

FIFTH ANNUAL REPORT

GREAT LAKES WATER QUALITY



WASHINGTON

INTERNATIONAL JOINT COMMISSION
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OTTAWA

The 1976 Annual Report of the Great Lakes Water Quality Board and its five appendices (A-Water Quality Objectives, B-Surveillance, C-Remedial Programs, D-Radioactivity, E-Status Report on the Persistent Toxic Pollutants in the Lake Ontario Basin), the 1976 Annual Report of the Great Lakes Research Advisory Board, and the July 1977 Annual Progress Report of the PLUARG are available, supplies permitting from:

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The International Joint Commission is pleased to transmit its Fifth Annual Report on Great Lakes Water Quality in accordance with the Great Lakes Water Quality Agreement of 1972.

In this report the Commission has not attempted to provide a summary of the 1976 Annual Reports of the Great Lakes Water Quality Board and the Great Lakes Research Advisory Board which have been transmitted to the Governments and are available to the general public. While the Commission, in general, supports the Boards' recommendations, it is now providing its own comments and recommendations on the conditions relating to Great Lakes water quality in 1976, and on progress under the Agreement to date.

Progress towards the goals of the Agreement continues to be slow and uneven. The phosphorus control program shows encouraging signs and total phosphorus loadings have decreased, but, in general, the program is behind schedule and has not yet resulted in significant overall progress toward the anticipated improvement in the water quality of the Great Lakes. The Commission is concerned with the growing evidence of the dangers of toxic chemicals in the lakes

and with the failure to implement enforcement measures on many industrial and municipal sources of pollution.

This year, the Great Lakes Water Quality Board has identified 47 problem areas throughout the Basin as compared to 63 listed in its 1975 Annual Report. This decline was primarily due to a refinement of the definition of problem areas. However, there were modest improvements in five areas, and one new problem area, Waukegan Harbor on Lake Michigan, has been added to the new list.

The lack of major improvement in overall water quality is due in large part to the size of the lakes and their resulting slow response to remedial programs. The Commission acknowledges that both countries have devoted large expenditures of money to these programs. As a result, the continued degradation of the lakes has been substantially checked. Further, the development of coordinated programs of research, surveillance and remedial measures has, in itself, been a major accomplishment on which the Parties should continue to build.

1. Municipal Treatment

While there has been a gradual increase in the percentage of sewered populations receiving adequate wastewater treatment, construction and funding efforts, especially in the United States, must be continued if the entire municipal sewered population in both countries is to be served by adequate treatment by the early 1980's, a target date which the Commission believes is reasonable.

In 1976, municipal phosphorus loadings to lakes Erie and Ontario, while lower than 1975, remained significantly higher than the target loadings presently specified in the Water Quality Agreement. Despite considerable expenditures to date, the sewage treatment facilities for Detroit and Cleveland remain behind schedule. Having these plants fully developed and operating efficiently as soon as possible remains of the highest priority as they account for almost two-thirds of the municipal phosphorus discharge into Lake Erie. In addition, the Commission recognizes that there is an associated sludge disposal problem that must be resolved before these plants are fully effective.

Few of the major treatment plants in operation are meeting the 1.0 mg/litre phosphorus effluent limitation for the Lower Lakes contained in the Agreement. The Commission believes that this and even more stringent targets are achievable with current technology. In many cases, the failure to meet the limitation appears to be associated with inefficient operation of the treatment facilities. The Commission recommends that Governments initiate a review of all existing facilities with a view to increasing operating efficiency. This review should include consideration of improved operator training, procedures of operation and maintenance, plant monitoring, management and technical alternatives and appropriate incentives.

Even if phosphates are completely removed from detergent products, the need for efficient operation of treatment plants will remain as there are other sources of phosphorus, notably human wastes, that are expected to increase in quantity over time and that will require treatment.

The Commission believes that combined sewer overflows and stormwater flows from urban areas are reaching serious proportions and contribute significant amounts of a wide range of harmful substances to the Great Lakes. The Commission is aware that substantial funds and manpower are being directed to finding solutions to this complex problem in both countries. The Commission considers it a matter of high priority that these efforts be accelerated.

2. Surveillance

The Commission notes with satisfaction the report of the Water Quality Board that Governments are now providing adequate funding for point source monitoring within the current Great Lakes International Surveillance Plan. It is imperative that efforts by the two Governments should continue to support this international surveillance program, at least to the levels presently established, and that Governments ensure that funds appropriated for this purpose are fully expended.

Despite this positive response on funding, the Commission wishes to draw the attention of Governments to certain areas where a further commitment to surveillance activities may be required.

As a result of the references on Upper Lakes Pollution and Pollution from Land Use Activities, the Commission will be making recommendations on remedial programs. The continuation of certain monitoring activities initiated under the references will be needed to assess progress and evaluate program effectiveness.

The Commission also believes that there is a need for a greater and early emphasis on biological monitoring and on the monitoring of biologically sensitive nearshore areas. While aspects of biological and nearshore monitoring are included in the Surveillance Program, their present scope appears to be insufficient to assess the effectiveness of the revised Water Quality Objectives

(recommended by the Commission) which are based on the protection of the most sensitive beneficial use of the Great Lakes, usually aquatic life or human health. This need is also inherent in a growing overall concern for the impact of Great Lakes pollution on biological resources and human health. While this matter will be subjected to a more detailed study by the Commission in order to provide further advice to Governments, the Commission recommends that Governments undertake to ensure an adequate level of funding as soon as possible for the additional monitoring necessary to complement adequately the present chemical and physical monitoring programs in the Great Lakes.

3. Industrial Pollution

The Commission is pleased to report that substantial progress has been made by both countries in the control of industrial pollution sources since the Water Quality Agreement was signed in 1972. Nevertheless, the Commission recommends continued strong pressure by both Governments to ensure the attainment of remedial program objectives as quickly as possible. In this regard, the Commission is concerned about recent attempts to relax compliance schedules and requirements, such as the recent revisions of the Federal Water Pollution Control Act in the United States, which would delay restoration of water quality in the Great Lakes. Final effluent limitations based on the application of "Best Practicable Technology" aimed at meeting water quality standards were scheduled to be attained in the United States by no later than July 1, 1977.

Of the 239 industrial sources that discharge more than one million gallons of effluent per day into the Great Lakes, 135 discharge into the 47 Problem Areas identified by the Great Lakes Water Quality Board. While many dischargers are meeting current permit requirements, 19 industrial dischargers in Canada and the United States, including some of the larger ones, have not completed their pollution control programs. In the United States, some firms have appealed their effluent restrictions through the courts, causing further delays in compliance. The Commission recommends that Governments continue to apply all available legislative and regulatory powers to achieve early compliance with the effluent limitations necessary to protect water quality in the Great Lakes.

The Commission has become concerned with an apparently uneven approach to industrial pollution control in the two countries. In the United States, waste dischargers are issued permits in accordance with government regulations which stipulate mandatory effluent standards, control technology and schedules for compliance. In Canada, industries may be required under a Ministerial Order to install certain controls within an agreed time frame. While under both systems non-complying firms are subject to court action, it appears that both the setting of regulations and their enforcement are more flexible in Canada than in the United States. The extent to which these differences may be affecting compliance with water quality objectives under the Agreement is not clear. The Commission suggests that an analysis of the relative effectiveness of these different procedures would be required in order to clarify the extent and nature of this problem.

4. Toxic Substances

The Commission believes that the control and monitoring of toxic substances within the Great Lakes ecosystem is the most urgent problem facing the Governments under the present Water Quality Agreement. Among the problems associated with toxic substances in the Great Lakes are their persistent nature, transformation, bioaccumulation, transport, complexity and the lack of basic information on quantities being discharged. The Commission re-emphasizes the strong statements made in its Fourth Annual Report and its Special Report to Governments on the Water Quality Agreement wherein the need for stringent controls, effective monitoring and increased research on

toxic and potentially toxic substances was stressed.

Both Governments have now passed legislation and are developing regulations and programs to deal with toxic substances. The Toxic Substances Control Act in the United States and the Environmental Contaminants Act in Canada relate to the control of toxic substances and include the prohibition of PCBs. The Commission strongly urges that regulations covering specific toxic substances be implemented quickly so that this legislation may be vigorously enforced in the respective countries.

The Commission's 1970 Report on Pollution of the Lower Great Lakes identified the problems associated with the synergistic effects of organic contaminants in the Great Lakes. In 1977 this remains a vital concern to be dealt with and the Governments are again urged to develop standard procedures for assessing the problem and the associated hazards to human health and the environment. The Commission supports the program being undertaken by the Great Lakes Research Advisory Board to prepare an inventory of chemicals used in the Great Lakes Basin as the basis for developing structure-activity correlations. These correlations will relate chemical structure to biological activity for different chemical compounds in order to assist in predicting their toxic effects and bio-accumulation potential. Both the Commission and environmental agencies have experienced difficulties in obtaining the required information on manufacture, distribution and use of chemicals within the Great Lakes Basin.

As a matter of utmost priority the Commission urges the two Governments to work towards implementing, as soon as possible, the Great Lakes Water Quality Board's recommendations for the control of toxic substances in the Lake Ontario Basin, and the recommendations of the Research Advisory Board concerning toxic substances, both attached to this Report as an Appendix.

Finally, the Commission wishes to draw the attention of Governments to the Water Quality Board's recommendation on mirex in the Great Lakes Basin (see Section 8) and to the information on lead in the Great Lakes environment derived from the PLUARG study. Preliminary information on lead and lead compounds indicates that a potential environmental problem with lead may exist similar to that experienced with mercury.

5. Radioactivity

The Commission is concerned about the time taken by Governments to develop an agreed radioactivity objective for the Great Lakes, and the attendant need to establish a surveillance program to monitor the accelerated nuclear reactor construction program in the Great Lakes Basin.

Currently in the Great Lakes Basin, there are 12 nuclear generating stations (3 in Canada, 9 in the United States) having a total of 20 nuclear power reactors, all using the water of the lakes for condenser cooling. Thirty-two additional reactors are presently under construction or planned for the basin. The total number projected to be added by the year 2020 is considerably greater. This level of nuclear development represents a substantial amount of nuclear material to be used, stored and transported in the basin over that period, and a consequent risk to water quality and the total environment.

Last year the Commission reported that a Radioactivity Task Force established in the fall of 1972 by the two Governments had recommended a new refined Great Lakes water quality objective for radioactivity. Two years have now passed with no solid indication that an agreement or ratification of the recommended objective is imminent. While Canada and Ontario have concurred with the objective, the United States Federal Government has yet to express its position in this regard.

The Great Lakes Water Quality Board has indicated that agreement on a refined radioactivity objective is required before the relevant portion of the Great Lakes Surveillance Plan, recommended

by the Commission a year ago, can be implemented and other aspects of radioactivity in relation to the Agreement can be considered. The Commission strongly recommends that the Parties to the Great Lakes Water Quality Agreement consider ratification of the radioactivity objective as a matter of urgency. The Commission believes that, if ratification does not occur in the immediate future, the Governments should inform the public of the reason why agreement has not been reached.

6. Non-Point Pollution

The contribution to the pollution of the Great Lakes from non-point sources is becoming increasingly apparent. Its significance will continue to increase with the reduction of polluting inputs to the Great Lakes System from municipal and industrial point sources, and with population growth and further economic development in the basin. While the Commission's investigation into pollution from land use activities is not yet complete, it is clear that these activities, particularly agriculture and urbanization, are polluting the Great Lakes with a number of substances. The Commission suggests that Governments continue to strengthen programs to rectify and prevent such pollution where evident, and prepare themselves and the public for further, major remedial measures in the future. In this regard, the Commission supports the need to continue and improve the monitoring of pollution from land use, particularly at river mouths and in pilot watersheds, in order to assess the effectiveness of remedial programs that may be implemented.

The impact of atmospheric pollution on water quality in the Great Lakes is of growing concern. Substantial quantities of nutrients and toxic materials are being deposited in the Great Lakes from the air. For example, the Upper Lakes Reference Group has estimated that atmospheric deposition accounts for as high as 30-40 percent of total loadings of copper and lead in the Upper Lakes. The sources of these substances are often far distant from the Great Lakes, and their deposition in the lakes, as well as the indirect contribution from land runoff of such depositions, is thus part of the larger problem of the long range transport of air pollutants. Despite the difficulties in controlling sources over a large geographical area and the legal complexities involved, the Commission urges the Governments to pursue control measures vigorously, and to adopt appropriate mechanisms for a consolidated effort to deal with the problem of the impact of atmospheric pollution on boundary waters.

7. Phosphorus

Phosphorus is the primary factor in the eutrophication of the Great Lakes and it remains a serious problem, especially in Lake Ontario and Lake Erie. Phosphorus levels in Lake Ontario have been essentially stable throughout the period of the Agreement but, as this lake will be slow to respond to changes in loadings, a continuing long term phosphorus reduction program is required. Mathematical models have assisted in understanding and predicting the response of the lake to phosphorus control programs. The further development and testing of these models should continue, and should be coordinated with surveillance activities to ensure the provision of adequate data.

In the western and central basins of Lake Erie, concentrations of phosphorus have continued to increase though at a declining rate, while in the eastern basin of the lake, they have decreased from previous years. A major decline in concentrations is expected following completion of the Detroit and Cleveland treatment plants, as these municipal sources account for most of the phosphorus discharged into the lake. Industrial discharges of phosphorus to Lake Erie, although now a small portion of the total phosphorus loading, increased markedly over 1975 levels. They declined on all other lakes except Lake Superior, which experienced a marginal increase in industrial phosphorus loadings in 1976.

The Commission believes that, while the studies and observed trends in phosphorus concentrations show hope for improvement, current efforts directed at further restricting the input of phosphates to the Great Lakes must continue with vigor.

Municipal Treatment

Overall phosphorus removal by wastewater treatment plants in the Great Lakes Basin is improving slowly and there have been significant reductions in phosphorus loadings to Lake Ontario since 1975. However, as noted elsewhere in this report (Section 1) total municipal loadings in 1976 remained much higher than overall target loadings, and a large number of treatment plants in the Lower Lakes had not achieved the target effluent limitation for phosphorus. Every effort should be made to remedy this situation without delay throughout the basin.

Detergents

Phosphorus: The Commission continues to believe that phosphorus should be controlled to the extent possible at its source, rather than relying solely on its removal by municipal treatment plants. As detergents are a major contributor, a strict limitation on their phosphate content would have a significant impact on the effectiveness and operating costs of municipal treatment plants in meeting phosphorus effluent targets, especially where there have been no controls to date. Further, the sludge disposal problems of treatment plants should be reduced and the discharge of phosphates from the non-sewered population, while small in proportion, should be sharply reduced. The Commission therefore reaffirms its support of a 0.5 percent limit on phosphorus by weight for all detergents. The Commission notes both the action of the United States Environmental Protection Agency in endorsing such a policy for the Great Lakes, and the failure of the legislation necessary to implement this policy in the United States Congress. Notwithstanding this action, and the position of the Government of Canada that further detergent phosphate restrictions below 2.2 percent are not justifiable at present, the Commission again urges all jurisdictions in the Great Lakes Basin to take the necessary measures to achieve this limitation.

NTA: In recognising the need for an alternative to phosphorus in detergents, the Research Advisory Board has implemented a program of studying in depth the possible impacts of such alternatives on human health and on the environment. As a likely substitute nitrilotriacetate (NTA), already in wide use in Canada, has been studied first. Other non-phosphate compounds will be examined by the board in due course.

A Research Advisory Board Task Force on Health Effects of NTA, has carefully reviewed available data including animal feeding studies on possible effects on human health. The Commission draws the attention of the Governments to the Research Advisory Board's Task Force Report on the Health Implications of NTA, and to the board's conclusion that, on the basis of health hazard, there is no reasonable cause for restricting the use of NTA as a replacement for phosphate in detergents in the Great Lakes Basin. A second task force studied the ecological effects of NTA and found that nothing in the literature or in Canadian experience would indicate an obvious environmental hazard from its use. The task force also concluded that NTA need not be prohibited from continued use in Canada on the basis of current knowledge, but that further environmental studies should be undertaken as outlined in the Task Force's report, if NTA is put into widespread use in the United States and the Great Lakes Basin.

8. Water Quality Objectives

A set of new and revised specific water quality objectives and definitions that had been developed by the Water Quality Board were the subject of public hearings in late 1976. The

Commission's Report was forwarded to the Governments in May 1977 with the recommendation that the objectives be incorporated in the Great Lakes Water Quality Agreement.

Twelve additional objectives were recommended by the Water Quality Board during 1977, nine of which are awaiting further documentation. These objectives will be widely circulated among parties having direct potential interest in them, to elicit comments and assess the need for public hearings. A Commission report on these additional objectives will then be provided to the Governments.

The Commission wishes as a matter of urgency, however, to draw the attention of the Governments to the Water Quality Board's proposed objective for mirex, namely that it be substantially absent (below detection levels) from water and aquatic organisms, and to the Board's recommendation that mirex be banned in the Great Lakes Basin in order to meet this objective.

9. An Ecosystem Approach to Great Lakes Restoration

The Great Lakes Water Quality Agreement of 1972 focuses on the restoration and enhancement of the water quality in the Great Lakes in terms of its physical *and* chemical characteristics. Inherent in this approach are water quality objectives which specify limits for the concentration of various substances in the water of the Great Lakes. The revised water quality objectives, which the Commission will continue to recommend to Governments from time to time, have been based on the best available scientific information about the requirements of the most sensitive beneficial use of boundary waters. Their formulation and implementation remain essential elements in basin planning and management under the Agreement.

In its July 1977 report to the Commission, the Research Advisory Board suggested that continued emphasis on the measurement and control of the chemical and physical characteristics of water quality, while necessary, may not be sufficiently broad in scope for effective, long term planning and management of boundary waters such as the Great Lakes. The physical and chemical qualities of water are but two aspects of a complex system consisting of many interrelationships with physical, chemical, biological and socio-economic components. Reliance on these two aspects of the ecosystem alone to guide planning and management decisions could be misleading. The elimination of or failure to recognize one problem on the basis of a set of indicators for only one or two dimensions could result in unexpected, detrimental changes elsewhere in the system, either immediately or in the future. Thus, it is important, in addressing the problems of the Great Lakes, to take account of contributing factors within both the natural and societal sectors of the ecosystem and, in the latter, of the cumulative impact of environmentally harmful actions.

The "ecosystem approach" recommended by the Research Advisory Board may have significant benefits for the long term management of the Great Lakes, by placing it in a wider context and providing a framework for assessing the real impact and significance of changes within the Great Lakes System. Such an approach should for the present at least be considered as complementary to, rather than replacing, efforts to address specific problems such as phosphorus and toxic substances on the basis of water quality objectives.

Therefore, the time may be appropriate to begin considering the wider implications of Great Lakes programs, within the concept of "ecosystem quality". However, the Commission believes that the scope and implications of ecosystem analysis in relation to current activities under the Water Quality Agreement merit more detailed investigation and it has requested that the Research Advisory Board and the Water Quality Board advise the Commission further on this aspect, to provide the basis for further recommendations to Governments.

10. Environmental Mapping

An essential part of the understanding and assessment of the impact of man's activity on the resources of the Great Lakes is improved knowledge of the nature and location of the resources and social use patterns. An inventory or "environmental mapping" of resources and use patterns is required. The Research Advisory Board has investigated recent experience with environmental mapping in other locations and sponsored a workshop to evaluate the possibility of developing environmental maps for the Great Lakes. Environmental maps appear to be valuable tools in making optimal resource management decisions, including such matters as guidelines for rehabilitation based on historical knowledge, identification of priorities for conservation and protection, and minimising the environmental impact of proposed activities.

The Commission endorses the concept of environmental mapping for the Great Lakes, and encourages the Parties to the Agreement to initiate an experimental international project to map a sub-area of the Great Lakes in order to determine the costs, benefits, potentials and problems of such a mapping program.

11. Fifth Year Review of the Water Quality Agreement

The Commission notes that the Parties to the Agreement are currently engaged in a comprehensive review of the Agreement's operation and effectiveness. To assist in this process, the Commission provided the Governments with A Special Report on Various Provisions of the Great Lakes Water Agreement in February 1977.

In its report the Commission addressed several aspects of the Agreement that, in its view, merited continued support or even some improvement. These included the need for

- further research on the effects of certain pollutants on public health and the environment,
- development of programs to control persistent toxic contaminants,
- strengthening of all pollution control efforts to protect public health,
- strong efforts to achieve agreed phosphorus loading reductions,
- measures to increase the effectiveness of land use planning as it relates to Great Lakes water quality,
- establishing agreed general target dates for the development and implementation of remedial measures in specific problem areas, and specific target dates for incomplete municipal and industrial treatment projects,
- a review of funding procedures with a view to minimizing delays experienced in the first five years of the Agreement,
- clarifying of agency responsibilities for "joint activities" envisaged in the Agreement so as to allow the Commission to carry out its responsibilities regarding these matters.

The Commission wishes to reiterate its support for the joint institutions established by the Agreement. They are the Great Lakes Water Quality Board, the Great Lakes Research Advisory Board and the Great Lakes Regional Office. These institutions have operated effectively to date, and have developed over the life of the Agreement to a stage of maturity that should make their roles even more effective and efficient in the future. The composition and procedures of these bodies have evolved from, and continue to be responsive to, the needs of the Commission, Governments, the public and those specific scientific or research communities with which they deal.

12. Public Participation

The Commission believes that substantial progress is being made in better informing the citizens of the Great Lakes Basin of the many programs and activities being carried on in both countries pursuant to the Great Lakes Water Quality Agreement and the Commission's two special efforts under reference, the Upper Lakes water quality baseline study and the Pollution from Land Use Activities investigation.

A new program was undertaken by the Commission this past year in an effort to increase and improve the public's understanding of a major technical report by the Upper Lakes Reference Group. The report culminated an intensive four-year effort to establish substantial baseline water quality data for lakes Superior and Huron. The Commission contracted with a private organization concerned with public awareness and public participation in government matters to conduct a series of workshops in basin locales where Commission public hearings were to be held on the Reference Group's final report. While the workshops did not attract the numbers of basin citizens hoped for, attendance was sufficient to indicate the absence of great controversy or disagreement with the findings and recommendations of the Reference Group. Attendees of the workshops were enthusiastic about the process as a major step forward in citizen/federal government communications.

The Commission also approved the conduct of a series of special public participation panels by the Pollution from Land Use Activities Reference Group (PLUARG) throughout the Great Lakes Basin, to obtain public response to preliminary information being generated by this study, also underway since April 1972. These panels are designed to test the reaction of local interested citizens to some of the information that is being developed by the study. These panel reactions will assist PLUARG in the preparation of its final report to the Commission in July, 1978.

Three major workshops were conducted by the Research Advisory Board during 1976. These workshops, while not primarily designed to inform the public, were open to it. They are an important part of a continuing program to bring together experts on water quality from the United States, Canada and elsewhere, and thereby assemble current knowledge on various topics, develop new information and describe gaps in current understanding. Recent workshops include one on Economic and Legal Mechanisms for Achieving Environmental Objectives, another on Fluvial Transport of Sediment-Associated Nutrients and Contaminants, and a third on Environmental Mapping of the Great Lakes.

Respectfully submitted

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Appendix

Recommendations Of The Research Advisory Board To The International Joint Commission Concerning Toxic Substances

The RAB recommends that the Commission:

1. Urge all jurisdictions to develop loading data for each lake for toxic substances which will aid in obtaining accurate mass balances for these substances.
2. Urge the Governments to adopt water quality objectives for metals on the basis of total concentrations of each metal in water, and ensure that the objectives are conservative with a reasonable margin of safety due to the potential interconversions of the metals to hazardous forms.
3. Urge Governments to undertake studies to determine the exchange of persistent toxic materials between air, water, sediment, and biota.
4. Request from jurisdictions more complete information on toxic or potentially toxic chemical substituents of complex effluents, especially for discharges from installations using or making many types of chemicals.
5. Urge jurisdictions to assure appropriate funding for expanded fish tissue monitoring programs for toxic chemicals.
6. Urge jurisdictions to support increased research to develop better analytical methods for toxic organic chemicals.
7. Ask the Governments to assure that agencies with responsibilities for toxic substances control, be guaranteed access to precise information (IUPAC name, quantities, etc.), for all chemicals currently in use.

Recommendations Of The Great Lakes Water Quality Board To The International Joint Commission Concerning The Control Of Persistent Toxic Substances

The Great Lakes Water Quality Board recommends to the Commission that:

1. Monitoring and laboratory programs in support of the International Great Lakes Surveillance Program in Lake Ontario should be continued at a level sufficient to establish
 - (a) trends of toxic substances such as Mirex (Dechlorane), PCBs, DDT and mercury for which some information is available, and
 - (b) the significance of the other toxic substances for which only qualitative information is available.
2. Water quality objectives and/or statements indicating a desired absence for a material

- should be considered for the substances identified in this report.
3. The collection, analysis and dissemination of data on sources and environmental distribution of persistent toxic substances should be extended to the entire Great Lakes System. These data would be gathered by the Surveillance and Remedial Programs subcommittees.
 4. Research should be intensified to determine the pathways, fate and effects of potentially toxic elements. Such efforts will be useful in the further development of surveillance and remedial programs to protect human health, fishery resources and wildlife of the Great Lakes.
 5. The environmental health agencies in both countries should consider establishing required action levels for the protection of human health from substances and any combination of toxic substances identified in this report and other toxic substances which may be identified in future.
 6. All jurisdictions should proceed to identify raw materials, processes, products, by-products, waste sources and emissions involving, as a priority, persistent toxic organic substances and quantitative data on the substances, together with recommendations on the handling, use and disposition.
 7. All jurisdictions should establish close coordination between the air, water, and solid waste programs to assess the total input of toxic substances to the Great Lakes System. In particular additional information is required on the concentrations of toxic substances in the atmosphere and the mechanism of transport to the water environment.