

International Joint Commission

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**Addendum to the  
First Biennial Report  
under the  
Great Lakes Water Quality  
Agreement  
of 1978**

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**Addendum to the  
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Great Lakes Water Quality Agreement  
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This document provides further discussion of the issues described in the First Biennial Report.

IJC Commissioners

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## **Addendum to the First Biennial Report under the Great Lakes Water Quality Agreement of 1978**

This Addendum to the International Joint Commission's First Biennial Report under the Great Lakes Water Quality Agreement provides further discussion of some of the issues in the main Report, and should be considered an essential adjunct of that Report.

This document is divided into four parts. Part 1 is a discussion of some of the aspects of defining and working towards goals for the Great Lakes Basin Ecosystem. Parts 2, 3 and 4 provide a review of the progress and problems that have occurred with the implementation of the Agreement. They include a brief summary of the present state of the Great Lakes System, a review of accomplishments in meeting the timetables established in the 1978 Agreement, and some of the more important obstacles the Commission feels affect further progress under the Agreement.



## **PART 1 - Toward Desirable Goals for the Great Lakes Basin Ecosystem**

The stated purpose of the Parties in the 1978 Great Lakes Water Quality Agreement is "to restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem." This statement presumably reflects some consensus as to the aspirations and attitudes of people living in the Great Lakes Basin. It defines one important policy goal for the Great Lakes Basin Ecosystem. Progress under this policy goal will depend ultimately on the relationship of this goal to other stated and unstated policy goals and on the level of consensus it reflects. Progress will also depend on the degree to which these various societal goals are pursued in a manner that is consistent with restoring and maintaining the chemical, physical and biological integrity of the Great Lakes Basin Ecosystem.

The Great Lakes Basin, particularly that portion encompassing the Lower Lakes, is a highly developed industrial and agricultural region. The present population of approximately 37 million people is expected to increase to 60 million by 2020. This growth will be accompanied by continued industrial and urban growth which, by its very nature, will continue to place stresses on virtually all components of the Great Lakes Basin Ecosystem.

There are now more than 800 major municipal and industrial facilities in the Great Lakes Basin, discharging a bewildering mix of toxic chemicals and wastes, nutrients, and other organic and inorganic substances. Furthermore, the smaller facilities discharging into the waters of the Great Lakes System number into the thousands. It is estimated that there are more than 4000 waste disposal sites in the Basin, at least some of which likely contribute wastes of an unknown nature and quantity to the Great Lakes System. Loadings of sediment, toxic and hazardous substances and nutrients from agricultural and urban land drainage and airborne deposition, and thermal loadings from electric power plants are examples of a few of the many stresses currently being placed on the Great Lakes Basin Ecosystem.

All of these stresses have worked to produce changes, some major, to the Basin ecosystem. Prospects for the future are that these stresses will continue and probably increase.

The overall Purpose of the Great Lakes Water Quality Agreement should not be interpreted to mean that the original state of the Great Lakes is to be (or even can be) restored. For various reasons, the original natural conditions no longer exist in most parts of the Great Lakes Basin Ecosystem, and, indeed the natural state is often unknown. There do remain some relatively unchanged parts of the Basin ecosystem, but by and large these are the exception rather than the rule.

On the other hand, while complete restoration of the lakes system is likely impossible because of the magnitude of the changes which have occurred and the costs that would be

involved in such a "restoration", unchecked degradation of the waters, sediments and biota of the Great Lakes System is completely unacceptable. Restoration or rehabilitation, as a practical reality, likely lies somewhere between these two extremes. The overall object, therefore, should be to stop and reverse the overall long term trend of ecosystem degradation. Ideally, the restored or rehabilitated ecosystem would ultimately allow people to drink water free of contaminants, swim in clean water, eat fish or waterfowl uncontaminated by chemicals, and enjoy the recreational, ecological and aesthetic resources of the Great Lakes Basin Ecosystem. These are fundamental societal goals which the Commission continues to endorse.

The main international instruments presently in place for the rehabilitation and protection of the Great Lakes Basin Ecosystem are the Boundary Waters Treaty of 1909, the 1955 Convention on Great Lakes Fisheries and the 1978 Great Lakes Water Quality Agreement.

The Boundary Waters Treaty, Article IV, states that boundary waters and waters flowing across the boundary "shall not be polluted on either side to the injury of health and property on the other". It is this international goal (or more appropriately, obligation) that provides the two countries a focus in regard to pollution programs. This goal seems, at first sight, to be compelling and clear. It is the interpretation of "injury", however, that generates discussion - what roles do factors such as the significance of the injury to both parties, the benefits returned, the short term versus long term considerations, the ability to compensate, etc., all play in the international obligation? A central problem is to define who is injuring and who is being injured. This can be difficult to do, since the effects may not be homogeneous and the beneficial uses being damaged may not be known. It is necessary to determine the goals or criteria against which injury must be assessed. A standard must also be established against which to determine how firm the evidence of injury must be.

It is necessary, therefore, to move to more specific measures of acceptable behavior and impact as guidelines. These specific measures, generally referred to as standards, guidelines or objectives (the last term being the one most commonly used in the binational context), provide the Parties and the Commission with estimates of the threshold levels or concentrations of substances in the environment or in the tissues or bodies of organisms. Substances present in the water at concentrations above these objective levels constitute potential environmental "hazards" of some sort.

The Great Lakes Water Quality Agreement incorporates various forms of goals, including the broad goal expressed in the Purpose of the Agreement, as well as the General and Specific Objectives. While the general goal of the 1972 Agreement to restore and enhance the water quality of the Great Lakes System has remained relatively unchanged in the 1978 Agreement, a shift in emphasis from eutrophication and phosphorus control to control of the environmental contamination caused by toxic and hazardous substances did occur.

The same General Objectives as in the 1972 Agreement are adopted in the 1978 Agreement, as well as the idea that the discharge to the lakes of substances resulting from human activity and which place unacceptable stresses on the Great Lakes Ecosystem should *be* "virtually eliminated". Achievement of the General Objectives, as listed in Article III of the Agreement, would mean that the waters of the Great Lakes would be essentially free from the gross pollutants resulting from human activity including those which are unsightly or deleterious, interfere with beneficial uses, or adversely affect human, animal or aquatic life. Stated another way, the overall water quality of the Great Lakes would theoretically be acceptable if these conditions were met.

A primary focus of the 1978 Agreement is a set of Specific Water Quality Objectives, a list which was expanded beyond that in the 1972 Agreement. As a means of restoring and maintaining the quality of the waters of the Great Lakes Basin System, the Specific Objectives are viewed as minimum standards of water quality in the Basin. They cover some chemical, physical, microbiological and radiological pollutants, and will likely increase in number as our scientific knowledge about their effects on human and/or environmental "health" increases. These objectives are based on the available scientific information on cause/effect relationships between pollutants and receptors. They are intended to protect the most sensitive uses in each instance.

It is estimated that there are now more than 100,000 chemicals in commerce in the United States and Canada. Upwards of 50,000 of these chemicals are likely present in the Great Lakes Basin Ecosystem. Furthermore, about 2,000 of these substances have properties which can result in adverse biological effects and which may persist or accumulate in the biota and/or sediments. Many of these substances can go undetected in the ecosystem because of the limitation of available analytical methods. Less than 200 of these chemicals have been studied sufficiently to allow for the development of objectives or allowable concentrations in waters or biota. Further, there are Specific Objectives in the Agreement for only about 30 of these chemicals. While control of all substances entering the lakes is not possible, it must nevertheless be recognized that there is a limit to the ability of the Great Lakes Basin Ecosystem to respond satisfactorily to remedial measures. Further, some materials now considered harmful may be shown later to be harmless while others considered harmless at the present time may, in fact, later prove to be hazardous.

This situation leaves the Parties with two basically conflicting options for the control of toxic and hazardous substances. The Parties may either develop Specific Objectives to control as many substances as possible, including some which may later prove to be harmless, or attempt to control only those chemicals known to have harmful effects. The former approach is more cautious but has a higher price tag. The latter approach contains the substantial risk of not controlling some substances which future research may show to be dangerous. More concentrated efforts in research and monitoring to distinguish between these categories are urgently needed but, when legitimate doubts arise about the potential "hazard" of a substance, the 1978 Agreement obligates the Parties to take the former, more cautious approach.

The Commission with the advice and initiative of its Boards has been active in recommending Specific Objectives to the Parties since the signing of the 1972 Agreement. A number of recommended Specific Objectives were forwarded to the Governments in 1977-78 and were subsequently incorporated in the 1978 Agreement. The Commission has supported its Science Advisory Board in recommending new or revised objectives for a number of compounds, and others are currently being studied.

The Agreement also incorporates a number of program objectives and target dates which can be considered as short term goals of the Agreement. These "goals" concern either the implementation of certain municipal, industrial or other treatment programs, or the provision of information. As discussed elsewhere in this document, these goals have generally not been met.

There are other concerns that should be addressed in the redefinition of goals under the 1978 Agreement. First, a broader approach is needed to take account of interactions among various components of the Great Lakes Basin Ecosystem. This is, in fact, basically a restatement of the ecosystem concept which the 1978 Agreement defines as "the interacting components of air, land, water and living organisms, including man, within the drainage basin...". The Agreement recognizes that everything in the Basin is related to and to some extent affects, everything else in the Basin. Unfortunately, the reality is that pollution control measures carried out by the various jurisdictions to date have been based largely on control of site and/or source specific problems.

It may initially have been necessary to focus on specific problems, but more attention must now be directed to lake-wide and system-wide considerations. Thus, while achievement of Specific Water Quality Objectives has contributed to protecting the integrity of the waters of the Great Lakes Basin System, it may now be time for the Parties to begin re-examination of the basic "philosophy" behind the designation of Specific Objectives in the Great Lakes Water Quality Agreement. These objectives are generally not capable of adequately addressing the complexities of various water use patterns, and the possible synergistic or antagonistic effects of mixtures of chemicals on the biota of the Great Lakes Basin Ecosystem. Rather, the Specific Objectives are essentially simplistic chemical and physical measures as opposed to life- and health-oriented indicators.

Work is underway on defining and developing more sophisticated "ecosystem objectives". This should result in the adoption of pollution control goals more fundamental and yet broader than the traditional approach of treating one pollutant and one source at a time, by taking account of the cumulative effect from multiple sources and contaminants over time.

On a broader level, despite its stated Purpose and its concentration on General and Specific Objectives, the Agreement lacks explicit provisions for establishing a broadly based formulation of societal goals and aspirations, and specific applications thereof to the development of General and Specific Objectives for the Great Lakes. Therefore, development

of such objectives has occurred largely in the absence of the consideration of goals that society itself may have for the resources of the Great Lakes System. If this is not done, there is no assurance that the objectives provide for more than a technical assessment of adequate water quality, or that achievement of the objectives is even adequate evidence of "safe" Great Lakes water. The town of Niagara-on-the-Lake, for example, has serious reservations about the quality of Niagara River water and is proceeding with plans for an alternate source of water, even though the Water Quality Board has reported that "annual average water quality conditions in the Niagara River generally meet the objectives of the 1978 Agreement".

For the Commission, a fundamental question remains unanswered in reconciling the Purpose and the General and Specific Objectives of the Great Lakes Water Quality Agreement with the goals of society for the beneficial uses of the Great Lakes resource. There can be little doubt that the overall goal of all concerned Great Lakes "parties" is that the water resources of the Great Lake System be of sufficiently good quality to ensure a healthy ecosystem in which the basic consumptive, recreational, biological and aesthetic uses of the resource are possible. The goals of society may differ considerably across the Basin, however, and may also differ between the long term and the immediate. What, for example, are the goals of the people living along the shoreline of Niagara River or Saginaw Bay, insofar as the use of these water resources is concerned? How do these goals compare with those for individuals living and working upstream, or in the Lake Superior Basin where overall water quality is generally better? How can these regional goals be reconciled with the broader goals and obligations in the binational resource context?

The Commission has concluded that greater public involvement in the setting of broad goals for the Great Lakes, and also of the more distinct ecosystem "indicators" and Specific Objectives, is desirable. Past mechanisms for eliciting public views and responses to such questions appear to have been unsatisfactory. The Commission is seeking means to improve its communication with the citizens of the Basin, to both learn and inform and, it is hoped, to contribute to the improvement of communication regarding the quality of the Great Lakes Basin Ecosystem between all sectors of society. In this regard, it is noted that the Commission's Great Lakes Levels Advisory Board is currently conducting a study on public information and public participation in the Basin in order to provide the Commission with some indication of how communication mechanisms can be improved. This and other initiatives may help the Commission (with respect to both water quality and quantity questions) to understand more clearly the specific goals of society, and to better use public opinion and response in assessing the setting and achieving of goals for the Great Lakes, as well as assessing government program activities with respect to the Great Lakes Water Quality Agreement.



## **PART 2 - State of the Great Lakes Basin Ecosystem**

### **INTRODUCTION**

A brief overview of the "State of the Lakes" within the context of the 1978 Great Lakes Water Quality Agreement is presented here.

The Great Lakes Basin area is approximately 750,000 km<sup>2</sup> (300,000 mi<sup>2</sup>), with a population of nearly forty million people. The region is characterized by high technology and energy intensive industries. There are also areas devoted to agriculture, forestry, and recreational facilities. Man is an integral part of this ecosystem, and many of the problems of the Great Lakes Basin Ecosystem occur as a result of man's activities.

The Commission has concluded that the major water quality problems in the Great Lakes System are contamination by toxic and hazardous substances, and cultural eutrophication (the premature "aging" of lakes) from excessive nutrient inputs, mainly phosphorus. While the Agreement calls for the "substantial elimination" of discharges of persistent toxic substances, General and Specific Water Quality Objectives exist for only a few (about 30) chemicals which may be contained in these discharges. The current monitoring and surveillance activities of the Parties primarily emphasize the detection and quantification of this limited number of chemicals. Because the current sampling program of the Parties is based on the Great Lakes International Surveillance Plan as developed by the Water Quality Board, this Commission overview assessment reflects the attention given to the individual lakes during 1980 on the basis of that plan. These monitoring efforts, therefore, should be viewed as providing a partial assessment of the behavior of a few chemicals of concern, in a few components of the Great Lakes Basin Ecosystem.

For this overview, the Commission has relied primarily on reports and information from its two Great Lakes advisory boards: the Water Quality Board (WQB) and its Surveillance Work Group, and the Science Advisory Board (SAB). The Commission, its Boards and the Parties themselves have advocated an "Ecosystem Approach" in assessing the environmental state of the Lakes. The 1978 Agreement defines the Great Lakes Basin Ecosystem as "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." Within an ecosystem approach, one would ideally assess the state of the Great Lakes Basin Ecosystem more holistically than in the past. Hopefully, the Commission's reports will reflect more of an ecosystem approach in the future.

While a broad overview of the state of the Great Lakes is provided in the following pages, several questions and their implications should be kept in mind since they can have a significant impact on the conclusions reached as a result of these data. Given the characteristics of the available data, e.g., degree of quality control, statistical validity of numbers of samples taken and the age of data, how reliable are the conclusions reached? The Water Quality Board reports primarily on levels and trends of DDT, PCBs, dieldrin and a few other organic and inorganic substances in several types of fish and herring gulls, as well as on phosphorus levels and loads. How representative of the overall "state of the environment" of the Great Lakes Basin Ecosystem are these data? What are the actual environmental and health implications of these data and the pollution trends they may suggest, since DDT, PCBs and certain related chemicals have either been banned or their use has been strictly regulated in the basin? What are the relationships between these reported data and the myriad of chemical substances not monitored on a routine basis? Such questions, unfortunately, are not easy to answer with confidence.

## **LAKE SUPERIOR**

The levels of toxic substances remain elevated in fish taken from the lake. The average levels of DDT, dieldrin and mercury in lake trout are generally below the Agreement objectives although the upper ends of the reported ranges exceed the Agreement objectives. PCBs levels greatly exceed the objectives. High levels of toxaphene are reported in lake trout taken from a lake on Isle Royale. The lack of known point sources of toxaphene in the area suggests that the atmosphere is an important transport and deposition mechanism for this chemical. PCBs and dieldrin levels in herring gull eggs also remained relatively unchanged at elevated levels in 1974-1980, indicating that these chemicals continue to be a serious problem in spite of controls on their production and use in the basin.

The phosphorus load to Lake Superior increased somewhat in 1979 and 1980, relative to the 1978 load. The phosphorus inputs in all three years, however, significantly exceeded the proposed target load in the 1978 Agreement.

## **LAKE MICHIGAN**

There are various trends reported in the levels of toxic chemicals in fish in this basin. Levels of selected inorganic elements (mostly heavy metals) in the lake are generally below the Agreement objectives. The situation with regard to organic chemicals is not as clear. DDT levels have declined significantly in the early- to mid-1970's in bloater chubs, coho salmon and lake trout. However, DDT levels in these fish appear to have stabilized at levels exceeding the Agreement objectives. Trends of PCBs levels in fish are less clear and conflicting data have been reported in recent years. Nevertheless, all reported PCBs levels in fish still exceed the Agreement objective. At the same time, there is continuing concern regarding the ability of lake trout populations in Lake Michigan to remain viable. It has been suggested that PCBs and DDT levels in Lake Michigan were sufficiently high throughout the 1970's to impair lake trout reproduction. This is of particular concern because PCBs and DDT

levels declined during this period. It also indicates that considerable additional effort may be required to address adequately the organic chemical pollution of the Great Lakes Basin Ecosystem.

PCBs levels in herring gulls have generally remained high. Atmospheric deposition is believed to play a significant role in the dispersal of PCBs throughout the Basin; Waukegan Harbor is also a significant source. Levels of dieldrin in coho salmon, lake trout and herring gull eggs generally remain elevated and relatively unchanged from previous years, in spite of controls on its production and use, similar to the Lake Superior situation. Dieldrin levels in bloater chubs in 1980, in fact, are about twice the levels noted in 1978. A mixed picture regarding organic contaminants is seen in herring gull eggs from Big Sister Island. Reported levels of heptachlor epoxide, p,p'-DDD, oxychlordan and dieldrin have generally remained elevated and relatively unchanged between 1971-78. Dieldrin in herring gull eggs from Big Sister Island are the highest reported levels in the Great Lakes Basin. By contrast, Mirex, p,p'-DDT, DDE and PCB levels have, with a few exceptions, generally declined in this same period.

Decreases in total phosphorus concentrations and thus increases in water transparency were reported in southern Lake Michigan between 1976 and 1977. This trend apparently continued into 1978. However, based on water quality data from water treatment plants in the southern basin, it appears that phosphorus levels have increased again between 1979 and 1980. Densities of green and blue-green algae in the lake have generally increased since the 1960's. These latter observations are the basis for the suggestion by the Water Quality Board that the temporary declines in total phosphorus concentration were an artifact of the unusually severe winter ice cover conditions that occurred between 1976 and 1979, rather than an actual response to phosphorus control programs. This hypothesis has not been substantiated. Phosphorus loads for 1979 and 1980 were both greater than the 1978 load and the loads in each of the three years considerably exceeded *the* proposed target loads in the 1978 Agreement.

## **LAKE HURON**

Data on toxic and hazardous substances in Lake Huron were sparse during the past year. Reported levels of DDT and dieldrin are below the Agreement objectives in lake trout, coho salmon, smelt and walleye. PCBs levels, however, are above the Agreement objective in these fish species. During the period 1974 to 1980, both PCBs and dieldrin levels have remained elevated and relatively unchanged in herring gull eggs. DDT levels, in contrast, have shown a substantial decline.

The presence of dioxin at trace levels in fish from the Saginaw and Tittabawassee River systems in 1978 was of special concern in an earlier report of the Water Quality Board. The presence of dioxin has not been reported in fish samples examined since 1978, although 1980 and 1981 results were not available at the time of this observation. Dioxin levels in Lake Huron herring gull colonies in 1980, however, are about six times as high as the

"baseline" levels noted in the other Great Lakes. Within the Lake Michigan Basin, it is noted that dioxin levels in gulls from the eastern shoreline are not as high as other colonies in the basin, suggesting the area of contamination may be confined, perhaps to fish in Saginaw Bay. Chemical plants located upstream of herring gull colonies are cited as a likely source of dioxin in this basin.

A "considerable improvement" was reported for Saginaw Bay, which remains the major eutrophication problem in the Lake Huron Basin. The phosphorus load and spring chlorophyll levels (a measure of existing algal biomass) were lower in 1979 and 1980 than in previous years. Furthermore, no taste and odour problems were reported in 1980 at the principal drinking water treatment plant, the principal control objective in setting the Saginaw Bay target load. The 1979 and 1980 phosphorus loads for Lake Huron were below the 1978 load, primarily as a result of a reduced Saginaw Bay load. These loads, however, still slightly exceed the proposed target load in the 1978 Agreement. It is noted that some municipal wastewater treatment plants along the Georgian Bay shoreline in Ontario have been required to achieve an effluent phosphorus concentration of 0.5 µg/L, twice as stringent as the levels currently called for in the Agreement, in order to combat local excessive growths of the algae *Cladophora* (an attached algae).

## **LAKE ERIE**

Declines in PCBs levels were reported for spottail shiners taken from the Thames River and Pike Creek in Lake St. Clair, and at Point Pelee and Thunder Bay in Lake Erie, but not in Detroit River shiners. DDT levels decreased in shiners taken from Point Pelee, Thunder Bay and the Detroit River. There was no similar decline in DDT levels in shiners from Pike Creek or the Thames River. A decline in PCBs, DDT and dieldrin levels was reported for coho salmon, smelt and walleye in the open waters of Lake Erie although the decline was less evident in the open water fish. A parallel situation exists for PCBs and DDT levels in herring gull eggs. These levels have remained elevated and relatively unchanged between 1974 and 1980. Reported mercury levels in walleye showed a rapid decline in the early 1970's, but in recent years leveled out at a level exceeding the Agreement objectives.

The St. Clair River Organic Study Group did a study on the state of organic contamination of the St. Clair River. The group identified 84 organic compounds in the river water including various industrial solvents. The presence of aromatic hydrocarbons was detected in all fish samples, some at high levels. It is believed that chlorination of sewage and wastewaters at treatment plants along the river contributed to the number of halogenated organic compounds observed. Furthermore, seventeen organic compounds were detected in treated drinking water samples taken at Tilbury, Windsor and Amherstburg, although at levels below Ontario guidelines. The levels of PCBs and heavy metals in sediments below industrial effluents exceeded Ontario guidelines in 1977. The benthic fauna were also examined and found to be representative of "highly polluted" conditions especially near industrial outfalls. The overall degree of organic contamination noted in this special study is a cause for considerable concern since this study was a more comprehensive

assessment of organic pollution than that ordinarily undertaken by the Commission's Water Quality Board. The presence of such a large number of organic chemicals at elevated levels suggests the "state" of the Great Lakes System regarding organic pollution may be more degraded overall than previously believed on the basis of the limited number of substances included in the Board's annual assessment of water quality.

Results of the 1980 monitoring program on the Detroit River indicated levels of iron and phenol compounds well above Agreement objectives. Smaller exceedences of objectives for total dissolved solids, ammonia and zinc were also observed. Concentrations of phenols, chlorides and phosphorus in the Detroit River have generally decreased between 1967 and 1980. Ammonia, nitrate and iron concentrations generally remained about the same, or increased, over the same time period.

Following a period of virtually no change between 1970 and 1977, the total phosphorus concentrations in the western, central and eastern basins of Lake Erie declined since 1978. The decline is of a smaller magnitude than the reduction in the total load, however, suggesting internal recycling of phosphorus from the bottom sediments. The major decline in concentration was noted along the Detroit River although this was still the single largest input to Lake Erie in 1980. The highest concentration was noted in the Maumee River, also a source of considerable sediment to the Lake.

Chlorophyll and Secchi depth measures in the central basin are generally at better levels than in the western basin. There has been no significant change in the overall chlorophyll concentrations in the central basin, however, in the decade between 1970 and 1980. The Water Quality Board reported that the data suggest "a shift toward more oligotrophic species" in the central basin. Dissolved oxygen levels in the central basin in the summer, however, are still significantly below the required Agreement level, indicating the Lake Erie phosphorus control goals in the Agreement are far from being achieved. Chlorophyll levels in the eastern basin have shown only a slight decline from 1971 to 1978, while levels of total nitrogen, nitrate, nitrite and phytoplankton have increased slightly.

Examination of the estimated total phosphorus loads for the period 1977 to 1980 shows annual inputs of 14,272, 19,376, 11,191, and 14,107 metric tons, respectively. This variability in load is due primarily to that in the tributary flows, a function of climatic conditions in the basin. The 1979 and 1980 loads are considerably below the reported 1978 loads. The loads in all three years exceed the proposed target load of 11,000 metric tons/year in the 1978 Agreement. It is noted the rate of hypolimnetic oxygen depletion and primary production has remained relatively unchanged between 1970 and 1979, in spite of reductions in the phosphorus load. Further, the dissolved oxygen concentration appears to decrease at a relatively constant rate, even when wide variations are noted in primary production rates in the surface waters. The limnological significance of these phenomena is unclear at present and warrants further study. There is currently debate in the Great Lakes scientific community regarding the interpretation of long term trends in hypolimnetic oxygen depletion rates in the central basin. Nevertheless, pending more conclusive scientific

evidence to the contrary, achievement of the proposed target load should remain the primary phosphorus control goal for Lake Erie.

## **LAKE ONTARIO**

The toxic and hazardous substances problem is more severe in Lake Ontario than elsewhere in the Great Lakes System. While the trends observed in Lake Ontario are generally similar to those observed in the other Great Lakes, the baseline levels of chemicals in organisms are considerably higher overall in Lake Ontario than in the other lakes. This situation is due largely to the continued input of toxic substances, especially organic compounds, from the Niagara River into Lake Ontario.

Levels of DDT generally declined in lake trout, coho salmon and smelt in the open waters between 1977 and 1980. In contrast, levels of PCBs and dieldrin in these species were unchanged or increased during the period. PCBs and DDT levels have declined in spottail shiners taken from Twelve Mile Creek, Credit River and the Humber River. These tributaries are indicative of nearshore conditions at three locations but are not directly comparable with samples from open water species. PCBs and DDT levels in spottail shiners taken in the nearshore zone are generally lower than those in lake trout, coho salmon and smelt taken from the open waters during the entire period.

Levels of DDT, PCBs and dieldrin have generally declined in herring gull eggs. The Water Quality Board reported that dioxin levels in herring gull eggs from Scotch Bonnet Island showed a "significant decline" from 1971 to 1980. These levels remain consistently above those observed in all other Great Lakes herring gull colonies, however, by a factor of nearly five. Dioxin levels in herring gull eggs are also relatively uniform in the four colonies sampled in the Lake Ontario Basin, suggesting that fish (mainly alewives and smelt) consumed by the gulls may be contaminated throughout the lake. Dioxin has also recently been detected in brown trout collected near Roosevelt Beach, New York.

The average total phosphorus concentration changed slightly between 1979 and 1980. The general decline reported since the mid-1970's may thus have reached a plateau. The same trend is seen in the nearshore waters although generally at higher levels than in the open waters. Whether or not these plateau values represent a long-term condition, however, is not clear.

Phytoplankton densities have not followed the same trends as the total phosphorus concentrations. The phytoplankton levels either decreased or remained constant in the western and central basins of Lake Ontario between the mid- to late-1970's. In contrast, the levels remained unchanged between 1970 and 1975 in the eastern basin and then doubled in 1977. This latter occurrence suggests that total phosphorus concentrations in the eastern basin are decreasing at slower rates than in the western and central basins. This is consistent with the low hypolimnetic dissolved oxygen levels in the eastern basin in the late summer, suggesting that oxygen concentrations are following the total phosphorus and

phytoplankton trends. It is noted that, although the 1979 and 1980 phosphorus loads were both lower than the 1978 load, the loads in each of the three years still exceeded the proposed target load of 7,000 metric tons/yr in the 1978 Agreement.

## **OVERALL GREAT LAKES BASIN**

The Upper Great Lakes (Superior, Michigan and Huron) continue to exhibit relatively good water quality. The water quality remains suitable for most beneficial water uses by man. There are, of course, specific examples of areas which exhibit environmental degradation, usually as a result of man's activities in the watershed, which should receive priority treatment. The main reason that these lakes have maintained their overall high water quality is their large volumes and the sparse distribution of human activities in these watersheds.

The Lower Lakes (Erie and Ontario), on the other hand, still exhibit considerable environmental degradation by sediments, nutrients and toxic and hazardous substances. While considerable efforts have been exerted to attempt control of pollution by these substances, the situation is still a cause for concern by the Parties. Phosphorus control efforts appear to have arrested the water quality degradation associated with eutrophication but have not yet achieved the desired water quality conditions described in the 1978 Agreement. Toxic and hazardous substances are a more serious problem, especially in Lake Ontario and the Niagara River. Considerable additional effort is necessary on the part of the Governments to address adequately the pollution of the Great Lakes Basin Ecosystem from toxic and hazardous substances.

In summary, progress has been made in controlling or at least arresting eutrophication in the Great Lakes. More work remains to be done to achieve the phosphorus control goals in the 1978 Agreement. Less progress has been made with toxic and hazardous substances, due to the large numbers of chemicals entering the lakes, their widespread sources and the overall complexity of trying to regulate or control such a ubiquitous problem. Considerably more effort on the part of all Great Lakes jurisdictions will be required if the goals of the 1978 Agreement regarding the control of toxic and hazardous substances are to be achieved.

## **AREAS OF CONCERN**

In recent years, the Water Quality Board has reported on various local areas in the Great Lakes Basin where environmental quality has undergone significant degradation. Such areas are often the major loading points for many pollutants discharged into the Great Lakes Basin Ecosystem and are the focus of obvious environmental or human health concerns.

Until 1980, the Water Quality Board referred to these areas as "Problem Areas" and usually related their status to that of remedial programs for their control. "Problem Areas" were those localities where Agreement Objectives were either exceeded or where desired

water uses were impaired. The Water Quality Board has initiated a new procedure using all available data including the 1978 Agreement Objectives, local jurisdictional standards, criteria and guidelines, and its professional judgment in its assessment. The assessment is "tempered" by such factors as the age of the data; the magnitude, persistence and geographic extent of the pollution; the water uses that are impacted; the state of relevant ongoing remedial programs; and transboundary implications of the water quality problem. The result is the designation of two distinct classes of Areas of Concern: Class "A" areas exhibit significant environmental degradation where impairment of beneficial uses is severe, and Class "B" areas exhibit environmental degradation but uses may not be as severely impaired as those in Class "A".

The Commission concurs with the Board that the designated Areas of Concern deserve priority in cleanup and/or restorative efforts by the appropriate authorities. Many of these "Areas of Concern" are, in fact, merely "Problem Areas" which were simply renamed and which continue to exhibit significant environmental or human health problems. The Areas of Concern designated by the Board are summarized in Table 1 and details regarding the specific nature of the pollution problems are provided in the 1981 Annual Report of the Water Quality Board.

The Commission is concerned that specific areas in the Great Lakes Basin continue to be identified by the Water Quality Board as environmental or human health concerns. The "Areas of Concern" have *been* compared with the "Problem Areas" identified in previous annual reports of the Water Quality Board (see Table 1). While some designated areas appear to have received adequate remedial treatment, there are approximately 24 locations noted in Table 1 that have been identified in every report of the Water Quality Board since 1974 as being degraded sufficiently to warrant remedial programs. While remedial programs have been in effect in many of these areas, in some cases for years, it is apparent that greater pollution control efforts are needed in some. There is little value in continuing to identify such areas if effective remedial efforts are not put into place. Consequently, the Commission the Parties to insure that such areas receive the attention that they require.

## Areas of Concern in the Great Lakes Basin

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### CLASS "A" Areas of Concern

#### **I. LAKE SUPERIOR:**

None Identified

#### **II. LAKE MICHIGAN:**

- \* Fox River/Southern Green Bay, Wisconsin (C)
- \* Milwaukee Estuary, Wisconsin (C)
- \* Waukegan Harbor, Illinois (C)
- \* Grand Calumet River and Indiana Harbor Canal, Indiana (C)

#### **III. LAKE HURON:**

- \* St. Marys River (C)
- \* Saginaw River System and Saginaw Bay, Michigan (C)

#### **IV. LAKE ERIE:**

- \* St. Clair River (C)
- \* Detroit River (C)
- Rouge River, Michigan (C)
- Raisin River, Michigan (C)
- \* Maumee River, Ohio (C,E)
- \* Black River, Ohio (C)
- \* Cleveland, Ohio (C)
- \* Ashtabula, Ohio (C)

#### **V. LAKE ONTARIO:**

- \* Buffalo River, New York (C)
- \* Niagara River (C)
- \* Hamilton Harbour, Ontario (C,E)
- Cornwall-Massena, Ontario-New York (C)

### CLASS "B" Areas of Concern

- St. Louis River, Minnesota (C)
- \* Thunder Bay, Ontario (C)
- \* Nipigon Bay, Ontario (C)
- \* Jackfish Bay, Ontario (C)
- Peninsula Harbour, Ontario (C)

- Manistique River, Michigan (C)
- Menominee River, Mich.-WI (C)
- Sheboygan, Wisconsin (C)
- Muskegon Lake, Michigan (C)
- White Lake, Montague, Michigan (C)

- \* Spanish River Mouth, Ontario (C)
- \* Penetang Bay to Sturgeon Bay, Ontario (E)
- Collingwood Harbour, Ontario (C,E)

- Clinton River, Michigan (C)
- \* Wheatley Harbour, Ontario (C)

- Eighteen Mile Creek, NY (C,E)
- \* Rochester Embayment, NY (C,E)
- \* Oswego River, New York (C)
- \* Toronto Waterfront, Ontario (C)
- Port Hope, Ontario (C)
- \* Bay of Quinte, Ontario (E)

(C) - Contamination of the water, sediments and/or biota by organic and/or inorganic substances (excluding phosphorus).

(E) - Eutrophication/phosphorus enrichment problems.

\* = Identified as an area of some type of environmental and/or human health concern in every report of the Water Quality Board since its 1974 Annual Report.

SOURCE: Great Lakes Water Quality Board. 1981 Report on Great Lakes Water Quality; Report to the International Joint Commission, November 1981, Cleveland, Ohio. pp. 13-28.



## **PART 3 - Responsiveness of Parties to Requirements of the Water Quality Agreement**

### **INTRODUCTION**

The 1978 Water Quality Agreement obligated the Parties to commitments which did not exist under the 1972 Agreement, especially regarding the control of toxic and hazardous substances. In many cases, there is a projected date of completion attached. Whether or not these requirements were met within the designated time period, and the reasons for not meeting them, provide measures of progress by the Parties. A review of the various deadlines and whether their completion can be expected in the foreseeable future is provided here.

### **AGREEMENT DEADLINES AND TIMETABLES**

#### Limited Use Zones

Annex 2 of the Agreement calls upon the Parties, in consultation with state and provincial governments, to "take measures to define and describe all existing and future limited use zones" and to "prepare an annual report on these measures". The components of this limited use zone requirement and a listing of the criteria to be used in their establishment are also presented.

According to Annex 2, limited use zones shall be designated for industrial discharges, and for municipal discharges in excess of one million gallons per day, within the boundary waters of the Great Lakes System. This designation was to be completed before January 1, 1980.

The Commission understands that the establishment of limited use zones has been delayed by the debate of whether or not they are legal under the provisions of the United States Clean Water Act. The Commission also understands that at least some limited use zones have been designated in Canada, but that such designations will not be formally transmitted to the Commission in the absence of similar actions on the part of the United States.

The deadline for designating limited use zones passed more than two years ago. The apparent lack of activity, primarily on the part of the United States Government, suggests that limited use zones will not be designated in the near future. The Parties should confer on their intentions concerning limited use zones. If limited use zones (as called for in Annex 2 of the Agreement) are not designated, the Commission assumes at present that the Parties intend that the Specific Objectives contained in the Agreement are to apply throughout the Great Lakes. If the Parties do not feel that it is possible to designate limited use zones within the life of the 1978 Agreement, admission of this possibility by the Parties is in order and will "clear the air" regarding the status of Annex 2 in the Agreement.

## Phosphorus Target Loads

Annex 3 of the Agreement requires the Parties in cooperation with the state and provincial governments to "confirm the future phosphorus loads" contained in the Agreement and, based on these loads, to "establish load allocations and compliance schedules," taking into account the recommendations arising from the Pollution from Land Use Activities Reference Group (PLUARG). The confirmation of the loads was to have been within eighteen months of the 1978 Agreement going into effect, a confirmation date of no later than May 22, 1980. This confirmation date was subsequently extended twice by diplomatic notes between the two countries.

The Commission has been informed that the Parties have made some progress in confirming these future phosphorus loads ("target loads") and that negotiation is underway regarding the allocation of these loads between the two countries. Commission recommendations on the land use pollution control study were submitted to the Parties in March 1980. A supplemental report on phosphorus management, based on the PLUARG study and that of the Commission's Phosphorus Management Strategies Task Force, was presented to the Governments in January 1981. From the viewpoint of the Commission, this latter report completed its mandate under the PLUARG Reference.

In view of the high visibility of the phosphorus problem in the Great Lakes Basin -- it was eutrophication of the Lower Lakes more than any other factor which served as the impetus for the 1972 Agreement -- it is disappointing that such a fundamental issue as confirmation of the target loads and establishment of load allocations and compliance schedules has not yet been resolved by the Parties. At the present time, the only phosphorus "requirement" is that a 1 mg/L effluent requirement be achieved in municipal wastewater treatment plants in the Lake Erie and Ontario basins which discharge in excess of one million gallons per day. This requirement has not changed since the signing of the 1972 Agreement, a decade ago. The requirements of the 1978 Agreement do not take effect until the target loads are confirmed and load allocations and compliance schedules are agreed upon by the two countries. The Commission has reported several times that it believes additional point and nonpoint source control measures are necessary to achieve acceptable phosphorus conditions in the Great Lakes. This conclusion is consistent with the findings of Task Group III, PLUARG and the Phosphorus Management Strategies Task Force.

Because the phosphorus control issue is a fundamental component of both Agreements, the Parties should make the utmost effort to come to agreement over the control requirements of Annex 3. It is noted that progress regarding the control of point source phosphorus has been made over the last decade -- indeed, the progress in some cases has been substantial. However, the phosphorus control goals highlighted in Annex 3 cannot yet realistically be achieved. Therefore, the confirmation of the target loads and allocation of loads between the two countries, even if final compliance schedules require further negotiation, would make a significant advancement in this direction *and* allow this problem to be addressed in a more diligent and comprehensive manner.

## Persistent Toxic Substances

Annex 12 of the 1978 Agreement requires that the Parties, in cooperation with the state and provincial governments, shall develop and adopt programs and measures for the elimination of discharges of persistent toxic substances, including "identification of raw products, processes, products, by-products, waste sources and emissions involving persistent toxic substances". The Parties are also to develop "quantitative data on the substances, together with recommendations on (their) handling, use and disposition". There is no specific completion date for these activities, although Annex 12 calls for every effort on the part of the Parties to complete this inventory by January 1982.

Annex 12 also commits the Parties to develop and adopt "joint programs for disposal of hazardous materials" to ensure that such materials as "pesticides, contaminated petroleum products, contaminated sludge and dredge spoils and industrial wastes are properly transported and disposed of". Again, no date is specified in Annex 12. The Parties are called upon, to make "every effort to implement these programs by 1980". There has been no substantial progress apparent to the Commission.

Degradation of the Great Lakes Basin Ecosystem by toxic and hazardous substances is the major overall problem facing the Parties under the 1978 Agreement. Environmental and human health impacts of such substances are especially significant in view of the slow degradation and often cumulative effects of persistent toxic substances in the environment. The requirements of Annex 12 would be a major component in addressing these problems in the Great Lakes Basin Ecosystem. The target dates, however, were not met by the Parties, and the Commission has seen little evidence that the Parties are "making every effort" to complete these activities.

The Governments should complete the required inventory and joint programs as rapidly as possible. While such activities will not comprehensively address toxic and hazardous substances, they will provide focus and direction to the specific problems of persistent toxic substances in the Great Lakes Basin Ecosystem. It is acknowledged these efforts will not be easy to complete. They are, nevertheless, an essential component to addressing toxic and hazardous substances in the Great Lakes Basin Ecosystem.

## Municipal and Industrial Pollution Control Programs

Article VI of the 1978 Agreement also requires programs for the abatement, control and prevention of "municipal discharges and urban drainage into the Great Lakes System" by December 31, 1982, and of "industrial sources entering the Great Lakes System" by December 31, 1983. Each has a number of program elements outlined in the Agreement.

There has been progress on several program components. However the rate at which progress is being made in fulfilling these components is disappointing. It is not clear that "effective enforcement programs to ensure" that the pollution abatement requirements, especially for industrial pollution, are being established. These point sources constitute a major input of many pollutants. Effective control programs for these sources are an integral

component of any strategy for addressing pollution problems in the Great Lakes System.

Although the completion date for these programs is still nearly a year away, it appears from the available evidence for both municipal and industrial dischargers that the Parties will have difficulty in meeting this and subsequent deadlines. The Parties should examine carefully the requirements of Article VI (paragraphs (a) and (b)) to determine what remains to be done to fulfill their obligations. The Commission is following the status of the required pollution abatement programs with great interest and hopes that the Parties will work diligently toward their achievement in order that the Purpose and Objectives of the Agreement will be fulfilled as rapidly as possible.

#### Joint Surveillance and Monitoring Activities

Annex 11 of the 1978 Agreement requires the development and implementation of a joint surveillance and monitoring program for the Great Lakes Basin Ecosystem by the Parties. This program is to assess the degree to which jurisdictional control requirements and the General and Specific Objectives in the Agreement are being achieved, to evaluate local and whole lake water quality trends, and to identify emerging problems in the Great Lakes Basin Ecosystem. There is no completion date in the Agreement for this joint program.

The Agreement also indicates that the Great Lakes International Surveillance Plan (GLISP) contained in the Water Quality Board report of 1975 and modified in subsequent reports, shall serve as a "model" for the development of the required joint surveillance and monitoring program.

The Water Quality Board presented a revised version of GLISP to the Commission in its 1980 Annual Report for the Commission's consideration and endorsement. The Commission has, nevertheless, been evaluating the adequacy of GLISP in relation to its view of the surveillance and monitoring requirements of the Agreement. It requested its Science Advisory Board to address several specific concerns in regard to the technical adequacy of GLISP.

In an overview assessment, the Science Advisory Board concluded that GLISP addresses the compliance assessment requirements of the Agreement adequately, but does not sufficiently address the detection and identification of emerging problems in the Great Lakes Basin Ecosystem. The Board further noted that GLISP generates enormous amounts of data, but that insufficient attention is given to the analysis, interpretation and review of these data. The Board also recommended that "an increased emphasis on integrators and biological indicators coupled with a reduced emphasis on water analysis for contaminants would be beneficial."

The Commission, although it has not yet completed its evaluation of GLISP, generally concurs with the views of the Science Advisory Board and encourages the cooperative interaction between the Science Advisory and Water Quality Boards in the ongoing review and modification of GLISP.

The Commission reiterates, however, that the development and implementation of the joint, coordinated surveillance and monitoring program called for in the Agreement is the responsibility of the Parties, not the Commission or its Water Quality Board. GLISP itself was not identified in the Agreement as the program called for in Annex 11. As a joint surveillance and monitoring plan is central to the collection of the necessary data base for the accurate assessment of the conditions and trends in the Great Lakes Basin Ecosystem, the Commission urges the Parties to develop and implement this required program as rapidly as possible.

The development and implementation of such a program will be a difficult task. Considering the range of materials in the Basin to be considered, the magnitude of the area to be monitored and the number of jurisdictions involved, the development and implementation of this program should be given priority by the Parties as an essential component of any effective program to address pollution of the Great Lakes Basin Ecosystem.

A possible interim strategy for addressing toxic and hazardous substances, which makes use of this program, is discussed in Part 4 of this document.

#### PARTIES' RESPONSIVENESS TO PAST IJC RECOMMENDATIONS

The Commission has made a number of recommendations to the Parties in recent years under both the 1972 and 1978 Agreements. The Commission recognizes its primarily "advisory" role to the Parties in relation to Great Lakes water quality matters. It is informative, nevertheless, to review past Commission recommendations and reflect on the apparent responsiveness of the Parties to these recommendations. The word apparent is stressed because the Parties may not formally or directly respond to particular Commission recommendations, but may instead incorporate such recommendations as components of existing or planned programs in the Basin.

The Commission has reviewed its past recommendations within the limits defined above and has concluded that the rationale for making these recommendations still exists in most cases. Accordingly, the Commission urges the Parties also to review the past recommendations of the Commission and, where circumstances warrant, take the appropriate steps to implement them.



## **PART 4 - Concerns Regarding Pollution in the Great Lakes Basin Ecosystem**

### **INTRODUCTION**

Part 4 presents an overview and assessment of institutional and other constraints which the Commission sees as being real or potential impediments to the development and implementation of effective pollution control measures in the Great Lakes Basin. It does not constitute an inclusive list of constraints and concerns -- indeed, some of the implications of portions of the 1978 Agreement are only now being recognized and appreciated by the jurisdictions involved. The items included do, however, constitute a list of problems which have arisen in various degrees since the signing of the 1972 and 1978 Agreements. The Commission brings these concerns to the attention of the Parties so that they can be considered when the Parties are negotiating future agreements between the two countries.

### **LACK OF COMPREHENSIVE MANAGEMENT STRATEGY**

The signing of the 1978 Agreement by the Parties represented a substantial commitment on the part of both countries to attempt to address and control pollution of the Great Lakes System from the multitude of point and nonpoint sources which exist within, and outside via atmospheric deposition, the Great Lakes Basin. The 1978 Agreement is more comprehensive than the 1972 Agreement and provides, in many cases, more specific guidance.

The Commission is concerned, however, that there is still no overall management plan for directing and guiding the activities of the Parties and the state and provincial governments in controlling pollution in the Great Lakes System. In the absence of such an overall management plan, the situation will remain one of a myriad of activities carried out by the various jurisdictions under diverse and occasionally contradictory legislative mandates.. This absence of an overall management plan, which would ideally integrate and coordinate such activities within and between jurisdictions, has often lead to fragmentation of purpose, direction and resources by the relevant jurisdictions.

The Commission feels that the Parties should proceed with the development of such an overall management plan for the Basin. Such a notion has, in fact, already been suggested to various degrees by several advisory groups to the Commission. For example, the Water Quality Board devoted a substantial portion of its 1981 report to an evaluation of programs for the control of toxic and hazardous substances in the Great Lakes System. A major conclusion of the Board was that no specific Great Lakes management strategy existed to direct the toxic substances activities of the various jurisdictions. Accordingly, the Board presented sixteen specific, program-oriented recommendations designed basically to ensure that all jurisdictions are "operating on the same wave length" regarding the establishment of toxic pollution priorities and methodologies for their assessment, and to facilitate the coordination of activities among and within jurisdictions.

The Commission's Pollution From Land Use Activities Reference Group (PLUARG) provided an even more comprehensive strategy directed toward, but not restricted to, the control of nonpoint pollution in the Great Lakes Basin. Specifically, PLUARG recommended management plans stressing site-specific approaches to reduce the inputs of phosphorus, sediments and toxic substances from agricultural and urban land use activities in the Basin. To be successful, these management plans must emphasize several essential elements, including planning; fiscal arrangements; information, education and technical assistance; and regulation.

PLUARG recommended that these plans include: a timetable (with identified priorities) for implementation of nonpoint source control measures; identification of the agencies responsible for their implementation and the programs under which they will be implemented; identification of the formal arrangements that have been made to insure inter-and intra-governmental cooperation; identification of funding sources for the programs; estimates of the expected costs and the degree of reductions in pollutant loadings to be expected; and establishment of a mechanism for public review of the management plans. The Commission supported and expanded on this concept in its 1980 Report to the U.S. and Canadian Governments on land use pollution in the Great Lakes Basin Ecosystem.

In its 1981 Annual Report to the Commission, the Great Lakes Science Advisory Board made similar types of recommendations concerning energy programs in the Great Lakes Basin. These recommendations concerned: integrated information on programs for more effective energy use; development of energy alternatives best suited to overall environmental quality in the Great Lakes Basin; coordinated planning and use of energy alternatives; and additional research into the sources and pathways of hazardous substances and their effects in order to identify impacts of energy alternatives.

The Commission is in basic agreement with the recommendations of these advisory groups. Accordingly, the Commission urges the Parties to, in effect, "step back" and examine the various requirements of the Agreement in the context of developing an overall management plan or plans for the Basin. It is not clear whether it will be possible to develop a single "grand" plan or strategy which will adequately address all concerns in the Agreement, or whether a series of management plans directed toward specific concerns (but which recognize and complement other plans where possible) will be most feasible. The present reality, however, is that there is no overall management plan. The development of such an approach, therefore, should receive priority attention from the Parties in order that they may more comprehensively and effectively address the requirements of the Agreement.

### **Interim Strategy for Toxic and Hazardous Substances**

The Commission considers the problem of toxic and hazardous substances in the Great Lakes Basin Ecosystem to be both urgent and important, and is concerned at the absence of an overall strategy for dealing with these substances. Because of this concern, the Commission urges the Parties to adopt an interim strategy along the lines of that proposed below.

As indicated in the Main Report, the Commission recommends that the Governments adopt an interim strategy for attempting to assess and control toxic and hazardous substances in the Great Lakes Basin. Initially this strategy would be based primarily on knowledge of the manufacture, use, transport and disposal of known toxic and hazardous substances in the Great Lakes Basin, and it is envisioned that it would be compatible with the yet-undeveloped joint monitoring and surveillance program called for in Annex 11 of the 1978 Agreement. The interim strategy is based in part on an existing list of toxic and hazardous substances developed within the IJC framework by the Health Effects Committee, a joint body of the IJC's Water Quality Board and Science Advisory Board. This list, together with the priority ranking within the list, would become part of an ongoing iterative process and would serve as one important factor when reassessing and planning monitoring and surveillance efforts in the Great Lakes Basin Ecosystem. The basic steps in this proposed strategy are:

- (1) Agreement on an initial master list of chemicals of concern; and
- (2) Use of available information on the manufacture, use, transport and discharge of these chemicals to:
  - (a) establish a control priority;
  - (b) identify where the chemicals of concern are likely to be used or found in the Great Lakes Basin Ecosystem; and
  - (c) augment the called-for joint surveillance and monitoring program as necessary so that the highest priority chemicals and locations are adequately monitored in the Great Lakes Basin Ecosystem.

### **Agreement on an Initial Master List of Chemicals of Concern**

Most control strategies for toxic and hazardous chemicals involve a list of chemicals to be regulated. Regulatory actions are then called for when a listed chemical is found in, or is likely to be introduced into, an area of concern. The existing lists of such chemicals of concern are generally similar. Many of the differences that do exist among these existing lists mostly reflect opinions as to the priority that a chemical should receive, rather than whether or not it should be on the list in the first place. Each list usually contains a few chemicals that are unique to that list. Differences among lists can produce confusion within and between regulatory agencies. Accordingly, the Commission feels that the Parties should give careful consideration to the contents of any new list of toxic and hazardous substances in order to avoid such unnecessary confusion.

The Water Quality Board, as one of its recommendations to the Commission regarding toxic and hazardous substances, has recommended that the Parties "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". The Board concluded that the absence of

a priority list of chemicals of concern has inhibited the development of control programs for toxic and hazardous substances. This being the case, the question then is, what list should be used for the Great Lakes Basin Ecosystem?

The Commission's Water Quality Board suggests that the development of a master list of chemicals of concern is the task of the Parties. The Commission is also of the view that the Parties will have to be the major actors in the development of such a master list, as part of a comprehensive and effective toxic and hazardous substances control program for the Great Lakes Basin Ecosystem. The Parties have shown little inclination to develop a "Great Lakes List", however, apart from those lists which already exist in the two countries. Accordingly, until the two countries agree to the development of such a master list, it would be reasonable to adopt an existing list.

One possibility is the list of "hazardous polluting substances" in Annex 10 of the Agreement. The use of this list may not be feasible, however, because of the large number of chemicals in the list and because the basis for many of the chemicals being placed on the list is not clear. Another possibility would be to adopt a master list developed or used within a particular jurisdiction. It is unlikely, however, that a list developed within the states or the province would be acceptable to all the jurisdictions in the Basin as a master list of chemicals of concern.

Accordingly, the Commission believes that an appropriate initial list for the Parties to use is the list of chemicals prepared by the joint Human Health Effects Committee of the Water Quality Board and the Science Advisory Board. The chemicals listed in Tables 1, 2 and 3 of the Committee's 1981 Annual Report to the Boards provide an initial priority listing. Further, the chemicals listed in Table 5 of the Committee's report are candidates that might also be included as further information on their potential toxicity becomes available.

It is important to note that this listing, prepared by scientific experts from both countries, is based on several previous reports of the Water Quality Board, listing approximately 400 chemicals already identified in various components of the Great Lakes Basin Ecosystem. Consequently, their presence in the Great Lakes "environment" is a reality. Many of the chemicals in the Committee's list are also incorporated in the "List of 129 Priority Pollutants" from a consent decree worked out between the Natural Resources Defense Council and the U.S. Environmental Protection Agency. Finally, there is a degree of priority already established among the chemicals discussed by the Committee on the basis of their inclusion in the specific tables prepared by the Committee. As noted above, those chemicals presented in Tables 1, 2 and 3 constitute the potential chemicals of immediate concern to the Parties.

Accordingly, the Commission recommends in the Biennial Report that the Parties use Tables 1, 2 and 3 of the 1981 Annual Report of the WQB/SAB Human Health Effects Committee as an initial master list of chemicals of concern in the Great Lakes Basin Ecosystem.

## **Establishment of Priority Within the Master List**

Although the Human Health Effects Committee list goes a long way toward reducing the chemicals of potential concern to a manageable list, it is still unrealistic to believe that all the identified chemicals can be monitored throughout the Great Lakes Basin Ecosystem. In order that GLISP can realistically accommodate the additional sampling likely to be required, it is necessary not only to have a master list of chemicals of concern, but also to have some measure of priority within the list.

Information on the use, manufacture, transportation or discharge of toxic and hazardous substances in the Great Lakes Basin is essential for establishing priorities. The Commission encourages the Parties to use the information and data that are available to identify chemicals in the master list that are likely to be "discharged" or escape within the Great Lakes Basin Ecosystem. For example, if large quantities of a chemical on the master list were used in manufacturing in certain areas of the Great Lakes Basin, those particular areas might warrant increased monitoring and/or surveillance attention by the Parties.

This focus on the sources of toxic and hazardous substances in the Basin is, of course, a simplification of the expected partitioning or behavior of a chemical in the Great Lakes System. Knowledge on sources does, however, allow the Parties to begin to be able to "point a finger" at potential areas of concern within the Basin. It should also be recognized, however, that the sheer quantity of use should not be the sole criterion for determining potential concern. PLUARG, for example, reported that one industry in Ontario was discharging about 7 kg/yr of PCBs into Lake Ontario. This is not a large quantity of PCBs, in the absolute sense. However, the persistent nature of this chemical in the environment and its persistence in the tissues of Great Lakes biota give it a priority considerably greater than the absolute numbers would suggest. Some of the chemicals on the master list may no longer be used in the Basin, eliminating them for priority consideration. The possibility of the large scale transport of such chemicals throughout the Basin also provides a criterion other than use of value in establishing surveillance and monitoring priorities.

Information on the use, manufacture, transport and/or discharge could be obtained from several sources. To begin with, the 1978 Agreement obligates the Parties to prepare some of the information which is necessary for this interim strategy. For example, Article VI (c) calls for the Parties to prepare "an inventory of pollution abatement requirements for all municipal and industrial facilities discharging into the Great Lakes System..." This inventory is to be prepared and revised annually and shall include compliance schedules and status of compliance with monitoring and effluent restrictions. Annex 2 of the Agreement, which calls upon the Parties to take measures to define and describe all existing and future limited use zones, indicates that these measures shall include "Identification and quantitative and qualitative description of all point source waste discharges (including tributaries) to boundary waters". Such measures can give the Parties valuable information regarding chemicals and their approximate quantities currently being discharged in the Great Lakes System.

The United States Department of Commerce will have information on economic,

industrial and transportation activities in the Great Lakes Basin. Commercial and industrial trade associations are also probable sources of such information. There are similar organizations in Canada with the same type of information and data. Even in those instances where the available data are only approximations or rough estimates, such information can, nevertheless, be valuable in providing a relative idea of what chemicals are being discharged or escaping within the Great Lakes System, and in what approximate quantities.

### **Augmentation of Joint Monitoring and Surveillance Program for Monitoring Chemicals of Concern**

Information on the use, manufacture, transport and discharge of chemicals of concern can help identify areas in the Great Lakes System where these chemicals are most likely to be found. Chemicals being discharged or escaping into the lakes are likely to be detected by monitoring and surveillance efforts near or around the points at which they enter the Great Lakes System.

The Commission believes that surveillance and monitoring efforts should be increased in those parts of the Great Lakes System where "usage characteristics" indicate that the chemicals of concern have a high potential of being found. This is not viewed so much as a modification of the normal monitoring and surveillance activities of GLISP, but rather as an enhanced sampling program in those areas where the chemicals of concern are most likely to be found. Additional monitoring and surveillance efforts would be justified on the basis of the greater potential of one or more of the chemicals of concern being present in given areas in the Great Lakes Basin Ecosystem.

It is envisioned that if these enhanced monitoring activities result in one or more of the chemicals of concern being found at unacceptable levels in the ecosystem, the Parties will develop Specific Objectives and/or implement remedial programs where necessary. Such programs would either be lake-wide or site-specific, depending on the chemical being monitored and its environmental properties.

The adoption of an interim action strategy along the lines outlined above represents a practical though simplified approach for attempting to identify, assess and control chemicals of concern on the basis of their potential environmental/human health impacts and their sources in the Basin. This approach uses an existing "master list" of chemicals of concern which was developed and ranked to some degree by experts from both countries. It also uses information on the manufacturing, use, discharge and/or transportation of these chemicals in the Basin, which should be relatively easy to obtain within the appropriate jurisdictions. Finally, it is envisioned that this approach will be compatible with the joint monitoring and surveillance program called for in Annex 11 of the 1978 Agreement. The interim approach can be modified over time in response to advancements in scientific knowledge. Thus, as scientific research defines more clearly the toxicity (or lack thereof) of a given chemical, the chemical may be removed from the master list. Changes in usage patterns of chemicals in the Basin can also be incorporated.

## **UNCERTAINTY AS TO THE ROLE OF CHEMICAL LISTS IN ANNEX 10**

Annex 10 of the 1978 Agreement commits the Parties to maintain a list of "hazardous polluting substances" which possess the potential of having toxic impacts on biota and which may be discharged to the Great Lakes System. The Parties are also to continually revise these lists in light of new scientific knowledge, as well as develop and implement programs and measures to minimize or eliminate the risk of releasing hazardous polluting substances to the Great Lakes System. Annex 10 also outlines procedures and criteria by which substances are to be added to or deleted from the list.

Annex 10 contains two lists of chemicals: Appendices 1 and 2. The first list contains those hazardous polluting substances having known toxic effects on aquatic and animal life; the second list contains those having potential toxic effects on such biota.

The Commission is concerned that the lists contained in Appendices 1 and 2 have apparently remained unchanged since the signing of the 1978 Agreement. The Commission is not aware that the Parties have revised the lists since their development, or that they have developed programs and measures to minimize or eliminate the risk of the release of the substances to the Great Lakes System.

Given this apparent inactivity, the Commission recommends that the Parties clarify the purpose of the Annex 10 lists. The use to which these lists should be put has been unclear since the signing of the 1978 Agreement. If a purpose is to be served by Annex 10 the Parties should proceed with such revision of these lists as may be necessary, and with the development and implementation of the control programs called for in the Annex. Until their use is clarified and the necessary attention is given to their maintenance and updating, these lists may be of little value in efforts to address pollution of the Great Lakes System by toxic and hazardous substances.

## **LACK OF ATTENTION TO NONPOINT SOURCES OF POLLUTION**

Article IV of the 1978 Agreement calls for the development and implementation of programs for the abatement and control of pollution from agricultural, forestry and other land use activities. Annex 3 of the Agreement specifically calls for the Parties to consider the recommendations of PLUARG in its confirmation of the phosphorus target loads.

The Commission's International Reference Group on Great Lakes Pollution From Land Use Activities (PLUARG) originally highlighted the substantial contributions of such pollutants as sediments, toxic and hazardous substances and phosphorus to the Great Lakes System from nonpoint sources in the Basin. PLUARG identified and quantified nonpoint pollution sources in the Great Lakes Basin, discussed factors which affected the severity of pollution from these sources and developed a framework and recommendations for attempting to deal with nonpoint source pollution. The Commission subsequently presented its recommendations to Governments on this subject, acknowledging the significant contribution of pollutants from urban and agricultural land use activities in the Basin. A Commission report dealing specifically with phosphorus pollution was subsequently

presented to the Parties.

Because the PLUARG study was a pioneer study, the Commission concludes that much remains to be learned about pollution from land use activities. While the role of land use activities in contributing significant quantities of various pollutants to the Great Lakes System is recognized, it is difficult for the Commission to identify and quantify specific inputs from the multitude of nonpoint sources in the Basin. For example, the Water Quality Board has not quantified any nonpoint source inputs of pollutants to date. Special efforts are necessary by the Parties to identify and quantify inputs to the Great Lakes System from such sources and especially to identify, assess and implement programs and measures for their abatement, control and prevention.

Another example of the necessity to address nonpoint pollution sources more vigorously, relates to the fact that the Parties are considering phosphorus load allocations for the two countries as part of their confirmation of the phosphorus "target loads" in Annex 3 of the Agreement. A significant concern is whether a phosphorus effluent limitation of 0.5 mg/L should apply for municipal wastewater treatment plants in the Lakes Erie and Ontario basins which discharge more than one million gallons per day. The associated costs of going from the present 1972 Agreement limitation of 1.0 mg/L to the proposed 1978 Agreement limitation of 0.5 mg/L can be substantial in some cases. Control of phosphorus from nonpoint sources, however, may represent a substantial step toward achieving these recommended target loads.

Identification and control of nonpoint sources of phosphorus, therefore, should be given much greater consideration by the Parties than it currently receives. As noted by the PLUARG and subsequent Commission reports, various agricultural and urban nonpoint pollution control measures are available which are relatively inexpensive and which can reduce phosphorus inputs to the Great Lakes System. The same consideration applies to the control of toxic and hazardous substances. Accordingly, a substantially greater effort is needed to identify and quantify nonpoint source pollution and to develop and implement control measures and programs for the abatement, control and prevention of pollution from such sources.

## **LACK OF ATTENTION TO CUMULATIVE IMPACTS OF POLLUTANTS IN SETTING WATER QUALITY OBJECTIVES**

Article III of the 1978 Agreement lists five General Objectives to be adopted by the Parties. These General Objectives relate primarily to gross pollution of the waters of the Great Lakes System including control of materials that would affect their colour, odour, temperature or taste. In addition, Article IV contains a definition of six Specific Objectives, expressed in more detail in Annexes to the Agreement. The Annexes include Specific Objectives for various chemical (including both organic and inorganic, persistent and non-persistent) physical, microbiological and radiological parameters. The Agreement also provides for the designation of limited use zones and the application of a nondegradation philosophy where water quality conditions are better than those prescribed by the Specific Objectives.

The Specific Objectives defined in Article IV and listed in Annex 1 of the Agreement constitute the basic reference against which the water quality conditions of the Great Lakes are assessed. The Commission notes that Annex 1 contains Objectives for only about 30 chemicals, in contrast to about 400 chemicals already identified in components of the Great Lakes Basin Ecosystem, as indicated in previous Commission reports. More will likely be identified as analytical procedures continue to improve. Thousands of different chemicals are manufactured, used or transported in the Great Lakes Basin at the present time.

Since Specific Objectives do not exist for many of the chemicals currently entering the Great Lakes Basin Ecosystem, the Commission has little basis for assessing chemical levels other than a general concern. For instance, it can only note that, as stated in its Special Report on Pollution in the Niagara River, "a number of other organic compounds have been found in the Niagara River for which specific objectives for the protection of fish and other biota and/or health implications have not been defined. While the significance of their presence cannot therefore be assessed, their very existence in the boundary waters is a matter for concern under the Great Lakes Water Quality Agreement under Annex 12 and the Specific Objective that they be at less than detection levels."

The Specific Objectives in Annex 1 do not consider the potential cumulative effects of interactions with other discharged or natural chemicals in the ecosystem. For example, the cumulative or simultaneous effect of two or more chemicals acting together on biota in the Great Lakes System may be greater (or less) than their individual effects considered alone. Such cumulative effects may necessitate changes in some of the Specific Objectives in order to account for their actual impacts on water quality, biota and/or human health. These changes could result in either a more stringent or a more relaxed objective, depending on the chemicals involved.

Governments should therefore reassess the Specific Objectives in light of the current knowledge on potential cumulative impacts of multiple pollutants and consider their revision, where appropriate, in order to more realistically reflect their expected impact in the aquatic environment. It is recommended especially that such knowledge be taken into account in the granting of municipal and industrial discharge permits both within and between jurisdictions. The Commission feels that such recognition of the expected chemical behavior of multiple types of pollutants will, over the long term, lead to a more realistic set of criteria by which to assess the potential environmental impacts of the range of chemicals discharged in the Great Lakes Basin Ecosystem.

## **RELATIONSHIP BETWEEN JURISDICTIONAL PROGRAMS AND GREAT LAKES WATER QUALITY OBJECTIVES**

Article V of the 1978 Agreement states that "water quality standards and other regulatory requirements of the Parties shall be consistent with the General and Specific Objectives." It further states that 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".

Such provisions would help ensure that at least a minimum level of quality is maintained in the waters of the Great Lakes System. However, it appears to the Commission that, although some efforts have been made in this direction, there is no uniformity at present in the application of these Objectives to the establishment of water quality standards in the various jurisdictions in the Basin. A greater effort is needed by the Parties to obtain the cooperation of the state and provincial governments in ensuring that their standards are consistent with the Agreement Objectives. Indeed, this is incumbent upon the Parties, as noted above in regard to Article V of the Agreement.

Although Agreement Objectives apply to the waters and biota in the Great Lakes, the consideration of whether or not given discharges may result in exceedances of the Objectives should be a criterion for granting discharge permits, especially in the case of persistent toxic substances. The Commission is pleased that the respective Parties have attempted to work with the States and Province of Ontario to incorporate the Water Quality Objectives in the 1978 Agreement into discharge permits and other institutional efforts related to enhancing the quality of the waters of the Great Lakes System. It encourages endeavours such as the recent policy by the Province of Ontario to use the Specific Objectives of the 1978 Agreement to achieve and maintain water quality in the Great Lakes. Such efforts on the part of the jurisdictions will work to the achievement of these Objectives in waters and biota in the Great Lakes System.

The Parties commit themselves, in Article IX of the Agreement, to seek "the cooperation of the state and provincial governments in all matters relating to this Agreement." The Commission feels that obtaining agreement among the jurisdictions regarding the use of the General and Specific Objectives as a basis for setting standards and regulatory requirements would be a significant demonstration of this commitment.

## **INTER-JURISDICTIONAL POLLUTION IMPACTS**

Article II of the Agreement states that it is the policy of the Parties that "coordinated planning processes and best management practices be developed and implemented by the jurisdictions to ensure adequate control of all sources of pollutants." The Commission understands this to mean that the Parties will work to ensure that pollution control is comprehensive and coordinated among all the jurisdictions.

The Commission has concluded that, unfortunately, there appears to be no provision for encouraging individual jurisdictions to become more aware of the impacts of their activities on other jurisdictions in the Basin. For example, the United States Environmental Protection Agency, under the provisions of the Clean Water Act, has delegated to each Great Lakes State the authority to issue discharge permits. In formulating and issuing permits, however, each state is concerned primarily with the potential impacts of these discharges on the waters within its own boundary. This is demonstrated clearly by the situation existing in the Niagara River. The permit processes used for the dischargers in this river have not considered the impacts of these discharges further downstream, nor have they considered the impacts of multiple discharges, even within the allowable limits of the discharge permit on water quality and biota in the immediate area. As noted in the Commission's Special

Report on Pollution in the Niagara River, "... it is also necessary to clarify the extent to which the overall environmental planning and pollution control strategies of the jurisdictions take into account the total long term assimilative capacity of the ecosystem in addition to time-specific ambient water quality objectives or standards."

Based on this observation, some oversight mechanism should be established by the Parties to ensure against such situations. Determination of the exact mechanism will require study on the part of the Governments since the cooperation of state and provincial jurisdictions will be required. The Commission offers no recommendation, therefore, as to the best specific mechanism. One possibility in the United States, is that the Environmental Protection Agency, while continuing to delegate authority to the states to issue discharge permits, could also require that permits for discharges having potential water quality or biota impacts beyond the boundaries of the state receive the approval of the Agency before the permit is granted. The sole function of the Environmental Protection Agency in this case would be to assess the potential interstate or international impacts of such discharges.

## **INSTITUTIONAL ROLES AND OPPORTUNITIES**

The 1972 Great Lakes Water Quality Agreement was a major undertaking by the Governments of Canada and the United States. It also marked the beginnings of a new and challenging role for the International Joint Commission. The Commission, with its many years as a fact-finding and advisory body for the two nations, has never before received a mandate with such broad and continuing responsibilities. In addition to its more traditional advisory and monitoring roles, the Commission was given new coordination and information responsibilities in the 1972 Agreement to assist the Governments in carrying out the Purpose of the Agreement and to encourage and monitor progress under the Agreement. These roles and responsibilities are continued in modified form in the 1978 Agreement. The Commission has, however, experienced some difficulty in coming to terms with its responsibilities and opportunities as they are outlined in the 1978 Agreement.

Some of the uncertainties surrounding the Agreement are a reflection of the complexity of the problems addressed in the Agreement. The 1972 Agreement, with its emphasis on phosphorus/eutrophication concerns, was relatively straightforward. The cause-effect linkages were reasonably well defined, and the control program options were relatively clear. In addition, the Commission was given authority to create and develop the Great Lakes Regional Office. The significance of this authority, at least in the view of some former Commissioners, was that it reinforced the role of the Commission as an independent, unitary body with the authority to develop the capability for independently gathering, analyzing and evaluation information, often of a highly technical nature.

The detailed Terms of Reference for the Regional Office and the two Commission Boards, presented in the 1978 Agreement, were a significant departure from the more general statement in the 1972 Agreement and appear to limit the Commission's ability to manage and use directly the expertise available at the Regional Office as a source of independent advice. The Commission is still attempting to develop ways and means of carrying out its responsibilities relating to the Regional Office in a manner consistent with

the 1978 Agreement and, at the same time, responsive to current realities. This involves a broad assessment of the institutional and personal relationships pertinent to the Agreement.

The Commission has consistently placed a high value on its own policy independence and on the technical competence of its advisors, in the belief that it was in the best interests of the Commission and the two Governments to maintain such a stance. At the same time, it is necessary and appropriate for the Commission to work cooperatively with governments and their personnel as well as with other interests, such as private industry. Thus, the challenge, from the Commission's perspective, is to develop an approach and style that allows for cooperative initiatives with governments and others without compromising the Commission's unique existence and traditional character. This is not an easy challenge.

The history of the relationship between the Commission and its Regional Office is closely associated with that of the Commission's other Great Lakes institutions, especially the Great Lakes Water Quality Board, designated in the 1978 Agreement as the "principal advisor" to the Commission on Great Lakes water quality issues. The Water Quality Board must include and has consisted, to date, entirely of "representatives from the Parties and each of the state and provincial governments" in the Basin. This status has been taken, at least by some, to mean that Board members serve as representatives of the governments concerned. This interpretation is contrary to the traditional orientation of most Commission boards whereby members serve "in their personal and professional capacity."

While this "government representative" viewpoint may be acceptable if data reporting were the only function of the Board, the fact is that interpretation and assessment of a broad range of scientific data and other policy considerations is required. The Commission needs non-representational, comprehensive advice. The Science Advisory Board is responsible for providing this type of advice on the scientific/research aspects of the Agreement. Neither the Science Advisory Board nor the Water Quality Board has been able to deal very successfully, however, with the important societal issues which the Commission has, in previous reports, suggested are a component of successful pollution control programs.

The Commission does believe that the current Agreement has some inherent limitations. To a large extent, Agreement activities depend on jurisdictional priorities, which often change. In the Commission's view, these changing priorities, together with the rather uncertain roles and relationships of the Agreement institutions, have created unnecessary confusion. The Commission has concluded that further consideration of the suitability of the current institutional arrangements is warranted.