively small distance not exceeding 1 km from the source. Levels were in the range of 10 to 120 µg/L. Similarly, total ammonia levels (ranging from 0.2 to 1.2 mg/L) met the Agreement objective at 1 km.

Bacterial contamination resulting from sewer system overflows along the Sault Ste. Marie, Ontario waterfront continues to restrict recreational use in some areas. The provincial fecal coliform objective (100 counts/100 mL) was exceeded at 50% of the stations located along the Sault Ste. Marie

waterfront. In the Lake George channel, downstream from the Sault Ste. Marie sewage treatment plant, fecal coliform levels exceeded the provincial objective at 50% of the stations for a distance of 7 km.

REMEDIAL MEASURES

Algoma Steel Corp. Ltd. at Sault Ste. Marie, Ontario is not yet meeting Ontario MOE's effluent requirements for suspended solids, oil, grease, cyanide, zinc, phenols, solvent extractables, dissolved iron, sulphite, and ammonia. On June 21, 1982, Ontario MOE served the company with a Control Order which will require Algoma Steel to limit the discharge of sulphides, cyanides, and ammonia, by September 30, 1985, such that the effluent will be non-toxic at the end of the prescribed mixing zone. The order also specifies that:

1. By September 30, 1986, Algoma must install the first phase of a dual media filtration system designed to reduce ether solubles from the existing 9,000 to 6,000 lbs/d and to reduce total suspended solids from 25,000 to 19,250 lbs/d.

2. By December 31, 1987, Algoma must install a biological treatment plant to treat phenols discharging from the steelworks, so as to reduce the load to 50 lbs/d or less. A load of 50 lbs/d will eliminate the transboundary movement of phenols.

3. By September 30, 1988, Algoma must install the second phase of the dual media filtration system and further reduce ether solubles to 3,000 lbs/d or less and suspended solids to 13,500 lbs/d or less.

The above program is based on the best available technology, reducing the concentration of all contaminants to levels that are either non-toxic or as low as technically achievable.

The installation of a primary clarifier by the Abitibi-Price Paper Mill in Sault Ste. Marie, Ontario should resolve the existing suspended particulate problems associated with the plant. This clarifier is expected to be operational before the end of 1982.

On May 20, 1982, an agreement was signed among the federal, provincial, and municipal governments in Sault Ste. Marie, towards the funding of a second municipal sewage secondary treatment plant (4.2 MIGD), to serve the westerly section of Sault Ste. Marie, Ontario. The first phase of this sewage treatment plant is expected to be completed and operational by 1985.

Michigan dischargers to the St. Marys River are in substantial compliance with NPDES permit requirements.

ASSESSMENT

WATER

The effluent limitations contained in the Control Order for Algoma Steel Corporation will, when implemented, prevent the problem of transboundary pollution and will ensure that the Agreement objectives will be met in a relaively small distance downstream.

The increased municipal sewage treatment capacity resulting from the provision of the new secondary plant is expected to ensure the protection of shoreline recreational areas.

SEDIMENT

The high contaminant levels in sediment are primarily a result of past discharges from Algoma Steel and Abitibi-Price. The Control Orders are expected to ensure that no further significant deposition of toxic or otherwise objectionable substances will occur. Dredging carried out as part of the Great Lakes Power Development project in 1981 resulted in the removal of some of the contaminated sediments. Material was disposed of in a confined area. The problem does not appear to warrant any further direct remedial action at this time. Natural physical and biochemical processes are expected to reduce the contaminant levels and lead to re-establishment of a healthy benthic fauna community over the longer term.

FISH

Since the problem of mercury levels in sport fish in the St. Marys River is not of local origin, no remedial action is indicated. The origin of the problem, point surce inputs of mercury to Lake superior associated with chlor-alkali and pulp mill operations, were eliminated in the early to mid-1970's. The remedial programs cited above with regard to phenolics, sulphides, cyanides, and ammonia will, however, contribute to a healthier sport fishery.

SUMMARY

The transboundary phenolics problem is expected to be corrected by 1987. The remedial programs scheduled for implementation over the period to 1988 are expected to correct the local bacterial and other pollution problems described. Improvement of bottom sediment quality and recovery of the benthic fauna will occur over the longer term through natural recovery processes.

INFORMATION SOURCES

Detailed environmental and remedial program information may be obtained from two reports:

1. Hamdy, Y.S. and G. La Haye, 1982. "Water Quality Conditions in the St. Marys River 1966-1980." Paper presented at XXV IAGLR Conf., Sault Ste. Marie, Ont., May 4-6, 1982.

2. Hamdy, Y.S., J.D. Kinkead, and M. Griffiths, 1978. "St. Marys River Water Quality Investigations 1973-74." Ontario Ministry of the Environment, Water Resources Branch, Toronto, 52 pp.

Information may also be obtained from:

Ontario Ministry of the Environment
135 St. Clair Avenue West
Toronto, Ontario M4V 1P5

Information about the Michigan shoreline of the St. Marys River may be obtained from:

Michigan Department of Natural Resources
P.O. Box 30028
Lansing, Michigan 48909

SAGINAW RIVER SYSTEM AND SAGINAW BAY, MICHIGAN

ENVIRONMENTAL DATA

SEDIMENT

Sediments in the Saginaw River contain levels of PCB up to 25.1 mg/kg. Sediments in the Pine River contain levels of PBB up to 77 mg/kg; however, PBB has not been detected further downstream. Chlorinated dioxins have not been detected in sediments from the Tittabawassee River.

FISH

Samples of whole fish collected in the Saginaw River in 1976 contained 8 to 12 mg/kg PCB, exceeding the Food and Drug Administration guideline of 5.0 mg/kg for fillets. Levels of hexachlorobenzene were 10 to 100 times greater in these fish, compared to levels in fish from other Great Lakes tributaries. High levels of PCB have been found in fish from the Flint and Shiawassee Rivers, tributaries to the Saginaw River.

PCB was detected in the Saginaw fishery at the following levels in 1980:

Chinook Salmon	3.04 mg/kg
Coho Salmon	2.28 mg/kg
Channel Catfish	6.80 mg/kg
Carp	9.47 mg/kg

Fish samples taken in 1974 and 1976 from the Pine River, another Saginaw River tributary, contained PBB levels up to 2 mg/kg; however, fish from locations further downstream did not contain detectable levels of PBB. Of ten composite fish samples taken from the Pine River in 1981, only three exceeded the 0.1 mg/kg detection limit; PBB was detectable only in rock bass.

The chlorinated dioxin 2,3,7,8-TCDD was detected in fish from Saginaw Bay at the following levels in 1980:

Northern Pike	4.0 ng/kg
White Sucker	Not detectable
Carp	61.0 ng/kg
Catfish	50.0 ng/kg

Levels of dioxin in fish samples from the Saginaw River system have been reported as high as 600 ng/kg; the U.S. FDA guideline is 50 ng/kg. A channel catfish from the Tittabawassee River in 1978 contained 695 ng/kg of dioxin; the highest level detected in fish samples taken from the Tittabawassee River in 1980 was 142 ng/kg in a carp. Tests are currently underway to more fully investigate the extent of dioxin contamination in fish from the Saginaw River system.

Michigan has issued fish consumption bans for the following rivers, because of contamination of fish by the substances noted: South Branch of the Shiawassee River (M-59 to Owosso) - PCB; Chippewa River (downstream from Chippewa Road in Isabella County) - PBB; Pine River (downstream from St. Louis) - PBB; Tittabawassee River (downstream from Midland) - PBB and TCDD; Cass River (downstream from Bridgeport) - PCB; and Saginaw River - PBB and TCDD.

A fish consumption advisory is also in effect for Saginaw Bay. Carp, catfish, muskellunge, salmon, and trout should not be eaten by children or by women who are pregnant, nursing, or expect to bear children; all others should limit consumption to no more than one meal per week. The advisory on muskellunge, salmon, and trout also applies to the whole of Lake Huron.

Additional discussion of area biota, including contaminants in herring gull eggs, is contained in the report of the Surveillance Work Group, "Great Lakes Surveillance," prepared as an appendix to the 1981 report of the Water Quality Board.

WATER

All 24 samples collected at the mouth of the Saginaw River during water year 1980 exceeded the total dissolved solids objective of 200 mg/L. The mean concentration was 468 mg/L.

REMEDIAL MEASURES

Several wastewater treatment plants discharging to the bay have come into compliance within the past year. The Bay City plant was in compliance for all of 1981. The West Bay plant has been on line since December 1981 and has been in compliance since April 1982. The Flint plant is now in compliance for all parameters except ammonia and nitrates.

The annual total phosphorus loading from the Saginaw River to Saginaw Bay decreased from 1,044 tonnes in 1974 to 409 tonnes in 1979. The 1980 load increased, however, to 472 tonnes. The 1981 tributary load cannot be estimated with a high degree of confidence, due to the paucity of flow and concentration data for that year. Since the 1978 Water Quality Agreement proposed target phosphorus load for Saginaw Bay is 440 tonnes per year, and since the Saginaw River makes up approximately 90% of the total loading to the bay, it is apparent that the target load is being approached.

Programs to reduce phosphorus loadings from point source discharges are generally in place in Saginaw Bay and Saginaw River System. It is estimated that more than half of the loading decrease between 1974 and 1979 was due to phosphorus removal efforts by municipal treatment plants in the Saginaw River Basin and to the detergent phosphorus ban in Michigan. The annual municipal phosphorus load to Saginaw Bay decreased from an estimated 800 tonnes in 1974 (Upper Lakes Reference Group estimate) to 211 tonnes in 1979. The annual loads in 1980 and 1981 were 220 and 232 tonnes, respectively. This increase in municipal phosphorus load from 1979 to 1980 and 1981 is due in part to an increase in the number of facilities reported, an increase in the total flow treated, and to poor performance by one or more of the municipal facilities. The point source component of the phosphorus load to Saginaw Bay nonetheless appears to have stabilized.

The rest of the phosphorus loading decrease from the Saginaw River to Saginaw Bay between 1974 and 1979 was due to reductions in river flow. The increase between 1979 and 1980 is mainly due to increased tributary flow.

The Saginaw Bay ecosystem has responded favorably to phosphorus load reductions over the last decade. The following changes in water quality indicators have been observed to date. Total phosphorus concentrations and secchi depth measurements have improved slightly, with an apparent lag in response to the reduction in loadings. Trend analysis on spring and fall chlorophyll a concentrations in Saginaw Bay shows a significant decline for the period 1974 to 1980.

Changes in the phytoplankton in Saginaw Bay have been dramatic. The peak blue-green algal concentration in inner Saginaw Bay in the fall of 1974 was 1.29 mg-dry weight/L while in the fall of 1980 it was 0.027 mg-dry weight/L. In addition, two species of nuisance-producing blue-green algae have virtually disappeared from most areas of the bay. The number of days that the odor of water (thought to be caused by these algae) at the Saginaw-Midland water treatment plant, the largest water intake on Saginaw Bay, exceeded the U.S. Public Health Service standard has been reduced from 56 in 1974 to 0 in 1980.

Indicators of eutrophication in the zooplankton community have also responded significantly to phosphorus reduction. The extremely abundant crustacean, Bosmina longirostris, has decreased almost 4-fold since 1974. Other indicators, such as total rotifer concentration and predatory rotifer concentration, have also decreased.

Eutrophication may be a natural characteristic of Saginaw Bay; however, continuance of point-source control programs now in place will ensure minimum human contribution to accelerating the eutrophication process.

PCB contamination in the Saginaw River basin is the result of historical contamination of the sediments and atmospheric deposition rather than current discharges. PCB in the intake water of the Chevrolet Plant in Bay City has decreased from approximately 7 µg/L in 1972 to less than 0.5 µg/L in 1980; PCB concentrations in the discharge from this facility have similarly decreased. PCB contamination exists in the Shiawassee River at the Cast Forge site. Dredging of contaminated sediments will be completed by October 1, 1982. The plant site was previously cleaned up.

PBB contamination exists in the Pine River but has not been detected in Saginaw Bay. The source, the Velsicol Chemical site, has been capped, and an approved plan for controlling runoff is now in place. There are on-going negotiations at the state and federal level for full resolution of the PBB problem.

All industrial dischargers on the Saginaw River are in compliance with permit limits. Dow Chemical Company, Michigan Division, is adjudicating its new permit but, it is, to date, submitting studies required by the permit. The new Dow permit placed increased monitoring requirements on the company and limitations on nine additional non-conventional/toxic pollutants. The permit requires a detailed wastewater characterization and a dioxin bio-uptake study.

Control measures proposed for implementation by Michigan are directed at providing necessary controls over chlorinated hydrocarbons; however, additional testing in Saginaw Bay will be necessary to determine the adequacy of these control measures and the impacts, if any, on Saginaw Bay of contamination problems in tributaries to Saginaw Bay.

Agricultural land management appears to contribute suspended solids, nutrients, pesticides, organic matter, and pathogenic organisms to Saginaw Bay and the Saginaw River system. These are detrimental to the quality of the water and the aquatic environment.

Agricultural nonpoint source contributions occur as either a direct or indirect result of the tilling of soils, supplemental drainage measures, or the disposal of plant and animal residues. The pollutants are transported to surface waters by wind, erosion, water runoff, leaching through agricultural tile systems, and by direct discharge.

The Saginaw Monitoring and Evaluation Project in Huron and Tuscola Counties, a program covering 72,000 acres and about 20% of the agricultural drainage in the Saginaw Bay Basin, has shown that the nutrient and suspended solids loads from agricultural nonpoint sources are measurable in the streams and ditches which directly receive agricultural runoff. Coastal areas and tributary mouths on the southeastern section of Saginaw Bay, areas which are most directly affected by the agricultural activities within this drainage basin, are especially degraded locations in Saginaw Bay.

Siltation is a problem throughout the Saginaw region, resulting in fish habitat degradation, the filling of surface drainage ways, and the filling of the Saginaw Federal Navigation Channel.

The dissolved oxygen level of the Saginaw River is particularly dependent upon photosynthetic oxygen production and the benthic oxygen demand. Both of these characteristics are adversely affected by the nutrient and suspended solids loads contributed by agricultural activities. Loadings from wholly agricultural tributaries of the Saginaw River, i.e. Dutch Creek and Cheboyganing Creek, have been shown to cause dissolved oxygen sags to as low as 1.9 mg/L in 1976.

INFORMATION SOURCES

Detailed information about environmental conditions in Saginaw Bay may be obtained from the following sources:

1. "Michigan Fishing Guide", Lansing, 1982.

2. Letter from W.E. McCracken, Michigan Department of Natural Resources, Lansing, to G.D. Haffner, IJC, Windsor, June 8, 1981.

3. "1981 - Highlights of Water Quality and Pollution Control in Michigan", Michigan Department of Natural Resources, Lansing.

4. "The Great Lakes Environmental Contaminants Survey. Summary Report 1972-1980." Michigan Department of Natural Resources Publication No. 3730-0038, Lansing, March 1982.

5. T.K. Rohrer, "2,3,7,8-Tetrachlorodibenzo(p)dioxin Residues in Fish from the Tittabawassee and Saginaw Rivers and Saginaw Bay - 1980," Michigan Department of Natural Resources, Lansing, 1982.

6. Bierman, V.J. Jr., D.M. Dolan, R. Kasprzyk, and J.L. Clark, "A Retrospective Analysis of the Responses of Saginaw Bay, Lake Huron, to Reductions in Phosphorus Loadings", U.S. Environmental Protection Agency, Grosse Ile, Michigan, 1982 (To be published after internal U.S. EPA review).

7. Great Lakes Water Quality Board, "1981 Report on Great Lakes Water Quality. Appendix: Great Lakes Surveillance," International Joint Commission, Windsor, Ontario. November 1981.

Information may also be obtained from:

Michigan Department of Natural Resources
P.O. Box 30028
Lansing, Michigan 48909

Great Lakes National Program Office
U.S. Environmental Protection Agency
536 South Clark Street
Chicago, Illinois 60605

ST. CLAIR RIVER, ONTARIO AND MICHIGAN

ENVIRONMENTAL DATA

SEDIMENT

As a result of the elimination of point sources, mercury levels in sediments have declined significantly in the last decade; however, concentrations are still higher in some locations along the Canadian shore than the provinicial guideline for open water disposal. In 1977, Ontario data indicated that the average mercury concentration in the surficial sediment was 3 mg/kg compared to an average level of 250 mg/kg in 1969. During the same year, PCB levels ranged from not detected to a maximum of 5.3 mg/kg, with an average level of 0.3 mg/kg. These high levels of PCB and mercury render the river sediments, especially in the vicinity of industrial discharges, unsafe for open water disposal. Ontario Ministry of the Environment (MOE) guidelines for open water disposal for mercury and PCB are 0.3 and 0.05 mg/kg, respectively.

Most stations in 1977 contained concentrations of heavy metals in excess of Ontario MOE's guidelines for open water disposal. Fourteen percent of the stations exceeded the 50 mg/kg guideline for lead, 97% exceeded the 25 mg/kg guideline for chromium, 34% exceeded the 100 mg/kg guideline for zinc, and 60% exceeded the 25 mg/kg guideline for copper.

A marked improvement in the biological community of the river sediment has occurred over the last decade. A resurgence of bottom-dwelling life forms is evident in the nearshore waters, as indicated by increased numbers and a greater variety of taxa.

FISH

Mercury concentrations in all species of fish from the St. Clair system have declined to less than half of what they were in 1970. The application of stringent controls on mercury losses from the Dow Chemical Company's chlor-alkali plant in Sarnia in 1969 and the subsequent elimination of the mercury cell operation led to this decline.

High levels of mercury in larger sizes of most fish species still necessitate restrictions on consumption. In 1982, Ontario published a consumption advisory for gizzard shad >10 inches from the St. Clair River. Restricted consumption of the following sport fish from Lake St. Clair was also advised due to elevated mercury concentrations: rock bass, pumpkinseed, and largemouth bass >6 inches; bluegill >8 inches; black crappie, smallmouth bass, yellow perch, and brown bullhead >10 inches; white bass and freshwater drum >12 inches; walleye >14 inches; channel catfish, northern pike, white sucker, and quillback carpsucker >18 inches; carp >22 inches; muskie >26 inches; and sturgeon >40 inches. Larger sizes of carp and channel catfish also contained elevated levels of PCB (exceeding the Canadian federal guideline of 2 mg/kg), necessitating consumption advisories.

Michigan has a fish consumption advisory in effect for muskellunge caught from the St. Clair River, because of elevated mercury levels; the mean mercury concentration in 1980 was 2.10 mg/kg.

The incidence of fish tainting had declined significantly in recent years, although it is still occasionally reported in areas close to industrial sources.

WATER

In 1981, Ontario data indicated that levels of total phenols ranged from 1 to 25 µg/L along the Ontario shoreline of the St. Clair River. The extent of the Agreement objective (1 µg/L) violation was 15 km along the shore with a maximum width of 50 m.

During the same year, fecal coliform levels exceeded the provincial objective (100 counts/100 mL) along the Sarnia waterfront (Sarnia Bay) for a longitudinal distance of 300 m and a maximum width of 30 m.

A recent survey of trace organics in industrial effluents indicated that, while there is no immediate threat to water supplies or fish, additional controls on the discharge of these compounds are warranted, for the long-term protection of the river ecosystem.

REMEDIAL MEASURES

ONTARIO

Significant industries are concentrated on the Canadian side of the St. Clair River. Shell, Petrosar, DuPont, Union Carbide, and Ethyl Canada are located at Corunna; Lambton Generating Station and CIL at Courtright; Suncor, Dow Chemical, Polysar, Imperial Oil, and Esso Chemical at Sarnia. Several industries in the St. Clair area are not meeting Ontario MOE's effluent requirements for conventional parameters on a consistent basis.

Phenols and BOD/COD loadings from Polysar exceed the effluent requirements. A two-stage remedial program has been required by Ontario MOE to correct water pollution problems. Stage 1 was completed on schedule, and Stage 2 is scheduled for completion in 1982 and will result in 85% of the organics being directed to a biological treatment plant.

Two industries, Petrosar and Esso Chemical, periodically exceed requirements for phenol in spite of the fact that both have effluent polishing with activated carbon. Neither contributes to the narrow band along the Ontario shoreline where the ambient objective for phenolic compounds is exceeded, since the outfalls extend into the deeper channel where dilution is achieved rapidly.

Lead levels from Ethyl Canada continue to exceed discharge objectives in spite of the installation of an inclined plate clarifier in 1981. The unit has been dismantled in an attempt to rectify shortcircuiting problems and should return to service by late summer 1982.

Since 1975, Ontario MOE has been investigating organic chemicals in municipal and industrial effluents along the St. Clair River. A report on the 1977-78 studies indicates that organics are present in municipal and industrial effluents. In 1979 and 1980, Ontario MOE and Environment Canada undertook a joint study to further characterize and quantify toxics in industrial effluents in the St. Clair River area; the study reports are in the final stages of completion. It is anticipated that this joint study will improve the data base on effluent characteristics both qualitatively and quantitatively, with the result that Ontario MOE may impose further requirements for toxic control on the industries involved, to ensure that water quality continues to improve in the St. Clair River.

Additional surveillance work is planned by Ontario MOE to refine the data obtained in the above studies, to assess trends, and to evaluate the benefit of recent and impending improvements in effluent quality from several industries. At the same time the industries are being required, by way of conditions on Certificates of Approval for new or modified discharges, to monitor for specific toxic organic chemicals. This will permit Ontario MOE to maintain an active data base of each outfall and monitor improvements achieved by process modifications or control techniques.

MICHIGAN

Michigan industrial and municipal dischargers to the St. Clair River are in substantial compliance with permit requirements.

ASSESSMENT

WATER

Remedial action at Polysar Corporation in conjunction with the extension of the Township ditch and other outfalls will significantly reduce the mixing zones associated with phenolic compounds and generally lower contamination concentrations within the river. Regulatory controls and discharge monitoring results indicate PCB input has been virtually eliminated. Achievement of further controls on persistent and non-persistent toxic substances emissions

will follow from further definition of priority compounds, identification of sources, and selection of appropriate control technology. It is expected that this will proceed on a scheduled basis as the results of additional fish contaminants analysis, discharge monitoring, and predictive modelling of instream concentrations become available.

SEDIMENTS

Improvements in contaminant levels and the zoobenthic community observed over the last decade suggest that effluent controls and natural river processes are contributing to system rehabilitation. The removal of contaminated sediment for confined disposal as part of periodic capital and maintenance dredging projects carried out in the immediate industrial area will result in further improvement. No other action is warranted at this time.

FISH

The mercury levels in sport fish in Lake St. Clair are now being resolved through natural processes. Scheduled abatement activity is expected to totally eliminate the fish tainting problem.

SUMMARY

The remedial action essential to reducing mercury levels in fish was taken in the early 1970's. Levels have declined in fish and should continue to do so, albeit at a reduced rate, as natural physical and chemical processes reduce the availability of mercury in sediments. Similarly, the major controls necessary to the recovery of the benthic community along the Ontario shoreline are in place and progress is being monitored.

Remedial measures at Polysar, when completed this year, should markedly improve water quality in the Sarnia area.

Correction of the bacterial contamination problem in Sarnia Bay is being sought in cooperation with the municipality.

INFORMATION SOURCES

Detailed information about environmental conditions in the St. Clair River may be obtained from the following reports:

1. Government of Ontario, 1982. "Guide to Eating Ontario Sport Fish - Southern Ontario and Great Lakes," Toronto, 1982, 191 pp.

2. Ontario Ministry of the Environment, Water Resources Branch, Toronto, 1977. "St. Clair River Organics Study. Fish Toxicity and Tainting Evaluations for Selected Industrial Effluents." Rept. LTS 81-1, 21 pp.

3. Hamdy, Y.S. and J.D. Kinkead, 1979. "St. Clair River Organics Study. Waste Dispersion." Ontario Ministry of the Environment, Toronto. 27 pp.

4. Ontario Ministry of the Environment, Southwestern Region, 1979. "St. Clair River Organics Study. Biological Surveys. 1968 and 1977." 90 pp.

5. Bouner, R.F. and O. Meresz, 1981. "St. Clair River Organics Study. Identification and Quantitation of Organic Compounds." Ontario Ministry of the Environment, Laboratory Services Branch Report, Toronto, 219 pp.

6. Ontario Ministry of the Environment, Laboratory Services Branch, Toronto, 1981. "St. Clair River Organics Study. The Screening of Industrial Effluents for Genotoxic Activity." 69 pp. plus appendices.

7. "Michigan Fishing Guide," Lansing, 1982.

8. "Great Lakes Environmental Contaminants Survey, Summary Report 1972-1980," Michigan Department of Natural Resources, Publication No. 3730-0038, Lansing, March 1982.

Additional information about remedial measures may be obtained from:

Ontario Ministry of the Environment
Southwestern Region Office
London, Ontario

Michigan Department of Natural Resources
P.O. Box 30028
Lansing, Michigan 48909

DETROIT RIVER, MICHIGAN AND ONTARIO

ENVIRONMENTAL DATA

SEDIMENT

The Ontario Ministry of the Environment (MOE) conducted a survey of bottom fauna, metals, and organic pollutants in the sediments of the Detroit River in 1981 in preparation for a more intensive study in the future. Levels in excess of the Ontario guidelines for open-water disposal of dredged materials for PCB (0.05 mg/kg) and mercury (0.3 mg/kg) were found at 78% and 34% of the stations sampled, respectively. The majority of exceedances were in sediments along the U.S. shore in the vicinity of the Detroit sewage treatment plant, Great Lakes Steel, and the Rouge River mouth, and would necessitate confined disposal of dredged materials.

Improvements in distribution and numbers of the pollution-sensitive mayfly have occurred along both sides of the river since 1968. However, a significant portion of the U.S. shoreline in the vicinity of and downstream from the Rouge River mouth still exhibits very high densities of tubificids (sludgeworms).

The Michigan Department of Natural Resources (DNR) will conduct a preliminary study of organic pollutants in the sediments of the Detroit River in 1982 in preparation for an intensive study in the future.

Conditions near the Detroit River mouth and in western Lake Erie suggest that an overall reduction has occurred in organic and phosphorus waste loadings into the area.

FISH

The 1982 Ontario Ministries of Environment and Natural Resources publication entitled, "Guide to Eating Ontario Sport Fish", indicated that mercury levels in walleye (>16 inches) and rock bass (>6 inches) ranged from 0.5 to 1.0 mg/kg. The Canadian federal guideline for fish consumption is 0.5 mg/kg. Fish consumption advisories issued by Ontario for the above species and sizes remained in effect.

Michigan has issued an advisory against consumption of muskellunge from the Detroit River as a result of a mean level of mercury contamination of 2.10 mg/kg.

WATER

In water year 1980, 78 of 456 samples (17.1%) from the Detroit River exceeded the fecal coliform bacteria objective. The mean phenol concentration was 0.5 µg/L in 1980, compared to a mean of 0.93 µg/L in 1979. Concentrations exceeded Agreement objectives most often below the confluence with the Rouge River. Total iron concentrations exceeded the objective at every station on the Detroit River on at least one date, but violations occurred more frequently in the lower reaches. The mean total iron concentration was 188 µg/L. The mean total dissolved solids concentration of 103 mg/L met the Agreement objective, but samples collected at both the head and mouth ranges in water year 1980 exceeded the objective.

The Ecorse River, a tributary to the Detroit River, in the past contributed to fecal coliform and phenol problems in the Detroit River, due largely to combined sewer overflows. In 1980, 15 of 18 samples exceeded the Agreement objective for fecal coliform bacteria, with a maximum of 2.6 million colonies/100 mL. Phenol concentrations reached 19 µg/L; the mean of 12 samples was 6 µg/L. One 1980 sample showed a total iron concentration of 620 µg/L, compared to 630 µg/L in one sample in 1979. Total dissolved solids concentrations averaged 382 mg/L in 1980, with a maximum of 754 mg/L. However, the communities of Lincoln Park, Taylor, and Dearborn Heights on the Ecorse River now have separate sewer systems, and Allen Park is under federal court order to construct a separate system.

The River Rouge is also a significant source of pollutants to the Detroit River. This river is considered below, as a separate area of concern.

Total phosphorus loadings from the Detroit River into the western basin of Lake Erie have declined significantly over a 12-year period. This improvement is reflected by a decrease in phosphorus levels in the western basin of Lake Erie and a decline in algal densities at a municipal intake in the basin.

The 1981 Ontario data for bacterial levels along the Ontario shoreline from Windsor to Amherstburg confirmed the restriction of the water use for recreational swimming, bathing, and other activities along the shoreline. This restriction is due to frequent violation of the provincial objective for

fecal coliform (100 organisms/100 mL). Bacterial contamination in the Detroit River does not, however, extend along the north shore of the western basin of Lake Erie.

REMEDIAL MEASURES

MICHIGAN

The Detroit Wastewater Treatment Plant, long a major pollutant source to the Detroit River, has fully met the standards for secondary treatment and phosphorus removal, as ordered by the courts, since June 1981 for all dry weather flows. The plant meets the standards for oil and grease removal for all flows through plant. The plant meets the standards for phenol removal for all flows up to 805 million gallons per day, which includes peak dry weather flows. Results are tabulated below:

DETROIT WASTEWATER TREATMENT PLANT DISCHARGE

		June 1980 - June 1981[a]	June 1981 - June 1982[b]
Flow	(average)	660 MGD	684 MGD
	(maximum)	993 MGD	1081 MGD
	(total)	241 billion gallons	249 billion gallons
Total Suspended Solids			
	(average)	52 mg/L	24 mg/L
	(total)	50650 tons	(25000 tons)[c]
BOD_5	(average)	37 mg/L	17 mg/L
	(total)	35350 tons	(18000 tons)[c]
Phenol	(average)	46 mg/L	19 mg/L
Total Phosphorus			
	(average)	1.32 mg/L	0.57 mg/L
	(total)	1259.5 tons	(590 tons)[c]
Fecal Coliforms			
	(average)	110 MPN	83 MPN

a. Data obtained from "Final Fiscal Year Record", prepared by the Detroit Water and Sewerage Department.

b. Data obtained from "Monthly Operating Report", prepared by the Detroit Water and Sewerage Department.

c. Estimate.

The Detroit Wastewater Treatment Plant, probably the main source of phenol to the Detroit River is now in compliance with the phenol limits. From September 1980 to May 1982, the 30-day and the 7-day averages for phenols discharged from the plant were 103.26, and 144.53 pounds, respectively. The limits are 400 to 800 pounds, respectively.

The Ford Motor Company, also previously a major discharger of phenols, is now in compliance.

Although preliminary examination of 1981 data indicates the phenol objectives may be exceeded in the Detroit River, those communities (Monroe, Wyandotte, and Detroit-Southwest Plant) drawing water supply from the Detroit River no longer register problems with taste or odor.

Several sites possibly contributing to surface water degradation have been or are being cleaned up. The BASF Wyandotte southworks are closed and being demolished. The mercury cell room has been closed and is being torn down. A previously owned BASF site in the City of Wyandotte has been cleaned up and capped.

The Liquid Disposal Incineration, Incorporated site in Shelby Township is being cleaned up under Superfund emergency provisions. The site is on the interim national priority list to receive funds for remedial action.

Urban surface runoff from the City of Detroit directly into the Detroit River, combined sewer overflows in the Rouge River Basin, and combined sewer overflows from the City of Detroit result in elevated levels of bacteria in the Detroit River and contribute to the total phosphorus load to the river and to the western basin of Lake Erie. The Detroit Water and Sewerage Department conducted a $5,000,000 facilities planning study addressing combined sewer overflows from the City of Detroit. The study showed that, although pollutant loads to the river from this source could be reduced, no significant improvement in water quality would result from any of the abatement alternatives identified to date. Any load reductions and improvements would be masked by the direct surface runoff from the City of Detroit and by the combined sewer overflows in the Rouge River Basin. There are no plans to address direct land runoff into the river. Combined sewer overflows in the Rouge River Basin are discussed below in a separate area of concern. It should be noted, however, that over the past ten years, the City of Detroit has eliminated approximately 50% of its combined sewer overflows through in-system storage, and by preventing river inflow; also, as a result of improved plant operation, this wastewater is receiving better treatment than in the past.

In its 1981 report, the Water Quality Board reported that the estimated annual phosphorus load from combined sewer overflows at Detroit was 110 tonnes. The Board further reported that, when all municipal treatment plants in the Lake Erie Basin achieve an effluent limitation of 1.0 mg/L, combined sewer overflows at Detroit would constitute the third largest point source of phosphorus in the basin, in terms of annual load. Since combined sewer overflows and direct land runoff contribute a sizeable loading of phosphorus, control of these sources could afford a greater measure of protection and improvement to the water quality of the Detroit River and the western basin of Lake Erie.

Monsanto Company in 1981 discharged 117 pounds per day of phosphate phosphorus, an annual average concentration of 0.92 mg/L, which represents 98.8% removal of phosphorus from the process waste flow. This is considered to be best available treatment and no further remedial action is proposed.

The high contaminant levels in sediment are primarily a result of past discharges from industries along the U.S. shore of the river. The regulatory emphasis on hazardous waste disposal sites in the Detroit metropolitan area ensure that no further significant deposition of toxic substances will occur. Natural physical and biochemical processes are expected to reduce the contaminant levels and lead to re-establishment of a healthy benthic fauna community.

ONTARIO

While Ontario industrial inputs do not in themselves result in objective exceedances or use impairment, described above, there are a number of waste treatment deficiences which are under active resolution or investigation with the objective of reducing overall waste loading. As such, they should contribute to the maintenance of water quality in the Detroit River and western Lake Erie once controls on major Michigan inputs are complete.

Ford Motor Company of Canada, Chrysler Canada Limited, Gulf and Western Canada Limited, Hiram Walker and Sons Limited, Allied Chemical Canada Limited, and Canada Salt Company Limited at Windsor and BASF Wyandotte Corporation at Fighting Island are the industrial sources. Except for Chrysler Canada Limited and Ford Motor Company, all of these Ontario sources are in compliance with Ontario MOE effluent requirements.

Chrysler Canada Limited was not in compliance with Ontario MOE loading requirements for phosphorus. The Company is planning to segregate those waste streams containing relatively high phosphorus concentrations for separate treatment, designed specifically for phosphorus removal.

Ford Motor Company was marginally not in compliance with the loading requirements for phenol and suspended solids. The reasons for this non-compliance are being investigated.

Shoreline bacterial contamination downstream of Windsor and at Amherstburg is being addressed through a number of municipal projects. The City of Windsor completed expansion of its Little River plant in 1981 and is presently expanding its Westerly wastewater treatment plant to 163 x 10^3 m^3/d (36 MIGD). Completion of this expansion is expected in late 1981. Extension of trunk and lateral sewers to areas presently serviced by septic tank systems will continue as an ongoing program.

A $20 million program to provide a sewage collection system, including pumping stations and forcemains, is presently under construction in Sandwich West Township, located immediately south of Windsor. This provincially financed system, when completed in late 1981 or early 1982, will transfer wastes to the West Windsor pollution control plant. Completion of this project should improve water quality in the Detroit River immediately downstream from Windsor.

At Amherstburg, a proposal to expand the existing 4.5 x 10^3 m^3/d (1.0 MIGD) primary type sewage treatment facility is presently under review by Ontario MOE for preliminary acceptance. Also included in the proposed expansion are pumping stations and modifications to chemical dosing

equipment. Upon acceptance of the proposal, final design will have to be completed and funding secured by the municipality before construction begins.

Recently completed and ongoing improvements to the Windsor area collection systems and expansion of sewage treatment facilities at Windsor and Amherstburg, coupled with the phased extension of sewer services into areas presently serviced by septic tanks, will bring about steady improvement in bacterial levels along the Ontario shoreline, and help ensure that the provincial objectives for public health indicator bacteria will be met.

The Windsor and the Amherstburg plants are currently discharging 97.2 x 10^3 and 4.3 x 10^3 m^3/d, respectively, with annual average phosphorus concentrations of 1.0 and 1.9 mg/L, respectively.

In addition to the above Canadian point sources, recent developments concerning the possible future use of Fighting Island, located in the Detroit River, are also noted. The island is in Canada and is owned by BASF Wyandotte of Michigan. It has been used for waste disposal since the 1920's. The U.S. EPA, Environment Canada, Ontario MOE, and Michigan DNR are concerned about the possible discharge of toxic substances in the event that Fighting Island is used as a treatment/containment facility for sewage sludge from the City of Detroit. Detroit proposed a pilot project for sewage sludge disposal on the island; this proposal received provisional approval from Ontario MOE and is now underway. The process basically consists of mixing sewage sludge with the settled materials from the abandoned treatment beds with the object of determining the feasibility of employing waste material to support vegetation to rehabilitate the island. The pilot study is expected to require 2-3 years for completion.

INFORMATION SOURCES

Detailed information about environmental conditions and remedial programs may be obtained from the following reports:

1. Ontario Ministry of the Environment, Southwestern Region and Water Resources Branch, 1981. "An Assessment of the Bottom Fauna and Sediments of the Western Basin of Lake Erie, 1979." Ontario Ministry of the Environment, Toronto. 24 pp.

2. Ontario Ministry of the Environment, Southwestern Region, London, and Water Resources Branch, Toronto. Unpublished data on 1981 trace contaminants and macrozoobenthos survey of Detroit River sediments.

3. Letter communication from W.E. McCracken, Michigan Department of Natural Resources, to G.D. Haffner, International Joint Commission, Windsor, June 8, 1981.

4. "1981 - Highlights of Water Quality and Pollution Control in Michigan", Michigan Department of Natural Resources, Publication Number 4833-9804, Lansing.

5. "Great Lakes Environmental Contaminants Survey, Summary Report, 1972-1980", Lansing, Michigan.

Information may also be obtained from:

Ontario Ministry of the Environment
Southwestern Region Office
London, Ontario

Ontario Ministry of the Environment
Water Resources Branch
135 St. Clair Avenue West
Toronto, Ontario M4V 1P5

Michigan Department of Natural Resources
P.O. Box 30028
Lansing, Michigan 48909

ROUGE RIVER, MICHIGAN

ENVIRONMENTAL DATA

SEDIMENT

No recent data are available; historical data show severe degradation.

WATER

In 1980, fecal coliform concentrations exceeded the Agreement objective in 11 of 12 samples, with a maximum of 60,000 colonies/100 mL. Phenol concentrations exceeded the Agreement objective, with a mean concentration of 9 µg/L and a maximum of 24 µg/L. Two samples were analyzed for total iron in 1980 with a mean concentration of 1,085 µg/L, compared to 6,700 µg/L in one sample in 1979. The mean total dissolved solids concentration was 295 mg/L in 1980, and the maximum was 490 mg/L.

FISH

No fish analyses have been performed. It should be noted as anecdotal evidence of improved water conditions that two steelhead were caught in the Rouge River in the spring of 1982.

REMEDIAL MEASURES

Industrial dischargers to the Rouge Basin are in substantial compliance with permit requirements.

The River Rouge is, nonetheless, a significant source of pollutants to the Detroit River. Combined sewer overflows are the major problem. Twenty-five percent of the total Rouge basin is drained by combined sewer networks. The outfalls from these combined sewers are located in the lower portions of the branches of the Rouge which are subject to low stream velocities. Many pollutants from the combined sewers settle out on the bottom and perpetuate polluted conditions for days and weeks after the combined sewers overflow.

Combined sewer overflow studies for communities in the basin, upstream from Detroit, were undertaken. The main study has been completed and other

studies will be completed by fall of 1982. More than $500 million would be required to alleviate the effects of combined sewer overflow. Based on information available, and considering the benefits to be derived and the costs involved, the court has concluded that measures to correct combined sewer overflows in the Rouge River Basin are not warranted at this time.

INFORMATION SOURCE

Environmental information was provided by W.E. McCracken of the Michigan Department of Natural Resources in a letter to G.D. Haffner of the International Joint Commission, dated June 8, 1981. Additional information about environmental conditions and remedial measures can be obtained from:

Michigan Department of Natural Resources
P.O. Box 30028
Lansing, Michigan 48909

RAISIN RIVER, MICHIGAN

ENVIRONMENTAL DATA

SEDIMENT

Sediments collected during 1975 and 1976 surveys from Monroe Harbor and the approach to the Raisin River are heavily polluted with volatile solids, oil and grease, and metals. Chemical oxygen demand is high.

FISH

Fish were collected from the Raisin River in 1978 and 1979. PCB levels were as high as 111 mg/kg, compared with the U.S. FDA action level of 5.0 mg/kg. Also present were DDT, nonachlor, tri-, tetra-, and heptadecane, naphthalene, methyl- and dimethylnaphthalene, methylbiphenyl, phenanthrene, fluoranthrene, pyrene, pyridine carboxamide, and mono- and dichlorobiphenyl.

WATER

Water samples were collected in 1978. Agreement objectives were violated for cadmium, chromium, copper, iron, nickel, zinc, dissolved oxygen, specific conductivity, and fecal coliforms. The Michigan standard for pH was also violated.

REMEDIAL MEASURES

All major dischargers to the Raisin River are in substantial compliance with their permits. Existing water quality problems result to a great extent from contaminated sediments. However, the Michigan Department of Natural Resources received support from U.S. EPA to conduct process evaluations of several chemical and manufacturing facilities in the watershed, in order to identify potential sources of toxic contaminants. Three evaluations were completed during Phase II of the study, and no problems were identified. Phase III, to be completed in October 1982, will include evaluation of three more facilities in the Raisin River watershed.

INFORMATION SOURCE

Additional information about environmental conditions and remedial measures can be obtained from:

Michigan Department of Natural Resources
P.O. Box 30028
Lansing, Michigan 48909

MAUMEE RIVER, OHIO

ENVIRONMENTAL DATA

SEDIMENT

Surveys conducted in 1973 and 1975 reveal that the sediments in the lower Maumee River and Toledo Harbor are heavily polluted with volatile solids, chemical oxygen demand, and metals. Sediments in the outer bay are also polluted, although less heavily so.

FISH

Fish collected between 1976 and 1979 contain PCB up to 5.9 mg/kg; the U.S. FDA action level is 5.0 mg/kg. Also detected were DDT, hexachlorobenzene, chlordane, nonachlor, methylbiphenyl, methylbenzanthrene, pyridine carboxamide, pentachloroanisole, heptadecane, and nonadecane.

WATER

Water collected at the mouth of the Maumee River contains cadmium, iron, manganese, nickel, zinc, copper, and chromium in excess of the Agreement objectives or Ohio EPA standards. In addition, dissolved oxygen, specific conductivity, phosphorus, and fecal coliforms do not meet Agreement objectives.

CAUSES AND REMEDIAL MEASURES

The Maumee River is the largest source of sediment and non-point phosphorus loadings to Lake Erie. In recognition of this, a consortium of state, local, and federal agencies has agreed to foster no-till and associated soil conservation practices in the Maumee River Basin.

The U.S. EPA has funded several large agricultural land management demonstration projects in the Maumee River basin, including: The Black Creek watershed of northeastern Indiana, Allen and Defiance Counties, Ohio and the Accelerated Conservation Tillage project (a nine-county program in northwestern Ohio, specifically affecting three counties in the Maumee River basin). Preliminary results are showing 30% to 90% reductions in soil loss, with attendant phosphorus loss reductions, depending on the specific soils and tillage practices being used. In addition to encouraging conservation tillage, the Cooperative Extension Service of the University of Ohio, the Ohio Department of Agriculture, and the Ohio Department of Natural Resources, Division of Soil and Water Conservation are promoting lower rates of application of phosphate fertilizer in northwestern Ohio to more closely match the crop utilization rates.

All of the large Ohio municipal treatment facilities in the Maumee River estuary averaged below the 1.0 mg/L effluent phosphorus requirement during 1981. All of these plants are at the advanced secondary treatment levels required to protect the dissolved oxygen requirements of the river.

Combined sewer overflow problems are currently under study at Toledo, Perrysburg, and Oregon. This problem is also being evaluated by an outside consultant under contract to U.S. EPA's Great Lakes National Program Office. Remedial programs will be developed at the conclusions of these studies. However, the funds to finance these proposals may not be readily available, which may require the deferral of the implementation.

The industrial dischargers in the estuary are in compliance with the NPDES permit requirements which were designed to meet the 1977 requirements for the traditional sewage parameters and also to meet the water quality standards for toxicants (heavy metals, cyanides, and phenols). A program to control other toxic materials is being developed.

Acute, static bioassay tests with fathead minnows were performed on the effluents from the two petroleum refineries, Standard Oil Co. of Ohio and Sun Oil Co., during 1982. No acute toxicity was discovered. Additional remedial measures may be required based on this review and the issuance of best available treatment (BAT) requirements by U.S. EPA. These BAT requirements for the petroleum refineries are expected to be issued in 1982 with compliance under the Clean Water Act being required by July 1, 1984. However, the implementation of any required control programs may take 3 to 4 years, with final compliance in 1985 or 1986.

ASSESSMENT

WATER

The combination of NPDES permits, the pretreatment program, and enforcement practices should result in all principal dischargers meeting Ohio's water quality standards.

The water quality in the estuary may never meet the Agreement objectives for Lake Erie because of the natural chemistry of the water in the drainage basin and the existing land use patterns. In addition, modifications of the geometry of the estuary (installation of bulkheads, loading docks, and deep channel dredging) have changed the hydrology so as to slow the movement of water through the estuary, resulting in a decrease in reaeration of the water and the assimilative capacity of the streams. The modified geometry promotes sedimentation, requiring periodic dredging.

The Maumee River estuary is also profoundly affected by "lake effects" through its location at the end of a relatively shallow lake. During periods of northeast winds, lake water is driven up the estuary for many miles, thus preventing the normal flow in the river. The U.S. Gelological Survey gauging station on the Maumee River is located 21 miles up river at Waterville in order to be out of the area influenced by the "lake effects".

The water entering the estuary from upstream of Waterville showed only minor problems with violations of state water quality standards for lead,

cadmium, zinc, and mercury during the period October 1, 1978 through September 30, 1980.

SEDIMENT

A portion of the high contaminant loads in the sediment can be attributed to past discharges of municipal treatment plants and industries and from agricultural practices. The continued practice of the existing remedial programs is expected to ensure that no further significant deposition of toxicants (heavy metals, cyanide, and phenols) will occur. The sediment pollution from non-point sources is more difficult to control and the remedial programs are voluntary. Time and natural processes are expected to reduce the contaminant levels. The U.S. Army Corps of Engineers operates an annual dredging program for the navigation channel of the Maumee River in Toledo and Maumee Bay. Information from an assessment of that activity over the period 1976 to 1981 indicates that the sediment is becoming less contaminated with time. The material taken from the channel northward from the Toledo Harbor Light may be suitable for open lake disposal. (Toledo Harbor Assessment, in preparation).

FISH

The ban on PCB and natural attrition will in time result in the reduction of this contaminant in fish. A similar statement can be made for the persistent pesticides and metabolites (DDT, chlordane, and nonachlor). The other identified materials are hydrocarbons, presumably from petroleum refining, coke manufacture, and other petroleum oil uses. The major sources of these products have control measures in place which should minimize the occurrence of these materials and allow natural attrition to occur. The other remedial programs discussed previously will also contribute to a healthier fish population.

GENERAL

The remedial programs in place for permit sources should decrease the pollutant loads into the river so that the natural processes of attrition should remove the contaminants from the sediments and fish over the next 5 to 10 years. The programs for non-point pollution controls are just under way, but noticable improvements in sediment and phosphorus loadings should be realized within 5 years.

It is unlikely that the water in the estuary will meet all of the Agreement objectives for Lake Erie.

INFORMATION SOURCE

Additional information about environmental conditions and the status of remedial measures may be obtained from:

Ohio Environmental Protection Agency
P.O. Box 1049
Columbus, Ohio 43216

BLACK RIVER, OHIO

ENVIRONMENTAL DATA

SEDIMENT

A 1975 survey indicated that the lower Black River and Lorain Harbor are heavily polluted with volatile solids, chemical oxygen demand, oil and grease, nutrients, and metals.

FISH

Fish caught at the mouth of the Black River in 1978 contained PCB, DDT, methylnaphthalene, biphenylphenanthrene, flouranthrene, pyrene, fluorene, acenaphthalene, dibenzothioprene, pyridine carboxamide, terphenyl, phenylnaphthalene, and pentachloroanisole. Many of these substances are of industrial origin. A maximum PCB level of 12.6 mg/kg was recorded in 1979, in excess of the FDA's action level of 5.0 mg/kg.

WATER

Water samples collected during a 1978 survey contained concentrations of phosphorus, ammonia, cadmium, copper, iron, lead, manganese, zinc, mercury, cyanide, conductivity, dissolved oxygen, and fecal coliforms which violated either the Agreement objectives or Ohio EPA standards.

CAUSES AND REMEDIAL MEASURES

The observed pollution is attributed in part to past industrial discharges. Sediment sampling is currently under way to assess the extent of contamination with toxic organic substances.

The lower Black River is affected by the discharge from the Elyria municipal treatment plant, which has significant industrial inputs of heavy metals. Elyria has applied for federal grants to develop a pretreatment program to address the industrial inputs and to update its treatment plant. Completion of construction is currently scheduled for 1985.

Amherst's municipal treatment plant also contributes to the pollution of the Lorain Harbor area. This entity is currently operating under a consent decree requiring it to meet interim effluent limits and to improve its plant to meet advanced secondary limits by the end of 1986.

U.S. Steel will be initiating a remedial program to meet best available treatment and water quality standards. These requirements will be included in the renewal permit to be issued this year which will require compliance by July 1, 1984.

An intensive survey of the lower reaches of the Black River from Elyria to Lake Erie was conducted during the summer of 1982. These results, along with the chemical/physical data collected by U.S. EPA, Eastern District Office will be used to assess the water use that can be achieved and to allocate the pollutant loads among the dischargers. The data analysis and final report is scheduled to be completed by September 1983.

One hazardous material site in Lorain County, Chemical Recovery, has been cleaned up by the owners under a consent decree obtained by the City of Elyria. A second site in Lorain County, Ford Road Landfill, is currently being monitored and may be a candidate for clean-up, possibly with CERCLA funds ("Superfund").

ASSESSMENT

WATER

NPDES permits, the pretreatment program (Elyria), and enforcement (such as the consent decree for Amherst) should result in the entities involved meeting Ohio's water quality standards.

The natural chemistry of the drainage area and the current land use patterns may preclude the river water from attaining the Agreement objectives for Lake Erie.

SEDIMENT

The reduction in pollution from point source dischargers discussed above should reduce significant deposition of additional pollutants. Natural physical and biochemical processes are expected to, in time, reduce the contaminant levels.

FISH

The elimination of sources of the contaminants found in fish seems to be the only practical remedial program for ensuring a healthy fish population. The controls on dischargers should provide a mechanism to eliminate the contaminants.

GENERAL

The remedial programs under way should result in adequate controls of the discharges of wastewater into the river by mid-1986. There will be a residuals problem which will require an additional 5 to 10 years for natural processes to correct.

INFORMATION SOURCE

Additional information about environmental conditions and the status of remedial measures may be obtained from:

Ohio Environmental Protection Agency
P.O. Box 1049
Columbus, Ohio 43216

CUYAHOGA RIVER (CLEVELAND), OHIO

ENVIRONMENTAL DATA

SEDIMENT

An extensive 1977 survey revealed that sediment from the Cuyahoga River is polluted, as is the majority of the sediment from the outer harbor. Using EPA's "Guidelines for Pollutional Classification of Great Lakes Harbor Sediments", heavy contamination still exists for the metals arsenic, cadmium, chromium, copper, magnesium, lead, and zinc. The Guidelines are also exceeded for volatile solids, chemical oxygen demand, total Kjeldahl nitrogen, and oil and grease. Nonetheless, sediment quality is substantially improved since 1972.

PCB levels in both river and harbor sediment samples exceeded 2.2 mg/kg in 1977.

FISH

Because of polluted conditions, the fish population remains severely depressed, although carp, goldfish, and white sucker were actually caught in the Cuyahoga River in 1980. PCB levels in these fish ranged from 1.6 to 23.0 mg/kg; the FDA action level is 5.0 mg/kg.

WATER

Water samples collected at the river mouth in 1978 exceeded the Agreement objectives for dissolved oxygen, conductivity, ammonia, mercury, cadmium, copper, iron, manganese, zinc, and phenols. The fecal coliform level exceeded the Ohio standard.

CAUSES AND REMEDIAL MEASURES

The Cuyahoga River has been severely impacted by numerous municipal and industrial dischargers, non-point urban runoff, and combined sewer overflows.

The City of Akron instituted a phosphate detergent ban and is currently meeting the 1.0 mg/L phosphorus limitation in their discharge by adding polymers for better solids removal. The city is complying with an enforcement order that requires them to upgrade and expand the treatment plant, with a completion date of 1986. This upgrade will minimize the current problems with combined sewer overflows and sewer system by-passes.

The Northeast Ohio Regional Sewer District has three major wastewater treatment plants: Easterly, Southerly, and Westerly. There are construction programs under way at all three facilities:

1. Easterly is currently meeting the phosphorus limitation, and the rest of the construction is currently scheduled to be complete by 1983.

2. Southerly is scheduled to have the phosphorus control facilities in place by the end of 1982. The rest of the construction is scheduled to be completed by 1985.

3. Westerly is not meeting the phosphorus limitation and the schedule for needed facilities has slipped. Facilities are currently expected to be complete in 1983.

In addition to the wastewater treatment plant expansions, the District has two large interceptor programs:

1. Cuyahoga Valley Interceptor is on schedule and will pick up the Summit County Macedonia plant in 1982. The Phase 2 extensions to pick up Maple Heights and Cuyahoga County S.D.#13 are scheduled for funding in September 1985, with completion in 1989.

2. The Southwestern Interceptor slated to serve Berea, Brook Park, Middleburg Heights, and NEORSD-Strongsville A is scheduled for funding by 1986, with completion in 1990.

Wastewater treatment systems have been installed at the major industrial point sources in the estuary to control conventional pollutants and toxicants. These facilities are in compliance. These facilities are being reviewed to identify whether additional controls are needed for other toxic substances.

The best available treatment guidelines for the iron and steel industries have been issued. The U.S. Clean Water Act requires compliance by July 1, 1984. The NPDES permits for Republic Steel and for Jones and Laughlin are being reviewed to determine what additional treatment may be required.

The permits for the two major chemical companies, du Pont and Harshaw, are also under review, especially with respect to possible toxic pollutants.

Several hazardous waste sites have been identified, closed, and/or cleaned up.

The Ohio Drum Reconditioning site was leased by L. Gray Barrel & Drum Company in November 1981. There remains no discharge from this facility, the marshy area having been diked. Superfund money is expected to be utilized for clean-up of the PCB-contaminated marsh area.

Approximately $440,000 in Superfund emergency removal monies have been used to clean up the Chemical Mineral Reclamation site. The final phase may require an additional $115,000.

The Old Mill Creek site clean-up is under way, with 400 of 1000 drums removed. Additional sites at Anaconda Avenue and Woodford Road Quarry are under investigation.

An intensive survey of the navigation channel of the Cuyahoga River is tentatively scheduled for 1985. This survey will gather all the pertinent information on biology, chemical and physical conditions of the water, detailed information on dischargers and the altered geometry/hydrology of the channel. The survey will allow Ohio EPA to assess the uses that are attainable for the river and develop wasteload allocations to enable those uses to be achieved.

ASSESSMENT

WATER

Completion of the present remedial programs will result in improvement in the water quality of the river. However, achievement of high quality water is problematic because of the extensive alteration of the stream geometry along with the intensive use as a navigation channel.

SEDIMENT

The improvement in water quality will result in less deposition of contaminants. Enforcement actions, such as the Ohio Drum Reconditioning case in 1980 and the identification of uncontrolled waste disposal sites, will also reduce pollutants in the sediment.

FISH

The probability of the Cuyahoga River ever becoming a sport fishery is small. However, with improved water quality and reduced pollutants in the water and sediments, fish may start to reappear.

GENERAL

There is inadequate information available to determine what water quality the current remedial programs will permit. However, in light of the natural chemistry of the drainage basin, the current intensive land use, and the greatly modified geometry of the navigation section of the river, it is unlikely that the water quality in the river will ever meet the Agreement objectives for Lake Erie.

INFORMATION SOURCE

Additional information about environmental conditions and the status of remedial measures may be obtained from:

Ohio Environmental Protection Agency
P.O. Box 1049
Columbus, Ohio 43216

ASHTABULA RIVER, OHIO

ENVIRONMENTAL DATA

Analyses of sediment, fish, and water samples collected from the lower Ashtabula River, the harbor area, the navigation channel, and the tributaries (Black Creek, Field's Brook, and Strong Brook) reveal that this heavily industrialized area has been and continues to be polluted.

SEDIMENT

Based on 1974 studies, Ashtabula Harbor was classified as polluted, because concentrations of volatile solids, total Kjeldahl nitrogen, chemical oxygen demand, zinc, iron, manganese, chromium, and oil and grease exceeded

EPA's "Guidelines for Pollutional Classification of Great Lakes Harbor Sediments."

An extensive 1979 study revealed the sediments in the navigation slip near Strong Brook to be heavily polluted with zinc, lead, and oil and grease.

Sediments collected in Field's Brook in 1979 contained high levels of chlorinated solvents, including hexachlorobenzene, polychlorinated butadienes, ethanes, ethylenes, and benzenes, as well as benzo(a)pyrene and PCB. These are all U.S. EPA priority pollutants. The sediments were also classified as heavily polluted with mercury, arsenic, cadmium, chromium, copper, lead, and zinc, all EPA priority pollutants.

Sediment samples collected in the navigation channel revealed contamination with polychlorinated compounds, including 1,4-dichlorobenzene. The metals arsenic, cadmium, and chromium were also present.

A 1980 study in Field's Brook reconfirmed that the sediments are heavily polluted with mercury, arsenic, cadmium, chromium, lead, and zinc. Polychlorinated solvents present in the sediments included trichloroethylene; 1,1,2-trichloroethane; tetrachloroethylene; 1,1,2,2-tetrachloroethane; hexachlorobutadiene; plus others. PCB is also present.

FISH

Fish collected from the Ashtabula River in 1976 contained a wide variety of chlorinated organic chemicals, including several known to be toxic and/or carcinogenic. Compounds present include PCB, polychlorinated butadienes, chlorinated propane, chlorinated propene, chlorinated styrenes, chlorinated norborenes, and hexachlorobenzene. No U.S. FDA action levels exist, except for PCB (5.0 mg/kg); the maximum PCB level measured was 7.2 mg/kg.

A 1978 study confirmed these findings. A 1979 study reported PCB (maximum 45.3 mg/kg) and hexachlorobenzene as present. A 1980 study again confirmed hexachlorobenzene to be present.

WATER

Water samples collected at the mouth of the harbor in 1978 exceeded Agreement objectives for conductivity, mercury, cadmium, copper, iron, and fecal coliforms.

CAUSES AND REMEDIAL MEASURES

The Ashtabula municipal wastewater treatment plant is probably the principal source of the violations of the fecal coliform objective due to a lack of a chlorine contact tank. Completion of construction of plant improvements is scheduled for 1984.

Acute, static bioassays were conducted for 24 and 48 hours on the effluents in 1981, using daphnia as the test organism. The results showed mortalities ranging from 0% to 100%. However, this species is sensitive to total dissolved solids and it is suspected that the high salt content of the effluents caused most of the mortality. Additional tests with other organisms will be performed.

A group of major industries is located on Field's Brook, a tributary to the Ashtabula River in the navigable portion. The industries include Gulf and Western Natural Resources Division, Olin Corporation, SCM Corporation, Detrex Chemical Corporation, General Tire and Rubber Company, and RMI, Inc. The discharge from these companies comprises the flow of the stream under low flow conditions (the intake water is from Lake Erie). All of the companies have installed treatment facilities to meet the 1977 requirements for the historic sewage and toxic pollutants. The treated wastewater could not achieve the water quality standards for total dissolved solids, and Ohio EPA eased the standard for total dissolved solids from 1,500 to 3,500 mg/L for the brook below the industries.

Olin Corporation has closed its plant because the economics were no longer favorable. Detrex Corporation continues to operate its plant for limited production of hydrochloric acid and N-methyl pyrrole. The other industries are being evaluated to see if additional controls are needed, especially to see if toxic pollutants are being discharged.

The Detrex Chemical Company has an old dump site on its property. Evidence shows that chlorinated organics are leaching into the ground water and into Field's Brook. Negotiations are under way with the company to develop a program for clean up of the site.

The contaminated sediment in Field's Brook is under study to determine the best method of removal/containment. A joint, cooperative project with the industry in the area is being discussed, with the option of using Superfund monies as a back-up option. Field's Brook is a priority site on the Superfund list; it is the only site where Superfund monies are being considered for the removal of contaminated sediment from a stream.

The contaminated sediment in the navigation channel of the Ashtabula River will be dredged by the Corps of Engineers, with the material being deposited at a secure disposal site. An agreement among the various governmental entities, the U.S. Army Corps of Engineers and the owners of the preferred site is under active discussion.

Hazardous waste sites were identified in the Ashtabula River drainage basin:

1. Raser Tannery: The company went into receivership in 1980. The site has been cleaned up with $33,000 of Superfund money.

2. Poplar Oil/Laskins Waste Oil: Superfund monies were used to remove some of the waste oils on an emergency basis. A contractor has been selected and is currently awaiting an award of $1.56 million to clean up the site.

Additional sites under review include Sitrex Chemical Co., Big D Campground, North Kinesville Sanitary Landfill, New Lyme Township Sanitary Landfill, and Detrex Chemical Co.

ASSESSMENT

WATER

With respect to traditional pollutants and toxicants, the improvement of the municipal sewage treatment plant and the control facilities built by the industrial dischargers should result in improvements to the water quality. The currently ongoing studies for other toxics must be completed and decisions made as to other controls required for industrial dischargers before any assessment can be made as to overall improved water quality.

SEDIMENT

Until the study of the removal of the currently contaminated sediments is completed, it is not possible to make any assessment of the effectiveness of any remedial program to correct sediment pollution.

FISH

If the water quality continues to improve and if the contaminated sediment is removed, the fish population in the area should become healthier and less contaminated.

GENERAL

Significant progress has been achieved in the last ten years in improving the water quality in the river basin. In the early 1970's, Field's Brook was a sterile watercourse because of large discharges of chlorine in addition to the chlorinated organic compounds and residues from the titanium dioxide refining processes. In 1980, the major problems were corrected and pollution-tolerant fish have returned to the lower reaches of Field's Brook and the stream is meeting Ohio's water quality standards.

The upper reaches of the Ashtabula River are relatively free of pollution except for infrequent iron, lead, and phenolic violations that are suspected to be from non-point sources.

The estuary, despite the contaminated sediment, is an important spawning area for many important Lake Erie fish. Local sport fishermen and the U.S. Coast Guard report salmonoid migrations and large numbers of white bass in this segment.

The remaining problems are the residuals problem and need for additional interpretation of the impact on human health, particularly for the chlororganics, as well as continuing monitoring to assess the rate that natural attrition is improving the water quality.

INFORMATION SOURCE

Additional information about environmental conditions and the status of remedial measures may be obtained from:

Ohio Environmental Protection Agency
P.O. Box 1049
Columbus, Ohio 43216

BUFFALO RIVER, NEW YORK

ENVIRONMENTAL DATA

SEDIMENT

Numerous surveys of Buffalo Harbor, the Buffalo River, and the Black Rock Canal conducted between 1967 and 1975 reported sediments heavily polluted with nutrients, volatile solids, oil and grease, and iron. Mercury is also present. A 1980 survey found concentrations of polynuclear aromatic hydrocarbons.

A comprehensive survey conducted by U.S. EPA in the Buffalo area in 1981 found that almost all sediments from the Buffalo River and the Buffalo waterfront are heavily contaminated with conventional pollutants and heavy metals. Many sediments also contained high concentrations of organic substances. Nine potential or positive carcinogens and eight organic substances having a potential for chronic aquatic toxicity were identified. Each was present at at least one sampling location and at a concentration of at least 5 mg/kg; the concentrations of some substances exceeded 50 mg/kg. The carcinogenic toxicants found were: anthracene, benzo(a)anthracene, benzo(a)pyrene, chlorotoluene, fluoranthene, fluorene, phenanthrene, pyrene, and tetrachlorobenzene. The aquatic toxicants found were: acenaphthene, p-tert-butyl phenol, chlorobenzene, chloronaphthalene, di-n-butyl phthalate, dichlorobenzene, pentachlorobenzene, and 1,2,4-trichlorobenzene. PCB and pesticides are also present in the sediment.

FISH

A 1977 survey of the Lower Buffalo River reported the presence of PCB, DDT, aldrin/dieldrin, and mercury in fish; however, these levels did not exceed FDA's action levels. Lead, chromium, zinc, and copper were also present. Populations of macroinvertebrates are severely impaired because of the multiplicity of toxins present in the lower Buffalo River.

WATER

In a 1978 survey, the Agreement objectives were violated for dissolved oxygen, specific conductivity, fecal coliforms, cadmium, copper, and nickel.

REMEDIAL PROGRAMS AND ASSESSMENT

The Buffalo River Basin is heavily populated and highly industrialized. It receives effluents from numerous industries and municipalities. Other inputs significantly contributing to the observed degradation of the ecosystem are combined sewer overflows and unsecured landfills.

MUNICIPAL DISCHARGERS

Buffalo Sewer Authority (BSA) - Most of the approximately 96 potential sources of toxic substances discharge to the Buffalo Sewer Authority, whose plant has repeatedly violated its permit limits and has operated its secondary treatment units only on a limited basis.

The BSA permit expired on April 30, 1980 and is currently being processed for renewal. In April 1981, U.S. EPA ordered the city to identify the remedial steps it will take to achieve compliance with its permit limitations. Corrective actions are underway and final construction is expected to be completed in 1983.

A Joint Order on Consent was executed with the BSA by the New York Department of Environmental Conservation (DEC) and the U.S. EPA on April 18, 1982. The basis for the order was the effect that the rehabilitation of the primary phase of the treatment facility will have on the ability of the facility to achieve its required effluent limits. Based on an average daily dry weather flow of 200 MGD or less, the BSA facility was required to achieve secondary limits by July 31, 1982. Effluent limits are to be adjusted for flows in excess of 200 MGD up to 540 MGD.

It is estimated that the bulk of the work involving primary treatment rehabilitation will be completed by the end of 1982.

There had been problems involving process control instrumentation relative to the secondary portion of the treatment facility. These problems have been resolved.

BSA's pretreatment program is at the stage where it will be able to submit an application for final program approval by March 1, 1983.

Based on the above information, it would appear that the attainment of operational levels by the BSA facility should be adequate to solve any environmental problem created by the current discharge.

A draft SPDES permit, expected to be issued November 1982, recognizes that a construction grant, for correction of combined sewer overflows, will be approved on September 1, 1984. The permit contains a re-opener clause, so that the construction schedule can be incorporated into the permit conditions.

Lackawanna (C) - The Lackawanna facility discharges to Smokes Creek. It is a primary plant, with chlorination, currently on line. A construction project is to lead to secondary treatment and phosphorus removal. In 1980, its effluent averaged 2.3 mg/L phosphorus.

The current discharge permit, which expires March 1, 1984, contains a schedule requiring attainment of operational levels by January 1, 1982. The city is currently behind schedule and it is anticipated that the plant will not be on line and achieving required effluent limits for several months. The New York DEC Regional Office is currently working with the community in an attempt to get the upgraded facility on line.

It has been determined that the City of Lackawanna does not require a local pretreatment program at this time.

It would appear that the attainment of operational levels by an upgraded facility should be adequate to solve expected environmental problems created by the current discharge.

PRINCIPAL INDUSTRIAL DISCHARGERS

Delays in the development of long-term draft SPDES discharge permits for industrial discharges have been caused primarily by the failure of the U.S. EPA to promulgate final best available technology economically achievable/best conventional pollutant control technology (BAT/BCT) effluent guidelines. BAT/BCT treatment levels must be achieved by July 1, 1984 pursuant to Section 301 of the Federal Clean Water Act.

In those cases where BAT/BCT guidelines have not been promulgated in a timely manner, draft discharge permits have been or are being developed incorporating effluent limitations based on "Best Engineering Judgement". The processing of the long-term permits incorporating limits based on BAT/BCT guidelines or "Best Engineering Judgement" is to allow for approximately two years to achieve BAT/BCT treatment levels.

In the absence of U.S. federally established categorical industrial discharge limitations, New York is committed to determine appropriate industrial and pretreatment discharge limits based on best professional judgment. This process is expected to yield sufficiently protective limits on sources of contamination. With the cessation of point and non-point source discharges of toxic substances, it expected that the 1980's will see a substantial improvement in the waters and environmental resources of the Buffalo River.

INFORMATION SOURCES

Sources for additional information are given at the end of the presentation for the Niagara River area of concern.

NIAGARA RIVER, NEW YORK AND ONTARIO

ENVIRONMENTAL DATA

SEDIMENT

Concentrations in excess of the Ontario guidelines for open-water disposal of dredged materials for PCB (50 µg/kg), arsenic (8 mg/kg), chromium (25 mg/kg), copper (25 mg/kg), lead (50 mg/kg), mercury (0.3 mg/kg), and zinc (100 mg/kg) were detected in some of the sediment samples taken in the Tonawanda Channel, at the mouth of the Buffalo River, and in the lower Niagara River in 1979 by the Ontario Ministry of the Environment (MOE). Levels of these contaminants were below the guidelines in samples obtained from the Chippewa Channel and at the mouth of the Niagara River at Fort Erie. In the Tonawanda Channel and at the mouth of the Buffalo River, the following ranges of concentrations were determined: PCB, 36 to 960 µg/kg; arsenic, 1.9 to 14 mg/kg; chromium, 5.8 to 79 mg/kg; copper, 7.8 to 110 mg/kg; lead, 5 to 200 mg/kg; mercury, 0.01 to 0.67 mg/kg; zinc, 42 to 460 mg/kg. Levels in lower Niagara River sediments ranged as follows: PCB, 66 to 2700 µg/kg; arsenic, 1.5 to 8.2 mg/kg; chromium, 9.5 to 170 mg/kg; copper, 7.5 to 32 mg/kg; lead, 6 to 60 mg/kg; mercury, 0.19 to 3.2 mg/kg; zinc, 55 to 170 mg/kg. With the exception of a lower level of PCB (not detected to 251 µg/kg) and some samples containing iron (range: 7,500 to 28,000 mg/kg) in excess of the dredging guideline of 10,000 mg/kg, similar ranges of concentrations were found in sediments of the lower Niagara River sampled by Ontario MOE in 1981.

Working under a U.S. EPA grant, the University of Indiana in 1979 identified a number of organic compounds in the water and sediments near industrial landfills. Compounds identified included chlorinated benzenes and toluenes, benzenehexachloride, dichlorophenol, trichlorophenol, chloronaphthalene, dodecanol, mirex, chloroanthracenes, cyclohexane and derivatives, PCB, and phenothiazene.

A comprehensive survey conducted by U.S. EPA in the Buffalo area in 1981 found that almost all sediments from the head of the Niagara River and in the Tonawanda Channel are heavily contaminated with conventional pollutants and heavy metals. Many sediments also contained high concentrations of organic substances. Nine potential or positive carcinogens and eight organic substances having a potential for chronic aquatic toxicity were identified. Each was present at at least one sampling location and at a concentration of at least 5 mg/kg; the concentrations of some substances exceeded 50 mg/kg. The carcinogenic toxicants found were: anthracene, benzo(a)anthracene, benzo(a)pyrene, chlorotoluene, fluoranthene, fluorene, phenanthrene, pyrene, and tetrachlorohinzene. The aquatic toxicants found were: acenaphthene, p-tert-butyl phenol, chlorobenzene, chloronaphthalene, di-n-butyl phthalate, dichlorobenzene, pentachlorobenzene, and 1,2,4-trichlorobenzene.

FISH

Ontario MOE data from their spottail shiner program show that concentrations of PCB, DDT, and mercury in whole fish collected at Niagara-on-the-Lake decreased significantly between 1975 and 1979. However, concentrations of PCB increased significantly in the 1980 collection (to 266 µg/kg from 153 µg/kg in 1979) and stayed at this level in 1981 as well. In 1980, higher concentrations of PCB were found in fish from the upper Niagara River (Tonawanda Channel) adjacent to the 102nd Street - Love Canal disposal sites (389 µg/kg) and at the mouth of the Little River (397 µg/kg) than in fish collected in the lower Niagara River. In contrast to these two areas, fish collected from the Chippewa Channel and the Welland River contained low PCB levels (56-66 µg/kg) and no detectable residues of mirex. Other organics detected in 1980 in fish from the lower Niagara River were chlordane, BHC, hexachlorobenzene, tri- and tetrachlorobenzenes, pentachlorobenzene, and octachlorostyrene. Higher concentrations of 2,3,7,8-TCDD (tetrachlorodibenzo-p-dioxin) were found in fish collected in 1981 in the upper Niagara River at the confluence of Cayuga Creek (receiving drainage from Love Canal) and the Little River (59 ng/kg) than in samples from the Niagara River near Frenchman's Creek on the Canadian side and from sites in the lower Niagara River (3-15 ng/kg).

1981 Ontario data for PCB, DDT, mirex, and mercury in boneless, skinless fillets of dorsal muscle flesh indicate that resident sport fish from the upper and lower Niagara River (yellow perch and smallmouth bass) are suitable for unrestricted consumption. The Canadian federal consumption guidelines for PCB, DDT, mirex, and mercury are 2.0, 5.0, 0.1, and 0.5 mg/kg, respectively. However, white sucker (18-22 inches) from both stretches of the river contained 0.5-1.0 mg/kg mercury and have restricted consumption advisories. Some species from the lower river contained 2,3,7,8-TCDD, but levels were below the Canadian 20 ng/kg consumption guideline. Species such as American eel and coho salmon (>22 inches) found in the lower river, but generally resident in Lake Ontario, show the typical elevated PCB/mirex levels and have

restricted consumption advisories. Some lake trout from western Lake Ontario contain 2,3,7,8-TCDD above the 20 ng/kg consumption advisory.

New York Department of Environmental Conservation (DEC) fish surveys conducted on the upper Niagara River in 1975, 1976, and 1977 found elevated levels of PCB and DDT, up to 11.3 and 2.34 mg/kg, respectively.

Similar fish surveys on the lower Niagara River in 1979 detected PCB, DDT, dieldrin, lindane, mirex, and mercury in the edible fillet portion. All concentrations were below the U.S. FDA action level (DEC Technical Report 82-1 BEP). Also, mirex and lindane were detected in fish taken from the Cayuga Creek area.

WATER

Municipal and industrial discharges and leachate from several disposal sites in the watershed contribute to a number of objective violations in the Niagara River; however, the extent of the contribution from disposal sites has not yet been determined.

Four surveys conducted in 1980 by Ontario MOE showed that in the upper Niagara River: 10% or less of the samples exceeded objectives for cadmium (0.2 µg/L), chromium (50 µg/L), copper (5 µg/L), zinc (30 µg/L), PCB (0.001 µg/L), aldrin/dieldrin (0.001 µg/L), total DDT plus metabolites (0.003 µg/L), and endrin (0.002 µg/L); the phenolics objective (1 µg/L) was exceeded in less than 10% of the samples (maximum concentration: 2 µg/L). With the exception of heptachlor/heptachlor epoxide, mean concentrations and the percentage of samples exceeding the objectives were higher on the U.S. side of the upper Niagara River (Tonawanda Channel) than on the Canadian side (Chippewa Channel).

In the lower Niagara River: up to 10% of surface water samples exceeded the Agreement and/or provincial objectives for the protection of aquatic life for cadmium (0.2 µg/L), chromium (50 µg/l), copper (5 µg/L), aldrin/dieldrin (0.001 µg/L), total DDT plus metabolites (0.003 µg/L), endrin (0.002 µg/L), heptachlor/heptachlor epoxide (0.001 µg/L), and endosulfan (0.003 µg/L); concentrations of iron (30 to 610 µg/L) and filtered mercury (0.04 to 0.71 µg/L) exceeded their respective objectives of 300 and 0.2 µg/L in 15% or less of the samples; and the phenolics objective of 1 µg/L was exceeded in approximately 25% of the samples (maximum: 1 µg/L).

During the same Ontario 1980 MOE surveys, the provincial total and fecal coliform objectives for the protection of body contact recreational use (1000 organisms/100 mL and 100 organisms/100 mL, respectively) were exceeded adjacent to the mainland (U.S.) shore throughout the length of the Tonawanda Channel. Similarly, the provincial phosphorus guideline of 30 µg/L for the protection of rivers and streams was exceeded downstream of the Buffalo River and throughout the eastern half of the Tonawanda Channel. The percentage of samples exceeding these objectives/guidelines in the Tonawanda Channel was 30%, 15%, and 30%, respectively, while downstream of the Buffalo River and in the Chippewa Channel the percentages were 10% or less. The influence of upstream sources was evident in the lower Niagara River, where the provincial total coliform and fecal coliform objectives were exceeded in 40% and 10% of the samples, respectively.

A 1976 study conducted by the New York State Department of Health, using artificial substrates, concluded that toxicity was the limiting factor for fauna along the U.S. shoreline of the upper Niagara River and that, although not so severe, toxicity was also a problem in the lower Niagara River. Along the Canadian shoreline of the upper Niagara River, a healthy fauna was present.

Regular monitoring by Ontario MOE of water supplies serving the Ontario municipalities of Fort Erie, Niagara Falls, and Niagara-on-the-Lake showed compliance with all existing (Canadian federal) and proposed drinking water guidelines and objectives during 1980.

REMEDIAL MEASURES

ONTARIO

While none of the exceedances described above have been attributed to Ontario discharges, Ontario MOE is pursuing, in conjunction with local industries and municipalities, a number of abatement programs which address local problems on tributary streams or which are intended to reduce the overall waste loading to the Niagara River and Lake Ontario.

The Welland and Niagara Falls sewage treatment plant effluents, which discharge to the Welland River and the Chippewa Power Canal, respectively, meet provincial requirements for phosphorus, suspended solids, and BOD. Extensive sewer rehabilitation is presently being carried out in the area of Fort Erie serviced by the Crystal Beach wastewater treatment plant, which discharges to Lake Erie. When the rehabilitation is completed, expansion of the treatment works will proceed if necessary.

Cyanamid of Canada Limited (Welland Plant) and Atlas Steels Company are the major Canadian industrial discharges to the Niagara River.

Cyanamid of Canada Limited (Welland Plant) is not in compliance with the provincial water quality and loading requirements for phosphorus and nitrogen compounds. The company was issued a control order in February 1978 which requires compliance of both air and water emissions by September 30, 1984. Interim compliance dates have been achieved.

Cyanamid of Canada Limited was successfully procecuted in June 1981 under the Canada Fisheries Act by a private citizen for discharging substances toxic to fish into the Welland River. The company was fined a nominal sum of $1.00, based on the court's assessment of the abatement efforts to date and anticipated compliance with the control order.

Atlas Steels Company has been granted an extension from December 31, 1981 to September 30, 1983, to the Amending Control Order to facilitate the installation of a solidification process which involves the most recent technology. Such a process will treat the waste acid and alkaline rinse solutions which at present are disposed of at the company's licenced landfill site. The company has completed sewer separation, with the cooling water being discharged to the Welland River and process water being treated and recirculated.

Other industrial sources such as Canadian Caborundum and Cyanamid Canada Limited (Niagara Falls plant) have substantial suspended solids loadings but remain in compliance with Ontario MOE's requirements. Norton Company does exceed the requirements for suspended solids; however, the exceedance is marginal. The company is reviewing the possible sources for this high loading. The discharges from these three industries have been identified as consisting essentially of cooling water.

With respect to toxic substances in point source effluents, Ontario MOE conducted a preliminary survey in early 1981 of all of the above-noted industrial and municipal sources and several other minor point sources in the Niagara area. Based on the survey findings, it was estimated that Ontario industrial and municipal point sources (including two combined sewer outflows) contribute a total of 10 kg/d of organic priority pollutants and 70 kg/d of heavy metals to the Niagara River and its tributaries.

Additional point source sampling for priority pollutants analysis was undertaken by Environment Canada in late 1981. Five industrial sources, 3 municipal sewage treatment plants, and 2 combined sewers were surveyed. Analytical results on the volatile and acid fractions of the priority pollutant scan confirm these sources to be minor contributors of these compounds to the Niagara River. Data on the base-neutral fraction of the samples are not yet available.

Ontario MOE has appointed a Niagara River Coordinator and established a study team who are reviewing all area municipal and industrial discharges with respect to the adequacy of existing treatment and control requirements and who are similarly evaluating the draft SPDES permits being issued by New York.

NEW YORK

The Niagara River Toxics Regulatory Program is the backbone of New York's remedial program for the Niagara Frontier. It addresses known major industrial and municipal wastewater discharges as well as abandoned and active hazardous waste disposal sites. The following highlights a few of the sources/activites.

Niagara Falls (C) STP - The Niagara Falls (C) STP discharge permit expired on January 31, 1980 and is currently being processed for renewal in late summer of 1982. The permit is to contain a compliance schedule requiring completion of construction by March 31, 1984 and attainment of operational levels to be achieved within six months of completion of construction (estimated date October 1, 1984).

The draft permit specifically mentions the construction of the carbon adsorption and regeneration system and the completion of the design and construction of the Falls Street Tunnel Diversion Project. Upon completion of the Diversion Project the permittee shall evaluate its environmental effectiveness and complete any additional flow reduction measures necessary to reduce influent flows to the sewage treatment plant (design flow of 48 U.S. MGD) as well as maximize industrial waste capture during overflow events.

The City of Niagara Falls has obtained a Step 1 construction grant for a pretreatment program. The city is submitting progress reports on a monthly

basis. On December 1, 1982 the city is scheduled to submit a phase 1 report. This report is to contain an industrial survey, an evaluation of legal authority, and a determination of technical information necessary to support development of an industrial waste ordinance. Based on recent information from New York DEC, the city is well on its way toward producing this phase 1 report.

SCA Chemical Services, Inc. - SCA is an industrial waste treatment facility in Model City. An SPDES permit to discharge was issued with an effective date of May 1, 1981. In June 1981, SCA was allowed to discharge 6 million U.S. gallons of treated effluent. SCA still has stored on its site 110 to 120 million U.S. gallons of treated effluent which must be discharged to the river in an environmentally safe manner. SCA has been unable to discharge the treated effluent because certain chemical parameters exceeded the SPDES permit effluent limitations. In order to discharge the accumulated treated effluent, certain effluent limitations were modified in conjunction with changing the required in-stream dilution from 20:1 to 500:1. A discharge of treated wastewater effluent in accordance with the agreed modifications to the SPDES permit, when diluted in the receiving stream to 500:1, will not result in violation of New York water quality standards.

The SPDES permit was modified on May 24, 1982. The modification is based on a stipulation and agreement made on March 31, 1982 by and between SCA Chemical Services, Inc., New York DEC, Towns of Lewiston and Porter, Operation Clean, Operation Clean-Niagara, and Pollution Probe. The modification contains many safeguards in order to prevent adverse environmental impacts resulting from SCA discharges and/or other activities at the Model City site. Under the terms of the modified permit, SCA is now conducting the prequalification testing in order to discharge one of its lagoons, containing 60 million U.S. gallons of the remaining treated effluent.

Hazardous Waste Sites - The detection, location, and remediation of both active and abandoned hazardous waste sites along the upper Niagara River is a major objective of the Niagara River investigatory program. A combination of river sampling of toxic effects on biological substrates, near-shore sediment analysis, and geohydrological assessment of adjacent land within three miles of the river will provide the basis for locating significant toxics loading points. Followup investigations will be utilized to pinpoint locations of active recharge of toxics to the Niagara River.

Remediation would follow one of two courses, depending upon acceptance of responsibility by the identified owner. If singular ownership is determined, the case would be referred to the department's Hazardous Waste Compliance Team for negotiations leading to remediation. If the site is abandoned and ownership cannot be determined, then the New York DEC regional office would initiate procedures to remediate through Superfund provisions. The timetable for remediating abandoned or active hazardous waste disposal sites is expected to require on the order of 5 to 10 years to complete.

Delays in the development of long-term, draft SPDES discharge permits for industrial discharges have been caused primarily by the failure of U.S. EPA to promulgate final best available technology economically achievable/best conventional pollutant control technology (BAT/BCT) effluent guidelines. BAT/BCT treatment levels must be achieved by July 1, 1984 pursuant to Section 301 of the U.S. Clean Water Act.

In those cases where BAT/BCT guidelines have not been promulgated in a timely manner, draft discharge permits have been or are being developed incorporating effluent limitations based on "Best Engineering Judgment". The processing of the long-term permits incorporating limits based on BAT/BCT guidelines or "Best Engineering Judgment" is to allow for approximately two years to achieve BAT/BCT treatment levels.

ASSESSMENT

NEW YORK

In the absence of federally established categorical industrial discharge limitations, New York is committed to determination of appropriate industrial and pretreatment discharge limits based on best professional judgment (BPJ). This process is expected to yield sufficiently protective limits on sources of contamination. With the cessation of point and non-point source discharges of toxic substances, it is expected that the Niagara River system will achieve objective water quality levels within this decade.

Several of the prime sources of toxic substances in the Niagara River are the subject of state and/or federal remediation. The City of Niagara Falls, Hooker Chemical Company (Occidental Petroleum), and Olean Chemical Corporation are examples of entities subjected to litigation. The federal action against the Hooker Chemical Company, which is joined by the State of New York, includes various of the company's hazardous waste disposal sites such as the S-Area and Hyde Park. Actions and schedules derived from the litigation will update the compliance schedules described herein. Overall, it is expected that the 1980's will see a substantial further improvement in the waters and environmental resources of the Niagara River.

The success of remedial programs on the Niagara River are predicated on substained state and federal funding in order to achieve success in reducing inputs and impacts of sources to the Niagara River and Lake Ontario. As designed, the Niagara River Toxics Regulatory Program will seek unknown toxic sources, establish toxic limits and discharge permits, and investigate/remediate hazardous waste disposal sites pursuant to the following action components:

- SPDES toxic effluent limit setting	November 1, 1982
- Preparation of BAT/BPJ methodology	April 30, 1983
- Economic incentives to industry	completed
- Environmental monitors	April 1, 1983
- Real time monitors	October 15, 1982
- Niagara River investigatory program for (1) information and data review; (2) ambient river monitoring; (3) effluent sampling, and (4) long-term toxics monitoring	December 31, 1983
- Niagara Falls (C) STP revised SPDES permit and reconstruction	September 30, 1982

ONTARIO

Since Ontario Niagara River area inputs are not the cause of the objective exceedances, planned remedial action at these sources will not directly impact

on the resolution of the Niagara River problem. Remedial activities will, however, reduce waste loading to the river and Lake Ontario thereby contributing to overall improvement in water quality once the primary sources in New York are abated.

INFORMATION SOURCES

In June 1981, the New York Department of Environmental Conservation published, "Toxic Substances Control in the Niagara River - A Preliminary Report". The report is a comprehensive summary of information available at the time, including environmental data and remedial measures, for the Niagara River and the Buffalo River. The report is available from the Department of Environmental Conservation, 50 Wolf Road, Albany, New York 12233. In March 1982, the U.S. EPA published, "Overview of Environmental Pollution in the Niagara Frontier, New York". The report is available from U.S. EPA, Washington, D.C.

Canadian sources of information include:

1. Canada-Ontario Review Board, 1981. "Environmental Baseline Report of the Niagara River - November 1981 Update." 31 pp + figures and tables.

2. Government of Ontario, 1982. "Guide to Eating Ontario Sport Fish, 1982 - Southern Ontario and Great Lakes." Toronto. 191 pp.

3. Ontario Ministry of the Environment, Water Resources Branch, Toronto. Unpublished 1981 data on 2,3,7,8-tetrachlorodibenzo-p-dioxin in spottail shiners.

4. Kauss, P.B., 1982. "Studies of trace contaminants, nutrients and bacteria levels in the Niagara River." Paper presented at XXV IAGLR Conf., Sault Ste. Marie, Ont., May 4-6, 1982 (to be published in J. Great Lakes Res.)

More recent information about environmental conditions and remedial programs in the Niagara River and the Buffalo River areas can be obtained from:

New York Department of Environmental Conservation
Region 9 Headquarters
600 Delaware Avenue
Buffalo, New York 14202

Ontario Ministry of the Environment
West Central Region
119 King Street
12th Floor
Box 2112
Hamilton, Ontario L8N 3Z9

HAMILTON HARBOUR, ONTARIO

ENVIRONMENTAL DATA

SEDIMENT

The surface sediments in parts of the harbour exceed the provincial guidelines for open-water disposal with respect to iron, lead, arsenic, zinc, copper, nickel, mercury, chromium, total phosphorus, total Kjeldahl nitrogen, ammonia, ether extractables, and oil and grease. The highest levels of contamination are found in sediments adjacent to municipal and industrial discharge sites and in the deep-water central basin. Contaminated dredged spoils are disposed of in a confined basin constructed for that purpose in the southeast corner of the harbour.

PCB levels in sediment exceed provincial guidelines for open-water disposal along the south shore and in the deep water areas, with the highest concentrations being found in the southeast portion. Organochlorine pesticides and their metabolites have been detected in sediments at average levels close to 10 µg/kg. The distribution of pesticides suggests a source in the southeastern portion of the harbour. No provincial guidelines exist for pesticides.

FISH

Ontario Ministry of the Environment (MOE) data taken from the young-of-the-year spottail shiner program show that PCB levels have declined significantly (by >70%) between 1977 and 1980 in fish collected at Burlington Beach, Lake Ontario which is exposed to outflow from Hamilton Harbour. However, 1980 concentrations in whole fish were still above the Agreement objective for the protection of fish-eating birds and animals.

Recent testing of edible portions of sport fish caught in the harbour by Ontario MOE indicates that rainbow smelt are now suitable for unrestricted consumption. As well, northern pike in the sizes taken (45 to 75 cm) were also found suitable for unlimited consumption. These species were tested for mercury, PCB, mirex, and a range of organochlorine pesticides.

WATER

The average levels of un-ionized ammonia, total dissolved solids, and zinc nearly always exceed the Agreement objectives; iron, cyanide, and phenols also occasionally exceed the objectives. Fecal coliform levels have decreased and seldom exceed the provincial objective for swimming and bathing; Harbour Commission regulations, in any case, prohibit swimming in the harbour. Total phosphorus concentrations (yearly average of 80 µg/L) considerably exceed the provincial guideline of 20 µg/L. In addition, the oxygen demand from municipal and industrial discharges, sediments, and algal decay are responsible for extremely low dissolved oxygen levels in the hypolimnion when the harbour is stratified. The aesthetic quality of the harbour is diminished by the poor water clarity and colour, caused by high levels of suspended solids, chlorophyll, and dissolved organics.

Organochlorine pesticides and their metabolites and polynuclear aromatic hydrocarbons at levels close to the detection limit of 1 ng/L have been detected on occasion in the water. There is no apparent distribution pattern of these compounds.

REMEDIAL MEASURES

Both Stelco and Dofasco are sources of iron, suspended solids, phenols, cyanide, and ammonia. Since 1978, substantial reductions in loadings of all of these parameters have been achieved at both plants.

At Stelco, phenols and cyanide loadings do not meet Ontario MOE requirements; a cooling water recirculation system and a filtration plant were completed in 1980. Stelco is currently working on the following major projects under a control order: the installation of a steam distillation unit and a blast furnace recirculation system, both to be completed by the end of 1982; and an indirect cooling system to be completed in four stages by 1987.

At Dofasco, suspended solids and phenols loadings still exceed Ontario MOE required loadings. A Zimpro ammonia oxidizer was installed, and the filtration plant was expanded in 1980. Improved ammonia and phenols removal were achieved in 1981 due to improved performance of the ammonia stripping tower and biological treatment plant. The plant is expected to comply with solids reduction requirements outlined in the Control Order by the end of 1982. Completion of a treatment system for ammonium thiocyanate wastes has been delayed due to equipment failure. Compliance with this order is expected by the end of 1982.

Expansion of the Hamilton sewage treatment plant to 409 x $10^3 m^3/d$ (90 MIGD) was completed in late 1979. An extensive study to improve operation and effluent quality has been completed and its recommendations implemented. The plant has generally met all Ontario MOE criteria, including phosphorus, since January 1, 1982. However, the plant is still the most significant source of ammonia to the harbour.

The conclusions of Ontario MOE's 1982 water quality management study of Hamilton Harbour will provide further assessment of the oxygen depletion problems and of remedial measures to be taken.

The Upper Ottawa Street landfill site, located in the Redhill Creek watershed (which drains into the southeast corner of the harbour), has been extensively investigated and was not found to be a contributor to water quality impairment of the harbour.

ASSESSMENT

WATER

It is not clear what program of remedial measures would be necessary to achieve full compliance of harbour water quality with the specific objectives of the Agreement. It is also not clear at this time whether this is a practically attainable goal.

Exchange flows through the ship canal connecting the harbour to Lake Ontario reduce the hydraulic residence time to around 0.25 years. This

flushing action keeps the water quality in the harbour from deteriorating further. The effects of the exchange flow on the water quality in the nearshore region of Lake Ontario along Burlington Beach were investigated by Ontario MOE in 1982.

Remedial measures at Stelco and Dofasco will reduce loadings of ammonia, cyanide, and zinc to the harbour.

The contribution of stormwater runoff to the harbour, and its significance to the oxygen depletion problem is under evaluation. Total loadings of phosphorus, nitrogen, suspended solids, and BOD from stormwater runoff have been estimated, and represent less than 15% of the total loadings to the harbour.

Ontario MOE analysis of the oxygen depletion processes in the harbour suggests that existing abatement programs will not improve hypolimnetic oxygen concentrations to the levels specified in the Agreement and in provincial water quality objectives. Ontario MOE is presently finalizing a water quality management study of the harbour which will examine possible remedial actions covering inputs of oxygen-demanding substances and nutrients and their expected impacts on harbour quality.

SEDIMENT

The sediment contamination problem will persist over the long term. Remedial dredging in the Windermere Basin area is under consideration. This, along with periodic maintenance dredging of navigational channels, would remove some of the more heavily contaminated material to contained disposal. In addition, reductions in emissions will bring about a gradual reduction in surface sediment contaminant levels.

INFORMATION SOURCES

Detailed information about environmental conditions and remedial measures may be obtained from the following sources:

1. "Hamilton Harbour Study 1977, Vol. 1." Ontario Ministry of the Environment, Water Resources Branch, Toronto, Ontario.

2. Ontario Ministry of the Environment, Toronto. Unpublished 1977 and 1980 data on young-of-the-year spottail shiners.

3. Ontario Ministry of the Environment, Toronto. Unpublished 1978, 1979, and 1980 water quality survey data.

4. "Hamilton Harbour Study, 1977, Vol. 2". Ontario Ministry of the Environment, Water Resources Branch, Toronto (unpublished).

5. Ontario Ministry of the Environment, Toronto. Unpublished data on municipal and industrial effluents, 1979.

6. Government of Ontario. "Guide to Eating Ontario Sport Fish - Southern Ontario and Great Lakes", Toronto, 1982. 191 pp.

Information may also be obtained from:

Ontario Ministry of the Environment
West Central Region Office
119 King Street
12th Floor
Box 2112
Hamilton, Ontario L8N 3Z9

ST. LAWRENCE RIVER (CORNWALL, ONTARIO - MASSENA, NEW YORK)

With the exception of potential impacts on migrating fish, discharges or residual inputs from the Cornwall, Ontario area are prevented from influencing water quality and water use in New York state waters by the prevailing flow regime around Cornwall and the St. Regis Islands.

ENVIRONMENTAL DATA

SEDIMENT

A study conducted in 1979 by the Ontario Ministry of the Environment (MOE) revealed that bottom sediments for a 4 km stretch of the Cornwall waterfront and at the mouth of the Grasse River (Massena) exceeded Ontario MOE guidelines for open water disposal of dredged spoils for PCB, cadmium, chronium, copper, iron, lead, mercury, zinc, total phosphorus, total Kjeldahl nitrogen, and oil and grease. The guidelines, the range of concentrations of these parameters in sediments from the Cornwall area, and the range of concentrations in sediments at the mouth of the Grasse River are given in the following table:

Parameter	MOE Guidelines (mg/kg)	Sediments in Cornwall Area	Sediments at Mouth of Grasse River
PCB	0.050	ND-2.67	0.22-1.50
Cadmium	1	0.30-1.10	0.30-1.60
Chromium	25	13-55	24-56
Copper	25	9.5-530	31-110
Iron	10,000	7,300-20,000	18,000-35,000
Lead	50	6.2-1,600	6.5-53
Mercury	0.3	0.18-19.8	0.07-0.36
Zinc	100	25-4,100	57-250
Total Phosphorus	1,000	470-1,200	790-2,100
Total Kjeldahl Nitrogen	2,000	500-3,200	710-3,700
Oil and Grease	1,500	191-13,838	-

Levels of PCB, cadmium, copper, iron, and zinc were also above their respective guidelines in sediments collected close to the Reynolds Metals and General Motors outfalls located downstream of the Grasse River mouth.

FISH

Ontario MOE data showed significant declines in PCB levels between 1979 (2,072 µg/kg) to 1981 (1,117 µg/kg) in spottail shiners collected at the mouth of the Grasse River, downstream of Massena and the Alcoa aluminum plant.

Levels are, however, still substantially above the Agreement objective (100 µg/kg in whole fish) for the protection of fish-eating birds and animals, and about five times those in Cornwall samples. Fish (spottails) collected downstream of the Domtar/CIL discharge at Cornwall did not change significantly in PCB content between 1979 (243 µg/kg) and 1981 (234 µg/kg). Spottails collected upstream of Cornwall in 1979 contained no detectable levels of PCB.

1981 Ontario data showing elevated mercury concentrations in the boneless, skinless fillet of dorsal muscle flesh of larger sizes of some game fish species caught in the Cornwall/Massena area, as well as in downstream Lake St. Francis (i.e. northern pike and walleye >14 inches) has led to restrictions on consumption and commercial sale. The mercury problem is mainly residual in nature; the industrial sources uplake have been under control since mid-1970's.

Larger sizes of a number of other species from the Cornwall/Massena area (i.e. brown bullhead, channel catfish, white sucker, and sturgeon) contain elevated PCB levels which have led to consumption advisories. PCB levels appear to be partly attributable to recurring inputs in the Grasse River area. The Canadian consumption guidelines for mercury and PCB are 0.5 and 2.0 mg/kg, respectively.

WATER

The 1979 Ontario MOE survey indicated that municipal and industrial discharges on both the Canadian and the U.S. sides of the river in the Cornwall/Massena area contribute to localized violations of a number of provincial and Agreement objectives for the protection of aquatic life. In the Cornwall, Ontario area, all samples exceeded the Agreement objectives for phenol (1 µg/L) and heptachlor/heptachlor epoxide (0.001 µg/L), while 50% of samples exceeded the provincial guideline for total phosphorus (30 µg/L) to eliminate excessive plant growth in rivers and streams. In the Massena, New York area, 50% or more of the samples from the mouths of the Grasse, Raquette, and St. Regis Rivers exceeded the Agreement objectives for cadmium (0.2 µg/L) and iron (300 µg/L); up to 50% exceeded the objective for copper (5 µg/L); and 13% exceeded the objective for heptachlor/heptachlor expoxide. The provincial objective for total phosphorus was exceeded in 13% of samples from the Raquette River mouth and in all samples taken at the mouths of the Grasse and St. Regis Rivers. Samples from the mouths of the Grasse and Raquette Rivers also exceeded the Agreement objective for zinc (30 µg/L) in 13% and 25% of samples, respectively. The Agreement objectives for aldrin/dieldrin (0.001 µg/L) and the provincial objective for PCB (0.001 µg/L) were exceeded in 13% and 25% of samples from the Grasse River mouth. Of samples taken at the mouth of the Grasse River during 1980 (5 surveys), 60% contained PCB levels in excess of the provincial objective.

Some recreational beaches immediately downstream of Cornwall are subject to recurring violations of the provincial total coliform and fecal coliform objectives for the protection of recreational use (1000 organisms/100 mL and 100 organisms/100 mL, respectively). Five surveys conducted by Ontario MOE during 1980 showed that violations of the objectives for bacteria as well as phenols along the Cornwall shoreline were related to high levels in the Domtar Fine Papers effluent and were noted as far as 9 km downstream of the outfall. Maximum mean fecal coliform levels ranged from 26,000 organisms/100 mL 100 m

from the outfall to 380 organisms/100 mL some 9 km downstream; for phenolics, this range was 17 to 2 µg/L, respectively.

REMEDIAL MEASURES

ONTARIO

On the Canadian side of the St. Lawrence River at Cornwall, Courtaulds, BCL of Canada Inc., CIL, Domtar Fine Papers, and the Cornwall sewage treatment plant discharge their effluents directly to the St. Lawrence River. CIL is in compliance with provincial effluent requirements and with federal chlor-alkali mercury liquid effluent regulations.

Domtar has also been identified as a source of high phenolics and bacterial levels in the river adjacent to Cornwall, and further investigations are underway to locate and remedy the causes.

Domtar Fine Papers currently meets both the federal and provincial guidelines for BOD in its final effluent but exceeds the Ontario MOE objective for suspended solids. A Control Order addressing the suspended solids problem was served in March 1982, and the final phase of the solids reduction program under this Order is to be completed by the end of 1983. The phosphorus loading (previously reported as 23.7 tonnes for 1980) has consistently met the Ontario MOE objective of 1 mg/L.

Courtaulds and BCL are not meeting the provincial requirements for BOD in their discharges. The suspended solids loadings have been reduced to within the required limit since the previous report. BCL is expected to be in full compliance with an outstanding Control Order by September 1982 with respect to BOD loadings and has now achieved compliance with the sulphuric acid requirement. Courtaulds is not currently under a Control Order, although sulphuric acid and BOD loadings are considerably above provincial requirements. The company is undertaking a voluntary program to assess additional abatement technologies. The results of this engineering work should be available in late 1982 and may form the basis of a Control Order in 1983.

PCB has occasionally been detected in some Cornwall industrial and municipal effluent samples (usually at less than 0.5 ug/L). The possible sources are being investigated.

Extensive studies to determine the needs of the collection and treatment system presently servicing Cornwall have been completed. Assessment of sewer separation and stormwater control, pre-treatment or control of industrial wastes being discharged to the collector system, and requirements for expansion of the existing wastewater treatment facilities, were included in the study. The city is currently negotiating with Ontario MOE for financing of the expansion. Subject to satisfactory completion of the negotiations, completion of the expanded facilities and other modifications has been tentatively set for 1985.

NEW YORK

The four major New York municipal facilities discharging to the St. Lawrence River Basin do not monitor or limit phosphorus in their effluent.

The New York Department of Environmental Conservation (DEC) has deemed that phosphorus loadings from municipal facilities in this basin will not affect water quality. Only the statewide ban on phosphorus in detergents would be applicable in this basin.

Massena STP - This is a new facility which has experienced startup problems. DEC is presently rendering startup assistance. Also, the Village consultant has proposed certain modifications to the treatment system (grit removal improvements, polymer addition to improve settling, etc.) which will bring this facility into compliance by October 1982.

Canton STP - Effluent violations are due to inflow/influent problems (weak influent). The facility permit contains a compliance schedule for correction. Recently a sewer system evaluation study was submitted and the permit should be modified to contain a construction schedule to achieve compliance. However, due to low priority, construction grants funds may not be available for some time.

Ogdensburg STP - Effluent violations due to weak influent are caused by combined sewer overflows. The facility permit contains a compliance schedule to correct the problems. Corrective measures were commenced this summer and compliance will be achieved by early 1984. In addition, this facility is also involved in development of an industrial pretreatment program, which is to be in place by the latter part of 1983.

Potsdam STP - A minor settleable solids violation was corrected. The facility is in compliance with effluent limitations.

Alcoa Facility - Alcoa is presently operating under a short-term SPDES permit. Processing for renewal of this permit is under way. It will be more restrictive than the previous, since the limitations will be based on best available tehnology (BAT) guidelines formulated by New York DEC using best engineering judgment. Possible PCB contamination will be addressed in a special engineering report which is being prepared for New York DEC technical evaluation. A draft permit should be ready for public notice this summer. New York DEC expects considerable comments from the industry and any disagreements may have to be resolved through the hearing process. Industry is mandated by federal law to meet BAT guidelines by July 1, 1984. The facility has been substantially in compliance (a few flow and marginal pH violations are noted).

General Motors Foundry - The foundry is in a similar position as Aloca. However, their present permit does contain effluent limitations for PCB. Review of recent monitoring reports indicates that GM is substantially in compliance. As for others, the renewal permit will be more restrictive and this firm must meet BAT guidelines by July 1, 1984.

Engineering studies are still under way to determine the security of the sludge disposal sites. Also, PCB concentrations have been found in sediments at the mouth of the Grasse River and in the St. Lawrence River in the vicinity of the Reynolds Aluminum and Alcoa discharges. The actual source of contamination is yet to be determined.

The Massena waste treatment plant is an upgraded secondary treatment facility which is not in compliance with SPDES permit requirements; the permit does not require phosphorus removal or monitoring. The facility is under review by New York DEC for effluent violations.

The Alcoa facility at Massena used PCB in the past. The facility discharged an average of 18 MGD in 1980 to the Grasse River; the PCB content of the effluent varied from 2.7 to 4.3 µg/L.

The General Motors foundry used PCB hydraulic fluid until 1973. PCB levels over 100 mg/kg have been found in waste sludge deposited in several disposal sites and in the waste treatment system; however, the runoff from the disposal sites was found to be free from contamination. The company has installed a new carbon column waste treatment system to remove toxic substances. Engineering studies are under way to determine the security of the sludge disposal sites.

New York DEC has proposed PCB effluent restrictions of 1 µg/L daily average and 2 µg/L daily maximum for the above industrial facilities.

ASSESSMENT

ONTARIO

Action on combined sewer overflows and expansion of the existing wastewater treatment facilities in Cornwall is expected to alleviate bacterial contamination of some downstream beaches. However, occasionally high bacterial (total and fecal) levels in the Domtar effluent will continue to result in downstream violations of the provincial water quality objectives. This, as well as high phenolics concentrations in the mill's effluent, are scheduled for further investigation by Ontario MOE personnel this year.

Pre-treatment and control of industrial wastes discharged to the Cornwall municipal collector system is expected to allow for better phosphorus control and to reduce inputs of trace contaminants from the municipal system to the river.

Both the jurisdictional consumption advisory limits for PCB and mercury in sport fish and the Agreement objective for PCB in whole fish will continue to be exceeded until the sources on both sides of the river are eliminated.

The high contaminant levels (e.g. PCB, mercury, zinc, copper, cadmium, and chromium) in bottom sediments in the Cornwall area are and will be reduced by natural processes. Further investigation of continuing low level inputs of some of these substances is being undertaken to determine the need for additional remedial action.

NEW YORK

The major problem focus in this area of concern is the Grasse River in the vicinity of Massena, New York. Municipal and industrial discharges into the river are targeted for abatement as indicated above. These remedial programs are expected to fully resolve the problems associated with the area by the mid-1980's.

INFORMATION SOURCES

Detailed environmental and remedial measure information may be obtained from the following sources:

1. Ontario Ministry of the Environment, Water Resources Branch, Toronto. Unpublished data on: 1979 trace contaminants survey of Cornwall/Massena area; 1980 bacterial/phenols survey at Cornwall; 1979, 1980, and 1981 data on young-of-the-year spottail shiners.

2. Government of Ontario, "Guide to Eating Ontario Sport Fish - Southern Ontario and Great Lakes", Toronto, 1982. 191 pp.

Additional information can also be obtained from:

New York Department of Environmental Conservation
Region 6 Headquarters
State Office Building
317 Washington Street
Watertown, New York 13601

Ontario Ministry of the Environment
Southeastern Region Office
133 Dalton Street
Box 820
Kingston, Ontario K7L 4X6

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Glossary

The Water Quality Board prepared this glossary of terms and abbreviations used in this report, with the intent of giving the general public a better understanding of its contents.

TERMINOLOGY

Adequate treatment - (For municipalities) United States: minimum of secondary treatment with maximum effluent concentrations of 30 mg/L each for BOD and for suspended solids and 1.0 mg/L for total phosphorus; Canada: minimum of secondary treatment or equivalent with maximum concentrations of 20 mg/L each for BOD and suspended solids.

Area of concern - a geographic location where water, sediment, or fish quality are degraded and the Great Lakes Agreement water quality objectives or jurisdictional criteria, standards, or guidelines are exceeded.

BAT - best available waste treatment technology.

BCT - best conventional waste treatment technology.

BHC - lindane. An insecticide.

Bioaccumulation - the process of concentration of substances in living organisms.

Bioassay - use of a living organism to determine the biological effect(s) of a substance, condition, or factor.

Biomagnify - to increase in concentration in the food chain.

Biomass - the amount of living matter present in a habitat in a specific amount of water.

BOD - Biochemical Oxygen Demand; amount of oxygen used by micro-organisms present in a water or sewage sample in 5 days. It is a measure of the effect of decomposition of organic matter on the oxygen content of the water.

CERCLA - the U.S. Comprehensive Environmental Response, Compensation and Liability Act.

Chlorophyll a - a plant pigment whose concentration is used as an indicator of trophic status.

Coliform - bacteria from the colon of a warm-blooded animal.

COD - Chemical Oxygen Demand; a measure by chemical means of the quantity of oxidizable material present in a water sample.

Consent Decree - a judgement by a court which puts into effect a legally enforceable remedy.

Contaminant - a substance foreign to a natural system and/or present at unnatural concentrations.

Control order/requirement and direction order - enforceable orders in Ontario.

Conventional pollutant - a term which includes nutrients, substances which consume oxygen upon decomposition, materials which produce an oily sludge deposit, and bacteria. Conventional pollutants include phosphorus, nitrogen, chemical oxygen demand, biochemical oxygen demand, oil and grease, volatile solids, and total and fecal coliform.

Conventional toxic substance - includes phenol, cyanide, ammonia, and chlorine.

Criteria - numerical limits of pollutants established to protect specific water uses.

DDT - 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane. A pesticide.

Deleterious substance - a substance which can be harmful.

Dioxin - a group of 75 chemicals of the chlorinated dioxin family, including 2,3,7,8-tetrachlorodibenzo-para-dioxin (2,3,7,8-TCDD).

Dissolved oxygen - oxygen dissolved in water, necessary to support aquatic life.

Effluent - water discharged from a pipe or treatment plant.

Enrichment - the state of containing an abundance or excess of a substance, for example, nutrient enrichment.

EPA - United States Environmental Protection Agency

Eutrophic - abundant in nutrients; waters highly productive in plants and organisms.

FDA - United States Food and Drug Administration

GLISP - Great Lakes International Surveillance Plan

Great Lakes Basin Ecosystem - the interacting components of air, land, water and living organisms, including man, within the drainage basin of the St. Lawrence River at or upstream from the point at which this river becomes the international boundary between Canada and the United States (from Article I of the 1978 Agreement).

Guidelines - suggested criteria for programs or effluent limitations.

International Joint Commission (IJC) - established by the Boundary Waters Treaty of 1909 with 3 United States and 3 Canadian members.

Leachate - water that percolates or drains through a material.

Limited use zone - a geographic area in the vicinity of present and future municipal, industrial, and tributary point source discharges within which some of the specific Agreement objectives may not apply. These zones are to be designed by the responsible regulatory agencies (from Article IV of the 1978 Agreement).

Loadings - total mass of pollutant to a water body over a specified time, e.g. tonnes per year of phosphorus.

MGD - millions of gallons per day

MIGD - millions of imperial gallons per day

Mirex - dodecachloropentacyclodecane. Used as an insecticide and a fire retardant.

Nonpoint source - a source of pollutants from a wide geographic area, such as runoff of water from land or atmospheric deposition and precipitation.

NPDES - National Pollutant Discharge Elimination System; a permit system limiting municipal and industrial discharges, administered by EPA and the states.

Nutrient - material that is necessary for growth, principally phosphorus and nitrogen.

PBB - polybrominated biphenyl; used previously as a fire retardant.

PCB - polychlorinated biphenyl; a family of chemically inert compounds, having the properties of low flammability and volatility and high dielectric constant. Past applications include use as hydraulic fluids, heat exchange and dielectric fluids; plasticizers for plastics; coating extenders for pesticides; and as an ingredient of caulking compounds, adhesives, paints, printing inks, and carbonless copying paper.

Persistent compound - a substance which remains in the environment.

pH - a measure of the acidity or alkalinity of water on a scale from 0 to 14; 7 is neutral; low numbers indicate acidic conditions, high numbers alkaline.

Phenolics - any of a number of compounds with the basic structure of phenol but with substitutions made onto this structure. Phenolics are produced during the coking of coal, the distillation of wood, the operation of gas works and oil refineries, from human and animal wastes, and the microbiological decomposition of organic matter.

Phosphate - salt of one of several phosphoric acids used as a builder for detergents; a constituent of fertilizer.

Phosphorus - generally considered to be the principal limiting nutrient controlling eutrophication in the Great Lakes.

Point source - a source of pollutants from a municipal treatment plant or an industrial facility, often by way of a pipe.

Primary treatment - mechanical removal of floating or settleable solids from wastewater.

Secondary treatment - primary treatment plus bacterial action to remove organic parts of the waste.

Sludge - solids removed from sewage.

SPDES - State Pollutant Discharge Elimination System - A state-administered permit system limiting municipal and industrial discharges.

STORET - Storage and Retrieval System - a computerized system operated by the U.S. government for the storage and retrieval of environmental data.

STP - sewage treatment plant

Suspended solids - solid material suspended in water.

Toxaphene - a complex mixture of toxic compounds produced by the chlorination of camphene. Technical grade toxaphene consists of about 170 different chlorinated camphenes. Used as an insecticide and a herbicide.

Toxic substances - those compounds which, in sufficient amount on or in an organism can cause death, disease, mutation, deformity, or malfunction in that organism or its offspring. These include organochlorines such as DDT, mirex, PCB, hexachlorobenzene, trichlorotoluene, dieldrin, endrin, heptachlor epoxide, chlordane, lindane, and methoxychlor. Other organic substances such as toluene, dioxin, phthalate esters, furans, and styrenes are also toxic substances. Toxic metals include arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, and zinc. This list is by no means complete.

Trophic - having to do with the processes of nutrition.

Water quality objectives - under the Great Lakes Water Quality Agreement, goals set by the Governments of the United States and Canada for protection of the uses of the Great Lakes.

Water quality standard - a criterion or objective for a specific water use that is incorporated into enforceable regulations.

WPDES - Wisconsin Pollutant Discharge Elimination System. The state-administered permit system limiting municipal and industrial discharges.

MEASUREMENT UNITS

UNITS

metre - m	1 m = 3.281 feet
gram - g	1000 g = 1 kg = 2.205 pounds
tonne - t	1 t = 2,205 pounds
litre - L	1 L = 0.2642 gallons (U.S.) = 0.2200 gallons (Canadian)
day - d	

COMBINATIONS

kilogram, 10^3 grams	kg	
milligram, 10^{-3} grams	mg	
microgram, 10^{-6} grams	µg	
nanogram, 10^{-9} grams	ng	
millilitre, 10^{-3} litres	mL	
cubic metres per day	m^3/d	
tonnes per year	t/a	
milligram per litre	mg/L	part per million
microgram per litre	µg/L	part per billion
nanogram per litre	ng/L	part per trillion
microgram per gram	µg/g	part per million
milligram per kilogram	mg/kg	part per million
microgram per kilogram	µg/kg	part per billion
nanogram per kilogram	ng/kg	part per trillion