Special Report on Potential Oil Pollution Eutrophication and Pollution from Watercraft: Third Interim Report on Pollution of Lake Erie, Lake Ontario and the International Section of the St. Lawrence River

International Joint Commission

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SPECIAL REPORT
ON
POTENTIAL OIL POLLUTION
EUTROPHICATION
AND
POLLUTION FROM WATERCRAFT

THIRD INTERIM REPORT ON POLLUTION
OF
LAKE ERIE, LAKE ONTARIO AND THE
INTERNATIONAL SECTION OF THE ST. LAWRENCE RIVER

BY THE
INTERNATIONAL JOINT COMMISSION

APRIL 1970
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INTERNATIONAL JOINT COMMISSION

SPECIAL REPORT

on

POTENTIAL OIL POLLUTION, EUTROPHICATION AND POLLUTION FROM WATERCRAFT

This is the third interim report on the water pollution of Lake Erie, Lake Ontario and the International Section of the St Lawrence River. The first interim report, dated December 1965, informed the two Governments of the then known conditions in Lake Erie and Lake Ontario and the more significant sources of pollution. That report outlined the three phases of the Commission's integrated programme for its investigation. The second interim report, dated August 1968, briefly outlined the progress made by the Commission's two Technical Advisory Boards and also summarized the progress being made in implementing remedial measures on both sides of the boundary.

The first phase of the investigation was completed in 1969. These short-term concentrated studies were designed to secure factual information on the two lakes and the St Lawrence River as well as the extent, origins and effects of pollution. The second and third phases, involving detailed continuing studies and research, were initiated during the first phase and are continuing.

The International Joint Commission is aware of the anxiety and wide public interest concerning the water
quality of these waters. After a thorough inquiry into the pollution problems of Lake Erie, Lake Ontario and the International Section of the St Lawrence River, the Commission concluded that three items of concern, namely oil pollution, eutrophication and pollution from watercraft, should now be brought to the attention of the two Governments as a matter of urgency.

The Commission will report comprehensively and as expeditiously as practicable on the other aspects of the inquiry undertaken by the Commission at the request of the two Governments. These other aspects will include but will not be limited to such matters as transboundary movement of pollution, water quality objectives and remedial measures. The comprehensive report may also contain further detail regarding the subject matter of this interim report but it will not materially alter the recommendations contained herein.

By reference dated October 7, 1964, the Governments of Canada and the United States requested the International Joint Commission to investigate and report upon the extent, causes, locations and effects of pollution in the waters of Lake Erie, Lake Ontario and the International Section of the St Lawrence River and to recommend the most practicable remedial measures which might be considered necessary. The text of the reference is appended hereto.
On March 21, 1969, following a serious oil pollution incident off the California coast, the two Governments requested the Commission to make a special report on the adequacy of existing safety requirements applicable to underwater drilling and production operations in Lake Erie to prevent oil escaping into the Lake; the adequacy of known methods of confining and cleaning up any major oil spill that may occur in Lake Erie from any source; and the adequacy of existing contingency plans, and their implementation, for dealing with such oil spills. The text of the letter of March 21, 1969, from the two Governments is also appended hereto.

After an initial review, the Commission made public on October 8, 1969, a detailed Summary Report on the pollution of Lake Erie, Lake Ontario and the International Section of the St Lawrence River submitted to the Commission by the two Technical Advisory Boards it established for that purpose in December, 1964. The Boards and their Committees consisted of acknowledged experts from the agencies of the two Federal Governments, the Province of Ontario and the States of New York, Pennsylvania, Ohio and Michigan. Similarly, on October 27, 1969, the Commission made public a special report entitled "Potential Oil Pollution Incidents from Oil and Gas Well Activities in Lake Erie", prepared by its International Lake Erie Water Pollution Board. Both reports were given
wide distribution and public hearings were scheduled in each country. Notices of the hearings were published in accordance with the Commission's Rules of Procedure and were also mailed to many persons known to be interested.

The public hearings on potential oil pollution in Lake Erie were held in Toronto, Ontario on December 2 and in Cleveland, Ohio on December 3, 1969. The hearings on the pollution of Lake Erie, Lake Ontario and the International Section of the St Lawrence River were held in Erie, Pennsylvania on January 20, Toledo, Ohio on January 21, London, Ontario on January 23, Hamilton, Ontario on February 2, Rochester, New York on February 4 and Brockville, Ontario on February 6, 1970.

At these hearings, all those interested were given opportunity to convey relevant information to the Commission and express their views orally or in writing. In fact more than 200 statements were made by elected representatives, spokesmen for governmental agencies, local organizations, industry and many private individuals.
OIL POLLUTION IN LAKE ERIE

The International Lake Erie Water Pollution Board in response to the Commission's directive of April 1, 1969 and with the concurrence of the Commission, established an ad hoc committee of its members to expedite the examination of drilling regulations and procedures, containment and cleanup of oil spills, and contingency plans. The ad hoc committee consulted responsible provincial, state and federal agencies in both countries. The drilling regulations were reviewed with state and provincial geologists and drilling specialists. The ad hoc committee examined in detail the drilling regulations of Ontario and Pennsylvania and the proposed rules and regulations of New York and Ohio. Pursuant to Michigan's long-standing policy, leases of state owned bottom land in the Great Lakes are not granted for offshore drilling. The committee also examined the means available to clean up oil spills and the status of contingency planning.

Lake Erie is an essential source of fresh water for some ten million people that live on or near its shores. Thus in its concern with the quality of Lake Erie waters, the Commission must take account of potential as well as current sources of oil pollution. The potential for serious incidents of oil pollution includes but is by no means
limited to underwater oil and gas exploration and development. In order to place the threat of pollution from drilling in its proper perspective it is necessary to consider the significant amounts of oil pollution from municipal and industrial sources, shipping, product transfer, shore storage and pipelines.

The Commissioners were appalled at the insidious intrusion of vast amounts of oil from the populous and industrialized communities in the Lake Erie basin. For example during 1969 more than 1000 barrels per day of oils and greases were discharged into the Detroit River, the major tributary to Lake Erie. The Buffalo River is another significant source of oil pollution of boundary waters. These oils and greases occasionally appear as slicks on the water surface but more often are emulsified in the effluents. Some of these pollutants are adsorbed onto the suspended load in the river and are deposited as sediment. Such is the situation in Cleveland Harbor where it was estimated that 17,600 tons of oil and grease were included in the 660,000 tons of dry solids removed during the 1966-67 dredging operations. (These wastes are currently being placed in a dyked disposal area.)

The Commission is concerned about the numerous accidental spills. In April 1969 it was estimated that 2,300
barrels of cutting oil from one industrial spill in the Trenton Channel of the Detroit River entered the western basin of Lake Erie.

The Commission fully appreciates the implications for Lake Erie of the recent groundings of the ships "Arrow" and "Delian Appollon" off the coasts of Nova Scotia and Florida respectively. The Commission was informed that on Lake Erie at any one time during the navigation season 22 lake freighters, 4 lake tankers and 7 deep sea freighters carry an estimated 120,000 barrels of oil as either fuel or cargo. These facts illustrate the gravity of the total oil pollution threat on Lake Erie and the need for adequate controls over the several aspects which comprise the total threat.

Lake Erie is part of a stable geologic basin, the latest movements occurring over 200 million years ago. These structural movements were gentle and did not involve extensive folding and faulting of the strata. The eastern and central basins of Lake Erie are in what is essentially a gas province. The traps of hydrocarbons are stratigraphic (lateral changes in permeability within widespread rock units), or were formed by ancient porous coral reefs. The bed rock sediments, into which the surface casing required in drilling operations must be cemented, are a minimum of 300 million years old, hard, and competent enough to control any subsurface pressures that might be encountered. The pressures
encountered are less than those expected under normal hydrostatic conditions.

In contrast, active oil seeps have been known to exist in the Santa Barbara Channel area for many years. The rate of flow from these seeps has been estimated to be 50 barrels a day or one tenth of the maximum rate of flow that escaped from the blowout on January 28, 1969. The Santa Barbara area is considered to be an oil province. It is an unstable area. Vertical uplift and subsidence is still being recorded on land. The traps which produce the hydrocarbons are tightly folded anticlinal structures, and complex fault features formed only a few million years ago. Strata underlying the Santa Barbara Channel are unconsolidated and apparently not strong enough to contain the pressures developed in the deeper formations. The pressures encountered are slightly greater than hydrostatic. Thus the hazard of sub-surface fluids breaking through the underlying strata is always great.

This explains why those who know the geology of both areas have assured the Commission that it is highly improbable that a dramatic drilling accident similar to the Santa Barbara incident would occur in Lake Erie.

The essence of pollution prevention from drilling operations is the containment and control of drilling and reservoir
fluids. The primary considerations which drilling regulations must take into account for each well are: the design and implementation of effective casing and cementing programmes, the adequacy of blowout prevention and related equipment, and the disposal of drilling and reservoir fluids. The regulations must be designed so as to ensure that operators during their drilling and development operations use the best materials and technology available.

The offshore drilling regulations of Ontario and Pennsylvania and those proposed for New York can provide effective protection of the waters of Lake Erie if adequate supervision and enforcement are also provided. A high degree of coordination between interested agencies is necessary to provide adequate but not repetitious coverage. However, if drilling is extensive accidents may occur. Thus it is necessary to have contingency plans prepared to cope with such incidents.

Adequate drilling regulations are only as strong as their enforcement and the willingness of the industry to act responsibly. Drilling and gas production activities in Lake Erie at present are limited to the Ontario portion of the lake. According to testimony received at the Commission's hearings, the Ontario Department of Energy and Resources Management does provide careful inspection and surveillance over the drilling and development operations.
in the Ontario portion of Lake Erie; and the industry has demonstrated a willingness to cooperate with the Government and has an awareness of the environment in which it operates. The Ontario departmental inspectors are on board the drilling platforms most of the time and are always present during critical periods such as spud-in and completion operations.

In Ontario, the Minister of Energy and Resources Management has discretionary power to suspend a drilling permit in whole or in part at any time or impose any terms or conditions on a permit which he deems proper. Such action is subject to a subsequent hearing and review by the Ontario Energy Board. The Minister can thus move very quickly to halt any operation which might pose a threat to water quality. The best evidence of effective implementation of existing regulations is the successful record of trouble-free drilling for gas in Lake Erie; oil production has not been permitted to date. Furthermore, the Ontario regulations are being progressively strengthened.

At the hearings, an official of the Ontario Department of Energy and Resources Management described the existing safety requirements and procedures in Canada applicable to drilling and production operations in Lake Erie and an official of the State of Michigan described its present policy of not permitting underwater drilling. Although officials of the States of New York and Ohio and the
Commonwealth of Pennsylvania cooperated with the Board during the investigation, no officials of these states presented testimony at the hearings to assist the Commission in assessing the safety requirements and procedures applicable in the portions of Lake Erie within their jurisdictions.

Although there have been no oil spills in Lake Erie from drilling (except for a minor incident in 1959 involving an estimated five barrels), the Commission is aware of the many oil spills reported along the shipping lanes in Lake Erie and from land-based sources. The frequent occurrence of accidental spills requires that effective means be available to contain and clean up oil spillages before the legitimate uses of Lake Erie waters are inhibited. Moreover, the collision or stranding of ships are potential sources of major pollution by oil or other hazardous materials in Lake Erie as elsewhere.

The Board on behalf of the Commission reviewed the current methods of containment of oil on water; its removal by mechanical methods, by physical materials and by chemicals; and of protection and clean up of shore areas. According to reports on major oil spills elsewhere in the world the adverse effects of materials used to sink or disperse oil can be more harmful than the effects of the oil itself. As indicated in the Board's report the equipment and techniques for the
containment and removal of large oil spills under adverse climatic conditions are primitive.

The Commission is of the opinion that those responsible for the confinement and clean up of spilled oil and other hazardous materials must have at their disposal the best technical advice and the required resources of manpower, materials and equipment. The on-scene commander needs sufficient executive authority to fulfill his responsibilities. Any contingency plan should provide for the discovery and reporting of pollution incidents and for the initiation of prompt action to restrict the spread of the pollutant. Experienced personnel should be available to direct the clean up and disposal of the collected pollutants.

The Board, at the direction of the Commission, examined the state of preparedness in both countries to respond to major oil pollution incidents which might occur on Lake Erie. Regional contingency plans have been developed by the United States for the Great Lakes and provide a response capability for spills that might occur in U.S. waters. However, there appears to be a concentration of responsibility on the federal establishment and little, if any, actual recognition of state and local capabilities or delegation of responsibility. Although the United States contingency plan for the Great Lakes region appears to be generally complete and detailed, its adequacy cannot be fully assessed in the absence of a satisfactory record of experience.
The contingency plan in Canada is still in the embryo stage. Individual agencies such as the Ontario Water Resources Commission, the Ontario Department of Energy and Resources Management and the Federal Department of Transport have internal response mechanisms established. It is understood that a Canadian national contingency plan is being developed. A major oil spill in the Canadian waters of Lake Erie at the present time, however, would be met with only a fraction of the response capabilities available because of the lack of a plan for coordination between the Canadian federal, provincial and local authorities. Furthermore, the Commission notes that there is no formal plan for a concerted international response; only informal notification.
EUTROPHICATION

The Commission in its first interim report on the pollution of Lake Erie, Lake Ontario and the International Section of the St Lawrence River, dated December 1965, pointed out that the excessive enrichment of these waters was due to nutrients contained in the effluents from municipal and some industrial facilities. At that time the Commission, on the advice of its technical advisers, stated it was satisfied that the removal from such effluents of phosphates, one of the essential plant nutrients involved, would materially retard further deterioration of these waters. Consequently, the Commission recommended that the Governments of Canada and the United States, as soon as possible, and in association with state and provincial governments take appropriate action to ensure sufficient purification of all municipal and industrial wastes before discharge into these waters and their tributaries to achieve the maximum possible removal of phosphates.

The Technical Advisory Boards established by the Commission for the purpose of investigating the pollution problem in the waters under reference reported to the Commission in September 1969 with specific findings and recommendations. The Boards' report is a product of four years of extensive study, research and evaluation. Several hundred scientists and engineers in both countries involved
in environmental assessment and pollution control participated in the multi-million dollar study. Their report is a balanced appreciation by experienced and specially qualified experts who collectively are engaged in the solution and control of all aspects of water pollution. The Boards' report summarizes their findings, identifies the critical problems, and briefly describes the measures necessary in both countries for abatement of pollution in these waters.

The Commission is convinced that the pollution problem requiring the most urgent attention of the Governments of Canada and the United States is the increasing eutrophication of the Lower Great Lakes, particularly the western basin of Lake Erie. Continued deterioration would further restrict the legitimate uses of these waters. Thus, this third interim report deals primarily with the inputs of man-derived nutrients into the lakes. This serious problem will be dealt with in greater detail in the Commission's main report, along with the other factors contributing to the deterioration of the quality of the waters of Lake Erie, Lake Ontario and the International Section of the St Lawrence River.

Eutrophication is the biological response caused by an increase of nutrients into lakes. The biological
productivity depends on the supply of essential nutrients. Lakes well supplied with these nutrients tend to be the most productive. This relationship is the basis for the "trophic" system of lake classification.

Oligotrophic lakes are poorly supplied with nutrients and support little plant growth. The biological production is generally low; the waters are clear; and the deeper waters are well supplied with oxygen throughout the year. Eutrophic lakes are rich in plant nutrients and support a heavy growth of aquatic vegetation. As a result, biological production is high; the waters are turbid due to the dense growth of phytoplankton; and the deeper waters during periods of restricted circulation become deficient in oxygen as a result of the decomposition of great quantities of organic material. Mesotrophic lakes are intermediate between oligotrophic and eutrophic. They have a moderate supply of nutrients, moderate plant abundance and moderate biological production.

If the supply of nutrients to an extremely oligotrophic lake is progressively increased, the lake will become mesotrophic in character, and with further enrichment it will eventually become eutrophic, even extremely eutrophic. This whole process of progressively becoming more eutrophic is known as eutrophication. Thus, eutrophication refers to the whole complex of changes which accompany continuing enrichment of waters by the addition of plant nutrients. These
include progressive increases in the growth of algae and aquatic weeds, a general increase in biological activity, successive changes in the kinds of plants and animals living in the lake, oxygen depletion in deep water during periods of restricted circulation, and decreasing depth as a result of accumulating organic sediments.

The biological response produced by natural eutrophication is extremely slow. On the other hand, the inputs of man-derived nutrients into a lake can produce in a few decades a biological response similar to that which under natural conditions would take tens of thousands of years.

Increased population, industrialization, intensified agricultural practices and the use of phosphorus-based detergents since the late 1940's have greatly increased the rate of eutrophication of lakes in many parts of the world. Dense nuisance growths of algae and aquatic weeds degrade water quality. Cladophora, an attached alga, piles up on the beaches when dislodged by wave action. Blue-green algae accumulate on the shore creating unsightly odorous scums.

These eutrophic conditions inhibit many of the legitimate uses of the lake. Algal growths interfere with domestic and industrial water supplies by causing taste and odour problems and by clogging filters; contribute to the dramatic decrease in the number of valuable species of fish; restrict the use of prime recreational areas such as beaches; degrade shoreline properties; and spoil aesthetic values.
Although all essential elements are required by plants for their growth, phosphorus and nitrogen are recognized as the most important elements responsible for triggering eutrophication because their supply is commonly lowest in relation to nutritional requirements. The reason for focusing attention on phosphorus rather than nitrogen is that it is more controllable both in terms of present technology for removal at sewage treatment plants and in terms of proportion of the total supply to the lakes that is directly attributable to man.

The phosphorus loading to the lakes can be controlled more effectively than nitrogen for several reasons. The percentage of the total phosphorus supply attributable to municipal and industrial sources (70 percent for Lake Erie, 57 percent for Lake Ontario) is higher than in the case of nitrogen (about 35 percent for Lake Erie, 30 percent for Lake Ontario). Thus, complete removal of phosphorus from municipal and industrial wastes would reduce the overall supply to a greater extent than in the case of nitrogen. Appreciable quantities of readily assimilable nitrogen compounds such as nitrates and ammonia are delivered to the lakes in precipitation, whereas the comparable quantities of phosphorus are minute. Finally, during times of nitrogen deficiency blue-green algae and bacteria can convert atmospheric nitrogen into nitrogen salts readily available for algal growth, thus
adding to the overall supply. For these and other reasons, control of phosphorus inputs is likely to be more effective in restricting plant growth than would be the case for nitrogen or any other single nutrient. The Commission is encouraged by the fact that the input of phosphorus into the lakes can be controlled because the concentrations of phosphorus in domestic wastes, certain industrial effluents and runoff from some agricultural operations are of our own making.

Massive growths of algae year after year are dependent on a persistent influx of phosphorus and other limiting nutrients from outside the lake. The resultant biological productivity is proportional to the rate of input of these nutrients. Theoretically, plant populations could be controlled by reducing the input of any essential element required for growth. The important feature of phosphorus is that it offers the best combination of a nutrient that is growth-limiting in the lakes and at the same time controllable by man. Phosphates are highly reactive materials and can readily be precipitated, absorbed or adsorbed by a variety of relatively inexpensive methods that remove 80-95 percent of phosphorus during sewage treatment. Comparable technology for the elimination of nitrogen compounds is not in such an advanced state.
The following table summarizes the input of total phosphorus from all sources to Lake Erie and to Lake Ontario in 1967 as reported by the two Boards.

INPUT OF TOTAL PHOSPHORUS IN 1967

<table>
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<tr>
<th>Source</th>
<th>To Lake Erie</th>
<th>To Lake Ontario</th>
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<tr>
<td></td>
<td>Millions of Pounds</td>
<td></td>
</tr>
<tr>
<td>Lake Huron</td>
<td>4.5</td>
<td>---</td>
</tr>
<tr>
<td>Lake Erie</td>
<td>9.0</td>
<td>9.0</td>
</tr>
<tr>
<td>U.S. Can.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Municipal</td>
<td>35.7</td>
<td>7.7</td>
</tr>
<tr>
<td>Industrial</td>
<td>1.8</td>
<td>0.3</td>
</tr>
<tr>
<td>Land Drainage</td>
<td>9.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Unaccounted</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>60.2</td>
<td>27.3</td>
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</table>

It is evident from the above table that the principal input of phosphorus is from the United States and that, in both countries, municipalities are the major source of total phosphorus. In 1967, the input of total phosphorus from United States municipal sources to Lake Erie was 35.7 million pounds, of which 25 million came from detergents. The input of total phosphorus from Canadian municipal sources to Lake Erie was 2.5 million pounds, of which 1.3 million came from detergents. Similarly, the input from United States municipal sources to Lake Ontario was 7.7 million pounds, of which 5.4 million came from detergents. The Canadian municipal input to Lake Ontario
was 7.0 million pounds, of which 3.5 million came from detergents. It is apparent from the foregoing that detergents are by far the greatest single source of total phosphorus input into the Lakes.

The reasons for reducing the phosphorus inputs from detergents are several. The first concerns timing. If a replacement for detergent phosphorus could be developed rapidly, a significant reduction of phosphorus inputs would be achieved prior to completion of phosphorus removal facilities at sewage treatment plants. Secondly, the effect would be to reduce phosphorus input from small communities, cottages and individual homes where the installation of phosphorus removal facilities would impose undue financial burdens. Thirdly, it is estimated that treatment costs for phosphorus removal at sewage treatment plants would be reduced considerably by removing phosphorus from detergents.

On the basis of the foregoing the Commission is convinced that the reduction of the phosphorus input into Lake Erie, Lake Ontario and the International Section of the St Lawrence River will significantly delay further eutrophication and will allow the recovery to begin through natural processes.
POLLUTION FROM WATERCRAFT

The Commission is concerned with the mobile sources of water pollution. Over 600 foreign vessels move cargo through the Great Lakes system each year. The domestic Great Lakes fleet is composed of nearly 600 Canadian and United States vessels. Only a very small percentage have holding tanks or treatment facilities for sewage. It is estimated that over 250,000 pleasure craft use the lower Lakes but relatively few have holding tanks or treatment devices. Only a few of the ports on the lower Great Lakes have facilities to collect and treat vessel wastes. Though an increasing number of marinas are being equipped with pump-out facilities for pleasure craft, the number is still inadequate.

Wastes discharged from commercial and pleasure watercraft include sewage containing human excrement, garbage, litter, oils, bilge and ballast water. They can endanger the health of those using the receiving waters for swimming, water skiing and other water contact sports. They can also damage or kill aquatic and wildlife. Bathing beaches and marinas can be seriously contaminated. Garbage and litter are not only aesthetically displeasing but can be extremely hazardous. Critical conditions occur where vessels congregate in harbours, at marinas and along the shoreline. The mobility of watercraft poses a potential contamination threat at or near water intakes.
In a special report on boat and vessel pollution the Board informed the Commission that no single law or regulation in Canada or the United States deals with all aspects of pollution of navigable waters from watercraft; and that many laws are of a token nature and not readily enforceable because of their impracticability or lack of personnel to perform the task or both. The Commission has been informed that the Ontario, Michigan and New York regulations governing pleasure craft now in force are compatible and satisfactory.

There is uninhibited movement of watercraft across state lines and the international boundary. Serious problems are created when regulations governing the discharge of wastes from watercraft in the several jurisdictions are not compatible. Thus it is essential that federal, provincial and state governments concerned with the control of pollution from commercial vessels and recreational craft which use the international waters of the lower Great Lakes have compatible regulations governing the discharge of all forms of wastes from these watercraft.
CONCLUSIONS

WITH REGARD TO POTENTIAL OIL POLLUTION IN LAKE ERIE THE COMMISSION CONCLUDES:

1. The safety requirements and procedures applicable to drilling and production operations in Lake Erie of Pennsylvania, New York and particularly those of Ontario, if effectively supervised and properly enforced, are adequate to prevent oil escaping into the Lake so as to produce serious transboundary oil pollution conditions. Drilling is prohibited in the Michigan portion of Lake Erie. The exact status of Ohio regulations is not clear. In the Ontario portion of Lake Erie, the only area where there are at present drilling and gas production operations, the enforcement of the regulations and the required operational procedures have been adequate to date.

2. Current methods of confining, removing, dispersing and cleaning up a major oil spill that may occur from any source are primitive and inadequate. Current methods can deal effectively with large spills only under the most ideal weather conditions. There is no one method that is a panacea. Each oil pollution mishap presents a unique situation in terms of water temperature, winds, currents, type of oil and the ecology of the area. Very little is known on the
residual effects on aquatic organisms of materials used to sink or disperse oil spills.

3. The United States contingency plan for the Lake Erie region is generally adequate although the roles of state and local agencies as well as private organizations require clarification. On the other hand, Canada does not yet have a detailed or coordinated contingency plan to marshal the capabilities of federal, provincial and local agencies or private organizations. Such local plans as exist are relatively uncoordinated. Furthermore there is an urgent need for a formal plan of international cooperation.

WITH REGARD TO THE EUTROPHICATION OF LAKE ERIE, LAKE ONTARIO AND THE INTERNATIONAL SECTION OF THE ST LAWRENCE RIVER THE COMMISSION CONCLUDES:

4. The accelerated eutrophication of these waters is due to the presence of nutrients. The resultant biological productivity is proportional to the rate of input of these nutrients. Of the nutrients involved, phosphorus is the only one that is both growth-limiting in the lakes and can be controlled effectively by man with present technology.
5. The major source of phosphorus is municipal sewage. In the United States 70 percent of the phosphorus in sewage originates from detergents, most of the remainder from human excreta. In Canada approximately 50 percent originates from each source. Other significant sources of phosphorus are agricultural run-off and some industrial wastes.

6. The input of phosphorus can be reduced by widespread additional treatment of municipal wastes and industrial wastes containing phosphorus. An overall programme to achieve this is essential if eutrophication is to be halted.

7. Because of the practical difficulties in implementing the programme contemplated in the preceding conclusion within the reasonable future, it is incumbent on both countries to reduce the phosphorus content of detergents to the maximum practicable extent at the earliest possible time.

8. The inputs to the waters of the basin of phosphorus, nitrogen and other nutrients from agricultural operations are also a problem that must be recognized.
WITH REGARD TO POLLUTION FROM WATERCRAFT THE COMMISSION CONCLUDES:

9. Although commercial vessels and pleasure craft are not major sources of pollution when compared with urban centres, they are mobile sources that can discharge pathogenic organisms and petroleum wastes at or near sensitive areas such as water intakes, bathing beaches and marinas.

10. Garbage, litter, bilge and ballast water discharged into the lower Great Lakes system are aesthetically unattractive, restrict recreational activities and interfere with the legitimate uses of these waters.
RECOMMENDATIONS

WITH REGARD TO POTENTIAL OIL POLLUTION IN LAKE ERIE
THE COMMISSION RECOMMENDS THAT:

1. The two Governments in concert with provincial and state agencies and with industry accelerate and expand, as a matter of urgency, their applied research programmes on the containment and clean up of oil spills so those responsible for the execution of contingency plans may have available the best possible technical advice, equipment and support.

2. The Government of Canada, as a matter of urgency, develop a detailed and fully coordinated contingency plan for the Canadian waters of the Great Lakes system; the Government of the United States progressively improve its contingency plan so as to include all available response capabilities; and the two Governments under the general aegis of the International Joint Commission arrange for the development of a coordinated international contingency plan so that both countries may quickly and effectively respond to major accidental spills of oils or other hazardous material in the boundary waters of the Great Lakes system.
3. In view of the urgency of the two preceding recommendations,

(a) the oil production and the production of "wet gas" containing appreciable amounts of liquid hydrocarbons from wells in Lake Erie be prohibited,

(b) all wells in Lake Erie capable of oil production be adequately plugged,

(c) in the western basin of Lake Erie (west of a straight line drawn from the tip of Pelee Point in Ontario to Marblehead in Ohio) all drilling be prohibited,

(d) in the remainder of Lake Erie drilling not be permitted unless the regulating agency having jurisdiction has determined in the light of known geologic conditions that there would be no reasonable likelihood of discovering oil or "wet gas" containing appreciable amounts of liquid hydrocarbons, until such time as the two Governments, through this Commission or otherwise, have examined and approved the containment methods and the contingency plans referred to above.
4. The two Governments take steps to exclude from the Great Lakes ships and masters likely to present an unreasonable risk of oil pollution; and also make provision to alert appropriate officials in both countries when hazardous materials are in transit in these waters.

WITH REGARD TO THE EUTROPHICATION OF LAKE ERIE, LAKE ONTARIO AND THE INTERNATIONAL SECTION OF THE ST LAWRENCE RIVER THE COMMISSION RECOMMENDS THAT:

5. The Governments of the United States and Canada in concert implement at the earliest possible date an integrated programme of phosphorus control to include:

(a) the immediate reduction to a minimum practicable level of the phosphorus content of detergents and the total quantities of phosphorus-based detergents discharged into the basin with the aim of complete replacement of all phosphorus in detergents with environmentally less harmful materials by December 31, 1972;

(b) further reduction, as a matter of urgency, of the remaining phosphorus in municipal and industrial waste effluents discharging to Lake Erie, Lake Ontario and their
tributaries and to the International Section of the St Lawrence River, with a view to achieving at least an 80 percent reduction by 1975 and thereafter additional reduction to the maximum extent possible by economically feasible processes;

(c) the reduction of phosphorus discharged to waters from agricultural activities.

WITH REGARD TO POLLUTION FROM WATERCRAFT THE COMMISSION RECOMMENDS THAT:

6. The federal, provincial and state governments in concert consider and implement at the earliest possible date compatible regulations for the control of water pollution from all classes of commercial vessels and pleasure craft using Lake Erie, Lake Ontario and the International Section of the St Lawrence River.
Signed this 3rd day of April, 1970, as the third interim report of the International Joint Commission on the pollution of Lake Erie, Lake Ontario and the International Section of the St Lawrence River.

A.D.P. Heeney

Charles R. Ross

Christian A. Herter Jr

A. D. Scott

Eugene W. Weber

Bernard Beaupré
October 7, 1964.

I have the honour to inform you that the Governments of the United States and Canada have been informed that the waters of Lake Erie, Lake Ontario and the international section of the St. Lawrence River are being polluted by sewage and industrial waste discharged into these waters. Having in mind the provision of Article IV of the Boundary Waters Treaty signed January 11, 1909, that boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other side, the two Governments have agreed upon a joint Reference of the matter to the International Joint Commission, pursuant to the provisions of Article IX of said Treaty. The Commission is requested to inquire into and to report to the two Governments upon the following questions:

(1) Are the waters of Lake Erie, Lake Ontario, and the international section of the St. Lawrence River being polluted on either side of the boundary to an extent which is causing or is likely to cause injury to health or property on the other side of the boundary?

(2) If the foregoing question is answered in the affirmative, to what extent, by what causes, and in what localities is such pollution taking place?

(3) If the Commission should find that pollution of the character just referred to is taking place, what remedial measures would, in its judgement, be most practicable from the economic, sanitary and other points of view and what would be the probable cost thereof?

In the conduct of its investigation and otherwise in the performance of its duties under this reference, the Commission may utilize the services of engineers and other specially qualified personnel of the technical agencies of Canada and the United States and will so far as possible make use of information and technical data heretofore acquired or which may become available during the course of the investigation.
The two Governments are also agreed on the desirability of extending this Reference to other boundary waters of the Great Lakes Basin at an appropriate time. The Commission is requested to advise the Governments when, in its opinion, such action is desirable.

The Commission should submit its report and recommendations to the two Governments as soon as practicable.
I refer to your letter of April 11, 1968 reporting the results of an exploratory meeting convened by the International Joint Commission approximately a year ago to obtain information about the programmes for drilling for oil and gas in Lake Erie which are in effect or are contemplated by the Province of Ontario and certain of the riparian States. In that letter you reported that the responsible State and Provincial officials considered that there was minimal risk of pollution of the lake's waters from drilling and production operations and that "with existing technology, any accidental escape of oil would be limited to a matter of minutes".

The recent serious oil spill off the coast of California may cast some doubt on the proposition that existing technology is adequate to confine the destructive consequences of a runaway oil well or that the risks of serious pollution can be described as minimal. The Californian experience suggests the necessity of a careful review of safety precautions and procedures applicable in Lake Erie, particularly in view of the shallow and confined nature of this body of water.

Accordingly the Commission is requested as a matter of urgency within the framework of the existing International Joint Commission pollution reference dated October 7, 1964, on Lake Erie, Lake Ontario and the International Section of the St. Lawrence River to investigate and to make a special report at the earliest possible date on the following matters:

(1) The adequacy of existing safety requirements and procedures in Canada and in the United States applicable to drilling and production operations in Lake Erie to prevent oil from escaping into the lake so as to produce serious transboundary oil pollution conditions;
(2) The adequacy of existing mechanical, chemical and other methods of confining, removing, dispersing and cleaning up any major oil spill that may occur in Lake Erie from any source, bearing in mind the damage that such methods may cause to marine life, domestic water supplies or to other beneficial uses of the Lake in both countries; and

(3) The adequacy of existing contingency plans and the action taken to implement them to confine and clean up transboundary pollution and to prevent or mitigate the destructive transboundary effects of any major oil spill from any source that may occur in Lake Erie.

If the Commission finds that any of the existing safety requirements, methods or plans referred to in clauses numbered (1), (2) and (3), respectively are inadequate, the Commission is requested to make recommendations as to what action should be taken to correct any such inadequacy.

Moreover if after preliminary investigation the Commission is of the opinion that certain interim measures are necessary with respect to one or more of the matters being herein referred to it, the Commission is requested to make recommendations concerning any such measures in advance of submitting its main report and recommendations.

The Governments of Canada and the United States are equally concerned about the risk of serious oil pollution in the Great Lakes from other sources, notably major oil spills from marine or industrial mishaps such as those referred to in your letter of April 11, 1968. The discharge of oil from land-based sources and from normal vessel operations is already being studied by the Commission. The threat of major oil pollution as a result of a disaster to a vessel in the Great Lakes involves broader international consideration. This aspect of the overall problem is under study by the two Governments through other appropriate channels.