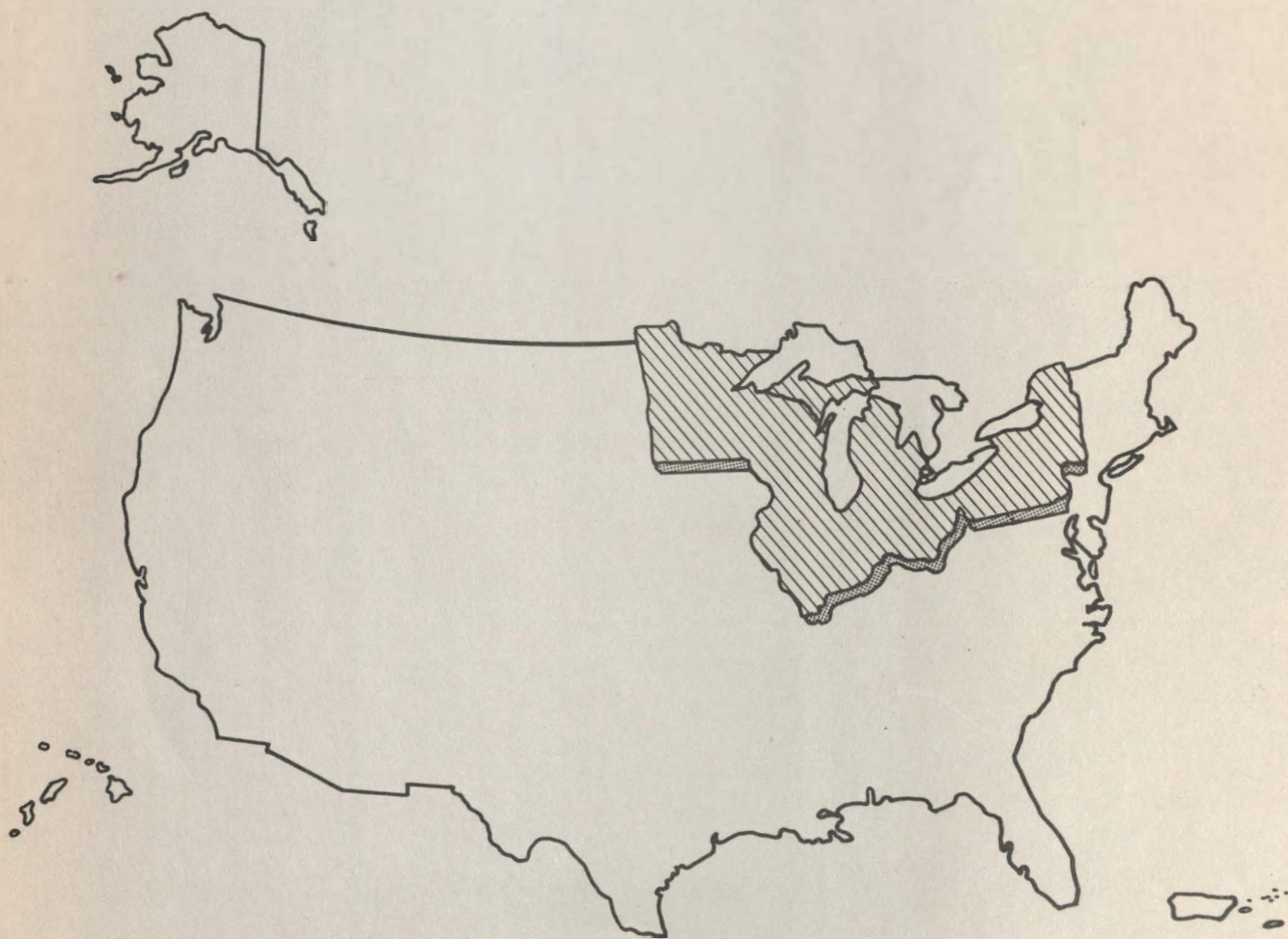


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# Report of Great Lakes Regional Workshop on Ocean Pollution Monitoring



Ann Arbor, MI, February 11-13, 1981



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Ann Arbor, MI, February <sup>11-13</sup> 10-12, 1981

Mimi Becker  
James W. Cowden  
Great Lakes Tomorrow  
Box 1934  
Hiram, Ohio 44234

Boulder, Colorado  
June 1981



**UNITED STATES  
DEPARTMENT OF COMMERCE**  
**Malcolm Baldrige,  
Secretary**

**NATIONAL OCEANIC AND  
ATMOSPHERIC ADMINISTRATION**

Office of Marine  
Pollution Assessment  
**R.L. Swanson,  
Director**

<p>1081</p> <p><b>OCT 6 1981</b></p> <p>N.O.A.A. U. S. Dept. of Commerce</p>
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## I. EXECUTIVE SUMMARY

A workshop on Great Lakes Pollution Monitoring was held by the Office of Marine Pollution Assessment of the National Oceanic and Atmospheric Administration to develop recommendations on monitoring, and information on needs and priorities for the five year Federal Plan for Ocean Pollution Research, Development, and Monitoring, mandated under P.L. 95-273. Convened in Ann Arbor, Michigan, February 11-13, 1981, the workshop was chaired by Commissioner Charles Ross of the United States-Canada International Joint Commission. Great Lakes Tomorrow provided technical support for the development and conduct of the workshop.

Fifty-five research and monitoring data users from local, state, provincial, regional and federal organizations were brought together to address a series of specific questions that served as a basis for developing Great Lakes regional monitoring priorities and needs. Workshop objectives were: to determine the adequacy of present Great Lakes monitoring programs; to assess the existing data management system; to establish priorities for monitoring programs and to identify alternatives and strategies to meet local and regional needs for monitoring and information management.

This report summarizes the proceedings of the workshop for use in developing the Great Lakes Regional Section of the National Plan for Ocean Pollution Research, Development and Monitoring and in providing a resource for Great Lakes Pollution Monitoring Workshop participants.

Section II is the Introduction and Background for the report. It briefly presents NOAA's mandate under P.L. 95-273, the results of the June 1981, Traverse City, Michigan, workshop on Great Lakes pollution problems, and the approach used at this workshop.

Section III presents the Consolidated Results of the Workshop. These represent a summary of the key points of consensus identified in the plenary session and obtained from analysis of individual work group findings and recommendations. Major findings are:

1. The characteristics of the Great Lakes Basin are unique, differing markedly from other U.S. marine environments. Surveillance and monitoring programs will require planning, design and operations that respond to those characteristics.
2. The International Joint Commission, established under the Boundary Waters Treaty of 1909 between Canada and the United States, is authorized under the 1972 and 1978 Water Quality Agreements to implement and advise on objectives and programs, including a coordinated program of "Surveillance and Monitoring", detailed as Annex 11 in the 1978 Water Quality Agreement. The IJC is the existing regional coordinating organization for Great Lakes Basin ecosystem monitoring and surveillance.

3. The Great Lakes International Surveillance Plan (GLISP) has been developed in the binational context as a framework for monitoring and surveillance in the Great Lakes. All jurisdictions and appropriate organizations have participated in development and review of this Plan for a period of years. As an operating regional monitoring program, it is recommended that GLISP be incorporated as part of the National Ocean Pollution Research, Development and Monitoring Plan.
4. GLISP, the 1978 Water Quality Agreement and the Canada-Ontario Agreement are flexible and responsive to changing conditions and monitoring requirements in the Lakes. The State - EPA Agreements need to be improved to be specific to GLISP needs.
5. The forthcoming Federal Plan for Ocean Pollution Research, Development and Monitoring should acknowledge the water quality objectives established under international agreement, with particular reference to public and environmental health.
6. Surveillance priorities have not been established for regional monitoring in the Great Lakes in anticipation of reduced funding. The United States is responsible for half the costs of monitoring under GLISP. Economic cuts may cause states and local governments to do only that monitoring required by law. Consideration needs to be given to monitoring priorities established under GLISP to meet Water Quality Agreement commitments.
7. The problems related to GLISP are mainly those related to implementation due to limited resources, difficulties in communication, and data access management.
8. A Great Lakes regional information clearinghouse should be developed to provide linkages between collectors and users of data.
9. The use of biotic indicators and integrators should receive more emphasis with a view to increasing the efficiency and sensitivity of water quality and ecosystem surveillance.
10. Identification and definition and monitoring of ecosystem health are required.
11. Design and planning of monitoring programs at all jurisdictional levels (and under GLISP) should be responsive to the needs of the users and should include requirements of public health decision makers with respect to risk/hazard assessment and to add new parameters to monitor emerging problems. Improved monitoring of atmospheric deposition, total loadings and mass balance is required. Increased attention should be given to monitoring fate, transport and effects of toxic pollutants.
12. There is need to address the role of analytical quality control in Great Lake pollution monitoring.

13. The allocation of resources for monitoring programs should commit in advance essential funds for the assessment and analysis of data. Allocations for GLISP should reflect this need.
14. There is need for a more precise definition of Great Lakes "coastal areas" under P.L. 95-273 to reflect the requirement for pollution control programs and monitoring to be conducted throughout the entire Great Lakes Basin ecosystem, which is defined in the 1978 Water Quality Agreement to include the drainage basin to the international boundary in the St. Lawrence River.
15. Research, monitoring and assessment efforts to date have not resulted in informing the IJC (except for selected geographic problem areas) as to whether things are getting better, whether there is coordination, whether state and local people know what is going on, and whether or not the IJC should take its message directly to the people.

Section IV presents a study of the existing regional pollution plan, called the Great Lakes International Surveillance Plan (GLISP). This has been developed after the workshop from the actual proceedings of the workshop and from documents made available at the workshop. A history of the Plan, U.S. and Canadian implementation of the Plan, results, and workshop recommendations for improvement are discussed.

Section V presents detailed findings and strategies for improvement, as these were identified and discussed by workshop participants. These are summarized and consolidated under the following headings: Monitoring Design, Data Utilization, Monitoring Technology, and Funding and Coordination.



## II. INTRODUCTION AND BACKGROUND

A workshop on Great Lakes Pollution Monitoring was held by the Office of Marine Pollution Assessment (OMPA) of the National Oceanic and Atmospheric Administration (NOAA) in Ann Arbor, Michigan on February 11-13, 1981. Participants included monitoring data users who have the responsibilities for policy development, implementation or management decisions in a variety of agencies and activities within the Great Lakes Basin. The objectives of the workshop were to determine the adequacy of Great Lakes monitoring programs, to assess the existing data management system, to establish priorities for monitoring programs, and to identify strategies to meet local and regional information needs.

The Ann Arbor workshop was one of six sponsored by NOAA/OMPA to obtain a nationwide perspective on the adequacy and utilization of marine pollution monitoring activities, and the associated institutional, fiscal and technical problems. The monitoring workshops followed an earlier series of workshops held by NOAA's National Marine Pollution Program Office (NMPPPO) to determine regional needs and priorities for marine pollution research and development and monitoring.

### A. P.L. 95-273 and the Federal Plan

In May 1978, Congress passed the National Ocean Pollution Research and Development and Monitoring Planning Act (P.L. 95-273). Congressional findings acknowledged the short- and long-term impacts of man on marine and coastal resources, the increasing dependency on those resources and the need for comprehensive information on pollutants in the marine environment. With numerous departments and agencies of the federal government involved in ocean pollution research, development and monitoring, often uncoordinated, Congress found that better planning was needed for more effective use of federal resources including funds, personnel, vessels, facilities and equipment. Congress identified three purposes for the Act:

- (1) to establish a comprehensive 5-year Plan for Federal ocean pollution research, development and monitoring in order to provide for planning, coordination and dissemination of information on these programs;
- (2) to develop the necessary base of information to support the rational, efficient and equitable utilization, conservation and development of ocean and coastal resources; and
- (3) to designate NOAA as the lead Federal agency for preparing this Plan and to require NOAA to carry out a comprehensive program of ocean pollution research, development and monitoring under the Plan.

In order to implement the legislation, an interagency committee on Ocean Pollution Research, Development and Monitoring (COPRDM) was established by the Director of the Office of Science and Technology Policy in the Executive Office of the President. The committee is chaired by NOAA's Deputy Administrator with EPA's Assistant Administrator for Research and Development as vice-chairman. Other members included policy level representatives from other Federal agencies with programs relating to ocean pollution and the Office of Management and Budget.

In the process of development of the second Federal Plan, NOAA/NMPPPO held five regional conferences during the summer of 1980, to review marine pollution problem areas and identify research or information needs and priorities. However, the "national needs workshop coordinators" recommended that the issue of monitoring be discussed at separate meetings. Six regional workshops were accordingly held, which dealt with the needs, problems and priorities of ocean pollution monitoring.

#### B. Great Lakes Conference on Marine Pollution Problems

This conference was convened in Traverse City, Michigan on June 9-11, 1980, by the National Marine Pollution Program Office (NMPPPO). The conference, held to solicit regional input to the federal planning process, identified the most important pollution problems in the Great Lakes and reviewed and determined research and information needs associated with each problem area. The conference identified six major problem areas which were considered equally important. These included (1) hazardous and toxic wastes, (2) eutrophication, (3) habitat modification, (4) socio-economic and institutional issues, (5) large volume discharges, and (6) risk analyses in water quality issues. An overriding theme related to issues was that an ecosystem approach to understanding and solving pollution problems must be adopted. The conferees gave major attention to requirements for identification and characterization of pollution sources, and to the specification of management strategies. While these issues did not necessarily involve conventional monitoring, the proposed research was viewed as critical to the solution of Great Lakes pollution problems. Examples include:

- Evaluation of management and remedial measures, on a watershed basis, to deal with causes of diffuse sources pollution.
- Identification of toxic contaminants, their sources, distribution, use and occurrence, and the determination of transport, fate, and effects in the Lakes.
- Public information strategies to inform the public on problems and alternative remedial strategies in order to achieve understanding and support.
- The application of risk analyses to policy issues affecting the long-term water quality of the Great Lakes.

- Improvement of the capability to predict future Great Lakes pollution events based on sources, probability of occurrences, potential effects, and consideration of prevention strategies.
- The identification and quantification of physical changes in the nearshore environment, and their impacts on habitat, fisheries, wildlife and water related recreation.
- The identification and removal of institutional barriers to successful implementation of Great Lakes pollution prevention and control strategies.
- The analysis of policy and jurisdictional relationships in order to resolve dredging and dredge spoil disposal problems for harbor and channel maintenance.

Key monitoring recommendations from the Traverse City Conference were (1) development of understanding of the functioning of Great Lakes ecosystems in order to evaluate their response to various stresses and corrective measures, and (2) establishment of a monitoring system meeting the need for continuing data on nutrient loadings, toxic substances, and on the response of the biota to these pollutants. The program should monitor processes as well as occurrence and concentration. Human health problems related to long-term accumulation of toxic wastes from industry, and airborne deposits, both affecting drinking water supply, plus the dramatic changes that have occurred in overall ecosystem viability, were cited as critical needs for improving the Lakes monitoring programs. The total array of contaminants, their interaction and cumulative effects need to be determined. Examples of research and monitoring recommendations included a need:

- to develop a coordinated, systematic and sustained monitoring program for a selected hazardous chemicals in selected species of recreation and food fish
- to identify and quantify atmospheric sources of contaminants
- to develop a data base concerning dynamic levels of toxic substances, and to evaluate their loading, deposition, mixing, and removal, including metabolic and degradation products
- to identify the properties that are the most cost-beneficial indicators of ecosystem health (aquatic indicator organisms)
- to determine sampling and analytic requirements for monitoring programs to accurately describe status of pollutants at specific locations
- to determine impact of multiple contaminants on productivity of aquatic systems

- to improve and implement a rapid assessment of transport, fate, and effects of new hazardous contaminants
- to establish cause and effect relationships between nutrient loadings and changes in or disappearance of Great Lakes biota
- to estimate loading and cycling of major nutrients, trace elements and toxic materials that may limit survival and productivity of the biota
- to indicate species and sizes of fish acceptable for food
- to identify behavior, fate, and effects of oil products in a cold, freshwater environment

C. Great Lakes Region Pollution Monitoring Workshop

The sixth in a series of monitoring workshops was held in Ann Arbor, Michigan, February 11-13, 1981, bringing together an expert group of pollution monitoring data users from the Province of Ontario, U.S., and Canadian federal agencies, and seven Great Lakes States (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, and Wisconsin). Agencies and organizations represented included: the International Joint Commission, the Great Lakes Fishery Commission, state, provincial, and local governments, private industry, universities, and citizen groups. Participants and invitees are listed in Appendix 4.

1. Specific Objectives for the Great Lakes Pollution Monitoring Workshop:

- a. To determine whether existing Great Lakes monitoring programs are providing local and regional agencies with the information they need, and to identify problem areas and any need for change;
- b. to assess the existing data management system (coordination, collection, storage, synthesis, distribution and access, assessment, use, etc.), and to identify options for improvement, including institutional change;
- c. to establish priorities for monitoring programs in view of increasing competition for resources; and,
- d. to identify and assess alternative strategies for Great Lakes monitoring operations, which will improve services to local and regional users.

The approach to meet the workshop objectives is discussed below.

## 2. Approach

The Ann Arbor workshop was structured to provide the maximum opportunity for participation and the sharing of information and ideas by individual data users. The process was encouraged by clearly identified objectives, mailed pre-workshop orientation and briefing materials, a structured agenda, and plenary sessions where presentations were targeted and were deliberately concise. More than half the time was allocated to small group sessions, where each individual contributed information and perspectives. Workshop invitees were asked to prepare a short informal briefing on their own (and organizational) experience as users of Great Lakes monitoring data, giving an evaluation of data adequacy and management, and recommendations for improvement.

Participants received, with their letter of invitation and logistical information, the workshop objectives and hoped-for products, a detailed working agenda, representative questions for discussion in each of the small group sessions, a summary and overview of the Great Lakes Surveillance Plan (GLISP), and a summary of comments from the four ocean pollution monitoring workshops held prior to their conference. In spite of inclement weather and difficult traveling conditions, 45 invitees participated.

The workshop was organized in a sequence of plenary sessions and small group sessions which retained their identity during the workshops. Both the mailed briefing material and the documents distributed at the workshop, as well as the plenary session presentations were phased to assist participants in their discussion and deliberation.

Plenary sessions were scheduled to provide briefings for participants, to allow opportunity for small group sessions to report their findings to the entire conference for discussion, and finally, to identify points of consensus and priorities on monitoring programs and requirements in the Great Lakes Basin.

In this report, the "Consolidated Results" reflect areas of consensus from both the plenary and the individual workshop sessions. The Case Study of GLISP was developed from GLISP itself, and from presentations and data provided at the workshop. It includes participant suggestions for specific modifications to meet monitoring data users needs. The Regional Concerns and Perspectives were identified in work sessions, and strategies for addressing them were developed in work and plenary sessions. Data for developing this section of the report were obtained from recorder notes, newsprint, tape recordings and copies of briefing documents. Individual work session findings are summarized and categorized on an arbitrary basis, but reflect the specific concerns stated by workshop participants. These do not necessarily indicate consensus, and were not intended to do so.

### III. CONSOLIDATED RESULTS

#### Findings and Recommendations

1. The characteristics of the Great Lakes Basin are unique, differing markedly from other U.S. marine environments. Surveillance and monitoring programs will require planning, design and operations that respond to those characteristics.

Background: The Great Lakes are an international freshwater resource that comprises nearly 95 percent of all U.S. surface water supply. Drinking water for 25 million people is a critical use and over 4,000 million gallons a day are withdrawn for domestic, commercial and industrial use. Four out of the five Great Lakes are international boundary waters between the U.S. and Canada and their location requires agreement between the nations to maintain and improve the water quality of the joint resource. That agreement is detailed in the 1978 Water Quality Agreement. The Lakes are a relatively closed system, with water retention times that range from decades to centuries. Pollutants that enter the lakes have a long residence and an opportunity to accumulate. Contributions from tributaries and from the atmosphere add to the pollutant load and must be considered in the monitoring design. Finally, the human health problems posed by water contact, drinking water, and the consumption of fish require early identification, quick response for acute problems, and a capability for early determination of emerging problems.

2. The International Joint Commission (IJC), established under the Boundary Waters Treaty of 1909 between Canada and the United States, is authorized under the 1972 and 1978 Water Quality Agreements to implement and advise on objectives and programs, including a coordinated program of "Surveillance and Monitoring" (detailed as Annex 11 in the 1978 agreement). The IJC is the existing regional coordinating organization for Great Lakes monitoring.
3. The Great Lakes International Surveillance Plan (GLISP) has been established in this binational context as a framework for monitoring and surveillance in the Great Lakes. All jurisdictions and appropriate organizations have participated in the development and review of the Plan for a period of years. As an operating regional monitoring program, it is recommended that GLISP be incorporated as part of the National Plan.

Background: GLISP is mandated under article VI of the 1978 Great Lakes Water Quality Agreement - "to assess compliance with pollution control requirements and achievement of the (water quality) Objectives, to provide information for measuring local and whole lake response to control measures and to identify emerging problems." The 1978 Agreement adopted the concept of the "Great Lakes Basin Ecosystem", recognizing that water quality depends on the interacting components of air, land, water, and living organisms. The purpose, formally stated, is to "restore and maintain

the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem". The two governments agree to a "maximum effort to develop programs, practices and technology necessary for a better understanding of the Great Lakes Basin Ecosystem and to eliminate or reduce, to the maximum extent practicable, the discharge of pollutants into the Great Lakes System".

The Agreement establishes both general and specific objectives, the first being broad descriptions of desirable water quality conditions. Specific objectives designate limits on numerous substances, mainly persistent toxics, in order to protect the recognized most sensitive use in all waters. Article IV (b) states that the "determination of the achievement of Specific Objectives shall be based on statistically valid sampling data". Monitoring requirements are detailed in Annex 11, Surveillance and Monitoring, and Annex 12, Persistent Toxic Substances. Annex 11 specifies that the program shall include baseline data collection, sample analysis, evaluation and quality assurance programs to allow assessment of inputs from tributaries, point sources, the atmosphere, and connecting channels; whole lake data including nearshore areas (harbors, embayments, general shoreline), open waters, fish contaminants and wildlife contaminants, and outflows, including water intakes and outlets. Annex 12 requires an early warning system to anticipate future toxic materials problems, and monitoring and research to identify temporal and spatial trends in persistent toxics, their impact on human health, the sources, and the presence of new toxic substances.

4. GLISP, the 1978 Water Quality Agreement, and the Canada-Ontario Agreement are flexible and responsive to changing conditions and monitoring requirements in the Lakes.
5. The forthcoming Federal Plan for Ocean Pollution Research, Development and Monitoring should state water quality objectives established under international agreement, with particular reference to public and environmental health.

Background: The 1978 Water Quality Agreement was built on six years of experience with the 1972 Agreement. It added the ecosystem concept and objectives for toxic materials which were not known to be a threat to the Lakes when the '72 Agreement was signed. New annexes were added to deal with toxics and hazardous substances, adopting a zero discharge philosophy for persistent toxics. The Canada-Ontario Agreement was amended to conform to provisions of the Agreement. There is no U.S. counterpart to the Canada-Ontario Agreement, although EPA-state agreements may refer specifically to Great Lakes issues. GLISP has changed emphasis from phosphorous and eutrophication to organochlorines and heavy metals, in response to changing demand and the Agreement. The rationale for change, including the need for enhanced nearshore monitoring, fish contaminant levels and other biotic monitoring in order to evaluate environmental levels and determine impact on human health, should be recognized in the National Plan.

6. Surveillance priorities have not been established for regional monitoring in the Great Lakes in anticipation of reduced funding for surveillance.

Background: GLISP is designed to monitor an entire system and to comply with the requirements of an international agreement, the 1978 Water Quality Agreement. The program is jointly funded by Canada and the U.S., and the cooperative sharing extends to personnel and facilities on open-lake monitoring and other aspects. Limitations have already been placed on monitoring programs to conserve funds (i.e., intensive surveys on each lake are accomplished only in a nine-year sequence). Funding is half from Canada/Ontario, a quarter from the USEPA and the remainder from the adjoining States. Economic conditions may cause cuts in monitoring, leaving only legally mandated programs. Surveillance priorities need to be developed with due regard for legal implications of the Water Quality Agreements.

7. The problems identified with GLISP are mainly those related to implementation due to limited resources, difficulties of communication, access to data, and data management.

Background: Participants identified specific problems in Great Lakes monitoring programs from the perspective of data users. The categories included planning and design of program, data access and exchange, the format and scope of data and information, financial and resource problems, analyses and interpretation of data, certain management questions identified as institutional, and ecosystem monitoring.

8. A Great Lakes regional information clearinghouse should be established to provide better communication between collectors and data users.

Background: Due to the number of jurisdictions and agencies involved and the diversity of concerned scientific and technical disciplines, there is a need to improve means of communication among participants. It is difficult for data users to know what data are available, who is producing data, how to access data, and how to communicate needs to collectors of monitoring data. There is a need for communication among generators for coordination and data sharing among the many jurisdictions, and for improvement in the lag time between data collection and availability. Means should be found to access grey literature (unpublished), and to provide relevant information to the general public in order to create public awareness and support for the control and remedial measures.

9. The use of biotic indicators and integrators of water quality should receive more emphasis with a view to increasing the efficiency and sensitivity of water quality surveillance.

Background: GLISP monitors herring gull colonies and various fish species on a limited basis. Organisms tend to concentrate certain contaminants from their environment, providing more reliable indices of



contamination both by area and over a period of time, than do isolated water samples. Organisms can also provide early warning of low-level contamination that might remain undetected in water until measurable concentrations had built up. Many of the Great Lakes toxic substances problems were first discovered in aquatic organisms. Research is needed to establish the relationship between biological indicators and integrators and water samples, especially concentrations of trace organics and heavy metals.

10. The necessary elements of an ecosystem health monitoring system need to be identified and implemented in the monitoring program.

Background: GLISP is a water quality management plan, not a resource management plan. Although fish and herring gull populations are monitored for contaminant concentrations, GLISP does not monitor fish populations or aquatic community structures. Currently, fish are the principal reference for ecosystem health; the intrusion of toxic substances, the changes in habitat, and the increased competition for the use of the limited resources create a collective impact. Baseline research is needed to identify, define, and subsequently monitor ecosystem health.

11. Design and implementation of monitoring programs should be responsive to management requirements for public health decision making, and these should be able to identify emerging problems.

Background: There is a need for clarification of surveillance objectives which should respond to the requirements of management. Data need to be collected and assessed for public health purposes, providing statistically significant sampling to support decisions, such as a public advisory on eating particular fish species. Data are needed for identification of exposure potential. Concentration of pollutants is useful if water quality objectives are being looked at, but if a broader ecological perspective is desired, information on total loadings and mass balance is required. Other stress problems are associated with acid rain, atmospheric deposition and long-range transport of pollution, which are originating in, and affecting the region from outside.

12. There is need to document the role of analytical quality control in Great Lakes pollution monitoring.

Background: The need for analytical quality control (data quality assurance) programs and data quality assessment for the Great Lakes regions were strongly stated at the workshop and in a recent publication of the Water Quality Board's Data Quality Work Group. However, the benefits and utilization of information from analytical quality control activities have not been documented and an accurate determination of their costs and benefits is needed.

13. The allocation of resources for monitoring programs should commit in advance essential funds for the assessment and analysis of data. Allocations for GLISP should reflect this need.

Background: Specific and substantial resources for data analysis and interpretation need to be allocated. The equivalent of 40 to 60 percent of sampling and laboratory costs should be committed when a sampling program is begun. Much of the data previously collected has been neither made available, nor analyzed and is, therefore, useless for policy development, management decisions, or implementation of pollution control strategies. Management is dependent on interpreted data, and modification of surveillance programs is best accomplished through analysis of past surveys.

14. There is a need for a redefinition of the Great Lakes coastal areas under P.L. 95-273.

Background: The definition of "marine environment" and "coastal resource" as used in P.L. 95-273 should be expanded to include the Great Lakes Basin ecosystem. Specifically, characteristics of the relatively closed Great Lakes system need to be acknowledged and measured, since this system receives pollution from tributaries, atmospheric deposition, and various land uses in the Basin.

15. Research, monitoring and assessment efforts to date have not resulted in informing the IJC (except for selected geographic problem areas) as to whether things are getting better, whether there is coordination, whether state and local people know what is going on, and whether or not the IJC should take its message directly to the people.

Background: The above observations made by Commissioner Ross reflect the limitations of scientific understanding of the Great Lakes ecosystem, a lack of resources to compile and assess existing research and monitoring information, and the institutional barriers to successful implementation of Great Lakes pollution prevention and control programs which were cited at the NMPPPO conference. Even the numbers and identities of operating agencies and programs involved in monitoring are not readily available; they change in response to changing needs and resources of the two Federal, eight state, one provincial, at least three regional, and the large number of local governments. In this connection, it should be noted that within the structure of the Commission itself, there are 22 boards, committees, and task forces, a regional office, and finally the Washington and Ottawa headquarter staffs which determine the type, amount, and timing of Great Lakes water quality information made available to the Commissioners and, within the context of the Water Quality Agreement, to the governments and the public.

#### IV. THE GREAT LAKES INTERNATIONAL SURVEILLANCE PLAN: A CASE STUDY IN REGIONAL POLLUTION RESEARCH AND MONITORING

##### A. Background

The Great Lakes form the largest body of freshwater in the world. They serve as a drinking water source for more than 25 million people and are a sewer for at least that many. Historically, they have been among the most abused waters in the United States. From the time that they were first settled, industries, municipalities, and individuals have thrown away every form of waste and refuse into the lakes and their tributaries. This has included sewage, garbage and other biological wastes, solid refuse and toxic substances. In addition, runoff from heavy rains or spring thaws of heavy snow cover have carried large amounts of sediment, fertilizers and pesticides with them into the Lakes and their tributary streams. By the late 1960's pollution problems in the Great Lakes became so severe that worldwide attention was focused on them. It became essential for both the United States and Canada to take direct action to deal with the eutrophication and contamination problems on an unprecedented scale in order to preserve the resource - and to restore it for use.

Under the United States-Canadian Boundary Waters Treaty of 1909, the Great Lakes were recognized as an important shared resource. They and other shared boundary waters were protected under this treaty, which created the International Joint Commission to deal with boundary waters problems. The Commission conducted many studies over the years and concluded that indeed, the Lakes were seriously polluted. This led to the development and implementation of the Great Lakes Water Quality Agreement of 1972, and later, a renegotiated agreement in 1978. Much of the monitoring and research done on the Great Lakes has been done to fulfill the objectives of those agreements. The 1978 Water Quality Agreement is significant and more comprehensive than the 1972 Agreement in several ways. Studies performed under the 1972 Agreement led to a number of findings and conclusions. Some were extremely significant for the future monitoring and management requirements in the Lakes. It was determined that to manage remedial programs and to prevent pollution to the Lakes, that the ecosystem approach would have to be taken. This recognized and included the entire Great Lakes drainage system -- the land surrounding the Lakes, the streams flowing into them, the connecting channels and the Great Lakes themselves. It involves more than water quality management and monitoring. It recognizes complex interrelationships among water, land, air and living things (including humans). The agreement requires the parties to develop remedial measures, preventive measures (toxics are to be kept out of the Lakes) such as source reduction, and other actions which require not just open-lake, water column monitoring, but which require ecosystem monitoring. It emphasizes the need to understand and manage toxics and the importance of controlling phosphorous pollution and, therefore, eutrophication rates. It renews the countries' commitment to control pollution from shipping and dredging and to collect the data necessary to monitor water quality effectively. The 1978 Agreement requires programs to determine the impacts

and sources of pollutants which are carried through the air to the Lakes and new measures to control pollution from land use activities. Both General Objectives and Specific Objectives are included in the Agreement as the minimum level of pollution allowable to preserve a certain level of quality in the Great Lakes Ecosystem.<sup>1</sup>

## B. The Lakes

In the late 1960's and early 1970's, the most serious problems perceived to be affecting the Lakes were eutrophication of Lake Erie, ("the dead lake") and the findings of DDT in herring-gull eggs. It was concluded by the governments that the most pressing problems with respect to eutrophication could be solved by controlling the amount of biological waste and nutrients (phosphorus, primarily) that were being discharged into the Lakes...that this would reduce the giant algal blooms, retard the rapid aging rates, and improve drinking water quality, the fishery, and the public's ability to use the beaches and engage in water contact activities. Under the new Clean Water Act, wastewater treatment requirements for sewage treatment plants were set to provide for secondary treatment with phosphorus removal. Industry began to correct its discharge problems and tax dollars were provided to meet pollution abatement needs. Since 1971, about \$5 billion have been spent by EPA to help clean up the Great Lakes. Additional billions have been spent by the states, industry, Ontario and Canada. The cost of monitoring the effectiveness of abatement programs for the United States is \$3-5 million per year. The total Great Lakes Monitoring Budget for GLISP is \$8-10 million per year and is<sup>2</sup> shared by the states, two Federal governments and the Province of Ontario. This may be inadequate to monitor the most critical pollutants in the Great Lakes Ecosystem...those that are tasteless, invisible and odorless in the water...those that have been identified as toxic pollutants. These may cause the most crucial problems in the years ahead. The 1978 Water Quality Agreement identified specific monitoring responsibilities to be undertaken by the Parties to the Agreement that would keep watch on the Lakes for progress made and problems emerging, particularly in the two critical problem areas of eutrophication and toxic pollution. These activities and requirements provide the rationale and framework for the Great Lakes International Surveillance Plan.

Great Lakes Water Quality Agreement goals and requirements for monitoring and surveillance to meet these goals are explained in Article II (Purpose) and Annex 11 (Surveillance and Monitoring) of the 1978 Water Quality Agreement. (See Appendix.)

The overall purpose of the Agreement is to involve the parties to it (United States and Canada) in programs and activities that will "restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem."<sup>3</sup> They will develop "programs, practices and technology"<sup>4</sup> needed to obtain a better understanding of the Basin ecosystem, and to "reduce to the maximum extent<sup>5</sup> practicable the discharge of pollutants into the Great Lakes System."<sup>5</sup> Some specifics related to these overall purposes are important to note in the development

and evaluation of an effective monitoring system. The policy of the parties to the Agreement is that: "a) discharges of persistent toxic substances to the Lakes be eliminated and discharges of other toxic substances in toxic amounts be prohibited; b) cooperative financing of waste treatment facilities be undertaken by jurisdictions in the Basin, and c) "coordinated planning processes and best management practices be developed and implemented by the respective jurisdictions to ensure adequate control of all sources of pollutants."<sup>6</sup>

Annex 11 spells out the requirements which must be met by a monitoring and surveillance plan to monitor actions carried out to meet agreement goals. The surveillance plan is to be undertaken jointly, for a number of specific purposes. These include monitoring for compliance (1) to determine progress/regress in achievement of the General and Specific Objectives and to identify needs for more stringent control requirements; and (2) to evaluate water quality trends including local and whole lake responses to control measures. This information is to be used in the development and application of predictive techniques for impact analysis. Results of the water quality evaluations are to be used for: assessing the effectiveness of remedial/preventative measures and identifying needs for additional controls; assessing the effectiveness of enforcement and management strategies and identifying the need for further technology development and research activities. The surveillance program should be designed to identify emerging problems in the Great Lakes Basin Ecosystem. <sup>7</sup>

In addition to specifying what a Surveillance Plan must accomplish, the Agreement states that it will be a joint program and include the various jurisdictions in the Basin. It states that the 1975 GLISP should serve as a model. Specific requirements for the program are also stated in Annex 11. These requirements are as follows:

- baseline data collection
- sample analysis
- evaluation and quality assurance programs (including standard sampling and methodology, interlaboratory comparisons, and compatible data management) to allow assessments of the following:
  - inputs from tributaries, point source discharges, atmosphere and connecting channels
  - whole lake data including that for nearshore areas (such as harbors and embayments, general shoreline and cladophora growth areas), open waters of the lakes, fish contaminants, and wildlife contaminants
  - outflows including connecting channels, water intakes and outlets.

(1978 Water Quality Agreement: Article II and Annex 11)

C.e The Plan: GLISPe

The Great Lakes International Surveillance Plan (GLISP) was developed over a period of several years by the Surveillance Subcommittee of the Great Lakes Water Quality Board of the International Joint Commission. The present document represents a basic framework for the surveillance activities required under the 1978 Water Quality Agreement. It is a long-term strategy (nine years) to coordinate the monitoring activities of numerous participating agencies at all jurisdictional levels in "a cost-effective manner." Quality assurance programs have been developed and there has been provision for rapid exchange of comparable data among the jurisdictions.

The Surveillance Plan is viewed as a framework to facilitate the long-term planning of monitoring programs. It is intended as a planning document to provide the basis for the identification of future resource needs for monitoring, for coordinating the monitoring programs of the various state, provincial and Federal agencies and to facilitate research planning so that research can make maximum use of monitoring facilities. The relationship between monitoring and research is understood to be an iterative one.

It is the intention of the parties to review GLISP on an annual basis and modify it, if necessary, to provide information on new or modified issues relating to water quality in the Great Lakes.

It is intended that the primary output of GLISP is "information to assist managers and policy makers in arriving at rational and effective decisions in the overall managements of Great Lakes ecosystem quality." (GLISP I-7).

The introduction to GLISP states that "The fundamental objective of the Great Lakes International Surveillance Plan is to determine the impact of man's activities on the quality of the Great Lakes ecosystem, particularly the effect of those activities on the desired uses of the Lakes." (GLISP I-7) "Desired uses" have been identified as recreational use (including intake for drinking and industrial use as well as discharge of wastewater), for support of freshwater biota (sport and commercial fishing), and for transportation. (See Table 1.) The Plan states that data obtained from the surveillance program will be interpreted: 1) to determine the state of compliance with jurisdictional control requirements and with the general and specific objectives of the 1978 Great Lakes Water Quality Agreement, including where possible, an assessment of the significance of any violation; 2) to assist managers of remedial programs in the design and implementation of such programs, including an evaluation of their effectiveness; 3) to identify emerging problems; and 4) to identify the need for special studies to improve the understanding of phenomena and/or trends observed as a result of the surveillance program." (GLISP I-8,9).

GLISP is designed to accommodate the following: 1) the requirements of the 1978 Agreement, particularly Annex 11, and in addition, to respond to requests by the International Joint Commission and agreed to by the Parties; 2) the identification of Great Lakes resource uses and related water quality concerns either affecting/impacting the use or resulting from the use; and 3) the development of a sampling rationale and implementation strategies for each Lake that will coordinate the surveillance and monitoring activities of the various responsible agencies in both countries in an efficient and cost-effective manner.

The Plan goes on to identify the effort needed to meet the requirements listed above and has designed a long-term (nine year) strategy. Its designers believe that it is flexible and can respond to evolving problems (and cite the increased emphasis on toxic substances). Information needs of the remedial program managers are given priority and the Plan states that information gathered under the surveillance program must be communicated in an "effective and timely manner" to program managers...and that the information be "precise, accurate and compatible." (GLISP I-9)

Specific information required by the Great Lakes Water Quality Management is presented in Tables 1 and 2. These tables provide a summary and description of how GLISP operates to meet the goals, objectives and requirements described above. (GLISP I-10 through I-14) The schedule for intensive surveillance is labeled Table 3, with cost estimates of meeting the surveillance schedule shown in Table 4. (GLISP I-17)

Reports of surveillance program findings are scheduled for publication annually or biannually. These reports will highlight the degree of compliance with water quality objectives, assess changes and trends in water quality, identify emerging problems, and summarize special studies.

#### 1. Implementation

Coordination of activities to implement GLISP is accomplished through the IJC Regional Office at Windsor, which provides secretariat support to the Great Lakes Water Quality Board Surveillance Subcommittee. The Subcommittee has responsibility for development and implementation of GLISP programs. Detailed reports of comprehensive studies are usually available two years following field work completion, and special reports keyed to issues of particular concern can be issued at any time. The Water Quality Board issues these reports to the Commission. They are available to the public. After being considered by the Commission, action may be taken by the Commission or the report may be forwarded to the Parties.

How well jurisdictions fulfill their responsibilities under the Water Quality Agreement depends upon funding and resource allocation by two federal governments, eight states and the Province of Ontario. Additional requirements have been placed on surveillance activities under the 1978 Agreement. The present plan is being modified and additional funding is being sought to meet the new requirements:

TABLE 1

SURVEILLANCE REQUIREMENTS OF 1978 WATER QUALITY AGREEMENT

- Article IV, 1(b) The determination of the achievement of specific objectives shall be based on statistically valid sampling data.
- Article VI, 1(e) . . . Identify pollutant sources and relative source contributions, including accurate definition of wet and dry deposition rates . . . . (from the atmosphere).
- Article VI, 1(m) Implementation of a coordinated surveillance and monitoring program . . . . in accordance with Annex 11.

ANNEX 1 WATER QUALITY OBJECTIVES

I. CHEMICAL - to protect uses in all waters

- A. 1. Organic - Persistent Toxic Substances  
 2. Inorganic  
     (a) Metals  
     (b) Others - Fluoride  
             - Total Dissolved Solids
- B. Non-Persistent Toxic Substances  
 1. Organic  
 2. Inorganic - Ammonia, Hydrogen Sulfide
- C. Other Substances  
 1. DO  
 2. pH  
 3. Nutrients  
 4. Tainting Substances (phenolic compounds)

II. PHYSICAL

- A. Asbestos  
 B. Temperature  
 C. Settleable and suspended solids, and light transmission

III. MICROBIOLOGICAL

IV. RADIOLOGICAL

ANNEX 3 CONTROL OF PHOSPHORUS

1. (a) Dissolved Oxygen in Lake Erie  
 (b-f) Algal Biomass - All lakes, St. Lawrence River and any other area.
3. PHOSPHORUS LOADS



Table 1 cont'd.

ANNEX 11 SURVEILLANCE AND MONITORING

1. (a) Compliance
- (b) Achievement of General & Specific Objectives
- (c) Evaluation of Trends  
Trend analysis - cause/effect analysis
- (d) Emerging Problems
  
3. Base Line Data Collection
- (a) Inputs
- (b) Whole Lake - open waters  
- nearshore
- (c) Outflows

ANNEX 12 PERSISTENT TOXIC SUBSTANCES

3. (b) . . . assess total input of toxic substances to the Great Lakes . . . .
  
4. Monitoring (& Research)
- (a) Temporal and spatial trends in concentrations of persistent toxic substances
- (c) Sources of input
- (d) Presence of previously unidentified persistent toxic substances

TABLE 2  
GREAT LAKES INTERNATIONAL SURVEILLANCE PLAN

RELATED ELEMENTS	REQUIREMENTS OF 1978 WATER QUALITY AGREEMENT		SAMPLING STRATEGY	RESPONSIBLE AGENCY
TRIBUTARY	Quantify material input. Annex 3	Monitor point source discharge to tributary. Annex 11, 1(b)(c)	Tributaries prioritized as to hydraulic characteristics.	States*, U.S. Geological Survey, MOE
POINT SOURCE	Quantify material input. Annex 3	Compliance monitoring. Annex 11, 1(a)	Point source categorized as to discharge volume requiring either daily, weekly, or bimonthly sampling.	States*, MOE
ATMOSPHERIC	Quantify loads greater than 1% of total load. Annex 3	Verification of transport models. Annex 11, 3(a)	Use of bulk and wet/dry samplers. Optimum network design requires further research.	U.S. EPA, DOE
CONNECTING CHANNELS	Quantify material input Annex 3, Agreement Obj.	Compliance monitoring. Annex 11, 1(a)	Samples collected in select number of ranges from head to mouth.	MDNR, MOE, DOE
NEARSHORE				
a) eAmbiente	Water quality assessment as to objectives and response to remedial programs Article VI (m)	Evaluation of water quality trends. Annex 11, 1(c)(d) Annex 12, 5(f)	Sampling designed to account for physical variability; 3-5 day collections at one sampling site.	States*, U.S. EPA, MOE
b) eProblem Areae	Determine status of water quality parameters in violation with Agreement objective. Annex 11 (b)	Effectiveness of remedial programs. Annex 11, 1(a)(b)	Sample on annual basis or more if status change is suspected from new remedial effort.	States*, U.S. EPA, MOE
c) eWater Intakee	Long term, continuous monitoring of water quality objectives. Annex 11, 3(c)	Human health and water treatment. Annex 12 (6) Annex 11, 1(a)(b)	Biweekly samples throughout the year.	States*, MOE
d) eBeachese	Public health perception. Annex 1, 3	Nuisance conditions. Annex 1, 1(c)	Microbiological - beach closure reports.	Public health authorities
MAIN LAKE	Detailed assessment of main lake condition. Response to remedial programs. Article IV, 1(b)(m)	Aid in model development. Annex 11, 1(c)	Sampling pattern based on analysis of past data to determine homogenous zones. Select number of stations/zone used. Temporal frequency based on seasonal pattern.	U.S. EPA, DOE, DFO <u>Lake</u> <u>Agency</u> Ontario DOE Erie EPA Huron EPA-DOE Superior EPA-DOE Michigan EPA

Table 2 cont'd.

RELATED ELEMENTS	REQUIREMENTS OF 1978 WATER QUALITY AGREEMENT	SAMPLING STRATEGY	RESPONSIBLE AGENCY
FISH CONTAMINANT a) Offshore Lake	Levels and trends of contaminants and impact of regulatory control and identification of emerging problems. Agreement Obj. Annex 11, 1(d); Annex 12 (4, 5)	Identify potential harm to fish stocks. Annex 12 (6)	U.S. FWS, MNR, U.S. EPA, DOE, DFO
b) Nearshore (Including connecting channels and tributaries)	Locate and identify potential dischargers. Annex 11, 1(d); Annex 12 (4, 5)	Identify human health concerns Annex 12 (6)	States*, MNR, MOE
WILDLIFE CONTAMINANTS	Determine nature, extent of environmental contamination Annex 11, 1(d) Annex 12 (4)	Ecosystem monitoring. Annex 11, 1(d)	DOE, CWS, U.S. FWS
	Search for new parameters of environmental concern. Annex 11, 1(d) Annex 12 (4)	Status of organic contaminants in Great Lakes. Annex 11, 1(d)	

AGENCY CODES:

MNR - Ontario Ministry of Natural Resources  
 MOE - Ontario Ministry of the Environment  
 DOE - Department of the Environment  
 DFO - Department of Fisheries and Oceans  
 CWS - Canadian Wildlife Service

U.S. EPA - United States Environmental Protection Agency  
 U.S. FWS - United States Fish and Wildlife Service

\*State Agencies include:

MDNR - Michigan Department of Natural Resources  
 ISBH - Indiana State Board of Health  
 OEPA - Ohio Environmental Protection Agency  
 NYSDEC - New York State Department of Environmental Conservation  
 PDNR - Pennsylvania Department of Natural Resources  
 MPCA - Minnesota Pollution Control Agency  
 WDNR - Wisconsin Department of Natural Resources

TABLE 3

PROPOSED GREAT LAKES SURVEILLANCE INTENSIVE SCHEDULE\*

DESIGN COMPONENT	1976	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86
<u>MAIN LAKE - INTENSIVE</u>											
Lake Michigan	X	X								X	X
Lake Erie			X	X							
Lake Huron					X						
Lake Ontario						X	X				
Lake Superior								X			
<u>NEARSHORE/PROBLEM AREAS - INTENSIVE</u>											
Lake Michigan										X	X
Lake Erie			X	X							
Lake Huron					X						
Lake Ontario						X	X				
Lake Superior								X			
<u>CONNECTING CHANNEL - INTENSIVE</u>											
St. Lawrence							X		X		
Niagara						X			X		
Detroit			X					X	X		
St. Clair			X					X			
St. Marys					X				X	X	
Lake St. Clair									X		

\*Annual programs required to address specific problems are part of the schedule.

TABLE 4

COST ESTIMATES (\$M) OF GLISP STRATEGY  
1978 - 1985

LAKE	1978	1979	1980	1981	1982	1983	1984	1985
Erie	5.8	5.8	3.6	3.6	3.6	3.6	3.6	3.6
Huron	1.2	1.2	2.4	1.2	1.2	1.2	1.2	1.2
Ontario	2.2	2.2	2.2	3.4	3.4	2.2	2.2	2.2
Superior	0.8	0.8	0.8	0.8	0.8	2.6	0.8	0.8
Michigan	0.7	0.7	0.7	0.7	0.7	0.7	3.4	3.4
TOTAL	10.7	10.9	9.7	9.7	9.7	10.3	10.2	10.2

TABLE 5

## LIST OF ENVIRONMENTAL PARAMETERS FOR THE GREAT LAKES

TYPE	PARAMETER	MAIN LAKE			NEARSHORE			WATER INTAKES			TRIBUTARIES			CONNECTING CHANNELS			ATMOSPHERIC			
		SS	AS	SC AC OBJ.	SS	AS	SC AC OBJ.	SS	AS	SC AC OBJ.	SS	AS	SC AC OBJ.	SS	AS	SC AC OBJ.	SS	AS	SC AC OBJ.	
Physical	Flow										X	X	2,3	X	X	2,3				
	Water Temperature	X	X	3	X	X	1,2,3	X	X	3	X	X	2,3	X	X	1,2,3				
	Wind Speed & Direction				X	X	3										X	X	2,3	
	Current Speed & Direction	X	X	3	X	X	3							X	X	3				
	Secchi Depth	X	X	2	X	X	2													
	Depth (extinction)	X	X		X	X														
	Aesthetics (oil, foam, etc.)	X	X	1,2	X	X	1,2				X	X	2,3	X	X	1,2				
	Taste & Odour							X	X	1,2										
	Colour				X	X	1,2				X	X	2,3	X	X	1,2				
	Turbidity	X	X	1,2,3	X	X	1,2,3			2	X	X	2,3	X	X	1,2,3				
	Suspended Solids				X	X	1,2,3				X	X	2,3	X	X	1,2,3				
	Asbestos (Lake Superior Only)	X	X	1,2,3	X	X	1,2,3	X	X	1,2,3	X	X	2,3	X	X	1,2,3				
	Chemical (Inorganic)	Dissolved Oxygen	X	X	1,2,3	X	X	1,2,3	X	X	2,3	X	X	2,3	X	X	1,2,3			
		pH	X	X	2,3	X	X	1,2,3	X	X	2,3	X	X	2,3	X	X	1,2,3	X	X	2,3
		Specific Conductance	X	X	1,2,3	X	X	1,2,3	X	X	1,2,3	X	X	2,3	X	X	1,2,3			
Alkalinity		X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	
Total Phosphorus		X	X	1,2,3	X	X	1,2,3	X	X	2,3	X	X	1,2,3	X	X	1,2,3	X	X	2,3	
Soluble Reactive P.		X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	X	X	1,2,3				
Total Kjeldahl Nitrogen		X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	
Total Ammonia N		X	X	1,2,3	X	X	1,2,3	X	X	2,3	X	X	1,2,3	X	X	1,2,3	X	X	2,3	
Total NO <sub>3</sub> +NO <sub>2</sub> -N		X	X	1,2,3	X	X	1,2,3	X	X	2,3	X	X	1,2,3	X	X	1,2,3	X	X	2,3	
Total Dissolved Silicate		X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	
Chloride		X	X	2,3	X	X	1,2,3	X	X	2,3	X	X	2,3	X	X	1,2,3	X	X	2,3	
Fluoride					X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	X	X	2,3	
Sulphate		X	X	2,3	X	X	1,2,3	X	X	2,3	X	X	2,3	X	X	1,2,3	X	X	2,3	
Major Ions		X	X	2,3													X	X	2,3	
Total Aluminum		X	X	1,2,3	X	X	1,2,3	X	X	1,2,3	X	X	2,3	X	X	1,2,3	X	X	2,3	
Total Arsenic		X	X	1,2,3	X	X	1,2,3	X	X	1,2,3	X	X	2,3	X	X	1,2,3	X	X	2,3	
Total Cadmium		X	X	1,2,3	X	X	1,2,3	X	X	1,2	X	X	2,3	X	X	1,2,3	X	X	2,3	
Total Chromium		X	X	1,2,3	X	X	1,2,3	X	X	1,2	X	X	2,3	X	X	1,2,3	X	X	2,3	
Total Copper		X	X	1,2,3	X	X	1,2,3	X	X	1,2	X	X	2,3	X	X	1,2,3	X	X	2,3	
Total Iron		X	X	1,2,3	X	X	1,2,3	X	X	1,2	X	X	2,3	X	X	1,2,3	X	X	2,3	
Total Lead		X	X	1,2,3	X	X	1,2,3	X	X	1,2	X	X	2,3	X	X	1,2,3	X	X	2,3	
Total Manganese		X	X	1,2,3	X	X	1,2,3	X	X	1,2	X	X	2,3	X	X	1,2,3	X	X	2,3	
Total Mercury		X	X	1,2,3	X	X	1,2,3	X	X	1,2	X	X	2,3	X	X	1,2,3	X	X	2,3	

KEY: SS - Selective Stations  
AS - All Stations

SC - Selective Cruises  
AC - All Cruises

OBJ. - Surveillance Subcommittee Surveillance Plan  
Rationale - Objectives. (1, and/or 2, and/or 3)

Table 5 cont'd

TYPE	PARAMETER	MAIN LAKE					NEARSHORE					WATER INTAKES					TRIBUTARIES					CONNECTING CHANNELS					ATMOSPHERIC						
		SS	AS	SC	AC	OBJ.	SS	AS	SC	AC	OBJ.	SS	AS	SC	AC	OBJ.	SS	AS	SC	AC	OBJ.	SS	AS	SC	AC	OBJ.	SS	AS	SC	AC	OBJ.		
Chemical (Inorganic) (cont'd.)	Total Nickel	X	X		1,2,3	X	X		1,2,3	X	X		1,2	X	X		2,3	X	X		1,2,3	X	X		1,2,3	X	X		2,3	X	X		2,3
	Total Selenium	X	X		1,2,3	X	X		1,2,3	X	X		1,2	X	X		2,3	X	X		1,2,3	X	X		1,2,3	X	X		2,3	X	X		2,3
	Total Vanadium	X	X		1,2,3	X	X		1,2,3	X	X		1,2	X	X		2,3	X	X		1,2,3	X	X		1,2,3	X	X		2,3	X	X		2,3
	Total Zinc	X	X		1,2,3	X	X		1,2,3	X	X		1,2	X	X		2,3	X	X		1,2,3	X	X		1,2,3	X	X		2,3	X	X		2,3
	Radioactivity (Refer to Appendix "D" WQB 1976 Report)																																
Chemical (Organic)	Aldrin/Dieldrin									X	X		2,3	X	X		2,3													X	X		2,3
	Chlordane									X	X		2,3	X	X		2,3													X	X		2,3
	Cyanide									X	X		2,3	X	X		2,3													X	X		2,3
	Diazinon									X	X		2,3	X	X		2,3													X	X		2,3
	DDT & Metabolites									X	X		2,3	X	X		2,3													X	X		2,3
	Endrin									X	X		2,3	X	X		2,3													X	X		2,3
	Heptachlor									X	X		2,3	X	X		2,3													X	X		2,3
	Lindane									X	X		2,3	X	X		2,3													X	X		2,3
	Methoxychlor									X	X		2,3	X	X		2,3													X	X		2,3
	Mirex									X	X		2,3	X	X		2,3													X	X		2,3
	Parathion									X	X		1,2,3	X	X		1,2,3													X	X		2,3
	Phenol					X	X		1,2,3	X	X		1,2,3	X	X		1,2,3	X	X		1,2,3									X	X		2,3
	Phthalic Acid Esters									X	X		1,2,3	X	X		1,2,3													X	X		2,3
	PCB									X	X		1,2,3	X	X		1,2,3													X	X		2,3
	TOC					X	X		3					X	X		3	X	X		3									X	X		2,3
	Dissolved Organic Carbon					X	X		3					X	X		3	X	X		3									X	X		2,3
	Toxaphene									X	X		1,2,3	X	X		1,2,3													X	X		2,3
Organic Scan													X	X		2									X	X						2,3	
Aquatic Biology	Heterotrophs	X		X	2,3	X		X	2,3									X		X	2,3												
	Total Coliforms	X	X		1,2,3	X	X		1,2,3	X	X		1,2,3					X	X		1,2,3												
	Fecal Coliforms	X	X		1,2,3	X	X		1,2,3	X	X		1,2,3					X	X		1,2,3												
	Fecal Streptococci					X		X	1,2,3	X	X		2,3					X	X		1,2,3												
	P. Aeruginosa					X		X	1,2,3	X	X		2,3					X	X		1,2,3												
	Phytoplankton	X	X		1,2,3	X	X		1,2,3	X	X		2,3																				
	Zooplankton	X	X		1,2,3	X	X		1,2,3	X	X		2,3																				
	Chlorophyll "a"/ Phacophytin	X		X	2,3																												
	Cladophora					X	X		1,2,3									X	X		1,2,3												
Sediment	Benthic Organisms	X	X		2,3	X	X		2,3									X	X		2,3												
	Loss on Ignition	X	X		2,3	X	X		2,3									X	X		2,3												
	Oil/Grease	X	X		2,3	X	X		2,3									X	X		2,3												
	Aldrin/Dieldrin	X	X		2,3	X	X		2,3									X	X		2,3												
	Chlordane	X	X		2,3	X	X		2,3									X	X		2,3												
	DDT & Metabolites	X	X		2,3	X	X		2,3									X	X		2,3												
	Endrin	X	X		2,3	X	X		2,3									X	X		2,3												





Table 5 cont'd

TYPE	PARAMETER	MAIN LAKE					NEARSHORE					WATER INTAKES					TRIBUTARIES					CONNECTING CHANNELS					ATMOSPHERIC						
		SS	AS	SC	AC	OBJ.	SS	AS	SC	AC	OBJ.	SS	AS	SC	AC	OBJ.	SS	AS	SC	AC	OBJ.	SS	AS	SC	AC	OBJ.	SS	AS	SC	AC	OBJ.		
Fish (cont'd.)	Total Arsenic	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Cadmium	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Lead	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Selenium	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Zinc	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Chromium	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Copper	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Iron	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Manganese	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Nickel	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Vanadium	X	X		2,3	X	X		2,3											X	X		2,3										
	Tainting					X	X		2,3											X	X		2,3										
	Organic Scan	X	X		2,3	X	X		2,3											X	X		2,3										
Tissue Bank	X	X		2,3	X	X		2,3											X	X		2,3											
Wildlife	Aldrin/Dieldrin	X	X		2,3	X	X		2,3											X	X		2,3										
	Chlordane	X	X		2,3	X	X		2,3											X	X		2,3										
	Cyanide	X	X		2,3	X	X		2,3											X	X		2,3										
	Diazinon	X	X		2,3	X	X		2,3											X	X		2,3										
	DDT & Metabolites	X	X		2,3	X	X		2,3											X	X		2,3										
	Endrin	X	X		2,3	X	X		2,3											X	X		2,3										
	Heptachlor	X	X		2,3	X	X		2,3											X	X		2,3										
	Lindane	X	X		2,3	X	X		2,3											X	X		2,3										
	Methoxychlor	X	X		2,3	X	X		2,3											X	X		2,3										
	Mirex	X	X		2,3	X	X		2,3											X	X		2,3										
	Parathion	X	X		2,3	X	X		2,3											X	X		2,3										
	Phthalic Acid Esters	X	X		2,3	X	X		2,3											X	X		2,3										
	PCB	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Mercury	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Arsenic	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Cadmium	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Lead	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Selenium	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Zinc	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Chromium	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Copper	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Iron	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Manganese	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Nickel	X	X		2,3	X	X		2,3											X	X		2,3										
	Total Vanadium	X	X		2,3	X	X		2,3											X	X		2,3										
	Tainting					X	X		2,3											X	X		2,3										
	Organic Scan	X	X		2,3	X	X		2,3											X	X		2,3										
	Tissue Bank	X	X		2,3	X	X		2,3											X	X		2,3										

- "a) methods of development, laboratory capabilities, quality control and more water quality objectives require routine monitoring
- b) an expanded atmospheric chemistry program requiring sampling techniques to analyze for parameters other than total phosphorus
- c) development of an early warning system utilizing biological integrators; and
- d) whole lake assessment requiring more man-years for data analysis, interpretation and report preparation." (GLISP I-19)

## 2. United States Implementation of GLISP

Authority to act under United States law is found in the Clean Water Act and Amendments (92-500) of 1972-77; the Safe Drinking Water Act of 1974, the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TSCA) of 1976, the Clean Air Act Amendments of 1970 and 1977, the National Environmental Protection Act (NEPA) and others.

The United States manages and controls EPA's abatement and control programs affecting Great Lakes water quality through the Great Lakes National Programs Office headquartered in U.S. EPA Region V in Chicago. This office (GLNPO) acts as the main means for "communication, coordination and cooperation" regarding Great Lakes pollution issues with the states, the public, and Canadian agencies. Much of its work is carried on through participation in Water Quality Agreement Activities.

Key areas for allocation of GLNPO scientific and technical resources have been:

- a. Implementation of the United States' portion of the Great Lakes Monitoring Program with particular emphasis on toxic organics, nutrients, and toxic metals.
- b. Investigation of specific problems or serious "hot spot areas" with emphasis on developing control measures for the full range of pollutant sources (land, air, water).
- c. Increased state and public involvement in Great Lakes decision making.

The Great Lakes National Program Office works closely with regional program offices, state pollution control agencies and EPA's research laboratories (Duluth, Grosse Ile, Cincinnati) in addressing complex pollution problems in the Great Lakes." The principal goal of the EPA effort in the Great Lakes is "to restore and enhance water quality in the Great Lakes Basin ecosystem so that public health, welfare and the environment are protected."

### 3. Results of U.S. Surveillance under GLISP

The most important results have been reported by the Great Lakes Regional Office of the International Joint Commission.

The intensive two-year study of Lake Michigan may provide for a major improvement in the ability to predict the effect of phosphorus removal programs on the Lakes.<sup>12</sup> The issue of "how much phosphorus removal is required to insure that accelerated eutrophication of the Lakes does not occur" has been an important one. Specific findings from the study will be released in publications due to be printed in March 1981. Key points are found in the Appendix. In addition to information on phosphorus monitoring, the Lake Michigan monitoring program has reported:

- (1) increasing levels of conservative ions, primarily chlorides, sulfides and sodium
- (2) that biological indicators reflect these changes as new marine algal forms are frequently observed in nearshore zones of Lake Michigan (e.g., *Bangia atropurpurea*, a red attached alga).
- (3) comparisons with historical data (FWPCA 1962-63, Beeton & Moffet 1954-55) indicate sodium concentrations are 20-40% higher in 1977 at 4 mg/l than shown by either study
- (4) average sodium concentrations in excess of 4.6 mg/l may encourage growth of blue-green algal forms. These forms are frequently toxic and/or noxious, and will result in reduction of the quality, if not the quantity, of food supplies for support of game fish in Lake Michigan
- (5) Monitoring of Lake Michigan fish for toxics continues. Consumption of fish from Lake Michigan is severely restricted and interstate sale of lake trout and coho salmon is forbidden. The public has been advised not to eat these fish for more than one meal per week. Children and pregnant women are advised to avoid eating trout or coho salmon altogether.
- (6) PCB tests done on Lake Michigan coho salmon, brown trout and chub by three different monitoring agencies (Michigan Department of Natural Resources, Illinois Department of Conservation and the Indiana Stream Control Board) revealed values of PCB concentrations in Lake trout fillets/coho salmon ranging from 5.55 to 45.3 mg/Kg. Incorporation of effective quality control measures in fish tests for organics such as PCBs might help to rectify the range problem. (The agreement specifies 1 microgram/gram.)
- (7) Dieldrin in bloater chubs appears to be increasing to levels that are about twice FDA levels for fillets as well as the 1978 Agreement levels for the contaminant.
- (8) Reliable laboratory analysis capability has severely restricted monitoring for toxic substances.
- (9) Ability to develop accurate predictions for phosphorus levels in Lake Michigan may be correlative to the ability to continue the ice cover observations begun by NOAA. Data gathered through these programs may be critical to the design of future monitoring programs.<sup>13</sup>

Current monitoring programs being carried out by Great Lakes National Programs Office under GLISP include working with the Food and Drug Administration and the U.S. Fish and Wildlife Service and state agencies to develop an overall strategy for monitoring toxic substances in Great Lakes fish. This strategy is now being implemented through a series of agreements with each state and agency.<sup>14</sup>

GLNPO is also engaged in a program of checking the lakes for toxic chemical "hot spots" through an extensive fish tissue analysis program using fish from open waters and nearshore tributary streams. These findings will be combined with the results of intensive sediment studies to identify toxic chemical problem areas in selected harbors and tributary basins. The data is then used to identify specific sources and remedial measures. Regulation assessments are underway or are planned for:

- the Ashtabula River in Ohio
- the Buffalo River in New York
- the Raisin River in Michigan
- Indiana Harbor Ship Canal in Gary, Indiana
- Milwaukee Harbor, Wisconsin

During 1981, GLNPO intends to evaluate sediments in 22 harbors for toxic substances.<sup>15</sup> Ninety harbors are planned for such surveys within the next four years.

#### 4. Canadian Implementation of GLISP

Canada's constitutional structure and institutional arrangements which permit her to act under the Water Quality Agreements are substantially different from those in the United States. Due to the British North America Act which gives Canada responsibility for resource management and a series of Supreme Court decisions, both the Federal and Provincial governments have legislative jurisdiction. However, pollution affects primarily property rights, which are owned by the province. Therefore, most legislative responsibility for pollution control lies with the province of Ontario. The Federal government has jurisdiction over matters of significant national interest. It should be noted that Canada would not have been able to sign the U.S.-Canada Water Quality Agreement unless it had first entered into an agreement with the Province of Ontario. The first Canada-Ontario Agreement (COA) was signed in 1971 to permit the governments to undertake commitment to the 1972 Agreement.<sup>16</sup>

The provisions of the 1971 Canada-Ontario Agreement provided for the Canadian Federal government to make loans available to the province for the construction of municipal sewage treatment plants in the lower Great Lakes. Over a five-year period from 1971 through 1975, \$250 million was made available for these purposes. In addition, COA provided for the province and Canada to share equally in the cost of a research program to investigate and develop economically efficient methods for controlling and treating phosphorus from municipal wastewater treatment processes. About \$6 million was subsequently invested in this research program.<sup>17</sup>

In 1976, the Canada-Ontario Agreement was renegotiated and the emphasis changed to reflect results of the initial program's new problems and issues being addressed by the International Joint Commission (IJC) as a result of findings from joint research programs. The 1976 COA concentrated on addressing municipal-industrial waste discharges, toxic contaminants, thermal discharges and pollution from commercial shipping and pleasure craft. It included a contingency cleanup plan, support for the IJC (including support to the reference groups such as the Pollution from Land Use Activities Reference Group and the Upper Lakes Reference Group), provision for information to the public, and cost-sharing with the Federal government. The 1976 Agreement has now expired and the two jurisdictions are operating under a Letter of Agreement until a new COA is negotiated to reflect the changed emphasis of the 1978 U.S.-Canadian Water Quality Agreement. The Canada-Ontario Agreements are extremely responsive to the U.S.-Canadian Water Quality Agreements. The 1978 COA draft parallels the structure of the Water Quality Agreement. <sup>18</sup>

The Canada-Ontario Agreement is under the supervision of a six-member Board of Review (three appointed by Canada, three by Ontario). The Board monitors and reports to the parties on the implementation of the COA. It also monitors sewage treatment plant construction, reviews sequence of projects recommended by the IJC, approves research for which sums are to be paid under the COA, reviews progress on research, reviews other progress made under the COA, considers any report by the IJC pursuant to the Water Quality Agreement on progress of pollution abatement in the Great Lakes that is transmitted to the Commission by one of the Parties, and recommends to the Parties further steps, if any, that may be required in the Province of Ontario to meet the specific water quality objectives. It is the responsibility of the Board to recommend to Ontario and Canada any amendments to the COA that will ensure the implementation in respect to the Great Lakes of the International Agreement and other responsibilities that the governments of Canada and Ontario may assign to it. <sup>19</sup> (1971 COA)

##### 5. GLISP Surveillance Under the COA

The 1976 COA requires that Ontario provides whatever data (except that bound in a lawsuit) it acquires on the quality of the boundary waters of the Great Lakes and its tributary waters (as they affect the Lakes) and such data that Ontario may reasonably be expected to acquire under the Agreement to discharge its responsibilities under the Water Quality Agreement. COA provides for cost sharing and coordination of Canada's Surveillance Program with Ontario. Under this, Ontario maintains surveillance of the quality of water in the Lakes, effects of municipal, industrial and other waste discharges and of the inflows of tributary waters into the boundary waters, and assesses impacts of inflows and remedial measures undertaken to improve the quality of the waters. Ontario is also responsible for maintaining surveillance on industrial discharges as necessary for adequate enforcement of the laws of both Ontario and Canada (other than the Canada Shipping Act) applicable to those discharges. <sup>20</sup> (1976 COA)

In 1978-79, the Federal government provided \$970,000 with Ontario providing an equal amount. The total Canadian share of implementing GLISP on the Great Lakes is \$5 million with an equal split between the Province and the Federal government. The Surveillance Committee of COA puts out an annual report with a budget, for review by both governments to be sure that there is no overlap in programs and that results are most cost effective for the money invested. The programs put forward are those required under GLISP.<sup>21</sup>

Surveillance is viewed as a management tool, fits into the established resource management framework and is used to identify problems, design and implement strategies, evaluate results of remedial strategies, identify new problems and serve as a basis for research. A semiannual report with annual updates is provided to evaluate the results of the program and provides information to the IJC for Water Quality Board reports. With only two agencies to coordinate, Environment Canada and the Ministry of the Environment,<sup>22</sup> in Ontario, communication and coordination is quite efficient.

#### 6. Results of Canadian Surveillance Activities Under GLISP

Ontario has used the data to work with industry to design "limited use zones" as required by the Water Quality Agreement. Data are also used to set effluent requirements, to check the effectiveness of pollution abatement activities and to modify control orders. This has occurred at Thunder Bay and with the Algoma Steel Mill in Sault Ste. Marie. It has noted where remedial actions have been effective such as along the northern shore of Lake Ontario from Prince Edward County to Toronto where monitoring results show that phosphorus control measures have been effective in reducing concentrations. The Bay of Quinte is cited as an example of ecosystem research and monitoring where benthos, phytoplankton, sediment and physical and chemical measurements have been collected in order to understand the effectiveness of various abatement measures. Ten years of data indicate that the abatement programs are succeeding. The mercury problem in Lake St. Clair was identified prior to 1970. Abatement measures were instituted over a period of time and the fishery monitored. Continuing surveillance has noted that the levels of mercury in the fish have continued to decline and the surveillance data have followed the institution of remedial programs for a period of 10 years.<sup>23</sup>

#### 7. Institutional Factors in U.S. and Canadian Implementation of GLISP

Some interesting considerations regarding the institutional difference between the United States and Canada and implications for the efficient implementation of GLISP are:

- The Canada-United States Water Quality Agreement is used by Ontario as a "lever" to obtain funding for surveillance programs. Politically, Canada looks at domestic programs in the light of international obligations.

- In Canada, only two levels of government and two agencies are needed to coordinate the Water Quality Agreement and GLISP obligations. There is no U.S. policy counterpart to COA.
- In the United States, the domestic surveillance programs seem to be the private concerns of the individual jurisdictions who do not look at the overall Great Lakes implications. The States do not all consider international obligations.
- There is no parallel U.S. Institutional arrangement such as the Canada-Ontario Agreement directed specifically at clarifying and assigning responsibility for specific roles to the U.S. Federal government and each of the eight Great Lakes states. The USEPA/State Agreements are an attempt to address some concerns, but most states in the Basin have large areas out of the Great Lakes Basin and their pollution abatement programs do not necessarily address concerns specific to the Great Lakes as priority.
- A number of U.S. Federal agencies have a role in monitoring in the Great Lakes. Monitoring activities are not as well coordinated as they should be.
- Incentives to protect the Great Lakes seem to be greater in Canada than in the United States. This is demonstrated by Canada's domestic pollution control programs which are very much in line with the requirements of the Water Quality Agreement. This reflects the fact that 32% of Canada's population resides in the Great Lakes Basin, while only about 15% of the U.S. population reside in counties bordering the Lakes and therefore interact directly with the Lakes. As noted above, there are significant differences in the U.S. and Canadian institutions and in the approaches to Great Lakes pollution monitoring.

#### 8. GLISP is Cooperatively Managed

The Surveillance Subcommittee of the IJC's Water Quality Board allocates responsibilities and assignments for open lake surveillance. The Subcommittee is usually made up of representatives of the agencies of jurisdictions who have responsibilities for surveillance under GLISP -- Ontario Ministry of the Environment, Ontario Ministry of Natural Resources (Fish & Wildlife Research Branch), USEPA Region II, USEPA Region V (Surveillance and Analysis Division), USEPA Great Lakes National Programs Office, N.Y. State Department of Environmental Conservation, USEPA Large Lakes Research Station, U.S. Fish & Wildlife Service Great Lakes Fisheries Laboratory, NOAA Great Lakes Environmental Research Laboratory, Michigan Department of Natural Resources, Erie, Pennsylvania Department of Health, Canadian Environmental Management Service -- Inland Waters Directorate, and the Canada Centre for Inland Waters. The IJC Great Lakes Regional Office provides secretariat support; contact members from Indiana, Wisconsin and

Minnesota have been identified. Ohio participates through Ohio State University Center for Lake Erie Area Research as a member of the Lake Erie Work Group.<sup>24</sup> The Surveillance Subcommittee and the Lake Work Groups are usually composed of an equal number of citizens from the United States and Canada.

The cooperation is unique because surveillance activities are often assigned on the basis of which jurisdiction has the technical competence to do a given type of surveillance even though it may be carried out in the waters of the other country. For example, the Lake Huron Work Group decided that monitoring assignments would go to whomever had the expertise...on either side of the Lake. Assignments are also made to allow effective use of in-lake resources. In 1975 it was agreed between the Parties that Canada would do all the monitoring on Lake Ontario and that the United States would monitor Lake Erie (open lake and some nearshore).

#### 9. A Unique International Program

The research, monitoring and surveillance carried out in the Great Lakes through international cooperation has developed the United States' longest term data base. The world's largest, historically continuous, and most coordinated data base is the one which exists for the Great Lakes.

It has evolved over a number of years, and the data gathered has been used not only by program managers, but also by researchers to address solutions for Great Lakes pollution problems. Some of the achievements which have been dependent upon monitoring and surveillance data are cited below:

- Data acquired through surveillance and monitoring on Lake Michigan provided the basis for a mathematical model which resulted in the nationwide ban of DDT.
- Surveillance and monitoring data collected on Lake Ontario in 1966-67 provided the first real understanding of long-term loss rates for Lake Ontario. This enabled development of accurate predictive models for the Great Lakes. This data set has been used world-wide.
- Monitoring data were used for assessing the effectiveness of remedial measures for the pollutant mercury. This enabled reopening of Great Lakes fisheries.
- Long-term data were used by the United States and Ontario to establish target loadings of pollutants to the Lakes for the Water Quality Agreement of 1978.
- Biological monitoring has been of historical significance. In addition to DDT bans which resulted from use of monitoring data, PCBs were also identified and banned. The Herring Gull Program also provided for the detection of TCDD (tetrachloro dibenzo para dioxin) in the Great Lakes.
- All mathematical modeling and predictive efforts depend on the data base gathered by surveillance and monitoring. An iterative relationship between monitoring and research exists and is essential.<sup>25</sup>



The Great Lakes International Surveillance Plan was designed to be resistant to rapid change so that surveillance programs would deal with long-term parameters of significance. Researchers feel that it is "essential that basic long-term surveillance and monitoring measurements be made on spatial and temporal scales which are consistent with corresponding space and time scales of the Lakes with which it is concerned."<sup>26</sup> (Flushing-retention times in the Lakes vary from up to 600 years in Lake Superior to 7-9 years for Lake Erie.)

Although GLISP is primarily a water quality surveillance plan, it provides a framework for incorporating ecosystem monitoring.

#### D. Problems with GLISP

A number of problems have been identified by those who have evaluated the Great Lakes International Surveillance Plan, by those who implement it, by resource managers, by the Science Advisory Board and by the International Joint Commission itself. Participants at the Great Lakes Pollution Monitoring Workshop identified specific problems and needs for additional data and improvement of data management. The Workshop participants were quite clear, however, that they began with GLISP and that they considered it the framework for Great Lakes monitoring programs, to be improved and modified, but not to be discarded.

Concerns over GLISP voiced by the IJC are excerpted below from the International Joint Commission's Interim Report under The Great Lakes Water Quality Agreement, dated January 28, 1981.<sup>27</sup> A summary, prepared by Great Lakes Tomorrow, of Science Advisory Board concerns is also provided.<sup>28</sup> Both reflect some improvement over monitoring operations described in a<sup>29</sup> 1979 critique prepared by the EPA Office of Water and Waste Management. In addition, concerns voiced by Great Lakes Regional Workshop participants are summarized.

#### 1. International Joint Commission Comments on GLISP

##### Great Lakes International Surveillance Plan and Other Data Requirements

"The 1978 Agreement requires that the Parties, in collaboration with the State and Provincial Governments, develop and implement a joint surveillance and monitoring program, using as a model the Great Lakes International Surveillance Plan (GLISP) contained in the 1975 Report of the Water Quality Board and revised in subsequent reports. The Commission cannot comment that present surveillance and monitoring meet the needs of the Agreement.

Notwithstanding the primary role of the Governments in developing a program, on their own initiative the Water Quality Board and its Surveillance Subcommittee prepared a revised GLISP and presented it to the Commission in November, 1980. The Water Quality Board has recommended that the Commission accept the revised GLISP as satisfying the requirements of Annex 11 of the 1978 Agreement.

The Commission is not making a recommendation on GLISP at the present time. It has the following concerns.

There are four purposes of surveillance outlined in Annex 11: monitoring compliance with pollution control requirements; achievement of the General and Specific Objectives; the evaluation of water quality trends; and the identification of emerging problems in the Great Lakes Basin Ecosystem. Each of these purposes has a set of specific information and reporting requirements. The Commission has not completed a review of these information needs pursuant to Article VIII of the 1978 Agreement.

The revised version of GLISP was developed as "the basic framework for surveillance activities in the Great Lakes Basin as required in the 1978 Water Quality Agreement" to represent a long-term strategy to coordinate and plan monitoring activities. The Commission has not concluded whether the plan provides the data required by Annex 11. The Commission is concerned that GLISP may have been constrained by budgetary considerations to the detriment of ensuring the satisfaction of the requirements of Annex 11. Until the Commission is informed by Governments of the relationship of GLISP to their programs and can assess the adequacy of GLISP as a framework for defining data needs under the Agreement, the Commission is not in a position to endorse GLISP.

The Commission wishes also to evaluate all data and information systems requirements necessary to fulfill its advisory function with respect to the various Articles and Annexes in the Agreement. These include the adequacy of Regional Office staff and facilities, quality control and the need for centralized information systems. Pending further assessment, the Commission reserves its further advice to the Governments on the questions of inter-jurisdictional data quality assurance programs (Water Quality Board recommendation) and a centralized information system for hazardous substances (Science Advisory Board recommendation)."<sup>27</sup>

"The Commission supports, however, its Water Quality Board's concerns about adequate resources for analytical capability within the jurisdictions to accommodate the increased complexity and quantity of monitoring. It also supports Science Advisory Board concerns (expressed at the Eighth Annual Water Quality Meeting) about the need for adequate routine analytical capability to free the increasingly strained research facilities from performing routine chemical analyses required by a monitoring and surveillance program. Without expansion of routine analytical capability, both the routine and the research functions will be weakened to a point that they are inadequate to meet the needs of the 1978 Agreement.

In order to move quickly towards a resolution of the surveillance and other information needs issues that are outstanding, the following actions have been taken or are proposed by the Commission:

- (a) The Commission has requested the Science Advisory Board to review the GLISP for scientific validity and quality with emphasis on tributary and nearshore monitoring, the adequacy for trend

analysis, sampling plans for toxic and hazardous substances, and the compatibility of simultaneous monitoring systems for eutrophication and toxic substances. Further, since the Science Advisory Board has strongly recommended centralized and coordinated information systems for toxic and hazardous substances in the Great Lakes Basin, the Commission has also requested this Board to provide a more definitive prospectus for such information systems so that the Commission can better assess the adequacy of current governmental and private systems (with attention to information management policies) and the need for further developments in this regard;

- (b) The Commission has established an internal Task Force to review the GLISP, other data needs of the Commission and the questions of data quality control between jurisdictions and information systems, all in consultation with the Boards as relevant;
- (c) The Commission requests that the Governments inform it of the current and planned surveillance programs of the jurisdictions pursuant to Annex 11 of the Agreement, as well as any comments that they may wish to provide on the GLISP document of November 1980.

The Commission is aware that the jurisdictions have used parts of GLISP as a basis of surveillance activities and, in order to ensure continuity, encourages the jurisdictions to proceed in the meantime with their annual programs of surveillance activities as planned. The Governments are also encouraged to continue and increase their activities in developing standardization of sampling and data handling, reporting and information exchanges and, further, to ensure that all jurisdictions make efforts to identify, within their own data systems, data that are specific to the Great Lakes Basin Ecosystem. This will allow rapid identification and retrieval of such data for the purposes of the Agreement."<sup>27</sup>

Summary: Comments Regarding the Great Lakes International Surveillance Plan (GLISP) Submitted to the Science Advisory Board, IJC

- The present version of GLISP is a major improvement over what has been available before. All monitoring and surveillance programs are in one catalogue and planning framework. The Plan is organized by lakes and elements, parameters are clearly identified, and sampling strategies are fully presented.
- The Plan appears reasonably adequate to assess compliance with water quality objectives, but will neither provide information necessary to determine trends in water quality nor provide better understanding of processes and phenomena in the Great Lakes. The Plan does not examine boundary waters in the context of the Great Lakes Basin Ecosystem.

- The Plan should include specific and substantial resources for data interpretation and whole lake assessment. GLISP relies heavily on sampling strategies and site selection based on past surveys, some of which have never been subject to complete analysis and interpretation. The best way to modify and improve surveillance programs is through feedback from examination of past surveys.
- The use of biotic indicators and integrators of water quality should receive much more emphasis with a view to increasing the efficiency and sensitivity of water quality surveillance. As organisms tend to integrate certain contaminants in their environment, they provide much more reliable indices of contamination both by area and over time than do isolated water samples. Organisms can also provide early warning of low-level contamination that might remain undetected in water until measurable concentration had built up. Many of the Great Lakes toxic substance problems were first discovered in aquatic organisms. Relation between results of biological indicators and integrators and water sample analyses should be carefully examined, especially with regard to trace organics and heavy metals.
- Assignments of responsibility for field operations need to be specifically stated so that gaps or omissions (due to changes in agency budgets) can be recognized in advance. Changes in population, resource uses and land use will greatly affect inputs of nutrients and contaminants, but no attempt is made to project these factors into the future. Reporting effort, especially state-of-the-lake assessments will require major expenditures of funds and effort. Who will provide these resources?
- Integrated lake reports must be more than a compilation of specialized reports. The essence of the ecosystem approach is that the part is never considered without reference to the whole, nor the whole without reference to its parts.
- GLISP remains primarily as a numbers oriented static approach rather than a dynamic program. Toxic chemicals, for example, are not examined in terms of fluxes through the system, but almost solely as accentuations in water, sediments or living organisms. Because of the importance of fishing interests, GLISP should contain integrated summaries of fisheries statistics.
- The role of wetlands in boundary waters issues has never been examined. The issue might be addressed as an intensive study in a designated year.

- Public attitudes, presumptions and behavior are neglected, giving the impressions that man is not part of the Great Lakes Basin Ecosystem. To the extent that such informational feedback is needed, it should be a budgetary element of GLISP.
- GLISP is primarily organized on a geographic basis, appropriate for operations, but requiring a supplemental section that examines the Basin as an ecosystem with stress on the unity of interactions in the Basin.
- An important facet of GLISP should be an accounting of the quality of boundary waters including the costs associated with maintaining and improving quality. A system needs to be developed with indices that would serve as guides in management.

## 2. Concerns With GLISP as Identified by Great Lakes Pollution Monitoring Workshop Participants

Specific concerns expressed in work group and plenary sessions are presented in the summary section of this report. Needs for improvement of GLISP include: 1) greater commitment of resources for management and assessment of monitoring program data, 2) better access to monitoring data, 3) better coordination of monitoring programs and activities by resolving jurisdictional and institutional problems, and 4) clearer definition of monitoring program objectives and implementation strategies. These were the key recommendations. Strategies for addressing these recommendations include:

- establishment of a central clearinghouse for Great Lakes data and information
- improving data quality assurance
- analyzing monitoring data in a timely fashion and providing it to decision-makers in appropriate formats
- improving institutional arrangements between the states and USEPA to provide explicitly for implementation of the Water Quality Agreement pollution control, prevention and monitoring activities
- modify GLISP so that ecosystem monitoring needs are more directly addressed by improving multimedia monitoring, implementing more nearshore monitoring. Such improvements will also more directly address the need of local and state water quality and public health management agencies, with respect to toxic contaminants in public drinking water supplies and in fish.
- improve research and development of technologies to include:

- better computer software systems which store and allow easy access to more than water quality data
- more reliable monitoring instruments for field use (pH meters, etc.)
- improved water column sampling and analysis for toxics
- improved sampling of atmospheric pollutants to identify source, transport and deposition
- improved ground truthing so better use of satellite monitoring data can be developed
- improved ice research and monitoring systems to assist in evaluating benefits of phosphorus removal.

Key needs expressed by local and state participants include: 1) more nearshore monitoring, 2) better designed fish monitoring programs to meet public health hazard assessment needs, 3) better, more timely assessment of monitoring data and access to it in appropriate formats, and 4) research and monitoring of ecosystem health. Note that state and local government priorities for monitoring are set by law and regulation, and while Federal and State agencies have responsibilities for pollution research and monitoring, it is the local agencies that must assure the public health of those who drink the water and use the beaches. State agencies must assure the public that the fish are safe to eat.

All jurisdictions indicated needs for better capability to monitor and assess toxic contamination of the water.

Federal agencies stated needs for better capability to monitor whole lake responsiveness to phosphorus management strategies, for improving cooperative arrangements and for commitment of leadership and other resources to meet U.S. responsibilities under the Water Quality Agreement. They also agreed with state and local participants that GLISP is designed for water quality monitoring and research and needs to be modified to monitor ecosystem health. The pathways by which toxics are introduced into the water and taken up through the biota are illustrative of this concern. Commitments to keep certain toxics from reaching the lakes requires source monitoring.

### 3. Uses of GLISP

Meanwhile, Great Lakes research and monitoring data utilization includes:

- setting water quality standards and measuring for compliance

- enforcement of control measures
- evaluation of remedial measures for point and nonpoint source pollution
- an information base for making program management decisions relative to resource allocation, priorities
- identification of emerging problems
- monitoring problem sites
- identification of potential public health problems (drinking water, fish contamination, beach, contact sports)
- hazard assessment for decision-making relative to beach closings, fishery warnings, closures
- political purposes to support request for funding of pollution control, for research and monitoring or for policy development such as phosphorus bans
- as basis for next phase of research relative to problem analysis.

These uses occur in all jurisdictions on both sides of the border. The need for monitoring data to meet the identified needs and to support these continuing uses becomes clearer as the knowledge about the Great Lakes Basin Ecosystem grows and the need to promote wiser use of its resources is made more urgent due to increasing competition for those resources. Participants' priority was that GLISP be funded and implemented to these ends.

## FOOTNOTES

1. International Joint Commission, Great Lakes Water Quality Agreement of 1978, Article II and Annex 11.
2. Haffner, Douglas, "Great Lakes Monitoring Programs," Speech delivered at Great Lakes Pollution Monitoring Workshop, Ann Arbor, Michigan, February 12, 1981.
3. Great Lakes Water Quality Agreement of 1978, op. cit., Article II, page 1.
4. Ibid., Article II.
5. Ibid., Article II.
6. Ibid., Article II, paragraph III.
7. Ibid., Annex 11: Surveillance and Monitoring.
8. International Joint Commission, Surveillance Subcommittee of the Great Lakes Water Quality Board. (Regional Office, Windsor, Ontario, Fall 1980). Great Lakes International Surveillance Plan 1980. Introduction.
9. Haffner, op cit.
10. Bowden, Robert, "The Great Lakes International Surveillance Program: An Experiment in International Cooperation." Speech delivered at Great Lakes Pollution Monitoring Workshop, Ann Arbor, Michigan, February 12, 1981.
11. GLISP, Introduction.
12. Bowden, Speech.
13. Ibid.
14. Ibid.
15. Ibid.
16. William, Donald, "Monitoring Under the Canada-Ontario Agreement." Speech delivered at the Great Lakes Pollution Monitoring Workshop, Ann Arbor, Michigan, February 12, 1981.
17. Ibid.
18. Ibid.



19. The Canada Ontario Agreement (Ottawa, Ontario, Canada: August 13, 1971) Article 9, paragraphs 1-5.
20. The Canada Ontario Agreement Respecting Great Lakes Water Quality (Federal Signing Authority, PC 1976-1-504: Tuesday, March 2, 1976). Programs and Other Measures: Section 4-17.
21. William, Speech.
22. Ibid.
23. Ibid.
24. Bowden, Speech.
25. Ibid.
26. Swain, Wayland, "Ecosystem Monitoring in the Great Lakes: Research Needs, Public Health Implications and GLISP." Speech delivered at the Great Lakes Pollution Monitoring Workshop, Ann Arbor, Michigan, February 12, 1981.
27. International Joint Commission, Interim Report Under the Great Lakes Water Quality Agreement. (Washington, Ottawa: January 28, 1981), pages 2-3.
28. Cowden, James W. Summary, Science Advisory Board Comments on GLISP. Prepared for Great Lakes Pollution Monitoring Workshop, Ann Arbor, Michigan, February 12, 1981.
29. Guarraia, L. and Cyrun, A., A Review of the International Surveillance Program for the Great Lakes Water As It Relates to Water Quality. (Washington, D.C.: Office of Water and Waste Management, June 1, 1979).

V. REGIONAL CONCERNS AND PERSPECTIVES:  
SYNTHESIS OF WORKGROUP DISCUSSIONS AND FINDINGS

A. Monitoring Design

1. Problem Area: Great Lakes Monitoring System Design: General Concerns

Environmental control programs tend to be legislated and developed in isolation from one another. Even with GLISP as a coordinating device, monitoring programs at state and local levels are fragmented with respect to program and coordination with other local/regional/state programs. This is particularly a problem with respect to interstate program designs for parameters not included in GLISP. Within the context of GLISP and specific needs of state and local public health and pollution control programs a number of specific concerns were cited. These include: inadequately defined monitoring needs, unclear definition of monitoring goals and objectives, inflexibility of monitoring systems to adapt to emerging problems, lack of clear rationale and specific need for parameter selection, and breakdown in monitoring program implementation. In addition, participants found that the present monitoring system was not designed to monitor the socio-economic impacts of pollution control strategies or to monitor changes in human population, resource uses and land uses which may greatly impact the input of contaminants to the lakes and assist in identifying cause and effect relationships. Monitoring system designs do not adequately take user needs into account. Specific concerns related to existing monitoring system design were noted. They included a number of categories:

- Inadequately defined monitoring needs: Existing systems do not adequately reflect needs for public health, environmental health data. They are not adequate with respect to meeting needs for the following:
- Ambient monitoring: The design should be able to detect changes in water quality, pollutant levels. Historic data is often overlooked, analysis of ambient data not included in the system design.
- Event monitoring: Specific objectives are unclear as to types of event monitoring. The Agreement specifies approaches to monitoring for spill impacts. However, it is generally difficult to determine whether sediment transport volumes are a short-term effect or whether we are actually seeing the recovery of a fishery. How can we identify and deal with criteria pollutant problems as they arise? Or obtain enough information for enforcement decisions?
- Ecosystem monitoring: The ability to manage pollutants in the ecosystem is cited as a major need. Ecosystem monitoring, with requirements for multimedia design and increased emphasis on

biological monitoring is not yet clearly understood. Public health monitoring requires attention to such a design. Present system stops short of incorporating needed parameters and indicators.

- Research: There have been a number of research needs identified which are not presently addressed: Is the biology a better indicator of pollutants in the lakes than the chemistry? How should needs for monitoring origin, transport, fate and effect of toxics be incorporated into monitoring design? What is effective ecosystem monitoring and how can GLISP be modified to incorporate it?
- Amount of monitoring; How much really is needed? Are we collecting the appropriate data. Unless user needs are clearly identified this issue remains at the bottom of political considerations for reduction of resources. Some participants were concerned that surveillance is often carried out to meet the immediate needs of an agency and the broader questions related to data interpretation and ecosystem analysis remain unaddressed. Perhaps a choice of key indicator parameters would suffice.
- Monitoring rationale is unclear. Because needs have not been clearly stated, objectives are unclear; people don't understand why certain monitoring is being done, who needs it or how they use it. Institutional problems result. It is difficult to develop program budgets for monitoring and data analysis.
- Monitoring system is inflexible and does not readily adapt to changing needs. GLISP was developed as a water quality monitoring plan and to respond to the 1972 International Agreement which focused attention on open lake pollution. Recent problem areas indicate need for additional nearshore, biotic, multimedia monitoring to address issues related to toxics transport, source, public health with respect to the fishery, and drinking water supplies and toxic contaminants. Budget and program allocations have not included data analysis in many instances. The 1978 Water Quality Agreement focused on the need for ecosystem management and recognized the serious nature of toxic contamination as a pollution problem in the Lakes. GLISP has not adequately responded to these.
- Requiring users to interpret the data is not a useful system. The system does not presently require interpretation to be done by the collector. Users are unaware of many factors which need consideration in analysis. Resources are not provided in the design of the system.
- Breakdowns in monitoring program implementation. Unclear objectives, a multiplicity of actors, interagency jealousies, lack of adequate funding and roles not specifically defined/ rationale not made clear (especially at the local level) create

confusion and lack of commitment to implementation. Federal confusion and lack of awareness result in major difficulties... some programs aren't funded, others depend on them, and when data are not analyzed quickly, they are not available for use. Next steps are frustrated. GLISP has achieved a remarkable level of cooperation within the Basin for the objectives which are included. However, GLISP does not presently meet all needs.

- Lack of attention to monitoring impacts of remedial programs on the social environment. We do not assess the impacts of remedial programs on urban centers, ability of citizens to bear costs, lifestyle impacts, public health effects. This makes it difficult to justify expenditure of funds, monitoring and control programs, development for unseen toxic pollutants, facilities development, etc.
- Lack of a centralized unit for data interpretation. Incorporation of monitoring design into interpretation is important. Data collected for one purpose should not always be used for another. Summarized data is difficult to find; decision-makers need accurately summarized data. Lack of central or coordinated analytic capability makes evaluation of remedial program effectiveness difficult.

#### Strategies For Improvement In Monitoring System Design

- Design of additions to the monitoring program should clearly reflect the need for specific information. Objectives should be stated. Additional specific information is needed in areas of ecosystem monitoring, toxic contaminants, biological integrators and indicators, fish, and drinking water for public health risk assessment, etc.
- Design of monitoring programs should reflect needs of users with respect to management requirements and parameter changes related to emerging problems. It should be "anticipatory" and able to respond to emerging problems by reassessing design, capability, and responding to changing data needs. New parameters should be added as needs arise. Trihalomethanes and benzenes/xylenes should be added now.
- Needs for developing monitoring systems to identify human exposure to TSCA identified materials, priority pollutants are high. Research is required to assess the adequacy of NPDES data base and industrial production data with respect to identifying human exposure. Epidemiological studies such as the Michigan PCB study of the fish-eating populations should be instituted. Inventories should be prepared as to where materials are produced in a manner similar to the Michigan requirement for reporting of use, discharge and management information for critical materials on an annual basis.

- Water intake data should become part of GLISP design, data base. Institutional arrangements for achieving this are somewhat obscure and should be clarified.
- If sampling and analysis of a given parameter is not within present technical capabilities, research should proceed to develop that capability, particularly with respect to priority pollutants.
- Care should be taken in system design that the correct questions are being asked.
- Historic data should be made available through a central clearing-house, and used as appropriate to evaluate trends prior to system design.
- GLISP should be evaluated to determine if key indicator parameters could be identified and selected as a means to cut the volume of data and analysis required as well as costs.
- GLISP should be designed and budgeted to include data analysis. Analysis should be scheduled to occur in a timely manner and provided to users.
- Social indicators should be identified and included in GLISP to assist in developing a data base regarding social effects of pollution control programs. This is a research need.
- Objectives should be clearly stated, with roles of participants in the monitoring program clearly identified, rationale for sampling and parameter selection provided to all involved. Users should be notified of any changes proposed.

2. Problem Area: Priority Monitoring Needs: Specific Concerns About the Great Lakes Monitoring Programs

The concerns identified regarding monitoring system design are related to the following needs which are stated in response to major gaps identified in GLISP and other monitoring programs.

- Public Health: Lack of enough of the right kind of data (nearshore, appropriate parameters, specimens) to provide information for assessment of hazard and risk to public health from fish and drinking water.

Strategies for Improvement

- The National Plan for Ocean Pollution Monitoring, Development and Research should acknowledge the water quality

objectives established under the 1978 Water Quality Agreement and recognize the necessity for extended nearshore monitoring of water quality with particular reference to public and environmental health.

- Additional parameters should be added to GLISP and State monitoring requirements for priority pollutants such as trihalomethanes, specific TSCA identified pollutants.
- Fish monitoring should be improved to meet such needs as more accurate public health advisories and management decisions to close Great Lakes fisheries due to toxic contamination. Locality oriented fish sampling, more consistent sampling and analytic procedures are required.
- Monitoring data from open-lake sampling should be incorporated into decision-making with respect to risk and hazard assessment.
- New problem areas should be carefully watched, and methodology developed to address monitoring needs of such locations as the new point sources of toxic effluents to the Niagara River from SCA Corporation, diffuse source inputs from Love Canal area, etc.
- Allocation of monitoring resources should reflect hazard to human health.
- Toxic Contamination: Chemical monitoring alone is inadequate to address the true nature of the problem. There is not enough use of biotic indicator and integrator organisms.

#### Strategies for Improvement

- More and better use of biotic indicators (gulls, gull eggs, open lake and nearshore fish species, benthos) and integrators of water quality should occur as a means of increasing the sensitivity of water quality monitoring. As organisms tend to integrate certain contaminants in their environments, they provide more reliable indices of contamination both by area and over time than do isolated water samples. Organisms can also provide early warning of low level contamination that might remain undetected in water until measurable concentration had built up. Many Great Lakes toxic substance problems (DDT, mercury, mirex, PCB's, etc.) were first discovered in aquatic organisms or biologic indicators.

- The monitoring data assessment program should be designed to examine relationships between results using biological indicators and integrators and water sample analysis. This assessment should target trace organics and heavy metals.

- Multimedia Monitoring: Pollution control programs have traded air or water pollution for solid waste to be disposed of on land: for air pollution control programs that create acid rain and other long-range transport pollution problems which in turn create water pollution problems. Present monitoring systems are inadequately designed to assess the impacts of specific pollution control programs on the environmental health of the Great Lakes Basin ecosystem. Ecosystem management will be ineffective without multimedia monitoring.

### Strategies for Improvement

- Multimedia monitoring programs which establish clear linkages between air, water and land pollution control programs should be designed and implemented. Mass balances should be developed for priority pollutants.

- Improve ability to monitor source and deposition of atmospheric pollutants.

- Incorporate specific recommendations made under Ecosystem Management.

- Incorporate monitoring of socioeconomic impacts of pollution and pollution control programs.

- Safe Disposal of Dredge Material in the Great Lakes: There is strong controversy surrounding the issue of safely disposing dredged sediment in or near the Great Lakes. This controversy has resulted in major conflicts between Federal agencies (EPA and Corps of Engineers) and between Federal and state agencies. Available information is inadequate or non-existent for open lake or diked sites. Some harbors have sediments so contaminated with PCB's, heavy metals, and organics that states have prohibitions on dredging. There is a shortage of safe, appropriate and available land disposal sites. Diked disposal sites are controversial. There is little monitoring of diked disposal sites to determine whether polluted sediments and water are leaching into the lakes or to note effects on nesting populations of migratory waterfowl. The Corps of Engineers proposes open lake dumping. Existing open-lake dumping sites are not monitored. Some harbors will have to be closed to shipping if a solution is not found in the near future.

## Strategies for Improvement

- A Dredging subcommittee operating under the Water Quality Agreement is working on a definition of polluted dredge spoils. There is no consensus as to how to dispose of them. There should be an identification of questions to be asked and addressed in designing a monitoring system for various disposal alternatives, which should be designed and applied. The results should be evaluated to determine which disposal systems operate most effectively in preventing pollution to the Great Lakes.
- Strategies should be addressed as a modification of GLISP.

### 3. Problem Area: Ecosystem Monitoring

The 1978 Water Quality Agreement recognizes the necessity of implementing an ecosystem approach with respect to Great Lakes Basin water quality problems. This will require a different approach to monitoring than that currently in place. GLISP was not designed to do ecosystem monitoring. Public health needs cannot be adequately addressed under the present system. Specific issues of concern:

- Water quality versus ecosystem management and monitoring: Strong philosophical differences between resource managers and water quality managers must be resolved if an effective surveillance system responsive to ecosystem management is to be designed and implemented. Regulatory agencies are most interested in concentrations of pollutants in the water or sediments of the lakes. Resource managers are most interested in concentration of pollutants in the fish and/or their impacts on biotic populations including humans. They are concerned about pollutant pathways, fates, and effects in all environmental media.
- There is limited multimedia monitoring to examine impacts of air, water and land pollution control programs on Great Lakes Basin ecosystem.
- Public health monitoring needs are not being met (i.e., nearshore data, more fish and biological indicator monitoring, atmospheric monitoring, drinking water supply monitoring for contaminants.)

## Strategies For Improvement

- Redesign GLISP to reflect need and mandate for ecosystem monitoring. Specific needs should be clarified and specified. Redesign should address development of multi-media monitoring strategies to be coordinated at appropriate jurisdictional



level. This will require that linkages between air, water and land pollution control programs be identified, and appropriate monitoring design developed and implemented.

- Additional research with respect to determining mass balances and developing monitoring for mass balance data is required.
- Monitoring system design should develop information regarding sediment transport and storage of toxics and other materials.
- Use of indicator organisms in monitoring system should be encouraged. These are important for monitoring ecological effects of pollutants with respect to population reproduction rates (gull eggs), accumulation of contaminants (gull, fish, human milk), indicators for oligotrophic water quality, indicators for low level contaminants such as heavy metals and for long-term monitoring (benthos).
- Social effects of pollution problems, remedial actions need to be identified and monitored.
- Demographic information with respect to resource and land use practices, population distribution, etc. will be needed to implement ecosystem monitoring.
- Amendments would need to be made to Annex 11 of the Water Quality Agreement to exchange ecosystem surveillance needs.

#### 4. Problem Area: Monitoring Parameters

- Need for additional monitoring parameters: The existing system does not include many of the parameters which would assure compliance with the Safe Drinking Water Act or some of the priority pollutants. Fish monitoring does not include certain specific parameters identified by the FDA. Some new pollutants may get into lakes from diffuse sources due to changes in energy policy (benzene/xylenes from increased use of unleaded gasoline) and may concentrate in biota.

#### Strategies for Improvement

- Additional monitoring parameters should be included in GLISP design and in state monitoring programs. These should include priority pollutants such as trihalomethanes so compliance with Safe Drinking Water Act can be monitored. Contaminants in fish for specific parameters identified by the FDA should be monitored. Monitoring systems should include parameters for benzenes/xylenes

as use of unleaded gasoline becomes more prevalent. Fish should be sampled to determine if residuals from low-lead fuels are being concentrated. Priority pollutants under TSCA should be evaluated to see which are used in the Basin and therefore should be added to monitoring parameters. Care should be taken to evaluate all parameters to ensure that unnecessary monitoring is not done. Provision should be made in design of GLISP for revision of monitoring parameters in appropriate manner so that new problems can be addressed.

Perhaps criteria such as the following should be used to select monitoring parameters:

- How much data, via key parameters is needed to serve a specific purpose? For scientific validity?
- Are the parameters being monitored giving us the best information--are we measuring enough variables? Are they reflective of the system ecologically? What is the balance between biological and chemical parameters?

## B. Data Utilization

### 1. Problem Area: Data Compatibility

Because monitoring data are collected by many jurisdictions for various purposes, they are not always comparably collected, or analyzed in a manner as to be usable to meet other needs. Due to differences in monitoring outputs of sewage treatment plants between New York and Illinois (Chicago), there is not comparable information available. This causes difficulty in assessing remedial program effectiveness and in assembling data for determining loadings to the Lakes, etc. It also causes major problems in data analysis. Data storage and retrieval problems also result.

### 2. Problem Area: Limitations of Monitoring Data Use

Limitations are placed on effective use of monitoring data due to inadequacies in the present system of timely data analysis, formats inappropriate to user needs, lack of a centralized information dissemination mechanism, unavailability of parameters needed by users, and inadequate mechanisms for information dissemination. Related problem areas are those of data access, institutional barriers, data compatibility, and quality assurance. Specific concerns were stated as follows:

- Data format: Data, unanalyzed, in a computer printout is useless unless the user has the means to analyze it. Raw data is of no use to decision-makers. States have difficulty using other agencies'

unanalyzed data. It needs to be in compact form. It should be analyzed so a second or third party is not left with the task of interpreting it so they can use it. Present formats are not standardized between agencies or jurisdictions. This makes interpretation and use difficult.

- Timely Data Analysis: Much of the data collected has never been analyzed or made available for use. The two or three years commonly taken to analyze data is too long. Data is often outdated before it becomes available or used. Remedial programs suffer. Resource allocation is difficult. Resources are not allocated for data analysis within GLISP. In addition, many programs are young and trends are not evident yet.
- Information dissemination: Results of monitoring are not made available to decision-makers in an orderly fashion. Lack of continuity in monitoring programs makes dissemination to users less valuable. Data error and variation are not identified. The data sources are not always available. Jurisdictions needing the data may not be the same as those collecting it. Data are often not disseminated to the public. There is no central data dissemination institution for data collected by the states and various Federal agencies except for that which is reported to IJC.
- Relevant data not readily available to users: States say there is too much open lake data, too little nearshore data and they cannot do adequate jobs of enforcement, regulation, and remedial program assessment. In addition, data collection has become institutionalized and does not readily respond to changing data needs of users (i.e.: need for sediment transport data in Niagara River to respond to toxic pollution problems, need for more fish sample data to respond to public health management). Much information is put into Storet and is difficult to access. Sometimes agencies won't provide it.

### Strategies for Improvement

Evidence shows that Great Lakes pollution monitoring data are being utilized when analysis has been completed. Basic data are used by the research community. Accurate data, appropriately analyzed and displayed, are needed to gain the confidence of a public which has lost confidence in the government's ability to address pollution problems or to work with producers to solve toxic and hazardous waste problems. IJC Annual Reports are widely used throughout the Basin. The user community includes all governmental levels and jurisdictions as well as the general public, researchers, educational institutions, and industry. The community also acts as a resource to disseminate data to the general public and other users. It acts through professional and trade organizations and through

various publications such as Focus, The Communicator, Environment Midwest, Michigan Natural Resources Journal, Journal of the International Association for Great Lakes Research, Northern Ohio Business Journal, Sea Grant publications and the newspapers. Specific strategies and rationale are suggested:

- To meet goals and objectives which have been stated in GLISP and other Great Lakes monitoring programs (local, state), data must be analyzed and assessed in a more timely fashion than at present. To ensure this, surveillance budgets should include costs of data analysis. Technical assistance/oversight to accomplish the analysis could be accomplished through the use of ad hoc teams such as those which are organized by the Lake Surveillance Work Group under GLISP.
- Once analyzed, data should be translated and displayed in formats which will be of use to the decision-makers: local officials, legislators, planning agencies, the IJC, public health agencies, the media, industry, the general public, etc. in making resource management, public health and water pollution control decisions and policies; for use in public education and constituency building and to provide accurate information for risk assessment and impact analysis. Some of this data is now available and used within the "Great Lakes elitist network", but people outside that network do not know it exists. Information as to what is available and how to obtain it should be widely publicized.
- There should be improvement in protocols for information exchange from monitoring programs affecting several jurisdictions to shorten the time frame and improve access to information. Agencies participating in GLISP should make every effort "not to hold data or protect it" (unless it is proprietary or in litigation) or withhold needed data until it can be published in scientific journals, etc...
- Develop more internal consistency regarding data collection, analysis, formats within the sections of the State-EPA Agreements dealing with the Great Lakes remedial programs, controls and monitoring so there is a more direct relationship to GLISP, Water Quality Agreement objectives and more consistency with other states' data with respect to the Great Lakes.
- Improved State-EPA Agreements should address issues such as the following: Great Lakes States have to do two major types of monitoring: Federal Water Pollution Control Act monitoring and monitoring to fulfill requirements of the Great Lakes Water Quality Agreement. In addition, they have their own state required monitoring programs. Many of the activities for the three levels are the same, but the state's internal priorities may change. There is no efficient way to adjust to this at present, particularly in states with most territory in other drainage basins.

- Improve planning and the development of cooperative arrangements with respect to data collection and distribution between states and EPA and within GLISP. States do not use open-lake or tributary monitoring data on a day-to-day basis for their own operations. If EPA wants data not normally gathered under GLISP, the states will provide it if EPA will pay for it. Data are made available to the IJC as a service. If EPA, IJC, and Canada can package the data collected, the states will use them where they will meet the needs.
- Better planning and coordination may result in more effective data use. Reasons for monitoring may be different for states or local jurisdictions than they are for GLISP, even though the same sample may be used for GLISP as for other programs the state is engaged in. States have networks of fixed stations for ambient monitoring and programs may be described individually. The same station samples may be used to provide tributary loadings data to the IJC, may reflect "urban area loadings", be part of a national network of 1000 stations to satisfy 208 agency functions and so forth. The same field crew and laboratory may serve multiple functions.
- A system of "data need alerts" should be developed and provided to cooperators among user groups and data collectors. It should be developed so that all involved know why each parameter or monitoring site is needed, for whom the data are being prepared (primary user), who is collecting data and for what reasons. If a change is being contemplated, the user community should be notified and accommodation made to meet needs. Emerging needs for additional monitoring data should be made known so that potential for cooperative collection, demand for use can be assessed.
- Lead agencies should be acquainted with need for data at state and local levels and with respect to GLISP commitments. They should take responsibility to identify gaps and assist in developing strategies to fill gaps (ecosystem monitoring) within their program mandates.
- Efforts should be made to determine where enough historical data exists and monitoring activities shifted to meet new priorities, or to determine opportunities for instituting longer time spans between specific monitoring activities (as in GLISP nine year cycles). This would encourage more timely analysis.

### 3. Problem Area: Lack of Access to Monitoring Data

Timely access to monitoring data in usable format has been identified as a key problem, particularly by local and state resource and pollution program managers. In some cases potential users do not know what data exist, how to access the data, or if they can find them. Some problems are

specifically related to inadequate computer storage and retrieval systems and resource allocation, some to slow analysis of data, some to the fact that much "grey information" exists but is hard to locate and in some cases access to data is refused by the agency holding it. It was noted that Article IX of the 1978 Water Quality Agreement guarantees the exchange of information and data relative to "water quality in the Great Lakes System" between the Parties, but this does not always happen, causing problems in implementing the surveillance program. Specific types of problems related to lack of access to monitoring data were noted:

- Proprietary behavior of agencies inhibits access to data. There are difficulties exchanging data through some bureaucracies due to policies, internal politics, or incompatible data formats. Sometimes the designated lead agency (NOAA) is not familiar with what is needed or important.
- Political sensitivity by agencies, especially at the State level, inhibits access to data (Michigan on PBB, New York on Love Canal).
- Lack of freedom of information act in Canada is inhibitory.
- Lack of information exchange between agencies on use of existing monitoring program data or notification of change in monitoring programs has resulted in change or discontinuance of monitoring programs upon whose data other agencies depended. (USGS discontinues stream surveillance program; Michigan needs the data).
- Data are not stored in a central location or in forms which are readily available to the user. Existence of needed data, such as water intake monitoring data, may be unknown to the user.
- STORET is difficult to use. One state can input and access its own data, but unless another state is familiar with the codes and methodology that data may be unavailable. Some data can be input, but not retrieved in usable form (industrial effluent). It does not accept toxics or ecosystem/biological monitoring data. Much data is therefore not put into data storage systems, but is kept in file folders. State and local governments do not always have adequate resources or trained personnel to make appropriate use of existing system.
- Monitoring data are not analyzed in a timely fashion (two to three year lapses are not uncommon) to be cost/effective for use in developing responses to water pollution problems and provide for public health advisories. Most decision-makers are not able to analyze data so monitoring results remain inaccessible.
- There are difficulties identifying the sources and limitations of the data. Information regarding how, when, where data were collected, how the monitoring system was designed and for what purpose is often not available with the data.

## Strategies for Improvement

Improvements in accessing Great Lakes monitoring data depend upon improving communications between the collectors and users of monitoring data and among the various agencies and jurisdictions with monitoring program responsibilities and in developing compatible data sets which can be accessed by those who need to use them. Specific recommendations included:

- Establish a Great Lakes data and information clearinghouse: Its role would be to establish linkages between collectors and users of monitoring data. It would not store data, but would provide information about what information exists, where it is (including grey data), how to obtain it, be able to do a literature search and provide abstracts. It would collect and prepare an inventory of data sources and environmental data systems in both the U.S. and Canada.
- Improve STORET or adopt an alternative system for data storage. Needs for improvement included being able to put industrial "end of pipe" data into the system in such a way that it can be retrieved. (It is possible to put it in, but not to retrieve it). STORET should also be able to take water treatment plant intake data. GLISP data should be entered into STORET in such a way as to allow for easy retrieval. Develop methods to input compliance monitoring data to computer storage as there is increasing need for such data, particularly with respect to information on materials present in power plant waste streams. Putting data into STORET may be more costly than monitoring itself, and it does not accept all data necessary under GLISP including toxics or ecosystem data. Alternatives may be better.
- Improve access to grey data. This would be invaluable in updating the Environmental Data Base (which has not been updated in five years). To identify existence, location, and subject of these, Great Lakes researchers, agencies, and industry needs to be educated regarding potential importance and use of this source. A repository for data from canceled programs, retired researchers, etc. should be considered.
- Data should be analyzed in a timely fashion and made available to users in appropriate formats. Unanalyzed data are of very little use to decision-makers. Resources should be allocated and timetables for analysis used.
- Monitoring data could be summarized, put into a volume and analyzed or interpreted so decision-makers could have more access to it. Also monitoring data could be put into a regional data bank accessed by users and analyzed according to need.

- Trends indicate that the need for the general public to have access to analyzed data is increasing. Presently litigation to achieve compliance or enforcement of pollution control laws is resulting from government monitoring and is government initiated in many cases. It is possible that the burden for initiating lawsuits will fall increasingly on the general public. They will need access to data and will have to develop analytic capability.
- Monitoring agencies should make every effort to provide needed data on request. (Acknowledging limitations for proprietary data, data in litigation). Sitting on data so people can publish should be discouraged. States and federal agencies should be reminded of their obligations for information sharing under the Water Quality Agreement.
- Some type of cost-sharing should be developed: A number of alternatives were suggested which would address the costs of providing data to the user. These included the following options: users could pay costs of accessing the data; EPA could require non-government agencies and individuals to pay and have a case-by-case determination of costs; data could be summarized on a regular basis and published in a volume, with user to pay at cost; or agencies would be provided data, industry be charged cost, individuals (general public) could be provided data at no cost. The latter is essentially present practice.

#### 4. Problem Area: Sample Archiving

The iterative relationship between research and monitoring is highlighted by problems related to the lack of an adequate repository system for sample archiving. Difficulties are being experienced in developing predictive models and assessing progress in solving Great Lakes pollution problems. Specific related concerns stated were:

- Monitoring samples of water, toxic sediments, fish and other biological specimens are not kept for comparison in any organized way. It is difficult to know where they are to be found.
- State programs are supposed to archive fish flesh samples, but are not presently effective. Not enough samples are collected and supplies are quickly exhausted.
- Often samples and data are both discarded.
- Samples of zooplankton and benthos are not archived.
- Samples intended for archiving sometimes are lost, even when sent to the Smithsonian.



## Strategies For Improvement

A program (perhaps part of GLISP) should be incorporated into the monitoring plans to keep track of who has what archives, identify commitments to maintain them. In addition:

- More samples of fish should be collected for archiving
- Benthos and zooplankton should be archived
- A system for maintaining archive samples and monitoring data when a program closes down or responsibility is transferred should be developed. This should include samples, grey data.
- Protocols should be developed for exchange and use of archive samples.

### 5. Problem Area: Data Quality Assurance

Use of monitoring data or assessment of raw data is a problem when various jurisdictions do not use the same sampling techniques, criteria, or analysis methods. State-of-the-art with respect to toxics monitoring is fairly primitive. Results of monitoring programs often depend on whose methods are used or may differ when standards differ. Rigorous training and performance standards have been a problem in laboratories doing routine monitoring and data analysis. Other specific problems are:

- Monitoring data for toxics are un dependable. Measurement of toxic levels in a given sample varies from lab to lab depending on the equipment and technique used. As needs for hazard assessment of toxics in fish and drinking water increase, this becomes more of a problem.
- Monitoring agencies and public health agencies disagree regarding the number of samples which are needed to obtain a scientifically valid set of data which can be used for enforcement, remedial program evaluation and hazard assessment.
- Data are not always collected and stored in a usable fashion. In many cases information regarding monitoring design, methodology, location, dates, is not included with data.
- Data collection and analysis may not be rigorous. Estimates of data accuracy are not routinely provided.
- There is lack of comparability and compatibility of data. Many jurisdictions and agencies with many mandates are collecting. Standard protocols are not always observed and do not exist in some cases. (Outputs of STP's from state-to-state are an example.)

- Insufficient data may be collected on which to establish trend zones.
- Data errors, variations are not known. This is important if you are trying to measure improvements, look at tiny changes, or determine whether data is statistically defensible.
- Data formats are not standardized; user access suffers.
- Due to difficulty in access, utilization of data in public education, information, and action is limited. Access by the public is important for meaningful public feedback and support for necessary programs.

### Strategies For Improvement

- Improve, refine and standardize techniques for toxic analysis.
- Establish quality assurance criteria to be met by labs performing monitoring or data analysis. (EPA has already begun this program.)
- Establish means for reporting which include information regarding sampling techniques, criteria used in analysis, etc.
- Improve technology for toxics analysis.

### C. Monitoring Technology

#### Problem Area: Monitoring Technology Concerns

Monitoring technology needs to be improved in a number of areas particularly with respect to toxics and atmospheric transport and deposition of pollutants. As the necessity to manage pollutants from an ecosystem perspective becomes more urgent, the development of multimedia monitoring systems becomes more urgent. Quality control in the design and manufacture of instruments was noted to be a continuing problem. Specific priority needs for improvement in technology were identified with respect to:

- Monitoring for toxic contaminants: State-of-the-art lags behind the surveillance strategies and the pollution problems in the Lakes. Commitment for source reduction of specific priority contaminants requires development of technology for monitoring localities for specific pollutants. Quality assurance in toxics

analysis is also cited as a major area of need. Water column sampling should be improved. Technology and skill transfer important.

- Atmospheric deposition: Better or new technology is needed to monitor pollutants in ambient air, in fallout, to trace sources, fugitive emissions, transport mechanisms. Monitoring should include PCB's, heavy metals, acidic precipitation, phosphorus, organics, metals that may be mobilized by acid precipitations, carried on particulates, etc.
- Satellite Monitoring: This was identified as potentially useful and appropriate for monitoring chlorophyll and particulates, but may be too costly because of the need for ground truth and because of ship costs and weather problems.
- Ice-monitoring: During periods of winter ice cover there are problems in measuring and predicting phosphorus levels. Potential modeling and remedial strategies are dependent on ability to predict water quality during freezeover.
- Dependable equipment: Participants responsible for monitoring expressed a need for simple instruments such as pH meters which would operate dependably in the field.
- Improve both software and hardware for data storage and retrieval. STORET is out-of-date. A centralized easily accessible system that will accept and retrieve water quality, biological and toxics data should be developed.

#### D. Funding and Coordination

##### 1. Problem Area: Resource Allocation for Monitoring

It was noted that more funds should be allocated to support Great Lakes pollution monitoring rather than less, that priorities for allocation of resources on the part of the states would be decided on the basis of legally required monitoring, and that there were a number of related concerns which should be addressed:

- The monitoring budget has no provision for followup work if a new problem is identified.
- There is very limited funding for data interpretation and information storage, including funding personnel for analysis and summarization and display in usable formats accessible to users.
- Insufficient allocation of resources to nearshore monitoring vs open-lake, large system monitoring.

- Lack of commitment at every level of U.S. monitoring programs as compared with Canadian allocation of resources.
- States feel that Federal resources invested in monitoring are directed to Federal interests, but that there is lack of perspective as to what Federal interest really is within the mandate of GLISP and the Water Quality Agreement, Safe Drinking Water Act, etc. The states and local governments generally feel that public health monitoring receives low priority from the Federal government.
- There are conflicts between allocation of money for research and allocation of money for utilizing data that already exists.
- Lack of resources to coordinate monitoring plan design and implementation, cooperation via meetings, other mechanisms.
- Lack of cost-benefit analysis in preparation of monitoring program design results in inefficient use of resources.
- Political support for resource allocation will require information regarding monitoring data need, use, and effectiveness. Achievable GLISP, local and state monitoring program objectives are not presently known to the political sector.
- The present GLISP is based on allocations of \$10 million per year equally divided between Canada and the United States. It had been assumed that these resources would be made available. However, the 1980 U.S. expenditure was considerably less than its \$5 million share and it is estimated that 1981 expenditures will be no more than \$2½ million. No determination has been made of priorities or of the impact on Canada.

### Strategies for Improvement

A number of actions and policy decisions are required to address these resource allocation issues. Participants agreed that GLISP is underbudgeted now and that the \$10 million figure must be cooperatively provided with each country meeting its obligations for providing half of the funding. Specific action strategies also suggested were:

- GLISP costs for monitoring should be portrayed within the context of the ecosystem, total environmental problem perspective so that costs can be considered within the total environmental management program including facilities development, program implementation, compliance AND monitoring.
- Stress the importance of providing basic resources for implementation of GLISP as a regional monitoring program for the Great Lakes and note that it is binational with resource

allocation made in equal (or more than equal) amounts by Canada. Provide information to Congress, Washington EPA, NOAA and other agency personnel regarding the nature of the Great Lakes as a binational freshwater resource, and its pollution problems and remedial action needs, surveillance needs.

- Improve planning to identify more specifically costs/needs for resources for data analysis, with development of detailed strategy of resource allocation for analysis, preparation of data formats appropriate to user populations so that additional funding can be sought.
- The equivalent of 40-60% of sampling and laboratory costs should be committed when a sampling program is begun, for analysis and format of data for decision-makers. Management is dependent on interpreted data. Modification of surveillance programs is accomplished via analysis of results of past surveys. Again, allocation and funding of GLISP, state programs should reflect these needs.

## 2. Problem Area: Institutional and Jurisdictional Coordination

While participants reported minimal duplication of monitoring in the Great Lakes because of cooperative activities under GLISP, institutional and jurisdictional problems exist. They include many relating to inter-agency or intergovernmental coordination of pollution control/monitoring/data management activities, lack of clear understanding as to a particular agency mission with respect to pollution control or monitoring in relation to other agency responsibilities, and lack of commitment to implementation of pollution control and monitoring programs at the Washington level relative to United States responsibilities. Specific examples of problems identified are:

- There is a redundancy of agencies overseeing Great Lakes pollution. This may be due to various legislative mandates but results in an overlap of functions of state and federal agencies. The relationship of programs at various funding and jurisdictional levels is unclear. The Great Lakes National Program Office in USEPA seems to be purely political as it has not addressed these problems and lacks perspective.
- There is a lack of communication and cooperation among programs. A number of adverse impacts to monitoring result:
  - Sometimes agencies arbitrarily discontinue monitoring program users' needs or add new ones already being done by present users. This is more apparent between state and federal jurisdictions where a federal agency may change its program (USGS) without notifying the users who are dependent upon the data.

- It is difficult to develop long-range program budget plans without a clear understanding of monitoring roles to be undertaken by local/state/Federal jurisdictions with respect to various parameters, locations.
- Local governments needing EPA data (i.e., Indiana) have had difficulty obtaining cooperation from the agencies who have it.
- More responsibility for monitoring is put on local or state governments than they have resources or capabilities to undertake. If EPA is going to require or request monitoring, it should provide the resources.
- Lack of state and local interest in Federal monitoring programs, such as whole lake systems data, due to their responsibility for public health and nearshore water quality results in lack of interest in the state of ecosystem health.
- There is lack of leadership and commitment on the part of EPA to address monitoring responsibility and solve pollution problems under the Water Quality Agreement. It is perceived that the Washington bureaucracy does not understand the value of the Great Lakes as a freshwater resource and does not honor the spirit or the specifics of international agreement with Canada with respect to providing resources for GLISP.
- Institutional arrangements between Federal and state levels are inadequate (no correlative of the Canada-Ontario Agreement) to ensure that all necessary tasks, programs will be carried out, resources allocated, etc. to implement GLISP.
- Too many demands for monitoring are made with inadequate resource allocation.
- Unclear as to NOAA's role with respect to Great Lakes pollution monitoring, GLISP. Too many federal agencies already. There is also a potential problem with respect to NOAA's operational definition of "monitoring" which could be interpreted differently than that of the IJC Water Quality Agreement.
- Environmental control programs tend to be legislated and developed in isolation from one another. Pollution control in the Great Lakes Basin and monitoring of pollutants cannot be effectively undertaken unless it is clearly understood that this will require monitoring and control programs in the tributaries. Source reduction strategies will not be effective and local political support for remedial programs is difficult to achieve without such data. There are problems with the use of the definition of "coastal zone" as used in the State Coastal Zone Management Programs to determine the extent of monitoring programs in the Great Lakes. No state in the Great Lakes defines "coastal zone" to include the tributaries.

## Strategies for Improvement

- The Great Lakes International Surveillance Plan should be the basis for Great Lakes Pollution monitoring. It should be incorporated into the National Ocean Pollution Research Development and Monitoring Plan.
- The International Joint Commission is the coordinating institution for GLISP under the Water Quality Agreement of 1978. It should remain so and GLISP should be amended to meet the needs identified in the following sections. It is essential that U.S. monitoring and pollution control programs and priorities reflect the fact that the Great Lakes are a binational resource and must be managed cooperatively and in partnership with Canada.
- EPA-State Agreements should be strengthened to have state monitoring priorities, responsibilities and budget allocations to meet the Great Lakes Water Quality Agreement and other mandates more directly.
- If EPA is requesting nearshore monitoring, or monitoring of parameters not normally within a local government's mandate, it should pay for that monitoring.
- Improved communications regarding monitoring system design, rationale and use are essential between various jurisdictions.
- GLISP should be a national priority. The U.S must meet its commitments for protection of the water resource in the Great Lakes. Steps should be taken to educate decision-makers about the resource and its pollution problems and with respect to responsibilities under the Water Quality Agreements. More timely data analysis and reporting would be of major assistance to the IJC in making information available to the governments and to the public.
- The Federal legislation P.L. 95-273 should be amended, or federal interpretation of the Act's intent formalized to ensure that the limited definition "coastal zone" will not be applied to define the boundaries for Great Lakes pollution monitoring. The definition accepted should be consistent with that in the 1978 Water Quality Agreement which includes the drainage basin as far into the St. Lawrence as the international boundary in its definition of Great Lakes Basin Ecosystem. Preferably the Ecosystem definition would apply.
- The NOAA monitoring plan should function to: identify deficiencies in existing monitoring programs, see that agency budgets are coordinated, identify gaps and needs in programs and budgets, be used by agencies as budget justification to obtain funding for GLISP, assist agencies in avoiding duplication, minimize use of federal dollars in unnecessary monitoring activities.

- Political contacts, education of congressional delegations, new administration will be needed to explain role of GLISP and additional needs.
- Emphasize the role of GLISP in minimizing duplication of monitoring activities in the Great Lakes and its role in achieving cooperation between U.S., state and Canadian jurisdictions in implementing activities.



## BIBLIOGRAPHY

1. GREAT LAKES WATER QUALITY AGREEMENT OF 1978. International Joint Commission Canada and the United States.
2. Surveillance Subcommittee of the Great Lakes Water Quality Board: GREAT LAKES INTERNATIONAL SURVEILLANCE PLAN 1980. International Joint Commission Great Lakes Regional Office, Windsor, Ontario. 1980.
3. Great Lakes Fishery Commission: PROPOSAL: A JOINT STRATEGIC PLAN FOR MANAGEMENT OF GREAT LAKES FISHERIES. December 1980. Great Lakes Fishery Commission, Ann Arbor, Michigan.
4. P.L. 95-273 (92 Stat. 228): NATIONAL OCEAN POLLUTION RESEARCH AND DEVELOPMENT AND MONITORING PLANNING ACT OF 1978.
5. THE CANADA ONTARIO AGREEMENT. August 13, 1971. Ottawa, Ontario.
6. THE CANADA ONTARIO AGREEMENT RESPECTING GREAT LAKES WATER QUALITY. Federal Signing Authority PC 1976 - 1 - 504. March 2, 1976.
7. International Joint Commission: SUPPLEMENTAL REPORT ON PHOSPHORUS MANAGEMENT (Under the Reference on Pollution in the Great Lakes System from Land Use Activities). IJC, Washington & Ottawa. January 30, 1981.
8. Beeton, et al: REPORT OF GREAT LAKES REGION CONFERENCE ON MARINE POLLUTION PROBLEMS: Traverse City, Michigan, June 9-11, 1980, (Working Paper No. 3: Federal Plan for Ocean Pollution Research, Development and Monitoring, FY 1981-85). National Marine Pollution Program Office, NOAA, Washington, DC. September 1980.
9. Segar, Douglas: (Draft) Considerations for a National Ocean Pollution Monitoring Approach Feb. 1981. Discussion Paper. NOAA.
10. Gunnerson, C.G.: Utilization of Data from Continuous Monitoring Networks. Reprint from Special Technical Publication 573, American Society for Testing and Materials, Philadelphia, Pennsylvania. 1975.
11. Botts, Lee: Memorandum to "Friends of the Great Lakes" Subject: NOAA Five-Year Ocean Pollution Research Plan. Great Lakes Basin Commission, May 1970.
12. International Reference Group on Great Lakes Pollution from Land Use Activities: ENVIRONMENTAL MANAGEMENT STRATEGY FOR THE GREAT LAKES SYSTEM. IJC. July 1978.
13. Abrams, Richard: Summary Report: Workshop on Marine Pollution Information Management. NOAA/EDIS, National Oceanographic Data Center, Washington, DC.

14. Swanson, R.L. and Joel S. O'Connor: A Recommended Direction for a National Marine Pollution Monitoring Program. A discussion paper. Aug. 1980.
15. International Joint Commission: INTERIM REPORT UNDER THE GREAT LAKES WATER QUALITY AGREEMENT. January 28, 1981. Washington & Ottawa.
16. Goldberg, Edward D. (Editor): Proceedings of a Workshop on ASSIMILATIVE CAPACITY OF U.S. COASTAL WATERS FOR POLLUTANTS, Crystal Mountain, Washington, July 29-August 4, 1979. Published by NOAA, Environmental Research Laboratories, December 1979. Boulder, Colorado
17. Goldberg, Edward D. (Editor): Proceedings of a Workshop on SCIENTIFIC PROBLEMS RELATING TO OCEAN POLLUTION, Estes Park, Colorado, July 10-14, 1978. Published by NOAA, Environmental Research Laboratories, March 1979. Boulder, Colorado.
18. Interagency Committee on Ocean Pollution Research, Development, and Monitoring Federal Coordinating Council for Science, Engineering and Technology: FEDERAL AGENCY PROSPECTUSES: OCEAN POLLUTION RESEARCH, DEVELOPMENT AND MONITORING: FISCAL YEARS 1980-1981, VOLUMES I AND II AND DOE VOLUME II ADDENDUM (Drafts). May 1980.
19. Interagency Committee on Ocean Pollution Research, Development, and Monitoring Federal Coordinating Council for Science, Engineering, and Technology: CATALOGUE OF FEDERAL OCEAN POLLUTION RESEARCH, DEVELOPMENT AND MONITORING PROGRAMS, FISCAL YEARS 1978-80, Working Paper 1. August 1979.
20. Interagency Committee on Ocean Pollution, Research, Development, and Monitoring Federal Coordinating Council for Science, Engineering, and Technology: FEDERAL PLAN FOR OCEAN POLLUTION RESEARCH, DEVELOPMENT, AND MONITORING: FISCAL YEARS 1979-83. NOAA. August 1979.
21. Great Lakes Water Quality Board: GREAT LAKES WATER QUALITY 1978 APPENDIX B SURVEILLANCE SUBCOMMITTEE REPORT. July 1979. IJC. Windsor, Ontario.

APPENDIX 1

National Ocean Pollution Research and Development  
and Monitoring Planning Act of 1978 (PL95-273)

92 STAT. 228

PUBLIC LAW 95-273—MAY 8, 1978

**Public Law 95-273  
95th Congress**

**An Act**

May 8, 1978  
[S. 1617]

To establish a program of ocean pollution research, development, and monitoring, and for other purposes.

National Ocean  
Pollution  
Research and  
Development and  
Monitoring  
Planning Act of  
1978.  
33 USC 1701  
note.  
33 USC 1701.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Ocean Pollution Research and Development and Monitoring Planning Act of 1978".*

**SEC. 2. FINDINGS AND PURPOSES.**

- (a) FINDINGS.—The Congress finds and declares the following:
  - (1) Man's activities in the marine environment can have a profound short-term and long-term impact on such environment and greatly affect ocean and coastal resources therein.
  - (2) There is a need to establish a comprehensive Federal plan for ocean pollution research and development and monitoring, with particular attention being given to the inputs, fates, and effects of pollutants in the marine environment.
  - (3) Man will increasingly be forced to rely on ocean and coastal resources as other resources are depleted. Our ability to protect, preserve, develop, and utilize these ocean and coastal resources is directly related to our understanding of the effects which ocean pollution has upon such resources.
  - (4) Numerous departments, agencies, and instrumentalities of the Federal Government sponsor, support, or fund activities relating to ocean pollution research and development and monitoring. However, such activities are often uncoordinated and can result in unnecessary duplication.
  - (5) Better planning and more effective use of available funds, personnel, vessels, facilities, and equipment is the key to effective Federal action regarding ocean pollution research and development and monitoring.

(b) PURPOSES.—It is therefore the purpose of the Congress in this Act—

- (1) to establish a comprehensive 5-year plan for Federal ocean pollution research and development and monitoring programs in order to provide planning for, coordination of, and dissemination of information with respect to such programs within the Federal Government;
- (2) to develop the necessary base of information to support, and to provide for, the rational, efficient, and equitable utilization, conservation, and development of ocean and coastal resources; and
- (3) to designate the National Oceanic and Atmospheric Administration as the lead Federal agency for preparing the plan referred to in paragraph (1) and to require the Administration to carry out a comprehensive program of ocean pollution research and development and monitoring under the plan.

33 USC 1702.

**SEC. 3. DEFINITIONS.**

As used in this Act, unless the context otherwise requires—

- (1) The term "Administration" means the National Oceanic and Atmospheric Administration.

(2) The term "Administrator" means the Administrator of the Administration.

(3) The term "Director" means the Director of the Office of Science and Technology Policy in the Executive Office of the President.

(4) The term "marine environment" means the coastal zone (as defined in section 304(1) of the Coastal Zone Management Act of 1972 (16 U.S.C. 1453(1))); the seabed, subsoil, and waters of the territorial sea of the United States; the waters of any zone over which the United States asserts exclusive fishery management authority; the waters of the high seas; and the seabed and subsoil of and beyond the Outer Continental Shelf.

(5) The term "ocean and coastal resource" has the same meaning as is given such term in section 203(7) of the National Sea Grant Program Act (33 U.S.C. 1122(7)).

(6) The term "ocean pollution" means any short-term or long-term change in the marine environment.

**SEC. 4. COMPREHENSIVE FEDERAL PLAN RELATING TO OCEAN POLLUTION.** 33 USC 1703.

(a) **LEAD AGENCY FOR PLAN.**—The Administrator, in consultation with the Director and other appropriate Federal officials having authority over ocean pollution research and development and monitoring programs, shall prepare, in accordance with this section, a comprehensive 5-year plan (hereinafter in this Act referred to as the "Plan") for the overall Federal effort in ocean pollution research and development and monitoring. The Plan shall be prepared and submitted to Congress and the President on or before February 15, 1979, and a revision of the Plan shall be prepared and so submitted by February 15 of each odd-numbered year occurring after 1979.

**Responsibility.**  
  
**Submission to President and Congress.**

(b) **CONTENT OF PLAN.**—The Plan shall contain, but need not be limited to, the following elements:

(1) **ASSESSMENT AND ORDERING OF NATIONAL NEEDS AND PROBLEMS.**—The Plan shall—

**National priorities.**

(A) identify those national needs and problems, which relate to specific aspects of ocean pollution (including, but not limited to, the effects of ocean pollution on the economic, social, and environmental values of ocean and coastal resources), which exist and will arise during the Plan period;

(B) reestablish the priority, based upon the value and cost of information which can be obtained from specific ocean pollution research and development and monitoring programs and projects, in which such needs should be met, and such problems should be solved, during the Plan period; and

(C) contain, if pursuant to the preparation of any revision of the Plan required under subsection (a) it is determined that any national need or problem or priority set forth in the preceding version of the Plan should be changed, a detailed explanation of the reasons for the change.

(2) **EXISTING FEDERAL CAPABILITY.**—The Plan shall contain—

**Existing Federal capability.**

(A) a detailed listing of all existing Federal programs relating to ocean pollution research and development and monitoring (including, but not limited to, general research on marine ecosystems), which listing shall include, with respect to each such program—

(i) a catalogue of the Federal personnel, facilities, vessels and other equipment currently assigned to, or used for, the program, and

(ii) a detailed description of the existing goals and costs of the program, including, but not limited to, a categorical breakdown of the funds currently being expended, and planned to be expended, to conduct the program; and

(B) an analysis of the extent to which each such program, if continued on the basis and at the funding level described pursuant to subparagraph (A) (ii), will assist in meeting the priorities set forth pursuant to paragraph (1) (B) during the Plan period.

(3) **POLICY RECOMMENDATIONS.**—If it is determined, as a result of the analysis required to be made under paragraph (2) (B), that the priorities set forth pursuant to paragraph (1) (B) will not be adequately met during the Plan period using the existing Federal capability described pursuant to paragraph (2) (A), the Plan shall contain those recommendations for changes in the overall Federal effort in ocean pollution research and development and monitoring which would ensure that those priorities are adequately met during the Plan period. Such recommendations may include, but need not be limited to—

(A) changes in the goals to be achieved under various existing Federal ocean pollution research and development and monitoring programs;

(B) suggested increases and decreases in the funding for any such existing program consistent with the extent to which such program contributes to the meeting of such priorities;

(C) specific proposals for interagency cooperation in cases in which the pooling of the resources of two or more Federal departments, agencies, or instrumentalities under existing programs could further efforts to meet such priorities or would eliminate duplication of effort; and

(D) suggested legislation to establish new Federal programs considered to be necessary if such priorities are to be met.

**Budget review.**

(4) **BUDGET REVIEW.**—The Plan shall contain a description of actions taken by the Administrator and the Director to coordinate the budget review process for the purpose of ensuring interagency coordination and cooperation in (A) the carrying out of Federal ocean pollution research and development and monitoring programs; and (B) eliminating unnecessary duplication of effort among such programs.

**Plan Period.**

(c) For purposes of this section, the term "Plan period" means—  
 (1) with respect to the Plan as required to be submitted on February 15, 1979, the period of 5 fiscal years beginning on October 1, 1978; and  
 (2) with respect to each revision of the Plan, the period of 5 fiscal years beginning on October 1 of the year before the year in which the revision is required to be prepared under subsection (a).

33 USC 1704

**SEC. 5. COMPREHENSIVE OCEAN POLLUTION PROGRAM IN THE ADMINISTRATION.**

**Establishment.**

(a) **ESTABLISHMENT OF PROGRAM.**—The Administrator shall establish within the Administration a comprehensive, coordinated, and effective ocean pollution research and development and monitoring program. The Administrator shall carry out all projects and activities under the program in a manner consistent with the Plan.

(b) **CONTENT OF THE PROGRAM.**—The program required to be established under subsection (a) shall include, but not be limited to—

(1) all projects and activities relating to ocean pollution research and development and monitoring for which the Administrator has responsibility under provisions of law (including, but not limited to, title II of the Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. 1441-1444)) other than paragraph (2);

(2) such projects and activities addressed to the priorities set forth in the Plan pursuant to section 4(b)(1)(B) that can be appropriately conducted within the Administration; and

(3) the provision of financial assistance under section 6.

#### SEC. 6. FINANCIAL ASSISTANCE.

(a) **GRANTS AND CONTRACTS.**—The Administrator may provide financial assistance in the form of grants or contracts for research and development and monitoring projects or activities which are needed to meet priorities set forth in the Plan pursuant to section 4(b)(1)(B), if such priorities are not being adequately addressed by any Federal department, agency, or instrumentality.

(b) **APPLICATIONS FOR ASSISTANCE.**—Any person, including institutions of higher education and departments, agencies, and instrumentalities of the Federal Government or of any State or political subdivision thereof, may apply for financial assistance under this section for the conduct of projects and activities described in subsection (a), and, in addition, specific proposals may be invited. Each application for financial assistance shall be made in writing in such form and manner, and contain such information, as the Administrator may require. The Administrator may enter into contracts under this section without regard to section 3709 of the Revised Statutes of the United States (41 U.S.C. 5).

(c) **EXISTING PROGRAMS.**—The projects and activities supported by grants or contracts made or entered into under this section shall, to the maximum extent practicable, be administered through existing Federal programs (including, but not limited to, the National Sea Grant Program) concerned with ocean pollution research and development and monitoring.

(d) **ACTION BY ADMINISTRATOR.**—The Administrator shall act upon each application for a grant or contract under this section within six months after the date on which all required information is received by the Administrator from the applicant. Each grant made or contract entered into under this section shall be subject to such terms and conditions as the Secretary deems necessary in order to protect the interests of the United States. The total amount paid pursuant to any such grant or contract may, in the discretion of the Administrator, be up to 100 percent of the total cost of the project or activity involved.

(e) **RECORDS.**—Each recipient of financial assistance under this section shall keep such records as the Administrator shall prescribe, including records which fully disclose the amount and disposition by such recipient of the proceeds of such assistance, the total cost of the project or activity in connection with which such assistance was given or used, the amount of that portion of the cost of the project or activity which was supplied by other sources, and such other records as will facilitate an effective audit. Such records shall be maintained for three years after the completion of such project or activity. The Administrator and the Comptroller General of the United States, or any of their duly authorized representatives, shall have access, for the purpose of audit and examination, to any books, documents, papers, and

33 USC 1705.

Grants and  
contracts.

Contract  
authority.

Recordkeeping.

Accessibility.

records of receipts which, in the opinion of the Administrator or of the Comptroller General, may be related or pertinent to such financial assistance.

33 USC 1706.

**SEC. 7. INTERAGENCY COOPERATION.**

The head of each department, agency, or other instrumentality of the Federal Government which is engaged in or concerned with, or which has authority over, programs relating to ocean pollution research and development and monitoring—

(1) shall cooperate with the Administrator in carrying out the purposes of this Act;

(2) may, upon written request from the Administrator or Director, make available to the Administrator or Director, on a reimbursable basis or otherwise, such personnel (with their consent and without prejudice to their position and rating), services, or facilities as may be necessary to assist the Administrator or the Director to achieve the purposes of this Act; and

(3) shall, upon a written request from the Administrator or Director, furnish such data or other information as the Administrator or Director deems necessary to fulfill the purposes of this Act.

33 USC 1707.

**SEC. 8. DISSEMINATION OF INFORMATION.**

The Administrator shall ensure that the results, findings, and information regarding ocean pollution research and development and monitoring programs conducted or sponsored by the Federal Government be disseminated in a timely manner, and in useful forms, to relevant departments, agencies, and instrumentalities of the Federal Government, and to other persons having an interest in ocean pollution research and development and monitoring.

33 USC 1708.

**SEC. 9. EFFECT ON OTHER LAWS.**

Nothing in this Act shall be construed to amend, restrict, or otherwise alter the authority of any Federal department, agency, or instrumentality, under any law, to undertake research and development and monitoring relating to ocean pollution.

33 USC 1709.

**SEC. 10. AUTHORIZATION OF APPROPRIATIONS.**

There are authorized to be appropriated to the Administration for the purposes of carrying out this Act not to exceed \$5,000,000 for the fiscal year ending September 30, 1979.

Approved May 8, 1978.

**LEGISLATIVE HISTORY:**

HOUSE REPORTS: No. 95-626 pt. 1 (Comm. on Science and Technology) and 95-626a pt. 2 (Comm. on Merchant Marine and Fisheries).

**CONGRESSIONAL RECORD:**

Vol. 123 (1977): Aug. 3, considered and passed Senate.

Vol. 124 (1978): Feb. 28, considered and passed House, amended.

Apr. 24, Senate agreed to House amendment.



APPENDIX 2

Great Lakes Water Quality Agreement of 1978

Article II and Annex 11

## GREAT LAKES WATER QUALITY AGREEMENT OF 1978

The following are quotations taken from the Water Quality Agreement.

### ARTICLE II

#### Purpose

The purpose of the Parties is to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem. In order to achieve this purpose, the Parties agree to make a maximum effort to develop programs, practices and technology necessary for a better understanding of the Great Lakes Basin Ecosystem and to eliminate or reduce to the maximum extent practicable the discharge of pollutants into the Great Lakes System.

Consistent with the provisions of this Agreement, it is the policy of the Parties that:

- (a) The discharge of toxic substances in toxic amounts be prohibited and the discharge of any or all persistent toxic substances be virtually eliminated;
- (b) Financial assistance to construct publicly owned waste treatment works be provided by a combination of local, state, provincial, and federal participation; and
- (c) Coordinated planning processes and best management practices be developed and implemented by the respective jurisdictions to ensure adequate control of all sources of pollutants.

### ANNEX II

#### SURVEILLANCE AND MONITORING

1. Surveillance and monitoring activities shall be undertaken for the following purposes:

- (a) Compliance. To assess the degree to which jurisdictional control requirements are being met.
- (b) Achievement of General and Specific Objectives. To provide definitive information on the location, severity, areal or volume extent, frequency and duration of non-achievement of the Objectives, as a basis for determining the need for more stringent control requirements.
- (c) Evaluation of Water Quality Trends. To provide information for measuring local and whole lake response to control measures using trend analysis and

cause/effect relationships, and to provide information which will assist in the development and application of predictive techniques for assessing impact of new developments and pollution sources. The results of water quality evaluations will be used for:

- (i) assessing the effectiveness of remedial and preventative measures and identifying the need for improved pollution control;
  - (ii) assessing enforcement and management strategies; and
  - (iii) identifying the need for further technology development and research activities.
- (d) Identification of Emerging Problems. To determine the presence of new or hitherto undetected problems in the Great Lakes Basin Ecosystem, leading to the development and implementation of appropriate pollution control measures.

2. A joint surveillance and monitoring program necessary to insure the attainment of the foregoing purposes shall be developed and implemented among the Parties and the State and Provincial Governments. The Great Lakes International Surveillance Plan contained in the Water Quality Board Annual Report of 1975 and revised in subsequent reports shall serve as a model for the development of the joint surveillance and monitoring program.

3. The program shall include baseline data collection, sample analysis, evaluation and quality assurance programs (including standard sampling and analytical methodology, inter-laboratory comparisons, and compatible data management) to allow assessments of the following:

- (a) Inputs from tributaries, point source discharges, atmosphere, and connecting channels;
- (b) Whole lake data including that for nearshore areas (such as harbours and embayments, general shoreline and cladophora growth areas), open waters of the Lakes, fish contaminants, and wildlife contaminants; and
- (c) Outflows including connecting channels, water intakes and outlets.

APPENDIX 3

Extract from Report of Subcommittee on Monitoring, COPRDAM, July 1979

Report of the Subcommittee on  
Ocean Pollution Monitoring

July 1979

Ferris Webster  
Subcommittee Chairman

E - X - T - R - A - C - T

Interagency Committee on Ocean Pollution Research and Development and Monitoring

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Federal Coordinating Council for Science, Engineering, and Technology

## EXECUTIVE SUMMARY

This is the final report of the Subcommittee on Monitoring of the Interagency Committee on Ocean Pollution Research and Development and Monitoring. The Subcommittee was charged with: (1) identifying existing and planned Federal ocean pollution monitoring programs and activities, (2) analyzing the extent to which they meet national needs and priorities, and (3) recommending changes in the Federal ocean pollution monitoring effort in order to satisfy more fully those needs and priorities.

### Definition and Purpose of Marine Pollution Monitoring

One of the first tasks undertaken by the Subcommittee was to define "marine pollution monitoring." After considerable discussion, the Subcommittee agreed that marine pollution monitoring is "the systematic, time-series observations of predetermined pollutants or pertinent components of the marine ecosystem over a length of time that is sufficient to determine the: (1) existing level, (2) trend, and (3) natural variations of the measured parameters in the water column, sediments, or biota." The basic purpose of monitoring marine waters is to obtain time-series data sets that can be used to detect significant change in the measured parameters, and to use this information to provide timely warning and other advice to management so appropriate actions may be taken.

### Current Level of Effort

A major difficulty encountered by the Subcommittee was differentiation of actual monitoring efforts (as defined by the Subcommittee) from the large array of research and development and monitoring programs and activities reported by the Federal agencies. This problem was partially resolved by dividing the programs and activities into two categories: (1) monitoring programs, and (2) monitoring-related programs. The former category is defined by a strict interpretation of the definition of marine pollution monitoring. The latter category consists of research activities that either have monitoring elements in them or develop data or techniques that support existing or future monitoring efforts. The Subcommittee determined that in FY 1978 the Federal monitoring effort was funded at \$17.8 million, whereas the total funding for all programs that contain elements of marine pollution monitoring, the so-called monitoring-related programs, adds up to \$59 million.

### Users of the Data

Users of information and data derived from marine pollution monitoring activities represent a wide spectrum of society. The greatest concern of marine pollution monitoring is to obtain information about changes to the marine environment that may be harmful to human health and/or marine ecosystems. Warnings must be issued and corrective actions have to be taken to ensure that contaminated seafood does not reach the marketplace.

Local governments, the general public, and certain industries rely on routine status reports of pollution conditions. For planning and regulatory agencies, current and accurate information on the health of ocean ecosystems is essential for good planning, for sound regulatory decisions, and for use in court proceedings. Particularly useful, but difficult to obtain, is reliable, quantitative information on trends in estuarine and ocean habitat conditions as impacted by man-induced alterations such as pollution. In international forums, the question is often raised: What is the total U.S. contribution to ocean pollution? A coordinated Federal ocean pollution effort could provide some reliable data on that issue. Finally, monitoring programs must be designed to serve as the nucleus of an early warning system to detect and, to the extent possible, permit control of the introduction of hazardous materials into the marine environment. High priority should be given to the monitoring and assessment activities required after spills of hazardous materials.

### Existing Programs

The Subcommittee identified 11 Federal departments and agencies that have mandates, responsibilities, and missions for ocean pollution monitoring and/or related research. These include: Department of Agriculture (DOA), Department of Commerce (DOC), Department of Energy (DOE), Department of Health, Education, and Welfare (HEW), Department of the Interior (DOI), Department of Transportation (DOT), Environmental Protection Agency (EPA), and Nuclear Regulatory Commission (NRC). Appendix A of the report summarizes the missions and mandates of these agencies. The total expenditure for Federal marine pollution monitoring was \$17.8 million in FY 1978. Of that amount, EPA accounted for over 40 percent, with \$3.7 million allocated to the Great Lakes Surveillance program, \$1.5 million for ocean dumping monitoring, \$0.7 million for Chesapeake Bay monitoring, \$0.4 million on the National Pollution Discharge Elimination System compliance, an estimated \$0.6 million (of the total \$11.3 million) on the direct marine part of the State and interstate agency support of monitoring activities, and \$0.6 million for the last downstream monitoring station in the National Water Quality Surveillance System (NWQSS), which is managed and operated by USGS. HEW's National Shellfish Sanitation Program of HEW was funded at \$2.3 million. Under this program, intermittent compilation of closures and openings of shellfish waters in the National Shellfish Register of Classified Estuarine Waters — at an estimated cost of \$60,000-75,000 per compilation — provides a very useful national quantitative measure of the status of estuarine habitat as affected by pollution. HEW spent another \$0.8 million to monitor pesticides and metals in fish. DOI funded \$2.7 million through Bureau of Land Reclamation for monitoring portions of the Outer Continental Shelf Environmental Studies Program, an estimated \$2.1 million through USGS to support the last downstream station in the National Stream Quality Accounting Network (NASQUAN), and \$0.8 through Fish and Wildlife Service for marine monitoring activities. The National Oceanic and Atmospheric Administration (NOAA) accounted for \$0.6 million, most of which was directed at monitoring in the Middle Atlantic Bight.

The Subcommittee found that relatively few Federal programs are conducted only to monitor pollution. Many of the programs have a finite life span, and many are site specific and of short duration. These do not provide the long-term data base needed to monitor the marine environment. The inventory of Federal programs relating to ocean pollution includes research and projects designed to monitor specific conditions and activities. In many of these it is difficult to identify program elements specifically relating to monitoring. An example is the NOAA New York Bight Project. This interdisciplinary research effort to understand the ecosystem of the Bight includes a planning objective to develop a feasible monitoring scheme. Thus, project funds are dedicated to monitoring, but are not identified as funded for monitoring. The problem is similar to NASA's satellite and the Army Corps of Engineers R&D programs. Also, major Federal freshwater monitoring programs, such as the EPA-funded NWQSS and the USGS-funded NASQUAN, do not monitor pollutant levels or effects in marine estuarine waters, but do monitor significant inputs of pollutants to marine waters from the Nation's streams and rivers. This monitoring of freshwater sources of pollutants contributes to the marine pollution monitoring effort, but it is difficult to identify the proportion of the funding that is applicable. The Subcommittee estimated \$59 million as the total Federal funding for all marine pollution-related programs and activities. This funding does not include vessel support for monitoring or monitoring-related activities. Appendix B of the report summarizes Federal funding for monitoring and monitoring-related projects in FY 1978, 79, and 80.

International marine pollution monitoring programs are in various stages of development and could benefit from increased U.S. leadership. Progress with such programs has suffered, because Member States have made inadequate commitments of resources needed to implement them. Improved U.S. foreign assistance would help meet objectives of international programs that can be viewed as extensions of U.S. domestic efforts. International sponsoring organizations include the International Council for Exploration of the Sea, International Atomic Energy Agency, the Intergovernmental Oceanographic Commission of UNESCO, and United Nations Environment Program.

### Analysis

In its review of Federal activities in marine pollution monitoring, the Subcommittee divided the activities into four basic categories. These are: (1) surveillance of pollutant inputs, (2) monitoring of the ecosystem, (3) monitoring of food resources, and (4) monitoring of spills. The Subcommittee examined for each category: the scientific and management questions addressed, the agencies carrying it out, the associated needs and problems, and users of the information. Review and analysis of the Federal monitoring efforts indicate that with the exception of an adequate concern for the long-term, chronic effects of coastal marine pollution, the present monitoring efforts respond to many of the most critical needs.



The deficiencies identified by the Subcommittee in its review of the four monitoring categories are: (1) the present effort is fragmented, and with that goes a presumption that duplications as well as gaps exist; (2) the present effort is reactive rather than anticipatory; (3) the current emphasis is on local problems — a regional focus is lacking; (4) monitoring efforts are independent of each other, with little exchange of information, technology, and data; (5) information is not readily available on all Federal and non-Federal marine pollution monitoring; (6) monitoring activities are generally site specific or pollutant specific; (7) an overall (national) rationale and strategy for monitoring is often lacking; (8) instrumentation development is lagging behind ocean pollution monitoring needs; and (9) national standards of accuracy are lacking for data-collection and analysis methodology, which diminishes the usefulness of the data.

### Conclusions and Recommendations

The Subcommittee on Monitoring concluded that, to meet the requirements of the National Ocean Pollution Research and Development and Monitoring Planning Act, it is necessary to establish a program incorporating all private, local, State, and Federal ocean monitoring activities. The proposed National Ocean Pollution Monitoring Program would have the following two goals:

Provide information necessary to assess the health of the U.S. coastal and Great Lakes ecosystems on a continuing basis; and

Provide information necessary to ensure present and future protection of human health, and the safe use and wise management of the U.S. coastal marine and Great Lakes resources.

The National Ocean Pollution Monitoring Program would encompass the four categories of pollution monitoring discussed previously, and a new category, the Regional Ecosystem Monitoring programs. The five categories are:

- o Surveillance of pollutant inputs,
- o Monitoring of marine ecosystems,
- o Monitoring of food resources,
- o Monitoring of hazardous materials spills, and
- o Monitoring regional ecosystems.

The Program would be implemented by designating a Federal agency to be responsible for its management and for providing staff for a management group. An interagency steering group would be formed to help

establish and implement the national program, and to provide advice and interagency coordination. Major tasks of the Program would include:

- o Assemble an inventory of private industry, local, State, and Federal programs of ocean pollution monitoring.
- o Designate coastal regions and develop and coordinate regional coastal monitoring plans by these regions, including the designation of the responsible lead agency. The regions included are: Great Lakes, northeast Atlantic coast, southeast Atlantic coast, Gulf of Mexico coast, southwest Pacific coast, northwest Pacific coast, and Alaska.
- o Establish regional and national monitoring data banks, and develop mechanisms to convert data into management use information. The data management aspects of marine pollution monitoring will be addressed by or incorporated into the plan for section 8 of Public Law 95-273.
- o Define regional marine pollution monitoring needs (those that are not already being met by existing programs) and implement new programs of marine pollution monitoring in the critical regions.
- o Implement the National Ocean Pollution Program in two phases: First, establish all monitoring and coordination functions of existing programs, including data and information distribution and the development of a regional monitoring plan. Second, implement new regional ecosystem monitoring programs that will use all information from existing programs and resources.

#### Regional Ecosystem Monitoring Program

This Program is one component of the National Ocean Pollution Monitoring Program that is specific for given regions. Basically, it is designed to fill the needs for long-term pollution assessment and surveillance in the regions. This would address two of the major deficiencies in the current programs: (1) lack of long-term monitoring of chronic effects and (2) lack of regional focus. Implementation of the program will depend on the following criteria:

- o Degree of pollutant stress in the region;
- o State of local concern and support;
- o Availability of pollution-related research knowledge in the given area;
- o Contributing programs (local, State, and Federal); and
- o Priority of the local concern viewed from a national perspective.

The Subcommittee recommends that federally funded and managed programs of coastal and Great Lakes pollution monitoring be established for each highly stressed region of the United States. It also recommends that detailed monitoring plans be developed regionally and that Federal agencies and States establish coordinated monitoring programs for specific coastal regions and discrete bodies of water. Coordinated regional plans and new monitoring activities under the National Program should be implemented in FY 1981.

The Subcommittee concluded that the greatest concerns about pollution and, consequently, most support for pollution-related research and monitoring activities exist along the northeast Atlantic coast, in the Great Lakes region, and along the California coast. In California, local and State organizations have extensive monitoring activities; in the northeast Atlantic coast and Great Lakes regions there is a more concentrated Federal involvement in pollution-related research and monitoring efforts. The present annual budget from local, State, Federal, and Canadian sources for pollution-related research and monitoring activities in the Great Lakes exceeds \$8 million, about half of which is Federal support. The combined local, State, and Federal budget for these activities in the northeast Atlantic coast exceeds \$13 million, and again more than half represents Federal support. Because of the critical pollutant stress conditions, public and institutional support, and the existence of a sufficiently complete research base, the new monitoring efforts should be initially in the northeast Atlantic coast and Great Lakes region.

## I. INTRODUCTION

### A. The Ocean Pollution Planning Act

In spring 1978, Congress enacted the National Ocean Pollution Research and Development and Monitoring Planning Act (Public Law 95-273). In reviewing the importance of the coastal and offshore oceans to national well-being, the Congress found that the United States increasingly will be forced to rely on ocean resources. This increased use of the marine environment and its resources can have a profound short-term and long-term impact on the ability of the ocean and coastal systems to provide the needed resources. The ability to use the oceans wisely depends directly on the knowledge decisionmakers have about pollution-related consequences of such activities. Unfortunately, while the Federal Government supports and undertakes extensive ocean pollution research, development, and monitoring that can yield such knowledge, these activities often are uncoordinated and result in potential duplication. The Congress concluded that there was a need to develop a comprehensive Federal Plan that would better identify the needs for ocean pollution research, development, and monitoring and demonstrate how the Federal effort was organized to meet these needs in a timely and efficient way. The overall goal of the Plan is to better assure that the Federal program for research, development, and monitoring provides the knowledge needed to make better decisions on ocean use activities that may cause pollution.

Public Law 95-273, the "National Ocean Pollution Research and Development and Monitoring Planning Act of 1978," has three basic purposes:

1. Establish a comprehensive 5-year Plan for Federal ocean pollution research and development and monitoring programs in order to provide planning for, coordination of, and dissemination of information on such programs within the Federal Government;
2. Develop the necessary base of information to support, and to provide for, the rational, efficient, and equitable use, conservation, and development of ocean and coastal resources; and
3. Designate the National Oceanic and Atmospheric Administration (NOAA) as the lead Federal agency for preparing the plan referred to in paragraph (1) and to require NOAA to carry out a comprehensive program of ocean pollution research and development and monitoring under the plan.

Section 4 of this Act specifies in detail the elements that the "comprehensive Federal Plan relating to ocean pollution" should contain. The key elements within this section are:

1. Assessment and ordering of national needs and problems. Within this area, priorities for the national needs and problems must be established, and, if these priorities should change in subsequent revisions of the Plan, a detailed explanation should be given.

2. Assessment of the existing Federal capability. This should include (a) a detailed listing of all existing Federal programs including a catalog of Federal personnel, facilities, vessels, and other equipment, and detailed description of existing goals and costs of the program, including a categorical breakdown; and (b) an analysis showing how the programs will meet the national priorities.

3. Policy recommendations. These may include, but are not limited to, (a) changes in the goals; (b) suggested increases or decreases of funding; (c) proposals for interagency cooperation, including pooling of resources; and (d) suggested legislation.

4. Budget review. This should contain a description of actions to indicate how interagency cooperation and coordination are accomplished.

#### B. Organization of the Effort

The approach to implement the legislation has been to involve to the maximum extent possible all concerned Federal departments and agencies in the development of the 5-year Plan. In June 1978 the Director of the President's Office of Science and Technology Policy chartered the Interagency Committee on Ocean Pollution Research and Development and Monitoring (COPRDM) under the aegis of the Federal Coordinating Council for Science, Engineering, and Technology.

The Interagency Committee, chaired by the Deputy Administrator of NOAA, with EPA's Assistant Administrator for Research and Development as Vice Chairman, is made up of policy-level representatives from the Federal agencies and departments that have programs relating to ocean pollution and a representative from the Office of Management and Budget. The departments and agencies represented are:

- o Council on Environmental Quality (CEQ)
- o Department of Agriculture (DOA)
- o Department of Commerce (DOC)
- o Department of Defense (DOD)
- o Department of Energy (DOE)
- o Department of Health, Education, and Welfare (HEW)
- o Department of the Interior (DOI)
- o Department of Transportation (DOT)
- o Environmental Protection Agency (EPA)
- o National Aeronautics and Space Administration (NASA)

- o National Science Foundation (NSF)
- o Nuclear Regulatory Commission (NRC)

The Interagency Committee formed four working subcommittees to develop specific portions of, and make recommendations for, the comprehensive 5-year Federal Plan. The subcommittees are:

National Needs and Problems — responsible for developing the statement of national needs and problems that forms the cornerstone for policy recommendations regarding changes in the overall Federal effort during the 5-year Plan period of FY 1979 through FY 1983.

Research and Development — responsible for identifying all existing Federal research programs and facilities related to ocean pollution in order to analyze the extent to which the present programs meet national priorities, and to make recommendations to the parent committee regarding changes necessary to satisfy those priorities more fully.

Monitoring — responsible for identification and analysis of Federal monitoring programs in a manner similar to the role of the Research and Development Subcommittee.

Data — responsible for analyzing the current Federal capability to respond to the requirements of Section 8 of the Act.

The working Subcommittees comprise members designated by members of the parent committee to assure broad participation in the substantive program and policy analysis work. The task of each subcommittee is to prepare a comprehensive report on its respective area. This document is the final report of the Interagency Subcommittee on Monitoring.

The purpose of this report is to review and analyze the existing Federal marine pollution monitoring effort; evaluate the adequacy of this effort in meeting national needs and problems, as these are seen from the point of view of these agencies; and formulate a national ocean pollution monitoring program based on:

1. National needs, problems, and priorities identified by the interagency COPRDM;
2. Agency authorities to monitor ocean pollution;
3. Agencies' current and planned programs; and
4. Information requirements sufficient to determine quality and trends in marine environment.

## Definition of Basic Terms

To address the subject of marine pollution monitoring, it was first necessary to establish a common base of references. This required careful definition of basic terms. The following definitions and considerations were used in the preparation of this document.

Marine Pollution. Marine pollution is a condition brought about directly or indirectly by human activities in the marine environment (including estuarine waters and the Great Lakes) that may result in hazard to human health, harm to living resources and ecosystems, hindrance to fishing and other marine activities, impairment of quality for use of seawater, and reduction of recreational and aesthetic amenities.

Marine Pollution Monitoring. Marine pollution monitoring is the continual systematic, time-series observation of predetermined pollutants or pertinent components of the marine ecosystem over a period sufficient to determine the (1) existing level, (2) trend, and (3) natural variations of measured components in the water column, sediments, or biota.

Purposes for Monitoring Marine Pollution. The basic, overriding purpose for monitoring marine pollution is to obtain time-series data sets that can be used to detect significant change in the environment, and to use this information to provide timely warning and other advice to management so appropriate actions may be taken.

Specific uses of monitoring data that may vary depending on the monitoring requirement are:

- o Establish input levels and dispersion characteristics of pollutants.
- o Assess safety of fish and shellfish for human consumption.
- o Assess water quality to determine potential hazards to human health and the marine biota.
- o Provide surveillance on the effects and fates of pollutants on selected components of the ecosystem.
- o Assess the effectiveness of measures taken to reduce marine pollution.

Marine Pollution Research. Marine pollution research involves the collection of data for the determination of abundance, concentration, and distribution of pollutants (and any other components of the ecosystem, provided these determinations are part of a marine pollution-related program), their dynamics, effects, fates, pathways, processes, and causal relationships to obtain fundamental understanding, a baseline, or practical applications relative to these phenomena.

Marine Pollution Monitoring Versus Marine Pollution Research. Marine pollution monitoring and research are mutually supportive. Monitoring, i.e., systematic, time-series observations of phenomena to determine their existing level, trend, and natural variations, may be part of a research strategy. On the other hand, to initiate operational monitoring, research programs are needed to determine what components of the ecosystem or what pollutants should be observed, what should be the frequency of observations, how long a phenomenon should be observed and in what area, and how the observations should be interpreted.

Where extensive research information exists in an area, monitoring program design is benefited, yielding more cost-effective strategies, greater selectivity of sensitive parameters, and realistic spatial and temporal sampling schemes. Where extensive monitoring precedes research, monitoring information suggests good working hypotheses regarding cause-and-effect relations that can be tested by follow-on research programs.

For the purposes of this report, marine pollution monitoring implies operational monitoring and does not encompass programs composed primarily of basic environmental research. Activities that are motivated primarily by research needs, but are precursors or in some other way directly related to monitoring, are classified separately in this report as monitoring-related programs.



## VII. SUMMARY AND RECOMMENDATIONS

The monitoring efforts currently being made or sponsored by the Federal Government have been analyzed according to four categories of activities:

- (1) the surveillance of pollutant inputs,
- (2) the monitoring of more ecosystems,
- (3) the monitoring of food resources, and
- (4) the monitoring of hazardous materials spills.

The analysis indicates that with the exception of the responsibility for the monitoring of marine ecosystems, Federal marine pollution programs are responsive to high-priority national needs. There does, however, appear to be a lack of concerted effort for assessing the health of ecosystems.

Principal criticism of the Federal effort focuses on the lack of centralized planning, coordination, accountability, and information retrieval. Other deficiencies involve less than adequate efforts to develop effective monitoring strategies, a standard bioassay methodology, a more cost-effective measurement and analysis technology, and to establish stringent quality assurance in the technology of measurement and analysis.

The major problem that this review of monitoring programs has identified is that a large number of discrete Federal, State, and local monitoring programs exist, each often planning, operating, measuring, and using data independent of and unaware of the other's existence.

To improve the monitoring effectiveness of the Nation's estuarine and coastal waters, all these monitoring efforts should be a part of a National Ocean Pollution Monitoring Program, and should respond to, or be part of, a regional monitoring strategy or plan. The following recommendations address this issue:

### Establishment of a Federal Monitoring Program

- o Establish federally funded and managed programs of ocean pollution monitoring for each highly stressed U.S. coastal region.
- o Federal agencies and States should coordinate their monitoring programs for specific coastal regions and discrete bodies of water.
- o Detailed monitoring plans should be developed regionally, because of the unequal coastal population density and industrial development, and because of the regionally different weather and oceanic climate.

The following regional divisions should be considered: Great Lakes, northeast Atlantic coast, southeast Atlantic coast, Gulf of Mexico coast, southwest Pacific coast, northwest Pacific coast, and Alaska coast. The regional plans and their implementation should be approved and coordinated by a management group (e.g., NOAA, EPA) under the advisement of an Interagency Steering Committee.

- o Coordinated regional plans and new monitoring activities, as the first phase of the National Ocean Pollution Monitoring Program, should be implemented in FY 1981. Because of the critical pollutant stress conditions, public and institutional support, and the existence of a sufficiently complete research base, the initial new monitoring efforts should be in the northeast Atlantic coast and Great Lakes regions.

#### Establishment of a Federal Management and Coordination Structure

To remedy problems related to program emphasis, a strong technical management structure on a Federal level needs to be implemented. To support this, the following are recommended:

- o Establish a management information system and a central data bank for all of the existing local, State, and Federal programs of marine pollution monitoring, and their data.
- o Establish an Interagency Steering Committee to advise on the development of a National Ocean Pollution Monitoring Program.
- o Establish regional centers to be responsible for the synthesis of monitoring information and data products into "management use" information.
- o Establish guidelines for quality controls and standard methods for monitoring data acquisition and analysis technology. Federal data and analysis technology relevant to marine pollution should meet these guidelines. Federal support of relevant academic and industry research and monitoring should require adherence with the guidelines.
- o Standardize monitoring data acquisition formats.
- o Increase monitoring and research efforts by the Federal agencies to develop, test, and adopt standard marine bioassay methods.
- o Increase Federal efforts to advance monitoring instrumentation technology (sensor development) and analysis methodology.

#### APPENDIX 4

Great Lakes Pollution Monitoring Workshop Objectives, Approach, Agenda,  
Questions, Definitions, Invitees, Participant List

## WORKSHOP APPROACH; Substance and Process

In addition to the mailed materials, participants were provided with:

- Working definitions of monitoring, research, etc.
- Comments on GLISP as submitted to the IJC Science Advisory Board
- Report of Traverse City Conference on Marine Pollution Problems
- P.L. 95-273 -- The National Ocean Pollution Research and Development and Monitoring Planning Act of 1978
- NOAA organization chart
- Hughes, Kent. Managing Marine Pollution Data and Information
- Great Lakes Fishery Commission. A Joint Strategic Plan for Management of Great Lakes Fisheries
- Two additional documents were reviewed by a few participants:
  - Canada-Ontario Agreement on Great Lakes Water Quality
  - Ongley, Edward. Information Requirements for Water Quality Management: A Reflective Appraisal of Present Practices and Future Requirements

## Plenary Sessions

The plenary sessions were scheduled to provide briefings for participants, to allow opportunity for small group sessions to report their findings to the entire conference for discussion, and finally, to identify points of consensus and priorities on monitoring programs and requirements in the Great Lakes Basin. The content of each session was as follows:

### Session 1:

- A review of workshop objectives, products to be developed, use to be made of results
- Workshop process and logistics
- Briefing on P.L. 95-273: The Federal Ocean Pollution Monitoring Planning Act and NOAA's role in developing the plan
- Key monitoring concerns identified at the NOAA sponsored Great Lakes Pollution, Research and Development and Monitoring Needs Workshop held at Traverse City, Michigan in June of 1980
- Opportunity for participants to state other information needs or to obtain clarification of information presented in above briefings

Presentations were made as follows:

1. Commissioner Charles Ross: Introductions, Overview

2. Charles Gunnerson, NOAA: Review of Workshop Objectives
3. George Peter, NOAA: Review of P.L. 95-273 & Interagency Committee Findings
4. Russell Moll, University of Michigan: Review of Findings from Traverse City Workshop
5. Mimi Becker, Great Lakes Tomorrow: Review of Workshop Process, Logistics

The Second Plenary Session was held at the close of the first day to present and review the results from small group sessions.

The Third Plenary Session, held early on the second day of the conference had two objectives:

- to review the summaries from the small group session on problem areas of present Great Lakes monitoring programs
- to provide participants with specific information regarding existing Great Lakes monitoring mandates and programs

A panel provided information about major monitoring programs as follows:

- The Great Lakes International Surveillance Plan (GLISP) -- Monitoring Requirements Under the 1978 U.S.-Canadian Great Lakes Water Quality Agreement

Dr. Douglas Haffner, IJC Great Lakes Regional Office

- Environmental Protection Agency Monitoring in the Great Lakes

Robert Bowden, Region V USEPA

- Monitoring Under the Canada-Ontario Agreement

Dr. Donald Williams, CCIW

- Monitoring for Rehabilitation and Restoration of the Great Lakes Fishery

Dr. Joseph Kutkuhn, U.S. Fish & Wildlife Service

- Ecosystem Monitoring in the Great Lakes

Dr. Wayland Swain, Grosse Ile Laboratory, USEPA

Questions and a general discussion followed.

The need to address the managerial and political implications of monitoring in the Great Lakes was discussed by Commission Charles Ross at the workshop luncheon:

"The Politics and Economics of Great Lakes Ecosystem Quality Monitoring."

The Fourth Plenary Session, held the last day of the workshop was conducted to present findings from the previous day's work sessions, to identify points of consensus

and priorities for Great Lakes Basin pollution monitoring programs, and to develop strategies for implementation of the monitoring programs. A facilitated discussion session was conducted by Commissioner Ross and Great Lakes Tomorrow. Recommendations were put on newsprint, consensus points noted and key discussion questions, answers and preferences noted. Participants began with printed summaries of the previous day's work group findings. Results are noted in the following sections of this report.

Work Group Sessions: Much of the "work" was accomplished during two extended sessions. Participants were arbitrarily assigned to one of three work groups to ensure that a variety of perspectives and user groups were represented in each group. Great Lakes Tomorrow facilitators provided "neutral" discussion leadership using a modified "nominal group" process to be sure that: (a) discussion addressed issues pertinent to achieving workshop objectives; (b) all participants contributed to the group discussion; and (c) results of the work group's findings/recommendations were accurately recorded. Newsprint, records, tapes and an assigned Recorder maintained the record. Following each work session, GLT prepared summaries, integrated results from each of the three groups, and had them typed, printed and distributed prior to the next session. Results from one work session were used as baseline information for the following session.

#### Work Session A

The objectives of this session were to obtain information about how each participant used Great Lakes monitoring data and the problem areas or needs, if any, with respect to that data. Each participant was asked to provide a short briefing and then the group continued to identify problem areas. Representative questions included:

- Is the existing monitoring system useful?
- Is the right data being collected? If not, what else is needed?
- Do monitoring programs provide you with the right information in a usable form? If not, how should data be packaged?
- What problems are not being addressed by present monitoring programs?
- How do you determine your data requirements?
- What do you use the data/information for?

- If you do not have the data you need, what do you see as the reason(s)?
- Are there any other problem areas you are aware of?

### Work Session B

Following the Third Plenary Session presentation and discussion of existing Great Lakes Monitoring and Surveillance Programs under the U.S.-Canadian Water Quality Agreement of 1978 and the Great Lakes Fishery Commission's Rehabilitation and Restoration Program, participants were asked to evaluate the adequacy of GLISP and Ecosystem Monitoring programs, to identify alternatives for the solution/mitigation of problems and needs, including any need to reallocate monitoring priorities or resources, revise management programs or institutional arrangements.

Representative questions addressed included the following:

- Are you satisfied with the coordination of data, your access to it, knowledge of what data is available, its distribution, other management areas?
- Are there local/regional needs that cannot be met by the existing system?
- Is GLISP an adequate regional monitoring program? Are the insitutional arrangements effective?
- Does GLISP and/or other monitoring programs meet the needs of ecosystem management, i.e., fisheries management, other multiple use considerations? What, if any, improvements are needed?
- Considering the competition for resources:
  - Are all the current monitoring programs/information useful?
  - What programs do you really need?
  - If monitoring resources are cut, what is the least monitoring you can get by with? What programs become priority in this case?

Additional questions raised by participants were also discussed.

# GREAT LAKES TOMORROW

P.O. Box 1935 • Hiram, Ohio 44234 • (216) 569-7015  
45 Charles Street East • 6th Floor • Toronto, Ontario M4Y 1S2 • (416) 961-6830

*An International Organization to Improve Citizen Participation in Great Lakes Decisions*

January 9, 1981

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The Great Lakes Pollution Monitoring Workshop, discussed with most of you last fall, has been rescheduled for February 11, 12, and 13, 1981 at the Michigan League, University of Michigan, Ann Arbor. As a key user of Great Lakes monitoring data, you can make an important contribution to this invitational working group. The workshop is sponsored by the Marine Pollution Assessment Office of the National Oceanic and Atmospheric Administration (NOAA). The Workshop Chairman is Commissioner Charles Ross, United States Section, International Joint Commission. Co-Chairman is Charles G. Gunnerson, NOAA Technical liaison for the project. Great Lakes Tomorrow is providing organizational and technical support for the workshops and will be responsible for facilitating the work group sessions.

Recent legislation assigns to the National Oceanic and Atmospheric Administration (NOAA) the responsibility for federal planning for marine and Great Lakes pollution research and monitoring. The latter function has been the focus of a series of regional workshops held throughout the United States. This workshop will fulfill the role of providing substantive advice to NOAA regarding what the Great Lakes community feels their program should include. Specific workshop objectives include:

- 1) To determine whether existing Great Lakes Monitoring programs are providing local and regional agencies with the information they need and to identify problem areas and need for change.
- 2) To assess the existing data management system (coordination, collation, storage, synthesis, distribution and access, assessment, use, etc.) and identify options for improvement, including institutional change.
- 3) To establish priorities for monitoring programs in view of increasing competition for resources.
- 4) To identify and assess alternative strategies for Great Lakes monitoring operations and responses which will meet local and regional information needs and uses.



Workshop products will include: A description of present uses of monitoring data in the Great Lakes; identification of regional pollution monitoring and information needs; existing barriers to meeting those needs; and scientific, technological and institutional recommendations for Great Lakes pollution monitoring and assessment operations.

The WORKSHOP will be held at the Michigan League which is located on South Ingalls on the Central Campus of the University. LODGING has been reserved at THE BELLTOWER (rates for singles, \$28.00-\$33.00) which is located on Thayer, about one block west of The League. A limited amount of travel and subsistence support will be available to participants who are NOT US Federal Government employees. If you require such support please indicate on the reservation form. PLEASE take time to complete the attached reservation and information form and return it to Mimi Becker at the Hiram address no later than January 31. Please indicate your desire for room reservation on the form, but send your room reservation card directly to the BELLTOWER.

Please review the attached materials to assist you in preparation for the workshop. In this packet you will find the following:

1. Workshop reservation form...complete and return to GLTn
2. General Workshop Information and Directions
3. A map of the Campus of the University of Michigan, Ann Arbor
4. The Working Agenda including WORK SESSION DISCUSSION QUESTIONS
5. The Summary and Overview of the proposed International Great Lakes Surveillance Plan presently under consideration by the International Joint Commission
6. A brief summary of comments about the other regional Ocean Pollution Monitoring Workshops held to date
7. The list of Workshop Invitees

ASSIGNMENT: We are asking that each workshop participant come prepared to present a short (5-10 minute) informal briefing to his/her Workgroup Session A which will provide the basis for discussion in identification of problems and barriers to effective monitoring and to identify specific needs for improvement. We ask that you also indicate which monitoring activities are effective and are meeting your needs. You may wish to review the WORK SESSION DISCUSSION QUESTIONS attached to the Agenda in preparation. If you are aware of any relevant information which would be of interest to fellow workshop participants, please inform us so that we may attempt to obtain copies. If you have additional questions or concerns which you believe should be addressed, please so indicate in the space provided on the attached Reservation Form.

The results of this workshop will affect the development of monitoring programs in the Great Lakes. The funding and allocation of resources for those programs, and the needs of data users must be clearly identified. We are looking forward to working with you. If you have questions, they may be directed to Mimi Becker or Jim Cowden at 216-569-7015 or to Charles G. Gunnerson at 303-407-6892 (NOAA Environmental Research Lab in Boulder, Colorado). (FTS 320-6387)

Sincerely,



Mimi Becker, President  
Great Lakes Tomorrow



Charles G. Gunnerson,  
Environmental Engineering Advisor  
National Oceanic and Atmospheric Adm.

Enclosures: As above

## WORKSHOP OBJECTIVES

To provide advice to the National Oceanic and Atmospheric Administration planning process regarding Great Lakes Monitoring Program Needs. Specific objectives are:

- 1) To identify monitoring information users and to determine whether existing Great Lakes Monitoring programs are providing local and regional agencies with the information they need and to identify problem areas and need for change.
- 2) To assess the existing data management system (coordination, collation, storage, synthesis, distribution and access, assessment, use, etc.) and identify options for improvement, including institutional change.
- 3) To establish priorities for monitoring programs in view of increasing competition for resources.
- 4) To identify and assess alternative strategies for Great Lakes monitoring operations and responses which will meet local and regional information needs and uses.

## WORKSHOP PRODUCTS

A final report, including all workgroup and plenary session findings and a synthesis of those identified as priority items will be prepared and provided to NOAA for use in their planning and to all workshop participants. The report will include :

- 1) A listing ( inso far as possible) present monitoring data users
- 2) A description of present uses of monitoring data in the Great Lakes
- 3) A description of regional pollution monitoring and information needs and existing barriers to meeting those needs
- 4) Scientific, technological and institutional recommendations for Great Lakes pollution monitoring and assessment operations that would address identified needs and priorities.

Additional objectives and information will be included based on needs and interest of workshop participants.

## GREAT LAKES REGIONAL POLLUTION MONITORING

### WORKSHOP

February 11-13, 1981

NOAA - OFFICE OF MARINE POLLUTION ASSESSMENT

GREAT LAKES POLLUTION MONITORING WORKSHOPS

AGENDA

February 11 - 13 , 1981

Michigan League

Ann Arbor, Michigan

Chairman: Charles Ross, Commissioner  
United States Section  
International Joint Commission  
Washington, D.C.

Co-Chairman: Charles G Gunnerson  
NOAA: Office of Marine  
Pollution Assessment  
Rockville, Md.

WEDNESDAY, FEBRUARY 11, 1981

11:00 am PLENARY SESSION I:

Welcome, Introductions, Overview.....Ross

11:10 am Review of Workshop Objectives, Use of Results, Regional Reports,  
Perspective.....Gunnerson

11:30 am Workshop Process, Logistics, Handouts, Resources.....Becker

11:40 am PL 95-273: The Federal Ocean Pollution Monitoring Plan and NOAA's Role  
L.R. Swanson, NOAA

11:55 am Review of Great Lake Pollution Research Needs identified at Traverse City  
Ocean Pollution Research Conference, June 1980.....Russ Moll, Michigan  
Sea Grant

12:10 pm Questions for Clarification. Identification of additional Workshop  
Objectives, Products.....Participants  
Assign Work Groups..... Becker

12:30 pm LUNCH-- Michigan League Cafeteria, (on your own). Eat in  
reserved dining room.

1:30 pm WORK GROUP SESSION A: PROBLEM IDENTIFICATION .....Facilitator: Great Lakes  
Tomorrow

Task: To identify problem areas and unmet needs in the present Great Lakes  
monitoring programs. Each work group member is asked to provide a short  
briefing from his/her own perspective as a user of monitoring data.  
Questions provided in advance may serve as a basis for the briefing and  
to begin the discussion. See Attachment : 'Work Session Questions.

2:45 pm Coffee Break

3:00 pm Continue presentations, Work Session discussions

4:30 pm PLENARY SESSION II

Present highlights of Work Session Findings

5:00 pm Adjourn....Dinner on your own

Evening Session: Workshop Facilitators, recorders, Chairman summarize and produce  
Work Session A Product and supporting documentation.

THURSDAY, FEBRUARY 12, 1981

8:30 am PLENARY SESSION III.....Charles Ross

Review and Summarization of Problem Areas with Great Lakes Monitoring.  
from Work Group Session A.....Great Lakes Tomorrow.  
Questions for clarification

8:45 am PANEL: Perspectives and Overview: PRESENT GREAT LAKES MONITORING MANDATES  
Chairman: Commissioner Ross

1..MONITORING UNDER THE CANADA-UNITED STATES 1978 WATER QUALITY AGREEMENT:.  
THE GREAT LAKES INTERNATIONAL SURVEILLANCE PLAN: Dr. Douglas Haffner.  
IJC Regional Office  
Windsor, Ontario

Questions for clarification.....participants

9:15 am 2. ENVIRONMENTAL PROTECTION AGENCY MONITORING IN THE GREAT LAKES

Questions for clarification.....participants US EPA REGION V  
Chicago, Ill.

9:45am 3..MONITORING UNDER THE CANADA ONTARIO-AGREEMENT: Dr Donald Williams.  
Surveillance Program Manager  
Canada Center for Inland Waters

Questions for clarification.....participants Burlington, Ont.

10:15 am COFFEE BREAK

10:30 am Continue PLENARY SESSION III

4..MONITORING FOR REHABILITATION AND RESTORATION OF THE.  
GREAT LAKES FISHERY, ASSESSMENT OF GREAT LAKES Dr Joseph Kutkuhn, Director.  
FISHERY PROGRAMS: U.S Fish & Wildlife Service.  
Questions for clarification.....participants Great Lakes Fishery Laboratory  
Ann Arbor, Michigan

11:00 am 5..ECOSYSTEM MONITORING IN THE GREAT LAKES:RESEARCH NEEDS,.  
PUBLIC HEALTH IMPLICATIONS.....Dr. Wayland Swain

Questions for clarification..... participants Large Lakes Research Labs  
USEPA, Grosseille, Michigan

11:30 am GENERAL DISCUSSION ... Panelist to Panelist, Participants, etc.

12:00 noon CONFERENCE LUNCHEON... ALL INVITED, MICHIGAN LEAGUE

LUNCHEON SPEAKER: Comissioner Charles Ross:"The Politics and Economics  
Of Great Lakes Ecosystem Quality Monitoring"

Questions

1:30 pm WORK GROUP SESSION B: MONITORING ALTERNATIVES

Task: Consider adequacy of present system, alternatives for solution/mitigation  
of problems identified in Work Session A and Panel Discussion, including  
reallocation of monitoring priorities, resources, revision of management  
programs and institutional change. Keep freshwater quality, interna-  
tional considerations in mind. See specific questions attached.

2:45 pm COFFEE BREAK

THURSDAY, FEBRUARY 12, 1981 con't.

3:00 pm Continue WORK GROUP SESSION discussion  
Identify preliminary recommendations, priorities

4:30 pm PLENARY SESSION IV.....Ross

Present highlights of work group findings to date

5:00 pm ADJOURN

Evening Session : Workshop facilitators, recorders, Chairman summarize and produce.  
WORK SESSION B product and supporting documentation

Homework for participants as need identified.

FRIDAY, FEBRUARY 13, 1981

8:30 am PLENARY SESSION V.....Ross

Review of Alternatives, Recommendations from Work Session B...Great Lakes Tomorrow

Questions for clarification, discussion..... Participants

9:00 am WORK GROUP SESSION C: DEVELOPMENT OF MONITORING PRIORITIES, STRATEGIES FOR  
IMPLEMENTING THEM

Task: Working from needs, alternatives, existing priorities, identify  
priorities for desired Great Lakes Basin Pollution Monitoring Program(s)  
(High, Medium, Low). Develop strategies for implementation, considering  
cost/benefit, freshwater requirements, current international institutions/  
agreements, local needs, regional needs, and the role of NOAA. See  
Attached quesitons for Work Group Session C)

10:30 am COFFEE BREAK

10:45 am WORK GROUP SESSION.. Develop Summary and Recommendations

11:30 am PLENARY SESSION VI.....Ross

Facilitator: Becker.....Recorders: Cowden and Timms

Presentation of Key Findings and Recommendations

Synthesis of Work Group Priorities

Discussion, Points of Consensus

Overview and Summary .....Ross

1:00 pm WORKSHOP ADJOURNS

Workshop Arrangements, technical support,  
discussion facilitators provided by  
Great Lakes Tomorrow.  
Box 1935  
Hiram, Ohio 44234

## QUESTIONS FOR DISCUSSION

This conference and workshop is being held to obtain your views on the adequacy of pollution monitoring and information management in the Great Lakes. Our results will be far more significant if you are prepared to share your views on the existing system and problem areas with other participants. Feel free to ask other members of your organization for their suggestions to bring to the discussion. The following questions are suggested as a place to begin:

### WORK SESSION A - Problem Identification

From your perspective as a user of monitoring data/information -

- is the existing monitoring system useful?
- is the right data being collected? If not, what is needed?
- Do monitoring programs provide you with the right information in a usable form? If not, how should data be packaged?
- what problems are not being addressed?
- how do you determine your data requirements?
- what do you use the data/information for - decision-making?
- if you do not have the data you need, what do you see as the reason?

### WORK SESSION B - Institutional/Management Arrangements

- are you satisfied with the coordination of data, your access, knowledge of what's out there, distribution, other management areas?
- are there local/regional needs that cannot be met by the existing system?
- do we need a regional management program? Other institutional arrangements?
- do present monitoring systems meet the needs of ecosystem management, i.e., fisheries, other multiple use considerations?

Considering the competition for resou

WORK SESSION B - Cost-effectiveness

Considering the competition for resources -

- are all current monitoring programs/information useful? Excessive?
- what programs do you really need?
- what is the least you can get by with? Priority?
- is the wrong data being produced? Is there too much useless data?

## ADDITIONAL QUESTIONS POSED BY INVITEES TO GREAT LAKES POLLUTION MONITORING WORKSHOP

### Problem Identification - Monitoring

- do traditional parameters identify all contaminant forms which are environmentally significant?
- to what extent must existing monitoring programs be modified to make them sensitive enough to detect response of watershed systems to remedial programs?
- do water quality objectives lead to emphasis in surveillance programs on single element compliance, rather than consideration of multiple factors and their interaction?
- to what extent do existing monitoring programs identify contaminants in association with suspended solids - transport, etc.?
- what are the needs for multi-media monitoring to identify cross impacts? i.e., air pollution control technologies add to water pollution
- what significant pollution problems are not presently being monitored? i.e., attempts to stabilize waste treatment plants result in uncontrolled discharges.
- what new monitoring activities are needed:
  - modification of programs
  - program coordination
  - information dissemination
  - emphasis on biotic monitoring
  - new programs
  - synthesis
  - change of pollutant emphasis
  - demographic, land and resource use

### GLISP - Great Lakes International Surveillance Plan

- does GLISP measure the health of the boundary waters of the Great Lakes Basin ecosystem? If not, whose responsibility is it to provide such assessment?
- GLISP identifies existing programs. Are they the wrong ones? Should the money be spent differently?
- to what extent does GLISP respond to the necessity of examining boundary waters in an ecosystem context as required under the 1978 WQ Agreement?

### Technology

- do existing surveillance strategies and parameter selection lag behind the state-of-the-art?
- is there new technology that could support monitoring programs and improve cost-efficiency?
- can remote sensing by satellite be usefully incorporated into current monitoring programs (temporal and spatial coverage)?



## Management

- would a central data depository/distribution facility in the region be useful?
- are poorly coordinated or contradictory requirements being imposed on monitoring programs due to defects in the institutional structure?
- to what extent do current monitoring programs address the problems of large area management?
- is data being synthesized into "useful" information directed toward specific management concerns? How can it be?
- how can appropriate information sets be deployed for use within a management framework that should be focused on Great Lakes Basin ecosystem management strategies?
- how can existing programs - local, industry, state and federal be incorporated into a region-wide monitoring program? Will ecosystem monitoring require a different structure?
- can we identify appropriate criteria for management models that link Great Lakes water quality with sources - point, non-point, land use, etc.?

## Workshop Participation

Potential participants were identified by category of interest, and to the extent possible, by name, at a first planning meeting on July 31, 1980 by the NOAA Project Manager, the conference co-chairman, and the GLT staff. The primary criterion was that invitees be principally users of monitoring data rather than generators. Additional organization, functions and individual names were added in subsequent weeks. When the workshop was rescheduled from October to February, 1981, recruiting was focussed on those individuals expressing interest in the original date plus certain alternatives and additions. The original list of invitees included data users in local, state, federal, regional and international agencies, Canadian federal and provincial agencies, including management and research interests. Private sector interests identified included industry, electric utilities, consulting and engineering firms, public interest and environmental groups, and academic and research facilities.

Industry and other private sector groups were underrepresented at the Ann Arbor workshop, in part because many had participated in the Traverse City Conference and had addressed monitoring and information needs at that time. Conflicting schedules also reduced participation by those available for the original October date. Due to the limited representation, the draft report is being made available for review by a few specific, knowledgeable individuals from industry and other private sector interests.

INVITATION LIST: Great Lakes Pollution Monitoring Workshop, Ann Arbor, Michigan  
Primary Target Participants: Monitoring Data USERS

United States Federal Agencies

Mr. Robert Bowden, Great Lakes National Programs Office USEPA Region V, Chicago, Ill.  
Mr. Valdas Adamkus, Deputy Regional Administrator, USEPA, Region V., Chicago, Ill.  
Mr. Robert Buckley, USEPA Region V Environmental Research Laboratory , Grosse Ile  
Dr. John Zapotowsky Division of Environmental Impact Studies, Argonne National Lab  
DOE, Argonne, Ill.  
Dr. Steven Spigarelli Division of Environmental Impact Studies, Argonne National Lab  
DOE, Argonne, Ill.  
Cmdr. William Andrews United States Coast Guard, Ninth District, Cleveland, Ohio  
Maj. Gen. William Harris North Central District, COE, Chicago, Ill.  
Col. Robert Vermillion Detroit District, COE, Detroit, Michigan  
Col. George Johnson Buffalo District, COE, Buffalo, NY  
Lt. Col. Howard Nicholas Chicago Dist. COE, Chicago, Ill.  
David Cowgill North Central District, COE, Chicago  
William Webster Buffalo District, COE Impact Assessment, Buffalo, NY  
Dr. Wayne Willford US Fish and Wildlife Service Laboratory, Ann Arbor, Michigan  
Dr. Joseph Kutkuhn- US Fish and Wildlife Service Laboratory, Ann Arbor, Michigan  
Capt. Wesley Hull, National Ocean Survey, NOAA, Rockville, Md.  
Mr. Kent Hughes, Deputy Director NDOC, NOAA, Rockville, Md.  
Capt. R. L. Swanson, Ocean Pollution Monitoring, NOAA, Rockville, Md  
Mr. Raymond Ramsey, OMPA, NOAA, Rockville, Md.  
Ms. Adriana Cantillo, NOAA/OTES, Rockville, Md.  
Ms. Elaine Stammon, NOAA/ Environmental Research Laboratory, Boulder , Colorado  
Mr. Charles Gunnerson, NOAA/OMPA, Boulder, Colorado  
Mr. Gerry Welsh, U.S. Department of Agriculture, Soil Conservation Service, Washington  
Dr. Richard Abram, NOAA/EDIS, Rockville, Md.

State Agencies

Dr. G. Anders Carlson, New York Dept. of Environmental Health, Albany, NY  
Dr. Harold Humphrey, Environmental Toxicology Div., Michigan Dept of Public Health,  
Lansing, Michigan

Dr. William C Ackerman, Div. of Water Resources, Dept of Transportation, Springfield, Ill.

Mr. Thomas Lauer, Division of Water Pollution Control, Indianapolis, Indiana

Mr. Robert Carter, Coordinator of Environmental Programs, Environmental Health  
State of Indiana, Indianapolis, Indiana

Dr. Italo Carcich, Director, Bureau Water Resources, Bureau of Pure Water, NY Dept.  
of Environmental Conservation, Albany, New York

Mr. Steven Buda, Environmental Protection , Michigan Department of Natural Resources  
Lansing, Michigan

Mr. Duane Schuettpelz, Water Quality Evaluation Group, Wisconsin Dept of Natural Resources  
Madison, Wisconsin

Dr. Lovell, Ritchie, Deputy Executive Director, Minnesota Pollution Control Agency,  
St. Paul, Minn.

Dr. John Konrad, Chief, Special Studies, Wisconsin Department of Natural Resources,  
Madison, Wisconsin.

Mr. Chris Shafer, Div. of Land Use Programs, Michigan Department of Natural Resources.

Dr. Ronald Mayleth, Division of Water Resources, NY State Dept of Environmental Conser-  
vation, Albany, NY

Dr. Gerald McKersie, Chief, Water Quality Control, Wisconsin Dept. of Natural Resources,  
Madison, Wisconsin

Mr. Joseph Vihtalic, Environmental Services Division, Michigan Department of Natural  
Resources, Lansing, Michigan

Dr. David Wade, Risk Assessment and Toxicology, Michigan Department of Natural Resources,  
Lansing, Michigan

James E. McEvoy, Director, Ohio Environmental Protection Agency.

#### Canada

Dr. Donald Williams, Surveillance Program Manager, Canada Centre for Inland Waters  
Burlington, Ontario

Dr. Murray Charlton, National Water Resources Institute, CCIW, Burlington, Ontario

Dr. George Becking, Chief, Environmental Toxicology, Health & Welfare Canada  
Ottawa, Ontario

Dr. Harvey Shear, Great Lakes Biolimnology Laboratory, CCIW, Burlington, Ont.

Dr. Robert Slater, Dir. General, Environmental Protection Service, Environment Canada,  
Ottawa, Ontario

#### Ontario

Dr. Steven Saalback, Ontario Ministry of the Environment, COA, Toronto, Ontario

Dr. William Steggles, Ontario Ministry of the Environment, Toronto, Ontario

### International Joint Commission

Commissioner Charles R. Ross, United States Section, IJC, Washington, D.C.

Dr. Douglas Haffner, Surveillance Program, Great Lakes Regional Office, IJC, Windsor, Ont.

Ms. Patricia Bonner, Head, Public Information, Great Lakes Regional Office, IJC Windsor.

Dr. William Nye, Director Designate, Great Lakes Regional Office, IJC

### International Great Lakes Fishery Commission

Carlos Fetterolf, Jr., Executive Secretary, Great Lakes Fishery Commission, Ann Arbor, Mi.

Dr. Henry A. Regier, Technical Advisory Group GLFC, University of Toronto, Dept. of Environmental Studies, Toronto, Ontario.

### Regional: Great Lakes Basin Commission

Lee Botts, Chairman, Great Lakes Basin Commission, Ann Arbor, Michigan

Timothy Monteith, Planning Staff, Great Lakes Basin Commission, Ann Arbor, Michigan

Sandra Gregerman, Public Information/Great Lakes Information, Great Lakes Basin Commission, Ann Arbor, Michigan

William Sonzogni, Scientist, GLB C, now of NOAA Environmental Research Lab, Ann Arbor, MI

### Local Government

William Katz, Chief Engineer, Milwaukee Metro Regional Sewer District, Milwaukee , Wis

John MÖser, Milwaukee Metropolitan Regional Sewer District, Milwaukee, Wisconsin

Charles A Froman, Superintnedent, Gary-Hobart Waterworks, Gary, Indiana

Keith Young, Gary-Hobart Water Corporation , Gary Indiana

### Educational Institutions

Dr. Lawrence Libby, Agricultural Economics, Michigan State University, Lansing, MI  
(Science Advisory Board, IJC)

Dr. David Edgington, Center for Great Lakes Studies, University of Wisconsin, Milwaukee

Dr. John Judd, Michigan Sea Grant, Ann Arbor, Michigan

Dr. Edward Ongley, Department of Geography, Queens University, Kingston, Ontario

Dr. Joel O'Connor, MESA-NY Bight Study, SUNY, Stony Brook, NY

### Research Institutions

Dr Andrew Robertson, NOAA Great Lakes Environmental Research Lab, Ann Arbor, Michigan  
Dr. Wayland Swain, EPA Large Lakes Laboratory, Grosse Ile, Michigan  
Dr. Russell Moll, Great Lakes Research Division, University of Michigan, Ann Arbor, MI  
Dr. Howard Johnson, Insitute of Water Resources, Michigan State University, Lansing, MI  
Dr. Larry Cooper, Ohio Sea Grant, Ohio State University, Columbus, Ohio  
Member, Coordinator of Lake Erie Work Group under GLISP  
Dr. Edward Herdendorf, CLEAR, Ohio Sea Grant, Ohio State University, Columbus, Ohio  
Dr. Al Beeton, Director, Great Lakes Research Division, Michigan Sea Grant, Univ. of Michigan, Ann Arbor, Michigan

### Public Interest Groups

Richard Robbins, Executive Director, Lake Michigan Federation, Chicago, Ill  
Fran Arcara, Coordinator, League of Women Voters Lake Erie Basin Committee, East Aurora, NY  
Joseph Castrilli, Esq., Research Director, Canadian Environmental Law Association  
Toronto, Ontario  
Thomas Klein, Director, Sigurd Olson Institute for Environmental Studies, Northland  
College, Ashland, Wisconsin

### Industry and Private Sector

Morton Sterling, Detroit Edison Electric Co., Detroit MI  
Dr. Al Garlauskas, Dalton, Dalton & Newport, Cleveland, Ohio  
Dr. Jack Ballard, Ontario Hydro, Toronto, Ontario.  
Blair T Bower, private consultant  
Dr. Douglas Segar, SEAM Ocean,  
Nanacy Hooper, METRICS, Atlanta, GA

### Great Lakes Tomorrow Staff

James W Cowden , Environmental Studies Program, Hiram College, Hiram, Ohio  
Arthur M Timms, Exec. Director, Conservation Council of Ontario, Toronto, Ontario  
Mimi Becker, Environmental Studies Program, Hiram College, Hiram, Ohio

PARTICIPANT REGISTRATION LIST: GREAT LAKES REGION POLLUTION MONITORING WORKSHOP

Ann Arbor, Michigan February 11-13, 1981

<p>Cmdr William Andrews US Coast Guard, 9th District 1240 E Ninth Street Cleveland, Ohio US F</p>	<p>Mr. David Cowgill US Army Corps of Engineers North Central District 536 South Clark Chicago, Ill 60605 US-F</p>	<p>Dr. John Judd, Asst Dir. Michigan Sea Grant 2200 Bonisteel Blvd Univ. of Michigan Ann Arbor, Michigan 48109 S</p>
<p>Dr Jack Ballard Ontario Hydrol 700 University Avenue Toronto, M5G 1X6 Canada CF</p>	<p>Ms Adrianna Cantillo NOAA-OTES 5Rm 1004 6010 Executive Blvd Rockville, MD 20852 US-F</p>	<p>Dr. Thomas Klein, Director Sigurd Olson Institute of Environmental Studies Northland College Ashland, Wisconsin 54806 PI</p>
<p>Dr. Al Beeton, Director Michigan Sea Grant 2200 Bonisteel Blvd Ann Arbor, MI 48109r S</p>	<p>Dr. Marlene Evans, President IAGLR C/O Great Lakes Research Univ of Mich 2200 Bonisteel Ann Arbor, MI 48109 PI</p>	<p>Dr. Vincent Krentz Ecological Analysts Midwest Regional Operations 1500 Frontage Road Northbrook, Ill 60002 PS</p>
<p>Ms Patricia Bonner, Head Public Information Great Lakes Office, IJCr 100 Ouellette 8th Floor Windsor, Ontario N9A 6T3r IJC</p>	<p>Mr Carlos Fetterolf, Jr. Ex Secy Great Lakes Fishery Commission 1451 Green Road Ann Arbor, MI 48105 IFC</p>	<p>Dr. Joseph Kutkuhn, Director USDOI- Fish &amp; Wildlife Serv. Great Lakes Fishery Lab 1451 Green Road Ann Arbor, MI 48105 US-F</p>
<p>Ms Lee Botts, Chairman Great Lakes Basin Commission PO Box 999 Ann Arbor, MI 48105 R</p>	<p>Mr. Charles Gunnerson Transport/Water/Telecommunications Room D-944 World Bank 1818 H St. NW Washington, DC 20433 US-F</p>	<p>Mr. Thomas Lauer Div of Water Pollution Control 1330 W. Michigan Ave Indianapolis, Ind 46246 S</p>
<p>Dr. Robert Bowden Great Lakes National Prog. Off. US EPA Region V 536 S. Clark Chicago, Ill 60605 US-F</p>	<p>Dr. Douglas Haffner, Great Lakes Regional Office International Joint Commission 100 Ouellette 8th Floor Windsor, Ontario N9A 6T3 IJC</p>	<p>Dr. William E. McCracken Environmental Services Div. Michigan Dept of Natural Res. PO Box 30028 Lansing, Michigan 48909 S</p>
<p>Dr. Robert Buckely US EPA Large Lake Research Sta 9311 Groh Road Grosse Ile, MI 48138r US-F</p>	<p>Dr. Ed Herdendorf Ohio Sea Grant, CLEAR 484 W 12th Ave. Ohio State Columbus, Ohio 43210 S</p>	<p>Dr. Jerry McKersie, Chief Water Quality Evaluation Wisconsin DNR Box 7921 Madison, WI 53707 S</p>
<p>Dr Richard Abram EDIS NOAA 6010 Executive Blvd Rockville, MD 20852 US-F</p>	<p>Dr. Harold Humphrey Environmental Epidemiologist MI Dept of Public Health 3500 N. Logan St Lansing, MI 48914 S</p>	<p>Dr. Russell Moll Great Lakes Research Division University of Michigan 2200 Bonisteel Blvd Ann Arbor, MI 48109 S</p>
<p>Dr. Murray Charlton National Water Research Inst. Canada Centre for Inland Waters PO Box 5000 (C-F) Burlington, Ontario L7R 4A6r</p>	<p>Dr. Howard Johnson Room 334, Institute of Water Res Natural Resource Bldg Michigan State University S East Lansing, MI 48824</p>	<p>Mr. John Moser General Supervisor, Research Milwaukee Metro Sewerage Dist. 735 N Water St Milwaukee, WI 53202 L</p>
<p>Dr. Lawrence Cooperr Center For Lake Eria Area Res. OSU 444 W 12th Ave Columbus, Ohio 43210r S</p>		

Dr. William Nye  
Director Designate  
Great Lakes Regional Off. IJC  
United States Section IJC  
1717 H St. NW Suite 203  
Washington, DC 20440 IJC

Mr. George Peter  
NOAA/OMPA  
11400 Rockville Pike, Rm 320  
Rockville, MD 20852 US-F

Mr. Raymond Ramsay  
NOAA/OTES-5 Rom 1004  
6010 Executive Blvd  
Rockville, MD 20852 US-F

Dr. Henry Regier  
University of Toronto  
InstitutE of Env. Studies  
Haultain Bldg  
Toronto, Ont. M5S 1A4o C-PIo

Dr. Andrew Robertson  
NOAA-Great Lakes Env. Res.  
Laboratory 2300 Washtenaw  
Ann Arbor, Michigan 48104  
US-F

Commissioner Charles Ross  
P.O. Box F  
Hinesburg, VT 05461 IJC

Dr. Steven Saalback  
Ontario Ministry of Environ.  
135 St. Clair Avenue West  
Toronto, Ont. M4V 1P5 C- Prov.o

Dr. Douglas Segar  
SEAMOcean  
Box 2234  
Wheaton, MD 20902 PS

Dr. Harvey Shear, Coord.  
Great Lakes Biolimnology Lab.  
Canada Centre for Inland Wat.  
867 Lakeshore Road  
Burlington, Ont L7R 4A6 C-F

Mr. Duane Simpson  
NOAA NOS Oceanography  
Ocean Poll. Monit. GrpC2x7  
Rockville, MD 20852 US-F

Dr. Steven Spigarelli  
Environmental Assess. Div  
Argonne National Lab  
9700 Cass Ave  
Argonne, Ill. 60439 US-F

Dr. Wayland Swain, Director  
Large Lakes Research Station  
US EPA  
9311 Groh Road  
Grosse Ile, MI 48138 US-F

Ms Elaine Stammon  
NOAA Environmental Research  
Laboratory  
325 Broadway  
Boulder, Colo 80302 US-F

Dr. Wayne Willford  
US Fish & Wildlife Service  
Great Lakes Fishery Laboratory  
1451 Green Road  
Ann Arbor, MI 48107 US-F

Dr. Donald Williams  
Surveillance Program Manager  
Canada Centre for Inland Waters  
PO Box 5000  
Burlington, Ontario L7R 4A6 CF

Dr. John Zapotowsky  
Div of Env. Impact Statements  
Argonne National Laboratory  
9700 Cass Avenue  
Argonne, Ill 60439 US-F

Ms. Sandra Greggerman  
Public Information  
Great Lakes Basin Commission  
PO Box 999  
Ann Arbor, MI 48109 R

Ms. Mary Schramm  
c/o Environmental Studies Prog  
Hiram College  
Hiram, Ohio 44234 PI

Mr. Joseph Vihtalic  
Environmental Services Div  
Michigan Department of Nat. Res  
PO Box 30028  
Lansing, MI S

Ms Rebecca Glover  
C/O Michigan Sea Grant  
2200 Bonisteel Blvd  
Ann Arbor, MI 48109 S

Mr. William Webster  
Environmental Resources  
US Army Engineer Div  
1776 Niagara St  
Buffalo, NY 14207 US-Fo

Mr. David Wadeo  
Risk Assess. & Toxicology  
MI Dept of Public Healtho  
3500 Logan  
Lansing, MI 48914 So

Mr. Duane Schuettpelz  
Water Quality Eval. Group  
Wisconsin DNRO  
PO Box 7921o  
Madison, WI 53707 So

Mr. John McGuireo  
Minnesota Pollution Control  
1935 W. County Road B 2o  
Roseville, MN 55113 So

Mr. Ronald Mayleth  
NY Dept of Env. Conservation  
50 Wolf Road  
Albany, NY 12237 S

Mr. Keith Young  
Gary-Hobart Water Corp  
650 Madison St.  
Gary, Indiana 46402 L

Dr. John Zapotowsky  
Div. of Env. Impact Statement  
9700 Cass Ave,  
Argonne National Laboratory  
Argonne, Ill 60439 US-F

Mr. William Frez  
Great Lakes Research  
University of Michigan  
2300 Bonisteel Blvd  
Ann Arbor, MI PI

Dr. Arthur Timms, Ex Director  
Conservation Council of Ont  
45 Charles St E 6th Floor  
Toronto, Ontario M4Y 1S2 PIo

Mr. James Cowden  
Great Lakes Tomorrow  
PO Box 1935  
Hiram, Ohio 44234 PI

KEY: US-F= US Federal IJC= International Joint Commission  
C-F = Canadian Federal IFC= International Fishery Commiss.o  
S= State; PS= Private Sector; PI= Public Interesto  
C-Prov= Canadian Provincial ; R= Great Lakes Regionalo

Mimi Becker  
Great Lakes Tomorrow  
PO BOX 1935  
Hiram, Ohio 44234 PI



APPENDIX 5 A

Summary of Workshop and Plenary Session Proceedings

APPENDIX 5 B

Regional Findings and Strategies for Monitoring Improvement in  
Great Lakes Basin Region, US and Canada

# GREAT LAKES POLLUTION CONFERENCE

## Summarization of Work Session A

February 11, 1981

### OVERVIEW: Problem Summary

#### A. Accessing Existing Monitoring/Research Data

1. There is no central storage/access area for data
  - a. No knowledge of data that is available
  - b. No hardware/software to access the data
  - c. Difficulties in identifying the sources and limitations of the data
  - d. Lack of consolidate data into useable form especially from similar areas since it is now often coded by jurisdiction and multiple agencies
  - e. Many different data formats and accessing techniques
  - f. Data often in raw form or too diffuse
  - g. Lack of knowledge of data quality
  - h. Lack of efficient methods to access it

#### B. Limitations of Data Use

1. Lack of a centralized unit for data interpretation
2. Limited or incomplete data base for decision makers
3. Quality control and other logistic limitations
4. Lack of data utilization in public communication and education

#### C. Information Exchange Between Agencies

1. Agencies exhibit proprietary behavior or political sensitivities
2. Lack of information exchange on programs affecting several jurisdictions

#### D. Lack of Coordinated Efforts Between Agencies and Jurisdictions

1. Redundancy of agencies overseeing Great Lakes pollution
2. Lack of communication among programs
3. Unclear agency purpose as related to jurisdictional needs
4. Lack of commitment in program identification

#### E. Objectives and Monitoring System Design

1. Lack of definition of monitoring needs
2. Lack of clarification on monitoring goals
3. Lack of necessary flexibility for future needs
4. Parameter selection
5. Breakdowns in program implementation

#### F. Resource Allocation for Monitoring

1. Conserving dwindling resources
2. Agency/jurisdiction lack of commitment
3. Allocation effectiveness
4. Lack of resources for follow-up work

SUMMARY OF BASIC USES OF GREAT LAKES MONITORING SYSTEMS (as identified by workshop participants)

A. Direct

1. State or jurisdictional data base
2. State enforcement and regulation
3. State monitoring of stream effluents
4. State legislation
5. Detect trends related to water use from the "health" perspective

B. Indirect

1. Indirectly use data for giving scientific advice
2. Information for later monitoring of isolated pollution incidents
3. Management information on water quality or toxic contamination
4. Assessment of remedial programs
5. Air, water, and solid waste management
6. Modelling of transport processes or geochemical cycles
7. Research for productive capability of resource

February 11, 1981

PROBLEM: LIMITATIONS OF DATA USE

A. Lack of a Centralized Unit for Data Interpretation

1. Incorporation of design information in interpretation is important.
  - a. Data collected for one purpose cannot always be transferred to another.
  - b. We cannot expect cause and effect information from monitoring.
2. Hampered by inadequate information on PROCESSES.
  - a. Necessary before data interpretation can be completed.
  - b. Scientific knowledge on complex chemicals is not complete; so hard to interpret data.
3. Data not in useable form and is often useless without interpretation.
  - a. Interpreted data needs to be available to managers centrally.
  - b. Summarized data is needed for budgets and models.

B. Limited or Incomplete Data Base for Decision Makers and Public

1. Format
  - a. Lack of data interpretation (not raw data) to be used by decision makers in "selling" investments that would benefit the public.
  - b. Useable data could be channeled to benefit the states but there is too much room for interpretation.
  - c. Lack of standardized data between similar agencies in different regions.
2. Timely return of data
  - a. Many programs are young and data isn't useable for several years.
  - b. Often outdated before it is used.
  - c. Necessary for faster resolution of problems.
3. Information dissemination
  - a. No orderly fashion to return data to the public or institutions.
  - b. Lack of continuity in monitoring results in problems in its use for data management or human health considerations.
  - c. Data error and variation is not checked or known when data is made accessible.

C. Quality Control and Logistic Limitations Are Not Addressed

1. Data not always collected in a useable fashion.
2. Data collection information (how? when? where?) may not be included.

3. Long-term collection and analysis can result in high variability.
4. Based on the design, how statistically defensible is the data?
5. Current data are often not collected or analyzed in a rigorous scientific fashion with no estimates on data accuracy.
6. Lack of compatibility and comparability of data: spotty with varying methods.
7. Form of data is important: tapes vs. printouts; summary vs. whole data set.
8. Laboratory inadequacies -- not up to state-of-the-art.

D. Lack of Data Utilization in Public Communication and Education

1. Necessary for public feedback and support for needed programs.

E. Should There Be Monitoring of the Monitoring Agencies for Quality Control???

PROBLEM: INFORMATION EXCHANGE BETWEEN AGENCIES

A. Proprietary Behavior of Agencies Inhibits Access

1. Difficulties exchanging data through bureaucracy.
2. Lead agencies not familiar with basic perspectives of what is needed or important.

B. Political Sensitivity by Agencies Inhibits Access

C. Information Is Not Being Exchanged on Inventories on Industrial Use and Distribution of Organics That Could Improve Monitoring Programs

D. Lack of Information Exchange on Existing Programs or Programs Slated for Discontinuation That Affect Another Agency or Jurisdiction

E. On an International Basis, We Need to Share Information and Determine What New Data Is Necessary

PROBLEM: LACK OF COORDINATED EFFORTS BETWEEN AGENCIES AND JURISDICTIONS

A. Redundancy of Agencies Overseeing Great Lakes Pollution

1. Is the Great Lakes National Program Office purely political?
2. Overlap in the functions of state and federal agencies -- too many jurisdiction
3. Redundancy in monitoring efforts and resources spent.
4. Do not understand relationship of programs at various funding and jurisdictional levels.

B. Lack of Communication and Cooperation Among Programs

1. Lack of state/local interest in federal programs.
2. Lack of interagency communication even within regions and between regions.
3. Monitoring may be carried out for public relations only.
4. Variations in regulations and mandates.
5. Few attempts to include non-federal agencies.
6. Lack of perspective from lead agencies (EPA).

C. Agency Purpose as Related to the Jurisdictional Needs

1. What is the function of states in monitoring? States do not do open lake monitoring.
  - a. What is the usefulness of the information to the funding jurisdiction?
  - b. Does it have a high public profile?
2. Are too many demands being made without adequate support? (i.e., EPA with the \$\$)

D. Lack of Commitment in Implementation of Programs, i.e., Canada-Ontario Agreements vs. none on the U.S. side, lack of Washington level understanding of the resource and their unwillingness to commit adequate resources to implement the Agreement.

PROBLEM: OBJECTIVES AND MONITORING SYSTEM DESIGN

A. Lack of Definition of Monitoring Needs

1. Ambient: baseline data and trends for assessment purpose, historic records, and establishing relations.
  - a. Methods should be able to detect changes.
  - b. Methods cannot predict cause and effect information.
2. Event: are we observing short-term pollutant transport or recovery of a fishery?
  - a. How do we meet criteria pollutant problems as they arise?
  - b. Can we get enough information for enforcement decisions?
3. Research: is the biology of the system a better indicator than chemistry?
  - a. This may be where we address cause and effect.
4. Ecosystem: vital including human health: stops short.
  - a. Need to acknowledge public health management needs in our designs.

B. Lack of Clarification on Main Goal of Monitoring

1. What is the resource we are trying to protect (local vs. all 5 lakes)?

2. Data not useable because we have not asked the right questions.
3. Presently, we lack a clear set of objectives,
  - a. Often designed for immediate needs; not interpretation and education.
  - b. Lack of explicitly defined objectives, i.e., nearshore vs. offshore.
  - c. To understand pollutant transport, we need more offshore work.
4. Do we have enough data to monitor the effectiveness of control strategies?
5. Are we getting enough information to address questions of ecosystem health or human exposure limits?

C. Lack of Necessary Flexibility for Future Needs

1. Good programs must anticipate future problems.
  - a. Necessary to detect new information; toxics vs. nutrients.
  - b. Need for reassessment and design to keep up with new needs.
  - c. Redesign programs to be cost effective.
  - d. The systems in effect are not responding to changing data needs (Niagara River).
3. Are not looking at risk assessment where it's needed (pollutants in Niagara River).
2. Need assessment program on all aspects of priority pollutants, such as effluent monitoring and toxic transport.
3. Need to monitor impacts of remedial programs on social environment.

D. Parameter Selection

1. Do the parameters we measure give us the best information?
  - a. Are they reflective of the system ecologically?
  - b. Are we measuring enough variables?
  - c. Biotic vs. chemical parameters.
2. How much data do we need to serve our interest? For scientific validity?
  - a. Key parameters may give us enough information and eliminate excess information.
3. Lack of technology/methodology
  - a. We need mass-balance measurements but do not have the methodology to achieve this.
  - b. Improvement on techniques for toxic analysis.
  - c. Lack of transfer of technology from federal to state level.
  - d. What are our technical capabilities within our design?
4. Lack of cost-benefit analysis in design preparation
  - a. Which variables should be priorities, i.e., shoreline loss?
  - b. On the socio-economic level; which affects the public most?

5. Experimental design is often inappropriate for our needs.

a. Lack of peer group evaluation of our needs.

E. Lack of Implementation of Programs or Breakdowns

1. Analyses are left undone (fish in a freezer).

2. Inconsistent performance and implementation.

PROBLEM: RESOURCE ALLOCATION FOR MONITORING

A. Conserving Dwindling Resources

1. Cooperation can get more for the \$, but

a. Local vs. large-scale monitoring needs have to be determined.

b. Do we spend \$\$ collecting new data or \$\$ searching out other data?

2. Programs with achievable aims will be those likely to survive budget cuts.

a. Federal \$\$ seem to direct the objectives to what benefits them.

B. Lack of Commitment to These Programs

1. Occurs at every level: U.S. commitment vs. Canadian.

2. Lack of resources to coordinate efforts through meetings.

C. Allocation of Effectiveness of Resources

1. Money is being used for data interpretation by the users that may not be compatible with its original purpose.

2. Can the collectors spare the resources to put it into a useable form that is accessible?

a. Lack of resources to put data into a needed format.

b. Lack of personnel and resources to store data.

D. Lack of Resources for Follow-up Work to Get Information on:

1. New problem that is defined.

2. Design does not meet Public Health Management needs.



BLUE GROUP: February 11, 1981

WORKSHOP SESSION A: PROBLEM IDENTIFICATION

PROBLEM: MONITORING SYSTEM DESIGN

- A. We need to acknowledge public health management needs in designs.
- B. Experimental design not appropriate.
- C. Objectives are not clear -- "are we collecting appropriate data?"
- D. Not enough thought to be useful for human health considerations.
- E. Do we collect too much data for the information we need?
- F. How much resolution do we really need, i.e., nearshore vs. offshore?
- G. Face three monitoring needs: research, events, ambient
- H. Little peer group evaluation of designs.
- I. Redesigning programs to be more cost effective (limit stations).
- J. Design system to look at new problems as they appear, i.e., 800 new topics vs. nutrients.
- K. Do they give us information on enforcement decisions?
- L. Not sure of technical capabilities within a design.

PROBLEM: INFORMATION EXCHANGE AND COORDINATION THROUGH AND BETWEEN AGENCIES

- A. Trouble exchanging data through bureaucracy.
- B. Lack of communication between agencies on studies.
- C. No peer group evaluation of systems and project designs.
- D. No coordination with jurisdictions, especially at state levels.
- E. Too many jurisdictions: State vs. EPA with \$\$ vs. NOAA.
- F. Coordinate efforts for more \$ return.
- G. Lack of perspective from lead agencies, i.e., EPA.
- H. Model Canadian/Ontario Pact -- no U.S. example.

PROBLEM: USE LIMITATION DUE TO DATA TYPE OR QUALITY

- A. No information for loadings for budgets and models.
- B. No uniform methodology or quality control.
- C. No estimate on data accuracy within system.
- D. Not sufficient data for levels and trends for zones for P.H. decisions.
- E. Data formats are not standardized.
- F. Data spotty and hard to relate studies.
- G. Data schedules not coordinated.
- H. Data errors -- variations not inown. Important: (1) if trying to measure improvements, (2) if looking at tiny changes.
- I. Is the data statistically defensible?

PROBLEM: LIMITED USEABLE DATA BASE FOR DECISION MAKERS

- A. Many programs are young and trends are not evident for several years.
- B. Lack of resources for people to get data in useable form.
- C. Parameter selection that is appropriate for legislation.
- D. Lag time between data collection and use.

PROBLEM: LACK OF A CENTRALIZED UNIT FOR DATA INTERPRETATION AND DESIGN

- A. Noone can identify sources of data.
- B. Too much room for interpretation of raw data.
- C. No simplified way to coordinate efforts.

PROBLEM: BREAKDOWN IN SYSTEM OF MONITORING PLANS

- A. Lab analyses not completed.
- B. Lead agencies not familiar with basic perspectives of what is needed.

PROBLEM: RESOURCE ALLOCATION

- A. No budget for follow-up work if a new problem is defined.
- B. No budget for interpretation and information storage.
- C. Lack of personnel for summarizing data.
- D. Conflict: money for research vs. money for searching out data.
- E. Lack of commitment for \$\$ from U.S.
- F. Lack of resources to coordinate efforts at meetings.
- G. Use \$\$ for local vs. large scale monitoring.
- H. Federal \$\$ do direct the interest to what benefits them but with a lack of perspective in their mandate.

SPECIFIC NEEDS OF A MONITORING PROGRAM ARE:

1. Direct use for legislation and negotiation.
2. Indirect use for comparisons for impact assessment, regulations, and discharge levels.
3. Direct use for trends relating to human health and exposure.
4. One knowledgeable group to control information and interpretation.
5. Need detail on information for judgements dealing with the populus so that monitoring is responsive to human health needs.
6. We need an information broker for Great Lakes data.

GREEN GROUP: February 11, 1981

WORKSHOP SESSION A: PROBLEM IDENTIFICATION

PROBLEM: ACCESSIBILITY OF DATA

- A. No problem with data availability from IJC, EPA, industry in Minnesota.
- B. Need a central location for storage/access of data. Interpreted data for use by managers should be available centrally.
- C. More effort should be made to disseminate data to users.
- D. Timeliness of data important for faster resolution of problems -- three years is too long to wait for monitoring data analysis. Cost/effectiveness data for remedial strategy evaluation must be processed quickly.
- E. The existence of needed data may not be known to users. (I.e., water intake monitoring data)
- F. Proprietary behavior of agencies inhibits access.
- G. Political sensitivity of data sometimes results in lack of access.

PROBLEM: FORMAT OF DATA

- A. Form of available monitoring data may be a problem. For example, receiving a general output computer printout is useless unless the user has a means to translate it. A magnetic tape in some cases would be preferable.
- B. Decision makers need analyzed, not raw data in compact format. Often not available.

PROBLEM: DATA QUALITY CONTROL ASSURANCE

- A. How many samples are needed for scientific validity for the enforcement and remedial program assessment?
- B. The measurement of toxic levels in a given sample varies from laboratory to laboratory. This occurs as a result of differences in technique (art), equipment. In light of this problem, should the federal government monitor the states who are doing their own monitoring? How to assure this given "state-of-the-art."

PROBLEM: ARE RELEVANT DATA BEING USED AND/OR ARE THEY AVAILABLE?

- A. States say there is too much open lake data and they cannot do their jobs in enforcement, regulation, remedial program assessment. Need is for more nearshore monitoring.
  - 1. Cannot do adequate environmental assessment to rationalize need/sell new water treatment plants/STP's without baseline monitoring.
  - 2. Need before and after data to monitor effectiveness of control strategies.
- B. Data collection has become institutionalized and we have too much of some types -- system does not respond to changing data needs (i.e., need for sediment transport monitoring data to address toxics issue in Niagara River).
- C. Monitoring of currents in harbors and channels needed to develop models to study pollutant transport.

- D. Data is not available (Canada) to government to provide inventories on industrial use, distribution of organics. Monitoring becomes difficult.
- E. Historic monitoring parameters/data are useful if we are to determine pollutant transport processes. To do this adequately, there is need for more open lake data.
- F. Monitoring and/or data analysis problems arise when federal, state, provincial agencies don't use the same criteria or data evaluation methods. Results often depend on whose methods used, or differ when standards differ. Not reliable indication of water quality.

PROBLEM: HOW ARE DATA BEING USED?

- A. State enforcement and regulation.
- B. State environmental data base.
- C. Data used by Feds to monitor isolated pollution incidents.
- D. State monitoring of stream effluents.
- E. Management information on water quality, toxic contamination of fisheries.
- F. Provincial air, water and solid waste management.
- G. Assessment of remedial programs.
- H. Monitoring data applied to research for productive capability of resource.

PROBLEM: WHAT POLLUTION PROBLEMS ARE NOT BEING ADEQUATELY ADDRESSED BY PRESENT MONITORING SYSTEM?

- A. Public Health effect of pollution:
  - 1. Monitoring data needed to develop understanding of toxicology and exposure potential.
  - 2. Problem of being able to do risk assessment where objectives do not exist. (i.e., new sources of pollution to the Niagara River)
- B. Monitoring of estuaries to determine effects of combined sewer outflow and other remedial actions (point, non-point source) in estuaries is insufficient. Causes a problem in "selling" investment in tax dollars.
- C. Criteria pollutants/priority pollutants monitoring needs must be addressed and monitoring begun to determine background levels, potential of achieving limitations -- especially with organics.
  - 1. Emphasize effluent monitoring.
  - 2. Need information re sediment/leachate transport of toxics from diffuse sources.

PROBLEM: INTERGOVERNMENTAL RELATIONSHIPS

- A. Sometimes agencies arbitrarily discontinue monitoring programs that users need or add new ones already being done by present users -- little coordination exists. Mechanism needed for showing needs of piggyback users are being met before discontinuing monitoring.
- B. There is a need to understand the relationship between effective monitoring at local/state/federal levels and effective long-range program budget planning.

PROBLEM: DATA COMPATIBILITY

- A. There is lack of comparable information on outputs of sewage treatment plants from state to state, i.e., New York vs. Chicago.

PROBLEM: NEW PROBLEMS IN POLLUTION MANAGEMENT MEAN NEW MONITORING NEEDS

- A. Need to be able to assess social impacts such as costs, lifestyle implications, maintenance of urban centers of monitoring. How can a methodology be developed to monitor impacts of remedial programs on social environment (human ecosystem)?

PROBLEM: MONITORING RATIONALE

- A. There is no direction to monitoring; how can this be solved?
- B. Lack of interpretation and collection of specific monitoring data on a continuous basis causes problems in pollution and data management.
- C. Requirements for the user to interpret data mean much is not useful. Interpretation must be done by the collector. Collectors of data must also be aware that not all users implement the same data objectives. They have special information requirements.
- D. Need to identify means of monitoring new pollutant with rationale for doing so.
- E. Rationale, methodology for monitoring bioavailability of phosphorus are needed.

PROBLEM: INTERNATIONAL MONITORING IJC

- A. Need to determine what additional data need to be obtained.
- B. Are the collectors giving their data to those who can make the best use of it?
- C. Advice on the health effects of certain chemicals is needed so appropriate monitoring can be designed and implemented.
- D. Are there new objectives to be developed, existing ones to be amended? If so, additional monitoring needs will arise.

YELLOW GROUP: February 11, 1981

WORKSHOP SESSION A - PROBLEM IDENTIFICATION

- present monitoring system is useful as information service to be translated for public consumption (public includes decision - makers)
  - interpretation of the data (i.e. information) is used rather than data itself.
- concern for ambient monitoring in terms of loadings and compliance of facilities to standards or other requirements.
  - isn't enough data and what is available is not always collected in a useable fashion.
  - we need more information on how the data is collected.
  - site PL 95-273 - NOAA lead agency.
- problem with how you define the Great Lakes
  - re: IJC it is the whole drainage basin including upper St. Lawrence (to international boundary).
  - agreement that this definition is O.K.
- redundancy of agencies overseeing Great Lakes pollution problems - what is the role of the Great Lakes Planning Office - was its establishment purely political?
- because Great Lakes constitute mainly a Federal concern there is often lack of state or even regional interest.
  - this leads to variation in the function of various state agencies in matter relating to the lakes.
  - lack of inter-agency communication even within regions.
- a great deal of redundancy in efforts of 11 Federal agencies involved in research. development and monitoring of ocean pollution and \$188 million spent on it annually.
  - PL 95-273 is an attempt to rectify some of this overlap by providing an umbrella by assigning a specific task to NOAA.
- NOAA may not use data directly but may have a need for it to develop research models.
  - indirectly used data as a base for giving scientific advice.

- question of the reason for doing surveillance in the first place, what is the resource we are trying to protect and are objectives of the surveillance program reasonable.
- we may not be able to efficiently use the data we now collect because the appropriate (right) questions have not been asked.
  - really have not defined the problem.
- parameters being measured may not be the best ones or be truly reflective of the system (ecological perspective)
  - eg. mass balance measurements would give a more thorough picture if the methodology to achieve this were available.
- not enough variables are being measured.
- cost-benefit analysis (including economic and social) would aid in defining those variables which ought to receive more attention.
  - eg. what is the impact of the loss of shoreline.
- public is concerned mostly with things affecting it the most, eg. health, clear beaches, etc.
  - if data is better packaged for public consumption and the public therefore better understands it then more effective feedback is generated resulting in more effective public pressure for carrying out the necessary programs.
- monitoring is a long-term proposition and will therefore produce high variability in the data.
  - this would require paying strict attention to how the monitor's program is designed and if so designed how to interpret the data.
  - design must be able to detect a change.
  - present designs address rather local issues -- how do we design a monitoring program that has more relevance for the whole Great Lakes system.
- requirement to understand how the system operates before the data interpretation can be complete.
  - this poses a serious question regarding how to deal with the data statistically.
  - biology of the system is a better indicator than are chemical pollutants.

- Current monitoring systems are designed to obtain data but it is not done in a rigorous enough scientific fashion.
- Chemistry of anthropogenic compounds is as complicated as the biology.
- Great Lakes Basin Commission attempts to coordinate various planning levels but there still exists a considerable lack of inter-agency coordination.
- There is failure to use the data that is already available.
- Some data collected are done so for a single purpose and cannot always be transferred for other purposes.
- Ecosystem approach to analysis is vital.
- Data collection per se is not a good approach to monitoring--it must be completed with interpretation.
- Fish and Wildlife Service do produce and use monitoring data and develop monitoring techniques and assessment procedures.
- A good monitoring program should have an anticipating mode built in so that it can detect new information.
- Present monitoring programs lack a clear set of objectives.
- We might be expecting too much information regarding cause and effect from the monitoring system.
- The cause/effect question is a research function.
- Surveillance is often carried out to meet the immediate needs of the agency and the broader questions of interpretation and ecosystem analysis get left unaddressed.
- Some think there is too much data being collected and that a wise choice of key indicator parameters should be made eliminating the rest.
- Contrary to above the program design per se is not a problem but rather how that program is implemented to assure consistency, for example, in its performance.
- Monitoring function of many states and/or their agencies is not of high interest and are carried out solely for public relations.
- A case in point for Wisconsin is that open lake data are collected but not used.
- Fish monitoring is worthwhile because it has a high public profile. Therefore, states cannot be expected to take on a monitoring function because they are not funded to do so.
- GLISP is unclear regarding the role of States but does seem to make unreasonable demands of them regarding the amount of sampling to be done.



- Through proper coordination of sampling efforts considerable money could be saved.
- States do stand to gain from a monitoring program.
- Techniques for toxics analysis need to be improved and refined and at least standardized.
- Technology transfer from the Federal to State level is not complete.
- If there is to be a significant drop in funding for marine pollution programs then likely only those with achievable aims will be viewed favorably.
- There tends to be some confusion about the definition of "monitoring." NOAA's could be interpreted differently from that of the IJC Water Quality Agreement.

YELLOW GROUP: February 11, 1981

WORKSHOP SESSION A: PROBLEM IDENTIFICATION

1. Lack of horizontal and vertical communication may be a matter of access.
2. Perceived lack of coordination.
3. Lack of comparability and compatibility of data.
4. Lack of commitment in implementing programs. This is manifest in lack of funding, variation amongst agencies in their function, and variation in their regulations under legislation. This results in an inability to design new laws with a systems approach in mind and in misalignments of priorities.
5. Lack of explicitly defined objectives for the monitoring program.
6. Water quality management programs need periodic reassessment in order to assure the need for and relevance of the surveillance programs associated with it.
7. Right data is not being collected nor is it being properly analyzed. It is often out-dated before it is made available for use.
8. Lack of correlation in non-Federal agencies in their scientific data.

GREEN GROUP: February 12, 1981

WORKGROUP SESSION B: STRATEGIES FOR ADDRESSING MONITORING PROBLEMS

PROBLEM: MONITORING DATA IS NOT AS ACCESSIBLE AS IT SHOULD BE TO BE EFFECTIVELY USED TO MEET THE OBJECTIVES OF GLISP OR TO SOLVE POLLUTION PROBLEMS.

- Data is not analyzed in a timely enough fashion (three years is too long to wait for monitoring data analysis). To be cost effective for use in developing, monitoring effects of remedial actions, compliance, to identify emerging problems, provide public health advisories, data must be processed more quickly.
- Data is not stored in a central location or in forms which are readily available to the user. Existence of needed data (i.e., water intake monitoring data) may be unknown to users.
- Proprietary behavior of agencies with respect to data inhibits access. In some cases political sensitivity of data results in suppression of data (Michigan, PBB) and lack of access. This is more of a problem in some states, agencies than others.

STRATEGY:

- A. Modify STORET to include water treatment plant intake data.
- B. GLISP data should be entered into STORET in such a way as to be easily retrieved.
- C. Alternatives to STORET should be explored. Putting data into STORET may be more costly than the monitoring itself. Also, it does not accept all data necessary for Great Lakes monitoring programs (toxics, ecosystem).
- D. Improve access to grey data. These would be invaluable in updating the Environmental Data Base (which has not been updated in five years). There is need to educate researchers, agencies, etc. that data may be important and useful.
- E. Improve format in which data is made available to users, especially decision makers. Unanalyzed data is of very little use to decision makers. Resources, timetables for analysis of monitoring data should be allocated and used. Most users have more need for analyzed data.
  - 1. Monitoring data should be summarized, put into a volume and analyzed, interpreted so decision makers could have more access to it. Or, monitoring data could be put into a regional data bank accessed by user and analyzed according to need.
  - 2. Trends indicate that the need for the general public to have access to analyzed data may be increasing. Presently, litigation to achieve compliance or enforcement of pollution control laws is resulting from government monitoring and is government initiated in the public interest in many cases. This causes increasing political problems and pressures. It is possible that the burden for initiating lawsuits will fall increasingly on the general public. They will need access to data and will have to develop analytic capability. Both systems are presently

in place, but the onus may fall increasingly on the public.

3. Provide for data analysis.

- F. Some type of cost sharing should be developed: User to pay costs of obtaining data. Or EPA could require non-government agencies and individuals to pay and have a case-by-case determination of costs. Or data could be summarized on a regular basis and put out in a volume at cost. Or charge industry, but not the general public (present practice).

#### ADDITIONAL CONSENSUS COMMENTS

##### Monitoring Costs

Consensus: Presentation, allocation under Great Lakes Surveillance Plan of monitoring costs need to be related to the environmental problem. Costs can be translated to management rationally by providing/considering cost of whole environmental management plan: facilities plus monitoring plus management progress and compliance (likely that not enough money is being spent on monitoring; not to expend enough money monitoring wisely could risk spending billions foolishly).

Consensus: There is a need to know how GLISP works. How was the plan drafted? Responsibility allocated? How does the Surveillance Committee work? What has been its past history/evolution?

Consensus: We need to convey to NOAA that we are at "Stage 2." We have a monitoring plan which is regional. When we talk about problems/changes we are talking about ways to improve the present approach.

Consensus: Present GLISP proposes \$10,000,000 per year and assumes this will be available. Budgets are being cut back and the actual expenditure may be only three-quarters or less. We actually are spending \$6,000,000 now.

- It is assumed that cuts will limit monitoring to what is required by law, i.e., permits, intakes, etc. will be done but the rest will be cut.
- We should consider the present Surveillance Plan as framework for monitoring in the Lakes.

GREEN GROUP: February 12, 1981

WORKGROUP SESSION B: NEEDS NOT PRESENTLY BEING ADDRESSED

- A. Additional nearshore monitoring is required.  
More resources will be needed.  
States would prefer to do the nearshore monitoring, but need more resources.  
The Feds are not doing it.
- B. (EPA is not now requiring States to monitor effect of outfalls on receiving waters. They are only requiring monitoring for permit enforcement information).  
EPA should require the States to monitor effect of effluent on receiving waters and provide the resources. A "block grant" approach should be taken.
- C. Shoreline erosion/sediment transport monitoring should be initiated/expanded.
- D. Monitoring the level of toxicants in nearshore fishery used by sport fishermen (perch, etc.) is required if the question of public health warnings for fishermen is to be adequately addressed, remedial action taken, or recovery noted.  
Michigan is designing such a system, but resources will be needed. (A million?)
- E. Monitoring should be more anticipatory and less reactionary. Need to look at the IJC Annual Reports for emerging problems.  
When new problems are identified the monitoring needs to be done more frequently.  
New testing procedures should be perfected and more use made of biological indicators.

YELLOW GROUP: February 12, 1981

WORKSHOP SESSION B: STRATEGIES FOR ADDRESSING MONITORING PROBLEMS

PROBLEM: LACK OF ACCESS TO MONITORING DATA

- In some cases, users don't know what data exists or how to access it. Some problems are specifically related to inadequate computer storage and retrieval systems, some to the slow analysis of data, some to the fact that much "grey information" exists but it is hard to find, use; and in some cases users are refused access to data by an agency or a state (or province).

STRATEGY:

1. Develop a Central Clearinghouse for Great Lakes Data: Such a clearinghouse would not store data, but would provide information about what information exists, where it is (including grey data), how to obtain it; be able to do a literature search and provide abstracts. It would collect and prepare an inventory of data sources and environmental data systems in both the U.S. and Canada.

The Great Lakes Information Referral Center which was established by the Great Lakes Basin Commission and Michigan Sea Grant could serve as a basis of such a center-clearinghouse. It has concentrated on accessing information sources on coastal zone issues to date and has provided its services free of charge to agencies and the general public. It would require a substantial investment of funds, trained personnel and reorientation of some established policy. Funding for Great Lakes Information has nearly run out. The States are unwilling to provide funding and so are federal agencies. They are willing to contribute data, but are not willing to pay to use the system. Use by the general public, educational institutions, etc. would also drop if payment were required, according to preliminary investigations regarding attempts to develop alternate means of funding the Center.

2. Improve STORET or adapt an alternative system so that industrial "end-of-pipe data" can be retrieved from the system. (This is presently impossible-- the data is put in, but cannot be retrieved in a form which can be accessed.) Develop methods to input compliance monitoring data in computer storage as there is increasing need for such data...particularly with respect to information regarding materials present in power plant waste streams.
3. Data should be analyzed in a timely fashion and made available to user agencies in appropriate formats. Resources for analysis should be in GLISP.
4. Monitoring Agencies should make every effort to provide needed data on request (acknowledging limitations for proprietary data, data in litigation). Sitting on data so people can publish should be discouraged. States should be reminded of obligations for information sharing under the Water Quality Agreement.

PROBLEM: LIMITED OR INCOMPLETE DATA BASE AND LACK OF TIMELY DATA ANALYSIS POSES PROBLEMS FOR DECISION MAKERS. THERE IS LIMITED USE OF DATA DUE TO LACK OF TIMELY ANALYSIS (by decision makers)

## STRATEGY:

1. To meet the goals and objectives which have been stated in GLISP and other Great Lakes monitoring programs, data must be analyzed and assessed in a more timely fashion than at present. (Sometimes it takes three years. A two year lag is not uncommon.) Surveillance budgets should include the costs of data analysis. Technical assistance to accomplish the analysis could be accomplished through the use of ad hoc teams such as those which are organized by the Lake Surveillance Work Groups under GLISP.
2. Once analyzed, data should be translated and displayed in formats which will be of use to the decision-makers: local officials, legislators, other agency personnel regarding nature of the Great Lakes as a binational fresh-water resource, pollution problems and needs and objectives of surveillance activities. Great Lakes should be the number one national priority in a national monitoring program because of the nature of the resource. .
3. Improve information exchange for data from monitoring programs affecting several jurisdictions to shorten time frame, access to information (unless it is proprietary, in litigation). Agencies participating in GLISP should make every effort "not to hold on to data to protect it" or withhold needed data until it can be published in scientific journals, etc.
4. Try to develop more internal consistency within the sections of the State-EPA Agreements dealing with Great Lakes remedial programs, controls, and monitoring so that there is a more direct relationship with GLISP, Water Quality Agreement Objectives and more consistency with other states in the Basin with respect to the Great Lakes.

- Case: Great Lakes States have to do two major types of monitoring: Federal Water Pollution Control Act monitoring and superimposed on that monitoring are the requirements for monitoring under the Great Lakes Water Quality Agreement. They also have their own state required monitoring programs. Many of the activities for three levels are the same, but the state's internal priorities may change from year to year or the Agreement priorities may change. There is no efficient way to adjust to this at present... especially in states where most of their territory is in other drainage basins.

States don't use open lake data, tributary monitoring data on a day-to-day basis or for their own operations. If EPA, IJC, Canada can package the data, analyze it and provide results to states, they will use it. They give IJC access to state data as a service. If a state does not normally gather specific monitoring data and EPA pays for or actually does monitoring to meet a need of EPA or the Agreement, EPA sends the data back to the states for their use. A great deal depends on cooperative arrangements and upon careful planning. Needed data, especially with regard to resource assessment is not gathered as GLISP has not been modified to meet the information needs for ecosystem management.

Reasons for monitoring may be different for states or local jurisdictions than they are for GLISP even though the same sample may be used for GLISP as for other programs the state engages in...States have networks of fixed stations for ambient monitoring and programs are described individually. The same station samples may be used to provide tributary

loadings information for IJC, may reflect "urban area" loadings, be part of a national network of 1000 stations to satisfy 208 agency functions and so forth. The same field crew and laboratory may serve multiple functions. Unless all involved know why each parameter is needed and for whom it is being prepared, needed parameters may be lost. Appropriate data need alerts should be provided to cooperators.

STRATEGY:

Data are being utilized when analyses have been completed; also basic data are used.

1. IJC Annual Reports are widely used throughout the Basin.
2. Michigan Sea Grant has developed a Great Lakes Curriculum for the 7th, 8th Grade level.
3. Community most easily educated is elitest to the extent that it has an interest in the Great Lakes...much of this community (the press, citizens, the scientific community, some agencies) acts as a resource to disseminate data to the general public and other users. An example would be the toxics data, hazardous waste data which has been reported in Focus, The Communicator, Environment Midwest, Michigan Natural Resources Journal, Northern Ohio Business Journal. These publications have also attempted to discuss possible solutions to problems. Accurate data are needed to gain confidence of a public which has lost confidence in the government's ability to address such problems, or to work with producers to solve toxics and hazardous waste problems.

PROBLEM: SOME DIFFICULTIES EXIST IN DEVELOPING PREDICTIVE MODELS, ASSESSING PROGRESS IN SOLVING GREAT LAKES POLLUTION PROBLEMS, DUE TO LACK OF AN ADEQUATE REPOSITORY SYSTEM FOR SAMPLE ARCHIVING. MONITORING SAMPLES OF WATER, TOXICS, SEDIMENTS, FISH, AND OTHER BIOLOGICAL SPECIMENS NEED TO BE KEPT.

- Although state programs are supposed to archive fish flesh samples, they are not doing very well. Not enough samples are collected and supplies are exhausted too quickly. Often samples and data are both discarded. In addition to contaminant samples from fish, benthos and zooplankton should be included. Programs should keep track of who has what and where. Even when samples are sent to the Smithsonian, they sometimes get lost.

PROBLEM: THERE ARE NOT ENOUGH EXPLICITLY DEFINED OBJECTIVES FOR ONGOING MONITORING PROGRAMS

STRATEGY:

- Determine what kind of data you really need, design monitoring programs to meet a specific set of objectives and subsets of objectives. Include fine line definitions, specific tasks, i.e., ask the right questions: What monitoring will you have to do to find out what is happening with phosphorus trends? How will this monitoring relate to evaluation of remedial programs?



PROBLEM: GLISP IS A GOOD PLAN, BUT IT IS NOT BEING IMPLEMENTED AS INTENDED

STRATEGY:

1. Identify need for resources of data analysis and provide funding, detailed strategy for analysis, preparation of data formats for key user populations. Incorporate into GLISP.
2. Priority, commitments for GLISP implementation are very high with cooperating agencies and most states in the Great Lakes Region. Also very high with both Canadian Federal and Provincial governments. U.S. commitment at the Washington level appears to be lacking. Congressional delegations need to be well informed, key information provided to Washington EPA, NOAA.

PROBLEM: THERE ARE NEEDS FOR IMPROVEMENT IN MONITORING TECHNOLOGY

1. Satellite Monitoring: This is useful, but may presently be too costly. It is appropriate for chlorophyll and particulates. A major problem is ground truthing and the expense of providing a ship that may be unable to perform schedule activities due to weather problems.
2. Toxics, Contaminant Monitoring and Analysis State-of-the-Art lags behind the surveillance strategy and pollution problems.
3. Atmospheric Deposition: Technology is needed to measure what is in ambient air, fall out, to trace sources, fugitive emissions. This should include organics and heavy metals...metals that may be mobilized by acidic precipitation, carried on particulates, etc.
4. Multimedia Monitoring Systems need to be developed to identify cross effects.

PROBLEM: THERE ARE MAJOR CONFLICTS ABOUT WHAT TO DO WITH DREDGE SPOILS IN THE GREAT LAKES

- Some harbors have sediments so contaminated with PCBs, heavy metals, organics, that states have prohibitions on dredging. There is a shortage of appropriate available land disposal sites. Diked disposal sites are also controversial. There is little monitoring of whether or not diked disposal sites are preventing polluted sediments from leaching into the lakes. Some agencies (Corps of Engineers) propose open lake dumping. Results are not monitored.

STRATEGY:

- There is a dredging subcommittee operating under the Water Quality Agreement. They are working on a definition of polluted dredge spoils, but there is no consensus as to how to dispose of them. Questions to be asked to design a monitoring system for various disposal alternatives should be identified, systems designed and applied, results evaluated as a means to identify which disposal systems operate most effectively.

- Related Information: Some diked disposal facilities such as Toledo's, have become habitat for large numbers of waterfowl, a number of which are important wetland species: heron, egrets, ducks, geese, tern, etc. Large breeding stocks are using these facilities. No monitoring is being done to determine whether there is any adverse impact on these bird populations. They are inhabiting the disposal facilities partly because their natural habitats are being drained and/or filled.
- The need to resolve the issue of polluted dredged spoil disposal safely is high due to the fact that certain harbors may be closed or so filled in with sediment that commercial shipping will be severely curtailed. (The Indiana-Burns harbor area near Gary-Hammond, Indiana is such an example.)\*

PROBLEM: GLISP WAS NOT DESIGNED TO DO ECOSYSTEM MONITORING

- There are strong philosophical differences between resource managers and water quality managers which must be resolved if a surveillance system responsive to ecosystem management is to be designed. Regulatory agencies are interested in concentration in the lakes. Resource managers are interested in concentration of pollutants in the fish and impact on biotic populations.

STRATEGY:

- Amendments would need to be made to Annex 11 of the Water Quality Agreement to emphasize ecosystem surveillance requirements, needs. GLISP structure would probably still be adequate, with modification, but there would have to be more emphasis on analysis of data within an ecosystem context rather than by individual parameters alone. Research would be needed to design such a system. It would also need to be more responsible to data needs for public health managers.

\* Editorial explanation: Some issues were discussed at Traverse City. This has been identified as a major need in various COE studies (Connecting Channels and Harbors, Winter Navigation, Proposed Harbor Dredging for Ashtabula, Buffalo, etc.)

GREAT LAKES POLLUTION MONITORING STRATEGIES, PRIORITIES

1. The Great Lakes International Surveillance Plan should be the basis for Great Lakes pollution monitoring. The International Joint Commission is the coordinating institution for GLISP under the Water Quality Agreement of 1978. It should remain so. The Great Lakes are a binational resource and must be managed cooperatively with Canada.
2. GLISP should be adapted to meet additional needs.
3. There should be a Great Lakes Monitoring Data Information Clearinghouse. It should not collect data, but serve as a referral center. It could be built on Great Lakes information, but they would need additional funds, specific direction and skilled personnel.

It could be developed on the model of the Lake Erie Work Group described by Larry Cooper. This is being used for Surveillance Plan implementation in Lake Erie.

4. Additional parameters should be added to present monitoring programs.
  - These should include the priority pollutants such as trihalomethanes so compliance with Safe Drinking Water Act can be monitored.
  - Contaminants in fish for specific parameters identified by the FDA.
  - As lighter fractions of petroleum distillates become more prevalent due to use of unleaded gasolines, diffuse source runoff from land and atmospheric deposition may increase. Monitoring systems should include parameters for benzene xylenes. Fish should be sampled to determine if residuals from low-lead fuels are being concentrated.

Care should be taken that only needed parameters are monitored due to budget constraints.

5. There are public health concerns for developing monitoring systems to identify human exposure to TSCA identified materials. This requires increased biological monitoring.
  - Exposure to toxics is not known. Adequacy of NPDES data base and industry production data is unknown with respect to identifying human exposure. Water column sampling cannot detect low levels due to technology and budgetary limits. It is not sufficient to determine human exposure. (Swain's PCB case illustrates.)
  - Inventories of where materials are produced -- locational information. This could be similar to Michigan requirement for reporting of critical materials on an annual basis (includes use, discharge and management information).
6. Water intake monitoring should be part of the GLISP data base. Institutional arrangements, data management arrangements for achieving this are somewhat obscure and should be clarified.

7. Ecosystem monitoring needs must be clarified, specified. These should include:
  - Multi-media monitoring with specific strategies at jurisdictional levels. Linkages between air, water, land pollution control programs must be identified, and appropriate management strategies implemented.
  - Mass balance research, information and monitoring is required.
  - Monitoring systems to develop information regarding sediment transport and storage of toxics, other materials are required.
  - Use of integrator organisms is important for monitoring ecological effects with respect to population reproduction rates (gull eggs), accumulation of contaminants (gulls, fish), indicator for oligotrophic water quality, indicators for low level contaminants (lead) and for long-term monitoring (benthos).
  - Demographic information with respect to resource and land use practices, population distribution will be needed to implement ecosystem monitoring.
  - Social effects of pollution problems, remedial actions need to be identified.
8. Monitoring objectives need to be refined and kept current (See Annex 11, P2 of Water Quality Agreement).
9. STORET or its successor needs to be designed to meet data access needs.
  - Personnel limitations should be overcome by training of qualified data managers.
  - The software needs to be updated.
  - STORET includes only water quality data. How can it accommodate biological data, toxics data so data can be accessed more efficiently? (Toxet, Bio-storet exist)
  - The states can use their own data input to STORET if they have trained operators. It is difficult for others.
10. The NOAA Monitoring Plan should function to:
  - Identify deficiencies in existing monitoring programs.
  - Coordinate agency budgets.
  - Identify gaps, needs in Agency programs, budgets.
  - Be used by agencies as budget justification to get funding for GLISP.
  - Assist agencies in avoiding duplication.
  - Minimize use of federal dollars.
11. More funds are needed for Great Lakes Monitoring.

Political contacts, education of Congressional delegations, new administration will be needed.

12. There is minimal duplication of monitoring in the Great Lakes at present because of GLISP. There is a history of cooperation, across state and international boundaries to carry out monitoring activities. The problems are primarily those of data access, compatibility, and coordination of management programs once the monitoring data are obtained. Also of data analysis. See specific case history in GLISP.
13. GLISP is probably underbudgeted. The 10 million figure is joint U.S.-Canadian, with each party responsible for half. The U.S. has not met its "half" of the commitment. With the exception of atmospheric surveillance research (to design a monitoring system), not a lot of GLISP is basic research. Researchers use GLISP

## The Use of Monitoring Information by Participants

Workshop participants were asked to provide, as part of their briefing to work sessions, information on their use of Great Lakes monitoring data and information. The responses are summarized below. Names of agencies and/or government type (state, local, etc.) are indicated rather than individually named.

International Joint Commission: Uses evaluated data for public information purposes, translating it for decision makers and the public as an aid to evaluating effectiveness of pollution control/remedial programs. The Commission uses data to identify new problems, evaluate effectiveness of remedial programs, to determine whether Water Quality Agreement commitments are being met and as a research data base for understanding system processes. Data are used as a basis of information/recommendations and advice provided to the governments.

U.S. Environmental Protection Agency: Data are used to determine compliance with Water Quality Standards and Water Quality Agreement Objectives; to determine loadings, transport, fate and effects of pollutants from both point and non-point sources, and for basic research. Research uses include modelling, large lake systems analysis, determination of the effectiveness of phosphorus control strategies, and the assessment of risk from toxics in the Great Lakes.....particularly with respect to the impact on human health. Atmospheric transport research is also being done.

NOAA: Uses monitoring data to design surveillance systems, and as a basis for the research program in the Great Lakes.

U.S. Fish and Wildlife Service Great Lakes Laboratory: Uses existing data as a research tool in the development of fisheries monitoring techniques and procedures.

The States: (Minnesota, Wisconsin, Michigan, Indiana, Illinois, New York) are currently using monitoring data for a number of purposes. Both water quality and public health interests were represented at the workshop. Uses stated were as follows:

- Setting water quality standards and measuring compliance
- Evaluation of effectiveness of both point and non-point source control and remedial action programs
- Enforcement of compliance with control measures
- As a basis for management decisions, resource allocation, program strategy, etc.
- To identify public health problems (drinking water, water contact sports or beach management, fisheries)
- To serve as the basis for beach closings, water treatment measures, fisheries warnings, and prohibition of fish consumption
- To identify emerging problems
- To do risk/hazard assessment
- To monitor problem sites
- For political purposes.....to support requests for funding of pollution control programs, or to support state legislation such as detergent phosphate bans
- For public relations purposes such as providing information to Congressional delegations regarding water quality problems, program needs, or improvements in the district and/or providing information to the media regarding effects of programs or new problems

Research Laboratories, Centers, Sea Grant: Monitoring data is used as a basis for research (an iterative process), to develop surveillance plans and programs, including assignment of responsibility and coordination of data gathering activities as in the development of the Lake Erie Work Group. Some research centers do monitoring. (CLEAR) Results are made available to others for use. Sea Grant also uses data as a basis for educational programs with the advisory service.

Local Government: Water treatment plant and wastewater management facilities managers were represented. Local governments are responsible for ensuring safe drinking water supplies and for meeting wastewater treatment requirements. Monitoring data is used:

- To determine effectiveness of pollution control strategies (point source programs specifically)
- For environmental assessment of proposed facilities, shoreline development, drinking water quality, etc.
- To meet public health requirements for municipal beaches and drinking water treatment

- For political purposes.....such as convincing local voters to commit tax monies for pollution control facilities and programs and to report back results; to assure people that water is safe for use, or to report that it is unsafe.

Corps of Engineers: For environmental assessment of projects for which COE has permit responsibilities and for dredging activities and disposal of dredged materials.

U.S. Coast Guard: Under U.S.-Canadian Water Quality Agreement, has certain monitoring and enforcement responsibilities. Gathers and uses monitoring data for identification and enforcement of vessel discharges, spills policies and as a basis for clean-up activities.

Canada-Federal: As a basis for implementing the Great Lakes International Surveillance Plan, to identify new problems, to determine compliance with the Agreement, as a basis for research to trace transfer of toxics in food chains through fish monitoring programs, to attempt to do mass balances, and to determine behavior of pollutants in the Great Lakes system.

Canada Centre for Inland Waters: Surveillance data is evaluated by the Centre and they try to "make sense of differences in the lakes from year to year." Basic research also uses monitoring data.

Ontario: Monitoring data are used for enforcement, regulatory and predictive purposes, to set effluent requirements and for applied research such as that used to provide a basis for the engineering design of wastewater treatment systems.

Ontario-Hydro: As the government owned electrical utility, Hydro needs monitoring data so they can develop strategies as a basis for negotiations with pollution control agencies. They also supply data to regulatory agencies.



## LOCAL PROBLEMS AND NEEDS RE GREAT LAKES POLLUTION MONITORING

Problems of local users of monitoring data were illustrated by situations and needs identified by participants from both local and state agencies.

Case: The Milwaukee Metropolitan Sewer District is the largest point source discharger to Lake Michigan. It serves one million people. They are involved in a court mandated 1.6 billion dollar expansion of their facility to deal with combined sewer overflow problems and to improve water quality in three rivers, nearshore areas and Lake Michigan. They feel the need to document water quality in these areas before and after construction. Existing nearshore water quality data documents the situation in the Milwaukee outer harbor, not nearshore. They need more data on water currents and meteorological conditions so transport of the pollutants can be modelled. Sediment is a continuous problem in the rivers. In order to make the plant (STP) acceptable they need data about water quality in the estuary and streams to monitor the effects of the combined sewer overflow control program. They need to determine whether the estuary will clean itself up or whether other measures are needed such as flow augmentation, dredging, etc. to meet the fishable, swimmable criteria. Political incentives to garner support for local funding, operation are also an important factor. They cannot afford to do the monitoring themselves and available data is insufficient. Coordination of monitoring activities of other agencies might provide assistance (EPA, USGS). The need to monitor this significant point source under GLISF might be considered.

## PROVINCIAL PROBLEMS AND NEEDS RE GREAT LAKES MONITORING

Provincial users have a great deal of difficulty using U.S. monitoring data and making it comparable with Canadian data. U.S. data is very diffuse and this inhibits efficient use of the data. U.S. data is stored in a raw form. It is difficult, for instance, to get just Lake Erie data out of the storage system. STORET will spit out the data for all rivers, tributaries, etc., making it necessary to go through and extract only Lake Erie data. There is no centralized information source

for loadings data and no standard means of collecting it. Each of the eight states send data to STORET in its own way. It is necessary to know the codes of all the jurisdictions on the U.S. side in order to access their information. Data is collected in different ways by different people and different agencies.

#### INTERNATIONAL PROBLEMS AND NEEDS RE GREAT LAKES MONITORING

GLISP needs to be implemented. That requires commitment and coordination. Too many cooks and/or no head chef spoil the broth and inhibit progress. There is no Canada-Ontario type agreement on the U.S. side between EPA and States that specifically addresses state responsibilities under the Water Quality Agreement. A lack of commitment from the U.S. Federal Government at the Region V and Washington EPA levels hampers the effectiveness of the U.S. portion of the monitoring system.

The IJC needs to determine whether the objectives of the Agreement are being met. The Commission is not sure that the right data are being collected and/or used, particularly with respect to toxics. They are concerned about the health impacts of certain chemicals so they can develop a monitoring program to determine if, when, and how the dangerous ones are in the environment. They need to know, for example, whether toxic contaminants are entering the Niagara River from waste dumps, SCA or other inputs. They need information about sediment transport and deposition. They need additional monitoring information about ecosystem implications of toxics in the system. They need data in a usable form for decision-making....interpreted and suitable for public dissemination. (When the Commission receives recommendations from its Boards and Committees, it often holds public hearings before reporting to the governments.)

#### Improvements in Design of GLISP and Its Implementation Are Needed

Improvements in the design of GLISP and GLISP implementation programs are needed to make the Great Lakes monitoring system more effective and to accommodate needs for ecosystem and public health monitoring. Resource management needs must also be considered.

### Improvement in Plan Design:

- Define specific monitoring needs more clearly and develop specific, adequately defined objectives for each need. Tasks for meeting objectives need to be identified. Results of such design improvement would be better planning for implementation strategies, more cost-effective planning and prioritizing, better coordination of monitoring activities and implementation of the plan itself. The more specific definition should include provision for data analysis, for specific user populations and more refined projections for resources which would be required to carry out the various tasks and meet objectives.
- Provide clear rationale for implementation of specific monitoring tasks. Tasks serving more than one need (water quality data, public health or resource management data, research) would be more easily identifiable. GLISP could be adjusted so that these multipurpose monitoring needs are fulfilled. (This has been done to a limited extent with the Lake Michigan Monitoring Program)
- Improve the decision-making infrastructure for funding GLISP activities (especially in the U.S.). The time lag between planning, funding application and allocation or appropriation needs to be shortened or at least the route needs to be more direct. Present GLISP planning does not provide for time lags which result when local or state agencies have to go to Boards, state level, regional level, and then to Washington. Either develop a scheme to obviate time lags or change the implementation plan to allow for adjustment.
- GLISP needs to provide for development of a data archiving system for water samples, sediment, fish, benthos, zooplankton, other biological specimens for long periods of time. There is continuing need for samples for contaminant analysis, comparative work.
- GLISP needs to be modified to incorporate ecosystem monitoring. Note suggestions from International Joint Commission, Science Advisory Board.
- Monitoring for diffuse source pollutants from land runoff and atmospheric deposition should be increasingly emphasized.

## STATE PROBLEMS AND NEEDS: GREAT LAKES POLLUTION MONITORING

State interests represented at the workshop included those responsible for water quality regulation and enforcement, water resource management, public health, research, and policy analysis and decision-making in environmental management. Both users and collectors of monitoring data were present. The only Great Lakes States not sending representatives to the workshop were Pennsylvania and Ohio. State participants at the Workshop indicated that they had five areas of need for monitoring data:

- For the setting of environmental standards\*
- For measuring compliance with environmental standards
- For enforcing compliance with environmental standards
- For determining preventive and remedial measures
- For measuring the effectiveness of preventive and remedial measures in achieving environmental protection

(\* interpreted, from participant discussion to include public health)

The States also indicated that their resources were too limited for them to engage in monitoring for the sake of monitoring... they had to have a specific purpose with specifically defined objectives. They want to work to achieve more clearly defined objectives and related tasks for the states than presently exist for them under GLISP.

Specific illustrations of State problems/and or needs with respect to Great Lakes monitoring are provided below. These are illustrative and do not constitute all needs expressed. They do indicate emphasis. Those which can be said to be of priority interest / need were determined on the basis of commonality, statement of priority, consensus. In some cases these problems/needs will require reallocation of resources under GLISP if additional resources are not available.

Regulatory and enforcement responsibilities, protection of public health reside primarily and at least initially at the State - local level. States indicated that they had no need, on a day-to-day management basis for open lake data and therefore that they did not collect it. They felt that their primary need were for nearshore data and stated specific needs for additional nearshore and tributary data. (They used open lake data if it was provided to them by IJC or EPA in other than raw form ie: analyzed and packaged, primarily in the political process at legislative and administrative hearings as ammunition to demonstrate need of regulations, legislation

resources to implement control and prevention strategies. If the data is not available to them, they will not collect it .

They are not allocating sufficient resources to analyzing monitoring data and therefore is presently not accessible to decision-makers. They do not allocate sufficient resources to monitoring given the amount of money being spent on facilities and control programs to assess the effectiveness of those programs

The State of Michigan expressed concern over the impact of unanticipated changes in historical monitoring activities of federal agencies, others upon whose data they depend. An example provided was related to the USGS provision of stream flow data. USGS has provided this stream flow data for years. Without determining the need of others (the state, in this instance) for this data, they are cutting back and increasing monitoring activities on chemical/toxic flows. This latter duplicates a program Michigan has been doing. Since they cannot afford to duplicate, the state has cut its chemical monitoring program back and is without the stream flow data which they need. Participants recommend that monitoring data be developed to meet particular needs, should not be duplicative and when monitoring is to be discontinued or changed in emphasis, users should be notified far enough in advance to be able to advise the agency of their priority of need for the program , to seek modifications in plans to change or to be able to design and institute a substitute to meet their needs.

State participants have found that information needs for making public health decisions are greater than those for obtaining basic water quality information. A problem with respect to public health and resource management policy decisions was posed by the State of Michigan participants, and underscored by Wayland Swain. Case:The ability to protect the public health adequately depends on being able to obtain and evaluate enough appropriate data samples to make informed judgements and subsequent management decisions. The Lake Michigan Sport Fishery is contaminated with PCB's (and other toxics). PCB's have been found to exceed FDA safe levels in the milk of nursing mothers. Babies are being dosed at 20-25 times daily safe limits established for human health. Research has shown that there is direct correla-

between the amount of fish consumed on an annual basis and the amount of PCB's in mother's milk.

Are all Lake Michigan sport fish contaminated with PCB's equally or are some areas of the lake likely to produce more highly contaminated fish? How much migration is there? Are near shore fisherman likely to catch highly contaminated fish? Public health officials do not believe that these questions can be effectively answered on the basis of a few fish samples which may be sufficient to determine the presence of a contaminant in the water (ie a water quality sample). Policy decisions relate to options with substantial economic as well as public health impacts:

Options include:

- Closing the Lake Trout fishery on Lake Michigan because the fish are unfit for human consumption due to high levels of PCB's
- A warning that human consumption should be limited to no more than  $\frac{1}{2}$  pound of lake trout once a week.
- A warning that no trout be consumed by pregnant women or by children with the remaining population limiting consumption to  $\frac{1}{2}$  lb/week.

Prior to making such decisions a risk or hazard assessment must be made with respect to human exposure. They have to have access to monitoring data about the levels of contaminants in fish (are they rising, falling, what are extrapolations), and must know where the sample fish were collected because contaminant levels are not uniform. In addition samples of the commodity taken at a specific location must be numerous enough so that a statistically defensible analysis can be made. They need flesh on and flesh off samples. In addition other species should be tested (salmon, etc.) which are sought after for human consumption. One cannot shut down a lake on the basis of three samples. In the case of fish found in a tributary lake and determined to be contaminated on the basis of three samples, the Department of Natural Resources was able to begin tracing the source, found the culprit and began going after remedial action. However the information and the resultant analysis and action did not relate to public health needs and the kind of information necessary to decisioning to protect the public health once the contaminant is in the system and until continued monitoring shows enough improvement so that the fish are safe for consumption.

Activities performed by the State of Michigan under GLISP- GL Environmental Contaminants Committee work include fish sampling. Again, timely data analysis is a problem. Frozen fish, unanalyzed and sitting in a locker are of no use in making management decisions. At present, when a new problem is discovered, the surveillance program doesn't have funds (contingency) to go back and collect additional data and analyze it. These kind of problems are not just brush fires... the same questions need to be asked of the big lakes. Should more than interstate sale of fish from Lake Michigan be banned. Are the PCB's in the fishery so widespread and at such high levels that fishing should be shut down entirely? Because the FDA does not enforce its own PCB standards, should the State of Michigan unilaterally enact and enforce its own policy to protect its citizens?

Michigan Public Health would like to design a demonstration program for addressing such issues and implement it to determine whether results are promising enough to warrant expansion of such public health monitoring.

The need for additional, more intensive nearshore monitoring was articulated by both state and local participants. "Early GLISP" has concentrated on open lake monitoring. Nearshore data is needed to determine effects of remedial measures, for enforcement purposes, to define mixing zones, and to monitor transport of contaminated sediments. Determination of whether point source phosphorus reduction is effective will require additional near shore and tributary monitoring. If the strategy for control of toxics is to emphasize source reduction and proper management of facilities and disposal sites, monitoring will have to move close to the source. Nearshore monitoring of fish and wildlife resources are needed. Shoreline sediment loadings need to be more specifically monitored with respect to associated contaminants and nutrients. States indicated that they would need additional resources to do the nearshore monitoring, but would accept the responsibility if EPA assisted with the resources.

States would like to have the institutions involved in monitoring programs, especially the federal government find a more effective means to coordinate their activities. At least one state, Michigan, sees IJC as the primary central agency to coordinate Great Lakes monitoring activities and believes that all agencies can be appropriately involved under that umbrella. Most agreed, tacitly or in their placing priority on GLISP with that strategy. Federal and state agencies with monitoring responsibilities in the Great Lakes should do better what they are doing now under GLISP...plan, coordinate and allocate resources and programs to meet goals and objectives stated in GLISP.

Although a number of participants defended STORET, most agreed that they had priority needs for better ways of storing and retrieving data.... and for making it available to those who need it. This problem is illustrated by difficulties presently experienced by Indiana with respect to the heavily polluted Indiana Harbor Ship Canal. Indiana has not had any monitoring programs on the Great Lakes (except for 20 years of water intake data) until quite recently. Region V EPA, Chicago, local governments had been doing what monitoring was accomplished. Now decision-makers at the state level have to make policy decisions regarding the limits they will impose on a polluter two years from now, etc. to achieve compliance with environmental standards. Since they have no historical data, they are uncertain as to what is technically possible over a period of time. EPA had collected data three years ago and placed it in STORET. Computer people were asked to obtain the data from STORET...(EPA)...the information that came out of STORET was for Milwaukee Harbor. The Indiana Harbor stuff is lost. It is in the computer someplace but they don't have the time or money to rummage around in the computer and try to find it. In addition, the EPA Regional office is perceived to have created unnecessary bottlenecks for the state in identifying what information is available and assisting them. The State has a resource problem for alternate means of obtaining the information. They need trained personnel to take monitoring data they do have (25,000 data points collected in 1980 on phosphorus inputs) and put it into a format that will be useable. So the data they do have is not being used for lack of technical resources. They are



a small agency in terms of Great Lakes monitoring (three people who work all over the rest of the state as well) with a large pollution problem in Lake Michigan. They have enough money for data collection, but neither money nor people to manage and assess the data. How can this problem be addressed cooperatively?