

Further Matters of Importance

This section of the *Eleventh Biennial Report on Great Lakes Water Quality* results from a commitment by the International Joint Commission to systematically review progress under specified annexes of the *Great Lakes Water Quality Agreement*. This report covers:

- **Annex 1 (Specific Objectives)**
- **Annex 2 (Areas of Concern)**
- **Annex 3 (Phosphorus)**
- **Annex 7 (Dredging)**
- **Annex 8 (Discharge from Onshore and Offshore Facilities)**
- **Annex 10 (Hazardous Polluting Substances)**
- **Annex 12 (Persistent Toxic Substances)**
- **Annex 15 (Airborne Toxic Substances)**
- **Annex 16 (Groundwater) and**
- **Annex 17 (Research).**

The format for this section differs from the main body of the *Eleventh Biennial Report*. On these topics, the Commission offers its observations while not recommending detailed solutions. With this approach, observations highlight a common understanding of a problem and recognize that a problem or issue could be addressed in a number of ways, not necessarily limited to current program emphases.

The topic of Annex 1 (Specific Objectives) illustrates this approach. There are a number of actions that could be taken by the governments of the United States and Canada to address deficiencies in Annex 1; many are well known and understood by senior officials and managers. The issue of record, however, is that Annex 1 is essential to the Agreement as a basis to quantitatively assess progress and, as such, it needs updating.

The Commission is hopeful that this approach will facilitate an ongoing dialogue with and between the two governments by placing greater focus on the issues and providing flexibility in the choice of workable solutions.

The Commission will be initiating such a dialogue at the earliest opportunity and has already begun discussions with representatives of Environment Canada and U.S. EPA on several of these topics.

Finally, the *Eleventh Biennial Report* reviews several issues arising from its Public Forum on Great Lakes-St. Lawrence Water Quality, held October 19-20, 2001 in Montréal, Québec, including: the Lake Superior Binational Program, risk and potential impact of nuclear facilities on the Great Lakes, unmonitored chemicals, and water use.

Section 1: Specific Objectives (Annex 1)

Observation

Because Specific Objectives listed in Annex 1 of the *Great Lakes Water Quality Agreement* have not been updated for more than 20 years, they have only limited relevance today to the goals of restoring and maintaining the chemical or biological integrity of the Great Lakes basin ecosystem. Revisions to Annex 1 are required if the Parties to the Agreement are to meet their responsibilities for, accountability to, and reporting on the adequacy of their efforts to protect the Great Lakes. The Parties recent work to develop indicators of Great Lakes environmental quality may enhance the development of new Specific Objectives.

Discussion

Annex 1 puts forth a series of Specific Objectives, intended to provide a basis for judging progress toward achievement of the Agreement's purpose, including numerical targets. Nevertheless, knowledge has advanced to such a degree since then that the Specific Objectives developed nearly a quarter century ago are now out of date and of only limited value.

In particular, our understanding of the nature of the risk posed by contaminants, cause-and-effect relationships, and factors that affect human and ecosystem health have improved considerably, with no corresponding update

to the Objectives. For example, we have learned that some chemicals are unsafe at levels far lower than previously thought, rendering inadequate the target levels stated in the Objectives. Specific Objectives should be able to drive management actions, but the outdated Objectives cannot properly serve this function. Furthermore, surveillance and monitoring data are not available to adequately evaluate the attainment of the Agreement's Objectives.

Many of the Objectives in Annex 1 no longer conform to revised or updated objectives of the Parties. Regulatory agencies no longer monitor many Annex 1 contaminants including aldrin/dieldrin, endrin, heptachlor/heptachlor epoxide, methoxychlor, and pharmaceuticals (see also Section 13). At the same time many other compounds, including polynuclear aromatic hydrocarbons, chlorobenzenes, and octachlorostyrene, have emerged as serious potential health risks, but these are not included among the Objectives.

Many of the lakes' contaminants are not routinely monitored in water, often because the available data show that concentrations are so low, and the standard deviation so large, that routine monitoring serves no scientifically valid purpose. The Parties need to develop a new approach to objectives and monitoring programs, such as the continued development and use of indicators of ecosystem health that focus not only on concentrations of substances, but on ecological and human health effects, as highlighted in Chapter 1.

Through its Great Lakes Science Advisory Board, the Commission investigated whether Annex 1 is still relevant, if revisions are necessary, if there is a role for ecological indicators, and how achievement of Specific Objectives could be judged. The Commission concluded that in principal Annex 1 and the Specific Objectives are still relevant because tangible evidence, including achievement of stated targets, is necessary to demonstrate progress toward achieving the Agreement's purpose. The Objectives need revision so they can provide direction to determine what is required to restore beneficial uses and maintain ecosystem quality.

In signing the Agreement, the Parties committed to, "consult ... at least once every two years ..." regarding Annex 1. The only substantive discussion by the Parties to date was initiated in 1999 and then terminated with no further action. As part of their next review, the Parties have the opportunity to explore the role of indicators and their relationship to the Specific Objectives.

Objectives are of little use without surveillance and monitoring data. Despite the Parties' commitment in Annex 11 (Surveillance and Monitoring), "to provide definitive information [regarding] ... non-achievement of the Objectives ...," present programs are not geared to developing such data. A commitment to Annex 11 will be necessary to support revisions to Annex 1 and subsequent revision of the Objectives.

Article IV of the Agreement requires the use of statistically valid data to determine achievement of Specific Objectives. The Agreement, however, provides little guidance on the treatment of surveillance and monitoring data used to judge achievement. Yet, such considerations are critical in the design of both sampling and data analysis programs. For example, it is unclear whether the intention of a particular Objective is to assess average conditions, maximums or minimums, or values typical of a given geographic area or depth. Ideally, the Parties should state Objectives in such a way that intended statistical methods, and thus, considerations, such as spatial and temporal monitoring frequency, are clear.

Section 2: Public Involvement and Experience Sharing in Areas of Concern (Annex 2)

Observation

Public involvement during the implementation phase of Remedial Action Plans enables community engagement and participation in remediation. Although new models of community collaboration are being developed and applied, the fiscal restraints of governments have reduced funding to some local committees, which has particularly affected the ability of community groups to enhance their expertise through the sharing of experiences. The Commission's 2001 Biennial Forum provided an example of the value of exchanging lessons learned about community-based restoration. It also showed that it can be valuable for participants in Areas of Concern in the Great Lakes to interact with their counterparts to the east in Quebec, who are facing similar challenges downstream in the St. Lawrence River.

Discussion

Public involvement and education facilitates a positive change in the culture and values of people, businesses and organizations in Areas of Concern. It is a long-range change toward better awareness and improved stewardship at the individual level. By changing the culture and values of those living in the community, a new set of sustainable behaviors can emerge. This can be one of the most subtle but powerful effects of broad public participation.

The Commission believes an active and engaged group of local citizens is critical to making progress in implementing a Remedial Action Plan and maintaining the viability of the process.¹ For this to emerge, communities need to mobilize leaders who can focus actions and activities toward a shared vision and common goals. Local advisory committees provide a mechanism for concerned citizens to become informed and, at the same time, provide government agencies a structured approach to consultation. Bringing together representatives from different committees for the transfer of information among Areas of Concern enables the cross-fertilization of ideas and approaches. It also provides a mechanism for the governments to work with them on shared topics such as new strategies.

During the 2001 Public Forum, the Commission heard that funding reductions for some local public committees both in Canada and the United States were purportedly impeding the ability of the public to play its role in the remediation of Areas of Concern. Some public committees in Areas of Concern are fully supported; others are not. The Commission recognizes that funding is not the only determinant of effective public involvement. For example, the groups need to have a legitimate role that is respected, and the planning horizon needs to be sufficiently tight to maintain momentum. Funding is required, however, to enable community members to interact across the basin so that they may share successes, challenges and solutions for sustaining community capacity through the period of Remedial Action Plan implementation.

A workshop held at the 2001 Public Forum enabled several Great Lakes and St. Lawrence River communities to learn about each other's programs and progress. Representatives from various groups could benefit from continued discussions on issues of mutual interest.

Section 3: Phosphorus (Annex 3)

Observation

Calculations suggest that limits on external phosphorus loads are generally being achieved and that known phosphorus sources were not the cause of increased phosphorus concentration levels in Lake Erie during the 1990s. Despite this, the concentrations of phosphorus in Lake Erie exceed limits, and suggest that eutrophication (excessive nutrient enrichment) is occurring. The Parties must invest in new basic research, monitoring and information sharing if they are to achieve the binational goal for the management of phosphorus under Annex 3 for Lake Erie. **As reported in newspapers of late, the discovery of a “dead zone” in Lake Erie is puzzling scientists, with causes currently undetermined.**

Discussion

Twenty-five years ago, numerous scientific studies conducted by the Commission’s Pollution From Land Use Activities Reference Group resulted in the Parties adopting policies and programs to manage phosphorus for each lake basin through a variety of point and nonpoint source control measures. This linkage of science and policy resulted in programs to reduce phosphorus loads to the Great Lakes based on reduction targets as set out in Annex 3. The achievement of a target load for each lake is currently represented by a specific outcome: concentrations of phosphorus in the open waters. For lakes Superior, Huron, Michigan and Ontario, concentrations indicate that progress has been sustained.¹ In the case of Lake Erie, however, open water concentrations of phosphorus often exceed the guideline, indicating that phosphorus is being released into the lake by sources or processes not fully understood.

Better information, derived from monitoring programs that can confirm the sources and loadings of phosphorus to the lake, could lead to improved policy decisions. As municipal wastewater discharges appear to decrease in importance due to technological improvements and infrastructure upgrades, reduced water quality monitoring efforts associated with this sector are

often perceived as justified. However, increased effort in point source and tributary monitoring may be warranted to account for the tremendous changes that have occurred in the basin over the last 25 years, particularly as a result of urbanization and the increase in pavement and other practices that create land that is impervious to water.² The impact of large point sources, such as Detroit's sewage treatment plant, is difficult to assess because suitable phosphorus loading data are not readily accessible for independent or binational interpretation. Although municipal sources may not provide the greatest contribution to the total phosphorus inputs to the lake, their impact can be significant, since the phosphorus they discharge is in a form that is more readily utilized by living things than is the predominant form transported to the lakes from nonpoint sources.

Tributaries are large sources of total phosphorus to the lake; however, because some forms of phosphorus are not readily bioavailable, good data are needed to distinguish phosphorus species and their relative contribution to increasing concentrations in the open waters. Current tributary monitoring efforts do not provide such loading estimates. Some streams are sampled no more than monthly and others have not been regularly sampled since 2000. The number of unmonitored streams is increasing, adding additional uncertainty in determining the primary sources of phosphorus to the lake.

Major tributaries to Lake Erie, such as the Maumee River, have achieved notable decreases in suspended sediment discharges and reductions in phosphorus loads as a result of improved agricultural practices.³ However, these tributaries are still very large sources of phosphorus with year-to-year loads varying with the frequency and intensity of flooding. For example, phosphorus stored in the sediment of tributaries can build up during dry or average rainfall years and can serve as a substantial load to the lake during a single flood event. Such major events could become common in the Great Lakes as a result of climate change, adding a further management challenge to achieving target loads. The Commission is evaluating the potential impacts of climate change based on different predictive models, and will report on this during the next few years and in its *Twelfth Biennial Report*.

Scientifically, the phosphorus cycle is well understood. However, detailed information to assess options to manage phosphorus effectively in Lake Erie

has not been available.⁴ Because of the level of uncertainty, scientific knowledge based on the past should not be assumed to be adequate to serve as a basis for decision-making for the future. New investment in basic research, monitoring, and information sharing for Lake Erie needs to include improved long-term monitoring of point and nonpoint sources and tributaries, calculation of the rate of inter-basin transfer of nutrients, and development of better tools for making predictions.

Section 4: Dredging (Annex 7)

Observation

The Great Lakes Dredging Team, a U.S. committee created in 1996 by Department of Transportation, Maritime Administration, is a strong advocate for research and development related to dredging technologies, sediment management and related environmental impacts. Canadians participate, but only in an *ad hoc* manner. Full Canadian membership on the Great Lakes Dredging Team would enhance binational cooperation and oversight of the environmental consequences of navigational dredging. Current information technology resources can satisfy the Annex 7 requirement to maintain a register of significant dredging projects.

Discussion

Specific studies assigned to the Subcommittee on Dredging under Annex 7 were completed during the 1980s and 1990s, and consequently, the annex no longer reflects current organizational relationships and activities.

The Great Lakes Dredging Team promotes uniform environmental regulation of the management of dredged material in the U.S. where there is currently some variation between the states. It is already a strong advocate for research and development related to dredging technologies, sediment management and environmental impacts.

If the Great Lakes Dredging Team had full representation from both U.S. and Canadian agencies, this organization could fill the role of a standing

subcommittee on dredging called for in Annex 7. The team could be recognized in future updates to Annex 7 of the *Great Lakes Water Quality Agreement*. Additional work by the Parties and/or the Commission to follow up on past recommendations or to investigate new concerns involving dredging could then be carried out by the team on an as-needed basis.

In addition to recognizing the value of the Great Lakes Dredging Team, the Parties could consider modifying the Annex 7 requirement calling for the maintenance of a formal register of significant dredging projects. The last register of Great Lakes dredging projects was published for the Great Lakes Water Quality Board in 1990. That report contained data on approximately 95 percent of all dredging activities in the Great Lakes basin from 1980 through 1984. Now that the governments have made more recent information available on the Internet, it appears unnecessary to publish an updated register. Use of the Internet could be extended so that all the data needed to conduct an environmental assessment of dredging projects could be easily accessed electronically.

Section 5: Discharges from Onshore and Offshore Facilities, including offshore and directional drilling (Annex 8)

Observation

Considerable public controversy has arisen over potential environmental risks from U.S. and Canadian offshore and directional oil and natural gas drilling in the Great Lakes. To date, there have been few reported problems. However, this matter does relate to Annex 8 of the *Great Lakes Water Quality Agreement*. (In the U.S., Congress has authorized a comprehensive U.S. review of oil and gas drilling practices in the Great Lakes basin.)

Discussion

Annex 8 includes definitions and principles as well as programs and measures to prevent discharges of oil and other substances into the Great Lakes system from drill rigs, pipelines, wells and other on or offshore facilities.

Jurisdictional Policies

Canadian Federal Government

Generally speaking, drilling in the Great Lakes falls within provincial jurisdiction.

U.S. Federal Government

The U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers in a 1982 joint report concluded that the development of natural gas from beneath the U.S. portion of Lake Erie can be done safely as long as current regulations governing the activity are strictly followed.

In November 2001, however, President Bush signed into law a two-year ban on any new drilling operations in the U.S. portion of the Great Lakes. The law also calls for a comprehensive study by the U.S. Army Corps of Engineers on all potential environmental impacts that drilling operations could have on the Great Lakes. This study has not yet been funded.

Actions taken by state and provincial governments with respect to drilling are shown in the table below.

State/ Province	Offshore Drilling	Directional Drilling	Comments
Michigan	Banned	Banned	Michigan has been leasing bottomlands since the 1940s. In 1979, the first well was drilled beneath the Great Lakes. There were 6 producing gas wells and 1 oil well.
New York	Under 2 year federal moratorium	Under 2 year federal moratorium	New York allows leasing but no drilling has been undertaken.
Ohio	Under 2 year federal moratorium	Under 2 year federal moratorium	Governor Bob Taft has stated that he will not support any move to allow drilling in Ohio's section of Lake Erie.
Pennsylvania	Under 2 year federal moratorium	Under 2 year federal moratorium	Pennsylvania signed the original Great Lakes Governor's memorandum of understanding in 1985 to disallow any offshore oil drilling in Lake Erie.
Ontario	Permitted (gas only)	Permitted	2,500 offshore gas wells have been drilled in Lake Erie since 1913. Ontario does not support the banning of environmentally sound directional drilling under the bed of the Great Lakes.
<i>The following jurisdictions have little, or no offshore oil and gas potential or drilling targets</i>			
Indiana	Under 2 year federal moratorium	Under 2 year federal moratorium	Drilling permits subject to review by Indiana Natural Resources Commission.
Illinois	"	"	No drilling is pending beneath Lake Michigan and no potential targets are identified.
Minnesota	"	"	Has no oil or gas production therefore no statute related to directional drilling.
Wisconsin	"	"	Has no oil or gas production therefore no statute related to directional drilling.
Quebec	Not applicable	Not applicable	

Other Stakeholders

The International Association of Great Lakes and St. Lawrence Mayors passed a resolution calling for a moratorium on Great Lakes oil and gas exploration, development and extraction.

The Chippewa Ottawa Resources Authority passed a resolution stating its unqualified opposition to any oil drilling activities to exploit oil deposits under the Great Lakes.

Section 6: Hazardous Polluting Substances (Annex 10)

Observation

Up-to-date lists of hazardous pollutants, now readily available by electronic means, can fill the need to provide a continually updated inventory as called for under Annex 10 of the *Great Lakes Water Quality Agreement*.

Discussion

Annex 10 was first included in the revised Agreement of 1978 to provide information regarding hazardous polluting substances. The annex has two appendices, a list of known hazardous polluting substances and a list of potential hazardous pollutants. The annex requires that the two lists be maintained and continually revised in light of growing scientific knowledge. When the Agreement was updated in 1987, a short paragraph was added to Annex 10 directing that the practices and procedures consistent with the general principals of the Agreement be applied to those substances categorized as marine pollutants by the International Maritime Organization.

However, no chemical has been added to either list since 1978 and more current information is now readily available through other sources.

The purpose of Annex 10 was explained in the Commission's 1992 *Sixth Biennial Report on Great Lakes Water Quality*. At that time the Commission recognized that information called for from the United States was available to the U.S. Environmental Protection Agency and to the state environmental agencies, but that the Canadian information was not readily available to the two Canadian departments holding responsibilities under the Environmental Contaminants Act. This problem occurred because data held by Statistics Canada and Revenue Canada were, by Canadian law, confidential and inaccessible to any other federal departments. The Commission recommended that the governments initiate the development of a continually updated inventory to identify chemical compounds used, manufactured, processed or imported in the Great Lakes basin. Additionally, the Commission expressed concern about the availability of information to Canadian regulatory agencies and recommended that the situation be corrected.

Since that time, problems with access to critical data about hazardous polluting substances that were needed to protect the public health and welfare have been corrected. In 1988, the First Report of Canada under the 1987 Protocol to the Agreement noted that the original intent of Annex 10 had been met by Canada through the promulgation of the Transportation of Dangerous Goods Act, Canadian Environmental Protection Act and legislation in Ontario. The government of Canada reported that the lists in Annex 10 were being superseded by new mechanisms and determined that a review of Annex 10 was necessary.

While the need for a continually updated inventory of all hazardous or potentially hazardous substances used, manufactured, processed or imported in the Great Lakes basin still exists, the Commission finds that new technology providing continually updated hazardous material lists by electronic means over the Internet has eliminated the need to publish printed lists as required by the Agreement.

Section 7: Persistent Toxic Substances (Annex 12)

Observation

Numerous programs in the United States and Canada, including the Great Lakes Binational Toxics Strategy, Remedial Action Plans (RAPs), and Lakewide Management Plans (LaMPs), and clean air and clean water legislation contribute to reducing and eliminating the input of persistent toxic substances to the Great Lakes from various sources. Improved coordination among these programs would enhance progress toward virtual elimination of persistent toxic substances.

Discussion

Persistent toxic substances reach the Great Lakes from airborne, land and aquatic sources. Through Annex 12, the Parties to the *Great Lakes Water Quality Agreement* in cooperation with the Great Lakes states and provincial jurisdictions committed themselves to virtually eliminate the input of persistent toxic substances. Because this complex endeavor poses many challenges, the Parties broke the issue into more manageable components, adding Annexes 13-17 to the Agreement in 1987. These annexes focus on specific sources of contaminants – nonpoint sources, contaminated sediment, atmospheric transport and groundwater – as well as associated research needs. Annex 2, also added in 1987, provides for greater public participation as another means to help achieve virtual elimination.

The Parties and jurisdictions have undertaken numerous initiatives in support of all these annexes, including those that promote pollution prevention over reduction and control. Because considerable progress has been made, the Great Lakes ecosystem today is much improved. Nevertheless, after more than two decades, virtual elimination is not yet realized for any compounds with the possible exception of octochlorostyrene releases. The case of PCBs illustrates the point. Despite the Parties' commitment a quarter century ago to ban their manufacture, remove them from use, and

dispose of or destroy stockpiles, PCBs remain in use and continue to enter the environment from landfills, storage yards and other pathways for transport worldwide via the atmosphere. While the Parties continue to make progress, including the removal of one million pounds of PCBs from Waukegan Harbor, large amounts of sediment heavily contaminated with PCBs still need to be cleaned up, since their presence constitutes an active source of contaminant cycling in the Great Lakes basin ecosystem.

In prior biennial reports, the Commission has presented assessments and advice on the achievement of virtual elimination. The Commission advised the Parties to develop a comprehensive virtual elimination strategy. Subsequent to the Commission's call, the Parties signed the collaborative Great Lakes Binational Toxics Strategy in 1997.

From 1999 to 2001 the Great Lakes Water Quality Board progress review work group on the Binational Toxics Strategy evaluated the Binational Toxics Strategy.

According to the Board's assessment, the Strategy:

- contributes to the development, assembly, and expanded use of information, and provides coordination for collaborative sharing of this information among various jurisdictions
- helps engage industry, trade and professional associations, and others in voluntary action to achieve reductions beyond regulatory requirements.

Among the Strategy's weaknesses are:

- problems with organization, including coordination and oversight of Strategy activities. The roles of various groups involved in this effort need to be defined and confirmed
- the work appears to be bilateral rather than binational
- the Strategy's web site is seriously outdated, with the notable absence of Canadian information sources
- some key reports lack adequate information, including which information inventories are being used, and how top sources for certain Level I substances were identified. Some are not linked to the Strategy's web site or are not publicly available. The Strategy's progress reports in

some cases lack quantitative baseline and current-year information, present incomplete information, or lack Canadian information

- The Strategy could be used to greater advantage if its profile were raised and its opportunities actively promoted.

The voluntary nature of the Strategy is both an asset and a liability. On the one hand, it facilitates stakeholder opportunities and participation in activities beyond regulatory requirements. On the other hand, the Strategy is only one of many initiatives competing for time and resources, and mandatory regulatory programs tend to take precedence over voluntary initiatives such as the Strategy.

The Binational Toxics Strategy is not a comprehensive strategy for virtual elimination. Rather, it is one initiative in a panoply of programs that address various components of the issue. While the Strategy encourages stakeholder opportunities and voluntary participation, its influence on other programs is unclear.

The role of the Strategy in fulfilling the Parties' commitments under the Agreement is uncertain, particularly in its relationship with Remedial Action Plans and Lakewide Management Plans.

The Parties should explicitly state whether the Strategy relies on Annex 2 requirements as a mechanism to deliver on selected goals, especially in regard to contaminated sediment and atmospheric transport. Further — could the Strategy offer leadership with regard to implementing Remedial Action Plans and Lakewide Management Plans?

Despite improvements to the Binational Toxics Strategy itself, the Commission sees a clear need for better coordination and effective linkages across program areas to resolve the persistent toxic substances issue and to fulfill the Parties' commitments under the Agreement.

Section 8: Airborne Toxic Substances (Annex 15)

Observation

The sources of a majority of airborne toxic substances remain unmeasured and, in some cases, unidentified. This hinders the ability of the two governments to reduce atmospheric deposition of toxic substances. Resolving this problem will require an extension of monitoring activities beyond the current International Atmospheric Deposition Network.

Discussion

Two past biennial reports have noted that emission inventories needed to support the objectives of Annex 15 are inadequate. Currently, only mercury, dioxin and cadmium inventories are adequate for source-receptor modeling on a broad binational geographic scale. Inventories of most of the 11 Critical Pollutants are marginal.¹ Those for the balance of the Critical Pollutants and Level II Binational Toxic Strategy contaminants range from inadequate to largely non-existent. Existing data on point sources, such as factory and power plant smokestacks, need enhancement and assurance of quality. Other sources, such as burn barrels (barrels used for the open burning of rubbish), which can produce dioxin, require initial analysis. The governments are making some gains with pollution prevention initiatives to reduce emissions of toxic substances. Nevertheless, the focus and achievement of such programs could be sharpened and measured by improved knowledge of the dominant sources and their pathways.

Loadings of PCBs to Lake Michigan from unmeasured and often unknown sources are far greater than those that can be attributed to regulated point sources. While we know that hundreds of kilograms of PCBs enter the lake each year via the atmosphere, only about 30 kg per year can be attributed to regulated sources. Urban air plumes originating in Chicago and Gary, particularly in the summer, contain significant amounts of persistent toxic substances, such as PCBs, from various nonpoint sources, which can

include transformer storage yards, landfills and brownfield industrial sites. These observations could well apply to other urban areas throughout the Great Lakes basin.

A number of techniques have been shown capable of estimating emissions from some of these sources. Applying such techniques to Critical Pollutants throughout the Great Lakes basin would provide important information to support more effective management actions.

To determine concentrations of several persistent toxic substances in the air, the governments use the binational Great Lakes Integrated Atmospheric Deposition Network of five master stations, one per lake basin, and 14 satellite stations. Studies focusing on Lake Michigan show that regional concentrations and loadings estimated from these data alone do not accurately represent actual deposition to that lake basin. For example, PCB concentrations at the Sleeping Bear Dunes master station were shown to be substantially lower than samples taken at another point on the eastern shore or adjacent to Chicago. Variations in concentrations across the basin were very pronounced. Similar determinations for the other lakes for this and other contaminants also would likely be inaccurate. Sampling at a number of other locales in the lake basins, including over water, and the development of better estimation tools are necessary to improve these regional deposition estimates and to develop and implement effective management programs and policies.

Section 9: Pollution from Contaminated Ground Water (Annex 16)

Observation

Millions of basin residents rely on groundwater for basic water supplies,¹ yet there is a serious lack of information on groundwater quantity and quality in the Great Lakes basin. Given the threat of contaminated groundwater to human health, as illustrated by the recent Walkerton, Ontario tragedy, and to the health of the Great Lakes basin ecosystem,² there is a critical need for more information on groundwater quality and quantity.

Groundwater issues were recently highlighted by the Commission in its 2000 report, *Protection of the Waters of the Great Lakes*.

Discussion

Groundwater contaminants of concern³:

Pathogens (bacteria/viruses)

Nutrients (nitrate)

Pesticides (triazines, DDT/DDE, Mirex)

Chlorinated solvents (trichloroethylene)

Petroleum products (BTEX, MTBE)⁴

De-icing compounds (road salt, glycol).

In the 1987 amendment to the *Great Lakes Water Quality Agreement*, the Parties agreed to identify sources of contaminated groundwater affecting the Great Lakes, map hydrogeological conditions, develop standardized approaches for sampling and analysis to support Remedial Action Plans and Lakewide Management Plans, control groundwater contamination, and report progress to the Commission biennially beginning in 1988.

Contaminated groundwater is polluting surface water due to direct, ground to surface withdrawals by people and through passage of contaminated water into tributaries to the Great Lakes or directly into the Great Lakes. Many Areas of Concern, such as the Maumee and Niagara rivers, are contaminated by groundwater and require serious attention to ensure restoration of beneficial uses.⁵

Citizens of the basin have expressed considerable concern about the potential impact of large scale, intensive livestock farming on the quality and safety of groundwater and surface water. Article VI, Section 1(e)(ii) of the Agreement, calls for “measures for the abatement and control of pollution from animal husbandry operations, including encouragement to appropriate agencies to adopt policies and regulations regarding utilization of animal waste, and site selection and disposal of liquid and solid wastes, and to strengthen educational and technical assistance program to enable farmers to establish waste utilization, handling and disposal systems.”

The methods and approach to mapping hydrogeological units are well developed. Nevertheless, there is a lack of such mapping, and far more detailed information about groundwater and the use of groundwater in the basin is needed. Data on withdrawals varies in quality, and data on consumption are extremely limited.

State, provincial and local government attention to the monitoring and regulation of groundwater withdrawals is especially warranted when climate change models are considered.⁶ Protection of groundwater recharge areas is the most efficient and cost-effective way to preserve groundwater quality.⁷

Because groundwater and surface water frequently interact, and it is impossible to distinguish between them in some instances, governments could be proactive and apply the precautionary principle (err on the side of caution) with respect to removals and use of groundwater in the basin. Land conservation programs within the 2002 U.S. Farm Bill offer incentives to protect water bodies from pollution.

Recently announced initiatives and new funding for groundwater monitoring and protection are welcome.⁸ Additionally, progress by governments in controlling the 26 most egregious sources of surface water contamination from contaminated groundwater along the Niagara River is commendable.⁹

Until new and proven technologies can be applied, these efforts will need to be sustained. More remediation sites will need to be added to ensure that the intent of Annex 16 is achieved.

Section 10: Research and Development (Annex 17)

Observation

Since there is no mechanism in the *Great Lakes Water Quality Agreement* to set priorities and implement research programs as delineated in Annex 17, the designation by the Parties of lead agencies with the authority and resources to support Annex 17 would allow for an organized, binational approach to more comprehensively meet the annex requirements.

Discussion

Annex 17 does not place priorities on the research it delineates to support the needs of the Agreement. The Annex requires the Parties to the Agreement to conduct research in coordination with state and provincial governments, but it does not identify lead agencies with responsibilities for binational coordination. Workshops and conferences sponsored by agencies throughout the Great Lakes basin foster collaboration, but there is no effort specifically targeted at Annex 17 goals.

In order to measure the level of research activity in support of the Agreement, the Commission's Council of Great Lakes Research Managers established a Research Inventory to assist research managers and serve as a networking tool. The Research Inventory can be used to discern the level of support directed toward various fields of research, which can be useful in determining future research agendas. Areas that have less measured activity than others can be identified, leading to a constructive debate over whether support should be increased.

The Commission recognizes that its collection of project data published on the Internet confronts many challenges including accessibility, comparability and the inability to ensure full participation by all Great Lakes researchers. Consequently, the results of the inventory are not viewed as a precise measure, but rather as a general indicator of activity.

When Research Inventory data from 1993 were compared to current data, trends in areas of emphasis in Annex 17 indicated increasing support for the goals listed in subparagraphs (d), (g), (h) and (l). A relatively high degree of emphasis continues to be placed on studies related to the impact of water quality and of alien invasive species on native fish and wildlife populations and habitats. Data from the inventory, however, indicate that two areas of Annex 17 continue to receive little emphasis in the basin: subparagraph (b) Development of Load Reduction Models in the Great Lakes and subparagraph (k) Development of Action Levels for Contamination that Incorporate Multi-Media Exposures and the Interactive Effects of Chemicals. It is possible that this research is being undertaken within or outside the Great Lakes and is not captured by the Research Inventory. Therefore, this issue merits further investigation.

In order to properly support all goals set in Annex 17, a more proactive approach to research management is needed. It will not be possible to manage priorities in research and development effectively without a binational mechanism in place to implement and support related research programs.

Section 11: Lake Superior Binational Program

Observation

The Parties have documented significant reductions in the in-basin emissions of dioxin and the in-basin discharge, emission, and disposal of mercury between 1990 and 1999. However, recent reductions in funding for the Lake Superior Binational Program, their program to restore and protect Lake Superior, may hinder their ability to address impaired beneficial uses due to other stressors. For example, during the past five years, the U.S. Environmental Protection Agency's contributions to the Binational Program have been reduced from \$2 million per year to \$480,000. This reduction has occurred during the transition from information gathering and goal setting to the more challenging stage of implementing required actions, which will require more, not less, funding than the planning stage. Environment Canada funding for the Stakeholder Forum¹ has remained at approximately \$50,000 for the past three years. Trends for the Program itself were not available.

Discussion

In 1990, the International Joint Commission recommended that Lake Superior be designated a demonstration area where "no point source discharge of any persistent toxic substance will be permitted." As part of their response, the Parties announced in 1991 a Broader Program in addition to the Zero Discharge Demonstration Program. The stated goal of the Zero Discharge Demonstration Program is to achieve zero discharge and zero emissions of certain persistent, bioaccumulative toxic substances, while the Broader Program focuses on the entire ecosystem of Lake Superior.²

Significant funding reductions for Lake Superior activities have occurred during the past five years, with the current U.S. Environmental Protection Agency funding substantially less than five years ago. Current funding may not be able to support both aspects of the binational program. The Commission previously expressed concern regarding a lack of information necessary to assess the progress and effectiveness of the Zero Discharge Demonstra-

tion Program.³ Because available funds for the Lake Superior Binational Program have been substantially reduced, the zero discharge program may be in jeopardy, and the potential capacity of the Lake Superior Binational Program may not be fully realized.

Previous achievements of the Stakeholder Forum have demonstrated that it is a necessary component of the governments' initiative to develop and implement a Lakewide Management Plan for Lake Superior. Tracking progress toward the goal of virtual elimination of all critical pollutants from all sources, as envisioned by the Commission in 1990, is still needed and beneficial. The Zero Discharge Demonstration Program was specifically designed to address this need. The Governments' Lakewide Management Plan 2000 report outlines significant progress toward the control of in-basin sources for mercury and dioxin. Although there is the goal of 33 percent destruction of accessible and in-use PCBs by 2000, no complete inventory exists for PCBs in the U.S. portion of the Lake Superior basin.⁴ More recently, the Lake Superior Binational Forum has identified a need to more effectively deal with potentially increased loadings of new sources of contaminants previously targeted for virtual elimination.

Section 12: Nuclear Issues

Observation

Because of energy requirements, both countries have extended the licenses of nuclear reactors beyond their original design lifetime. This could create problems of structural stability as well as renew ongoing concerns about nuclear waste handling, and add to the more recent security concerns. On the other hand, increases in the number of fossil fuel plants to replace lost nuclear power can increase emissions of airborne hazardous substances.

Discussion

In its 1997 report to the Commission, the then Nuclear Task Force noted that beginning in 2003, and continuing for the next several years, numerous nuclear reactors at nuclear power plants were scheduled for decommissioning. These reactors were reaching the end of their 40 year design life as well as the time limit on their operating licenses.¹ Since 2000, this situation has changed considerably -- with a new emphasis on energy self-sufficiency, utilities have requested that the nuclear licensing authorities in both countries extend licensing periods.

A “fast track” review process had been established in the United States by the U.S. Nuclear Regulatory Commission to address the extended licensing issue. Atomic Energy of Canada is using a process that authorizes license extension one to two years at a time.

Radiation ages metals and causes metallurgical fatigue. Members of the public have raised the issue that extending the operating license of a reactor beyond its original design lifetime could lead to safety problems from reactor structural stability. The U.S. Nuclear Regulatory Commission’s studies show that many of the aging mechanisms that cause radiation damage to metals take place within the original license period for the reactor, and they have stated that it does not expect additional metal aging to be a problem in reactors granted license extensions.²

All environmental requirements for nuclear reactor facilities call for sufficient on-site storage for high-level wastes, primarily fuel rods.³ At virtually all nuclear power plants, spent fuel rods continue to accumulate in storage facilities originally intended to be only temporary. The on-going actions by the U.S. government to develop storage facilities in Nevada may mitigate this situation. Under the license renewal guidelines, the on-site storage problem is exempted from consideration in license applications. However, the possibility of radioactive waste discharges to the Great Lakes from breaching of the sites must be considered in the application for license renewal and extension. The issue of security at nuclear power plants has also been raised.

Despite the above very real concerns, nuclear power can eliminate the need for fossil fuel generation and the increase in airborne contaminants that would result. For example, in the United States from 1990-1995, “21 states achieved a 16.4% increase in nuclear generation” and “avoided 480,000 tons (non-metric) of sulfur dioxide emissions.” In 1998, “nuclear power plants avoided 100 million metric tons of carbon dioxide.”⁴ If instead of nuclear-generated energy in the Great Lakes, coal/fossil fuels had been the alternative for energy production, the amount of green house gases emitted would have seriously exacerbated air quality degradation.

Section 13: Unmonitored Chemicals

Observation

The Commission is concerned that the number of chemicals being monitored to establish the chemical integrity of the Great Lakes ecosystem is inadequate for that purpose.

Of particular concern are many unmonitored chemicals, especially pharmaceuticals, flame retardants, and high-volume chemicals, such as a new generation of biodegradable pesticides, which have the ability to dissolve in both water and fat and therefore often show unusual patterns of bioaccumulation and environmental degradation. The mix of chemicals, and potential to cause unknown harm in combination, adds further concern. Most of the environmental consequences of these chemicals, usually found at low concentrations, are unknown.

Discussion

The U.S. Environmental Protection Agency uses a list of 129 Priority Pollutants as part of its regulations under the U.S. Toxic Substances Control Act. Other lists of toxic substances address the contents of waste repositories, notably the CERCLA Priority List of Hazardous Substances, which contains 275 trackable pollutants.¹ There are also numerous Canadian toxic

substances lists, including the Canadian Water Quality Guidelines for the Protection of Aquatic Life,² which lists 180 chemical substances, and other sources from which to make selections of additional chemicals to monitor for the purposes of establishing the chemical integrity of Great Lakes.

Yet the number of chemicals actually monitored, often as few as 30, is a very small subset of the total, with more intensive monitoring occurring in special cases (*e.g.* monitoring for heavy metals, pesticide residue screening) at infrequent intervals or one-time special efforts. There are also questions about how to select the chemicals to be monitored, and which additional chemicals to select. Questions surround the available methods for monitoring at low environmental concentrations on a mass production basis, and the availability of infrastructure to accommodate the monitoring (laboratories, vessels, sampling facilities, etc).

Several groups of unmonitored chemicals have caused specific concerns among citizens and scientists, including pharmaceuticals, flame retardants, and high-volume chemicals. A landmark study by the United States Geological Survey has recently documented the distribution and levels of some of these chemicals in water bodies, mainly in rivers of the United States.³ None of the chemicals in this study has a Specific Objective in Annex 1 of the Great Lakes Water Quality Agreement. Also, many of these chemicals do not fit into the category in Annex 1 of nondegradable, bioaccumulative and persistent. They are persistent, but usually biodegradable and not all of them are bioaccumulative. The mechanisms and rates of biodegradability often depend on specific environmental conditions, which are sometimes present, and sometimes not. Studies at sewage treatment plants have shown the need for special adaptations to ensure removal of these materials from treated wastewaters.⁴

Pharmaceuticals include antibiotics, growth hormones, contraceptive drugs, veterinary products, and pesticides for animals and household pets.⁵ Some of these chemicals have known endocrine disruption properties;⁶ others confer antibiotic resistance to certain bacteria.⁷ Some have high-volume use in agriculture and medicine. Recent attention has been paid to pharmaceutical residues in drinking water supplies.⁸

Many flame retardants are brominated organic compounds similar in structure to PCBs, and can have even greater toxicity than their chlorinated counterparts. Some have been appearing in waters and biota of the Great Lakes system where they have not been previously documented.⁹

There is also a new generation of biodegradable pesticides that have solubility both in water and adipose (fatty) tissue. Atrazine, a widely used pesticide, is one example. Because of their high volume usage, these pesticides may pose new kinds of challenges in terms of their environmental toxicology and effects.

Most of the environmental consequences of these chemicals, usually found at low concentrations, are unknown. Also, these chemicals are rarely found alone, and the mix of chemicals adds further concern.

Section 14: Water Use in the Great Lakes Basin and Annex 2001

Observation

In its 2000 report to governments on *Protection of the Waters of the Great Lakes*, the Commission noted that water quality and quantity are inextricably linked.¹

The Commission continues to be concerned about the risk to the Great Lakes from factors such as future consumption, small-scale removals, diversions, and climate change. The Commission has made recommendations to governments regarding water use in the basin and has been given a reference to report in early 2003 on progress made by basin jurisdictions in this regard.

In December 2001, the government of Canada passed amendments to the International Boundary Waters Treaty Act to better implement the Boundary Waters Treaty by prohibiting the bulk removal of boundary

waters from the water basins in which they are located and requiring persons to obtain licenses from the Minister of Foreign Affairs for water-related projects that affect the natural level or flow of waters on the United States side of the border. Regulations envisioned in the amendments have not yet been issued, and the amendments are not yet in force.

Discussion

Under Annex 2001, the governors and premiers agreed to a number of commitments including:

- 1) preparing a new set of binding agreements as may be necessary within three years of the effective date of the Annex (June 2001)
- 2) developing a broad-based public participation program to ensure ongoing public input in the preparation and implementation of the binding agreements
- 3) establishing a decision-making standard for reviewing new proposals to withdraw water from the Great Lakes basin for diversions and major consumptive uses as well as proposals to increase existing water withdrawals
- 4) developing a decision support system to implement the Great Lakes Charter and Annex 2001 to ensure availability of the best information on water uses in the basin, including the role of groundwater
- 5) developing guidelines for the implementation of mutually agreed upon measures to promote the efficient use and conservation of water
- 6) developing a mechanism by which individual and cumulative impacts of water withdrawals will be assessed, and
- 7) identifying and implementing effective mechanisms for decision-making and dispute resolution.

Pending final approval of the agreements mentioned above, the governors of the Great Lakes states will notify and consult with the premiers of Ontario and Québec on all proposals subject to the U.S. Water Resources Development Act of 1986, amended in 2000.

The Commission is pleased to note that work is proceeding apace on a number of these commitments. In particular, under the guidance of the Great Lakes Commission, the water use database for basin jurisdictions is being updated and improved and the decision support system is being developed. A high-level state and provincial task force, chartered by the governors and premiers, is developing standards to be used in assessment of the impact of proposed withdrawals and consumptive uses and to develop the institutional structure needed to support the process.

The development of the new decision-making standard will be based on the following principles: preventing or minimizing water loss from the basin through return flow and implementation of feasible water conservation measures; no significant adverse individual or cumulative impacts to the quantity or quality of the waters and water-dependent natural resources of the basin; an improvement to the waters and water-dependent natural resources of the Great Lakes basin; and compliance with the applicable state, provincial, federal and international laws and treaties.