GREAT LAKES BINATIONAL TOXICS STRATEGY

2006 Progress Report

February 2007

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ACRONYMS

ADA	American Dental Association
AER	Atmospheric and Environmental Research, Inc.
AHA	American Hospital Association
AOC	Area of Concern
B(a)P	Benzo(a)pyrene
BEC	Binational Executive Committee
BETR	Berkeley-Trent Model
BFRs	Brominated Flame Retardants
BGSU	Bowling Green State University
CAA	Clean Air Act
CAMNet	Canadian Atmospheric Mercury Measurement Network
CAMR	Clean Air Mercury Rule
CCME	Canadian Council of Ministers of the Environment
CanMETOP	Canadian Model for Environmental Transport of Organochlorine Pesticides
CEPA	Canadian Environmental Protection Act
CGLI	Council of Great Lakes Industries
COA	Canada-Ontario Agreement
CWS	Canada-wide Standards
EC	Environment Canada
EMEP	Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
GEM	Global Environmental Multi-scale model
GIS	Geographic Information System
GLBTS	Great Lakes Binational Toxics Strategy
GLFCSP	Great Lakes Fish Contaminants Surveillance Program
GLNPO	Great Lakes National Program Office
GLRC	Great Lakes Regional Collaboration
GLWQA	Great Lakes Water Quality Agreement
HARP	Hayton Area Remediation Project
HBCD	Hexabromocyclododecane
HCB	Hexachlorobenzene
HCH	Hexachlorocyclohexane
Hg	Mercury
HPBA	Hearth, Patio and Barbeque Association
HWC	Hazardous Waste Combustors
H2E	Hospitals for a Healthy Environment
IADN	Integrated Atmospheric Deposition Network
IDEM	Indiana Department of Environmental Management
IJC	International Joint Commission
IPM	International Plow Match
ISO	International Standards Organization
LaMPs	Lakewide Management Plans
LDR	Land Disposal Restrictions
LMMB	Lake Michigan Mass Balance

LRTAP	Convention on Long-range Transboundary Air Pollution
MACT	Maximum Available Control Technology
MCDI	Midwest Clean Diesel Initiative
MDEQ	Michigan Department of Environmental Quality
MDN	Mercury Deposition Network
MOE	Ministry of the Environment (Ontario)
MOU	Memorandum of Understanding
MWC	Municipal Waste Combustors
MWI	Medical Waste Incinerators
NAPS	National Air Pollution Surveillance Network
NDAMN	National Dioxin Air Monitoring Network
NADP	National Atmospheric Deposition Program
NEI	National Emissions Inventory
NGO	Non-Governmental Organization
NOx	Nitrogen Oxides
NPL	National Priority List
NPRI	National Pollutant Release Inventory (Canada)
NRDA	Natural Resource Damage Assessment
OCS	Octachlorostyrene
OTS	Ontario Tire Stewardship
OU	Operable Unit
P2	Pollution Prevention
PAH	Polycyclic Aromatic Hydrocarbon
PBDEs	Polybrominated Diphenyl Ethers
PBT	Persistent Bioaccumulative and Toxic
PC1	First Principal Component
PCA	Principal Components Analysis
PCBs	Polychlorinated Biphenyls
PCDD	Polychlorinated Dibenzo-Para-Dioxins
PCDF	Polychlorinated Dibenzofurans
PCP	Pentachlorophenol
PFCs	Perflurochemical Compounds
PFOS	Perfluoroctanesulfonate
PM	Particulate Matter
POPs	Persistent Organic Pollutants
PTS	Persistent Toxic Substances
PVOC	Polar Volatile Organic Compounds
RAPs	Remedial Action Plans
RCRA	Resource Conservation and Recovery Act
ROPS	Remedial Options Pilot Study
SAB	Science Advisory Board
SOLEC	State of the Lakes Ecosystem Conference
SOP	Strategic Options Process
SWARU	Solid Waste Area Reduction Unit
SVOC	Semi-Volatile Organic Compound
TEQ	Toxic Equivalent

TF HTAP	Task Force on Hemispheric Transport of Air Pollutants
TGM	Total Gaseous Mercury
TSMP	Toxic Substances Management Policy
TRC	Thermostat Recycling Corporation
TRI	Toxics Release Inventory (U.S.)
TSCA	Toxic Substances Control Act
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USWAG	Utility Solid Waste Activities Group
VOC	Volatile Organic Compound
WDNR	Wisconsin Department of Natural Resources
WETT	Wood Energy Technology Transfer
WG	Workgroup
WLSSD	Western Lake Superior Sanitary District

A Message from Gary Gulezian and Danny Epstein
Co-Chairs of the Great Lakes Binational Toxics Strategy

Dear GLBTS Stakeholders,

On this the 10th anniversary of the Great Lakes Binational Toxics Strategy, we wish to extend our thanks to those individuals and organizations who have participated in and contributed to the work of the Strategy. Without your sustained involvement and contributions, the Strategy would not have achieved the many successes it has to become a key initiative of environmental management in the Great Lakes.

Since its launch in 1997, the Strategy has succeeded in providing a governance model that facilitated government, business, First Nations and Tribes, and civil society to come together in a forum to collaborate and mutually work toward virtually eliminating toxic substances in the Great Lakes Basin. This is evidenced by the robust attendance and engagement that consistently characterizes Stakeholder Forum and Integration Workgroup meetings, as well as substance-specific Workgroup meetings and teleconference calls. Beyond this significant foundational accomplishment, others successes also warrant mention.

First, the Strategy has made significant progress toward the goals established by the Governments to virtually eliminate toxic substances in the Basin. The enclosed report sets out the full extent of the Strategy's progress. This has been made possible in part because stakeholders to the Strategy have taken on a shared sense of responsibility for the necessary actions to reduce and eliminate persistent, bioaccumulative and toxic substances from the Great Lakes Basin.

Second, through its evolution, the Strategy has established an important interface with the Lakewide Area Management Plan initiatives and the State of the Lakes Ecosystem Conference program. The work of each undertaking has benefited from the cooperation borne of those relations.

Third, the Strategy has forged a stronger relationship with the North American Free Trade Agreement's Commission for Environmental Cooperation Sound Management of Chemicals Workgroup. The Integration Workgroup has explored, with input from the Commission, how each initiative might enhance the work of the other, and, from this, proponents of each now confer regularly to exchange ideas on matters of mutual interest.

Fourth, the Strategy has become an exemplar of sustainable planning through the development and implementation of its four-step process. That process, being both systematic and transparent, has provided consistency and objectivity with respect to the manner in which matters of significance in the Basin are taken up and pursued.

Fifth, the Integration Workgroup has become a forum for meaningful deliberation and direction setting. Stakeholder participants have forged strong, mature working relationships that balance the pursuit of both individual and collective interests.

Finally, the Strategy has evolved into an integrative and holistic approach to toxic substances management in the Great Lakes, by incorporating environmental surveillance in its overall strategy toward mitigating threats to the Basin.

Many individuals and organizations have contributed to the Strategy's ongoing success since its beginning. While those contributions have varied, one thing has remained consistent: each and every contribution has moved the Strategy forward in some manner, helping to sharpen its focus, sustain its approach, and define its success. To recognize the impact of those contributions, and to express our gratitude, we have sought, in Appendix A of this report, to identify each individual who has contributed to the Strategy.

For those now involved in the Strategy, we look forward to your continued participation; for those just discovering the Strategy, we eagerly encourage your involvement. Much remains to be done, and we welcome the opportunity to continue working together to secure sustainability in the Great Lakes Basin.

Thank you,

Gary Gulezian
U.S. GLBTS Co-Chair

Danny Epstein
Canadian GLBTS Co-Chair

Stakeholder Perspectives

In recognition of the 10-year anniversary of the GLBTS, stakeholders were invited to share their perspectives on significant achievements of the GLBTS over the past 10 years. The following viewpoints were submitted by stakeholders.

Council of Great Lakes Industries' Perspective

In the spring of 1997, following the official signing of the GLBTS, the Council of Great Lakes Industries (CGLI) called the document "a pragmatic approach to achieving virtual elimination." CGLI pledged to join with other qualified stakeholders "in taking the next steps toward accomplishing the aggressive objectives set out by this strategy."

Now, after 10 years of lively multi-stakeholder discussions, active recruitment of industry representatives, volumes of source characterization and release data, workshops and conferences, CGLI considers the GLBTS to be a successful program.

The GLBTS has been an effective program because of some of its unique and specific features. The first is the multi-stakeholder nature of the Strategy, which brings government, environmental groups, and industry together to meet the programmatic goals of the program. Second, the goals themselves are especially effective because there are specific goals for each substance, in each country, with established timetables. Third, the program is binational. Fourth, and critical to industry, the program is voluntary. Industry views voluntary programs as proactive, non-regulatory responses to societal needs. The GLBTS has sought solutions to supplement existing regulation in order to achieve the Great Lakes Water Quality Agreement (GLWQA) objectives. There has been a great deal of progress.

Multi-stakeholder

Over these 10 years, members of diverse groups, including industry, environmental groups, and governments, from both nations have come together to hold open discussions, create solutions to the remaining issues, and meet the set targets and timetables.

CGLI has devoted considerable time and resources to meeting the objectives of the Strategy. In the process, CGLI has reached out to industry representatives with the goal of increasing their participation in the GLBTS process.

When CGLI began contacting industry to participate in this program, it was difficult. Most had never heard of the program, some were reluctant to get involved in another government program, and still others were not eager to discuss their industry issues alongside environmentalists. Multi-stakeholder processes were not the norm.

CGLI has conducted an ongoing industry awareness program. Initially, CGLI created GLBTS awareness materials and held workshops for industry representatives to discuss release sources, reduction methods, and progress. Through phone calls, presentations to industry groups, websites, face-to-face meetings, and informational material prepared specifically for industry, CGLI has involved more than 165 industry representatives in the GLBTS process during the past 10 years.

These industry participants were carefully selected to make sure that the right parties were part of the discussion for each substance workgroup. This outreach process has continued throughout the program. As some industries are identified as new sources, others were found to no longer use or produce the selected substances.

This unique collaborative process with government representatives and environmentalists has created relationships which go beyond the GLBTS. This process also created a better understanding of the issues, the trade-offs that often must be made, and the prioritization that is often necessary. Environmentalists learned of the impact of bad business cycles, and industry was sometimes surprised by being on the same side as environmentalists on certain issues.

These relationships have continued in other regional activities such as the GLWQA Review.

Specific Goals and Established Timetables

The process of meeting specific goals and timetables for each substance was easy for industry to understand. Industry's daily operations are based on meeting specific goals. It is how industry gets things done. By working toward the specific goals and timetables of the Strategy, industry understood the goal, determined how to achieve the needed progress, and how to determine when the goal was reached. Industry operates efficiently to meet specific goals. While striving to meet the substance goals, CGLI and industry representatives worked to constantly inform the process. Industry efforts included:

- Worked to build source and release inventories
- Collected success stories of industry action
- Provided speakers on substance issues
- Researched industry incentives
- Prepared comprehensive workgroup reports
- Piloted and help implement a decision tree process for guiding industry sector significance
- Provided pollution prevention reports
- Introduced risk-based prioritization
- Examined U.S. Areas of Concern (AOC) sediment issues and the application of risk-based decision-making
- Conducted monthly industry stakeholder calls to update progress
- Developed chemical inventory source characterization
- Worked on communication planning
- Worked on issues such as burn barrels that contain a public outreach component
- Worked to ensure that the GLBTS process was conducted in coordination with national and international programs to address persistent, bioaccumulative, and toxic (PBT) chemicals
- Continually worked to involve all relevant industry sectors and to remove focus from sectors that were deemed not to be sources.

Binational

The members of the CGLI are from the U.S. and Canada. Because of the binational nature of the program, CGLI worked with industry, CGLI members and non-members, on both sides of the border to meet the differing goals of each country. The GLBTS meetings brought better understanding of how issues are dealt with in each country and emphasized the regional nature of the environmental issues of the substances being addressed. The open discussion brought more opportunities to deal with the regional issues.

Voluntary

The proactive, non-regulatory responses to the GLBTS objectives have been especially attractive to industry. The program has given industries the ability to determine the most efficient and economically feasible ways to meet the specific challenges. In addition, it has provided a forum to showcase industry accomplishments in meeting the stated goals through innovative solutions. Industry pollution prevention programs, environmental stewardship programs, and the requirements of environmental management systems were shared with all stakeholders. The voluntary approach was showcased as a method of how best to make environmental improvements. Industries had the opportunity to learn from each other and an opportunity for public recognition of their efforts.

Future

As the GLBTS looks toward the future, CGLI has been involved in charting its new course of action. CGLI has:

- Participated in the development of the chemical evaluation protocol adopted by the Integration Workgroup
- Prepared a Level 2 substance pollution prevention report
- Provided comments for existing Level 1 Substance Management Assessment Reports
- Made recommendations regarding key considerations when contemplating whether to add to the substance list
- Provided a catalog of existing national and international screening programs.

While recommendations of the Great Lakes Regional Collaboration and the GLWQA Review process will impact a future GLBTS, CGLI believes that the current GLBTS program successes serve as the best model for future program designs.

The Chlorine Institute's Perspective

In 1996, the Chlorine Institute and its U.S. based mercury cell chlor-alkali producers voluntarily committed to reduce mercury use in the chlor-alkali industry by 50 percent by 2005 in support of the Canadian and U.S. GLBTS mercury reduction goals. The Chlorine Institute and it members also agreed to provide to U.S. EPA an annual report on the progress it has made.

When the commitment was made, the industry used an average of 160 tons of mercury per year. In 2005, the industry used 10 tons, a reduction of nearly 94 percent. After adjusting for closed facilities, mercury use per ton of chlorine produced declined from 0.182 lb/ton in the base period to 0.017 lb/ton in 2005, a reduction of 91 percent.

During the period, the Chlorine Institute and its member mercury cell producers worked proactively to address many operational issues pertaining to the use of mercury in the industry. The following points summarize some of the more significant activities:

- Held half-day workshops for all worldwide members involved in mercury cell chlor-alkali production to discuss mercury issues at every Chorine Institute Annual Meeting during the 10-year period. The topics discussed in the workshops included environmental, technical, safety, health, and regulatory issues. During these workshops, industry experts, and frequently regulators from agencies such as US EPA, presented topics of interest.
- Workshops involving all the mercury cell producers were held at various production sites throughout the 10-year period. These workshops were one to three days in length. The work products of the workshops were the following Chlorine Institute guidance documents:

    - Guidelines for the Handling of Rubber-Lined Cell Parts Potentially Contaminated with Mercury
    - Guidelines for Conducting a Mercury Balance
    - Guidelines for Technologies to Reduce Mercury in Sodium Hydroxide
    - Guidelines for Mercury Cell Chlor-Alkali Plants Emission Control: Practices and Techniques
    - Guidelines for the Optimization of Mercury Wastewater Treatment (Sulfide Precipitation Process) Systems
    - Guidelines to Physicians in Conducting Mercury Medical Surveillance Programs
    - Guidelines: Medical Surveillance and Hygiene Monitoring Practices for Control of Worker Exposure to Mercury in the Chlor-Alkali Industry (This document was updated and expanded to include the Guidelines to Physicians document).

All of the above work products were distributed to mercury cell producers through the world and mostly at no cost. All were posted on the U.S. EPA Binational Toxics Strategy website.

- The members participated in key mercury reduction activities undertaken by various groups including the U.S. EPA, United Nations Economic Commission for Europe (UNECE), North American Commission for Environmental Cooperation, the U.S. Department of Defense Logistics, various U.S. States, and the Environmental Council of the States.
- The Chlorine Institute was one of the first groups to formally urge the United States to sign the UNECE's Heavy Metals Protocol.
- The Chlorine Institute and its members participated actively in GLBTS Mercury Workgroup activities and periodically gave reports at meetings describing the mercury reduction activities undertaken by Chlorine Institute members.
- The Chlorine Institute and its members participated in international workshops addressing the use of mercury in chlor-alkali plants in Brazil, India, and South America.
- In May 2006, the Chlorine Institute issued its *Ninth Annual Report to EPA* describing the last year's progress.
- The Chlorine Institute and its mercury chlor-alkali producers were separately commended for progress made at different times over the past 10 years by the EPA Region 5 Administrator and the U.S. EPA Administrator.

Western Lake Superior Sanitary District's Perspective

The Western Lake Superior Sanitary District (WLSSD) has benefited greatly from involvement with the GLBTS over the past 10 years. WLSSD staff have appreciated the interaction with representatives of other agencies, joint projects and the greater opportunity to receive grants to undertake larger initiatives than might have been possible alone.

WLSSD was especially interested in the emerging concept of voluntary pollution prevention programs, as pollution prevention concepts are ideal ways for wastewater treatment plants to reduce their contribution of toxins to the Great Lakes. The GLBTS afforded WLSSD the opportunity to share knowledge and learn from other relevant projects around the region, even those across international boundaries.

As members of the Mercury and Dioxin/Furan Workgroups and various subgroups, WLSSD received and managed numerous large US EPA GLNPO grants to undertake pollution prevention demonstration and public education projects. Notable projects include the Zero Discharge Demonstration Project for Lake Superior, the development of a "Blueprint for Mercury Reduction" to provide guidance to other wastewater treatment facilities in mercury reduction efforts, and the creation of a public garbage burning prevention campaign featuring the "Bernie the Burn Barrel" character. Most recently, as a member of the Burn Barrel Subgroup, WLSSD produced a toolkit for Great Lakes area local government officials entitled "Clearing the Air: Tools for Reducing Residential Garbage Burning." The toolkit was produced in conjunction with an updated "Bernie" public awareness campaign about the hazards of burning which can be adapted for use in any municipality.

These projects allowed WLSSD to further its mission to prevent pollution and protect Lake Superior. WLSSD applauds the past work of the GLBTS, and hopes to see additional future reductions in persistent toxins as the GLBTS completes its important goals.

National Wildlife Federation's Perspective

The National Wildlife Federation (NWF) has looked upon the GLWQA as a landmark binational commitment by the citizens of the U.S. and Canada to protect and restore the waters of the Great Lakes. The Agreement has been innovative in its vision for Great Lakes protection, including in its purpose to "restore and maintain the physical, chemical, and biological integrity of the waters of the Great Lakes Basin Ecosystem," and the commitment to virtual elimination goals for toxic chemicals.

Consistent with our strong support for the GLWQA, NWF was encouraged with the signing of the Canada-U.S. Great Lakes Binational Toxics Strategy (GLBTS) in 1997, which facilitated a collaborative process – with an emphasis on pollution prevention – to work toward the goals of the GLWQA. While we have supported strong regulatory mechanisms to address toxic chemical issues in the Great Lakes, we have recognized the importance of pursuing voluntary approaches as well in efforts to protect and restore Great Lakes water quality. NWF has been fortunate to have been involved in the GLBTS since its inception. We have appreciated the opportunity to work with a number of stakeholders in support of shared goals for protection and restoration of

Great Lakes water quality, goals toward which NWF has worked through activities out of our Great Lakes office for over two decades.

We believe the GLBTS organizing structure has worked quite well through the years, with the emphasis on substance-specific workgroups; this has allowed a focus that may have facilitated progress addressing some of the chemicals of concern. We have been supportive of the governance system (in particular following discussions on this issue in 1999 and 2000), which has allowed for significant stakeholder input into the GLBTS process, from consideration of topics for individual workgroup meetings to contributions to broader strategic questions that the GLBTS has periodically considered. This aspect is particularly important now as we assess next steps for the GLBTS after 10 years of efforts.

Through our Great Lakes office, NWF has been involved in a diverse array of pollution prevention (P2) projects for the past decade and more involving PBT chemicals. This work has involved a number of current and former NWF staff and interns through the years, including Guy Williams, Tim Eder, Lisa Yee-Litzenberg, Jully Metty Bennett, Molly Chidsey, Tony Defalco, Jane Reyer, Freya McCamant, Andy Buchsbaum, Zoe Lipman, and Michael Murray. Though not formally done through the GLBTS, we were heavily involved in supporting the Great Lakes Initiative process, through which common water quality standards were developed for a number of PBT chemicals for all Great Lakes States, a framework which has helped spur innovative P2 work in the region. By the mid-1990s we were significantly involved in P2 outreach and education with the healthcare and wastewater treatment plant sectors (in particular concerning mercury), and more recently have extended our outreach to other sectors.

Examples of NWF P2 activities conducted through the GLBTS have included the following:

- From 1999 through 2001, NWF ran the Mercury-Free Medicine campaign (conducted in partnership with Health Care Without Harm), through which hospitals would commit to phasing out uses of mercury in their facilities. This involved numerous meetings and presentations around the region by Molly Chidsey and Guy Williams. The period saw significant growth in the interest in the campaign and in the number of participating facilities. The campaign – currently operated through Hospitals for a Healthy Environment – now boasts over 4,000 participating healthcare facilities throughout the U.S.
- We worked on P2 issues in other ways with the healthcare sector, ranging from developing the 1997 report *Mercury Pollution Prevention in Healthcare*, which included approaches to phasing out mercury and case studies of successful P2 programs around the Basin, to work from 2000 to 2003 preparing and updating materials for healthcare professionals. The latter included *A Woman's Guide to Eating Fish Safely,* a brochure on the risks of fish contaminants and ways to reduce exposures (in English, Spanish, and Arabic), to be distributed via women's health clinics, as well as annotated fact sheets on fish contaminants of concern for medical professionals.
- NWF was particularly active in the early years of the GLBTS in a number of efforts addressing PBT chemicals in the Lake Superior Basin, including participation in discussions involving the Lake Superior Zero Discharge Demonstration Project, conducting outreach (including through a joint meeting with Marquette wastewater

treatment plant staff) on mercury P2 in healthcare, and initiating, with other partners' efforts, the ongoing St. Louis River Total Maximum Daily Load (TMDL) Partnership.

- In 2000, NWF advanced the idea of development and implementation of comprehensive mercury phase-out strategies in lieu of costly and complex mercury TMDLs, and developed scenarios for reaching an aggregate 90 percent reduction in emissions in Michigan and Ohio. We have promoted this concept within and outside the GLBTS through correspondence and deliberations with US EPA and other stakeholders over subsequent years, including within the Quicksilver Caucus, through which a related National Mercury Reduction Strategy was developed in 2003.
- NWF has continued work with wastewater treatment plants, including working with the Detroit Water and Sewerage Department to develop a survey of significant industrial users on their use of mercury-containing products and PCB-containing electrical components in 2002.
- In parallel projects in recent years, NWF produced several reports on mercury-containing products, including *Getting Serious About Mercury* on approaches to developing state-based mercury reduction programs, *Mercury Products Guide* on alternatives to mercury-containing products, and *An Assessment of Mercury Products Policies and Programs in Six Great Lakes States.*
- NWF has been significantly involved in deliberations on approaches to reducing mercury emissions from coal-fired power plants (including improved efficiency, demand-side management, and other non-control options), including formally participating in state utility workgroups in Michigan, Indiana, and Wisconsin and providing significant technical input to deliberations in other Great Lakes States.
- NWF has examined mercury release inventories in detail, both through earlier work on scenarios to meet 90 percent reduction targets and in an assessment of three major inventories for each of the Great Lakes States, published as a paper in *Environmental Research* in 2004.[1]
- In recent years, we have become more involved in promoting environmentally preferable purchasing (EPP) as a means of reducing sources of PBT chemicals in the Basin. This has included, in a parallel project, producing an EPP guidebook, *Environmentally Preferable Purchasing: A Getting Started Guide,* that provides an overview of the process and includes a number of fact sheets and resolutions on EPP initiatives from around the country. We are also completing an assessment of EPP programs in the Great Lakes States and selected municipalities, which will help highlight opportunities to further advance EPP as a tool for contributing to toxics reductions.
- We have also expanded P2 outreach and education to additional sectors, including targeting auto salvage yards in Ohio. We completed a survey of a small subset of yards indicating interest in mercury switch removal programs, and we are promoting a new state-initiated voluntary program through direct outreach. We have also conducted outreach to contractor associations to expand interest in participating in mercury thermostat recovery programs.

[1] Murray, M. and Holmes, S.A. (2004) Assessment of mercury emissions inventories for the Great Lakes states. *Environ. Res.* 95:282-297.

- NWF has also been significantly involved in recent fora related to the GLBTS, including the development of recommendations on toxic chemicals through the Great Lakes Regional Collaboration, and the ongoing review of the GLWQA, through participation in both Review Working Group B (on toxic chemicals) and the Special Issues Working Group.

In addition to the above activities, NWF has contributed significantly to regular reviews of progress under the GLBTS, including providing reviews of several management assessment documents prepared over the past two years, and we have appreciated being involved in strategic discussions within the Integration Workgroup on broader issues involving the strategy.

Looking forward, we believe there remain opportunities for the GLBTS to contribute to reductions in toxic chemical releases in the Great Lakes Basin. While much progress has been made, it is clear that further progress will be necessary in meeting virtual elimination goals (and elimination of fish consumption advisories) for several of the Level 1 substances. But it is also clear that increased attention is needed on additional chemicals in the Basin, including some Level 2 substances and other chemicals of emerging concern. As the GLBTS approaches the 10-year mark, it is a propitious time to both evaluate progress to date and formulate a path forward that recognizes both remaining work to be done on existing chemicals and the importance of addressing emerging chemical threats to Great Lakes water quality.

We believe the GLBTS should be open to a more holistic approach to addressing chemicals in the Basin, which may include greater emphasis on promotion of green chemistry, design-for-the-environment, life-cycle assessment, and related approaches that can help lead to both a healthier regional economy and more proactive policies that prevent injury (and the need for expensive remediation) to the ecosystem in the future. In addition, we feel it is important to make additional efforts to increase stakeholder participation in overall GLBTS efforts, in particular among regional industry, academic institutions, and nongovernmental organizations, in order to create more momentum for broader systemic change that will be necessary to protect the Great Lakes from toxic chemical threats in the next decade and beyond.

Great Lakes United's Perspective

As an instrument dedicated to achieving water quality objectives set forth in the Great Lakes Water Quality Agreement, this international forum and collaborative working group has been a rich and unique opportunity to advance specific pollution prevention strategies in the Great Lakes Basin. Certainly the GLBTS governance model has been successful in promoting open and substantive dialogue among agency, industry, and environmental stakeholders; and opportunities to exchange current science information, innovative assessment tools, or updates on pollution reduction achievements. The GLBTS provides a niche where public and private sector stakeholders can maintain long-term partnerships to pursue specific toxics reduction goals.

Great Lakes United (GLU), an international coalition of labor, environment, health, and indigenous groups from across the Great Lakes, has been a voice in the Strategy's Integration Workgroup since its inception. Our organization's work has benefited from the wealth of knowledge around the table and the diverse perspectives of stakeholders. GLU contributed to

GLBTS mercury reduction goals through partnerships such as the Clean Car Campaign mercury switch removal project by hosting binational workshops and web conferences for stakeholders. GLU also held a workshop in 2004 in Toronto on Extended Producer Responsibility and clean production strategies. Much of this work overlapped or complemented the work of the GLBTS substance workgroups, and participation in the GLBTS has allowed GLU to foster ongoing working relationships on GLBTS reduction projects and other related PBT reduction work.

Since 2004 GLU has focused on the future direction of the GLBTS. The 10-year anniversary marks an exciting and critical time to explore and promote cutting-edge science and technology focused on long-term sustainability and rich opportunities to enhance pollution prevention in the region. To this end, GLU has worked to educate stakeholders on innovative preventative strategies for toxics use reduction and elimination, particularly green chemistry/green engineering science and applications. GLU presented an introduction to green chemistry principles in February 2006. Subsequently, GLU worked with US EPA, EC, and industry to organize a panel of green chemistry practitioners in May 2006. Building on these presentations, GLU co-organized a SOLEC workshop with fellow GLBTS stakeholders and other Basin stakeholders to explore the idea of a Great Lakes Green Chemistry Network. The GLBTS Integration Workgroup provided an incubator to launch this exciting initiative. The perspectives and participation of GLBTS agency, industry, and non-governmental organization (NGO) stakeholders were essential to scoping this project from all angles and ensuring the most cooperative and informed approach moving forward.

From GLU’s standpoint, the Strategy has the potential to address additional emerging toxic threats to the Basin. The GLBTS framework could potentially affect a greater rate of reductions of persistent and bioaccumulative substances such as brominated compounds and perfluoronated compounds while preventing future inputs. The GLBTS should also contribute to correcting the legacy of past pollution by taking an aggressive role in working for the cleanup of contaminated sediments. We look forward to participating in these efforts and to continuing in the spirit of meaningful regional collaboration across borders to achieve a toxic-free future.

INTRODUCTION

Signed in 1997 by Environment Canada (EC) and the United States Environmental Protection Agency (US EPA), the Great Lakes Binational Toxics Strategy (GLBTS, or Strategy) established challenge goals for Canada and the U.S. for 12 Level 1 persistent toxic substances, and targeted a list of Level 2 substances for pollution prevention measures. Over the past 10 years, the governments of Canada and the U.S., along with stakeholders from industry, academia, state/provincial and local governments, Tribes, First Nations, and environmental and community groups have worked together toward the achievement of the Strategy's challenge goals. Significant progress has been achieved in reducing the use and release of Strategy substances.

In recognition of the 10-year anniversary of the GLBTS, this edition of the progress report features reflections on the past 10 years of efforts to implement the Strategy. The perspective of the EC and US EPA co-chairs of the GLBTS is presented in the opening letter. Stakeholders were invited to submit their perspectives on the GLBTS as well, including reflections on their individual organizations' contributions, the process for implementing the Strategy, its achievements, and its future. Stakeholder perspectives are presented following the letter from the GLBTS co-chairs.

About This Report

This report contains a compilation of activities and progress achieved under the GLBTS for the year 2006. Chapters 1 through 4 present highlights for the active Level 1 substance workgroups for mercury, polychlorinated biphenyls (PCBs), dioxins and furans, and hexachlorobenzene (HCB) and benzo(a)pyrene (B(a)P), respectively. These highlights include a summary of progress toward the GLBTS challenge goals, a review of workgroup meetings, and descriptions of activities undertaken to reduce the use or emissions of the Level 1 substances. Chapter 5 presents a summary of four Integration Workgroup meetings and two semi-annual Stakeholder Forums held in 2006. Chapter 6 reports progress in remediating contaminated sediments in the Great Lakes Basin, including descriptions of Great Lakes sediment remediation projects, estimated sediment volumes remediated or capped, and estimated volumes of contaminated sediment remaining in specific Areas of Concern (AOCs). Chapter 7 describes examples of efforts to evaluate the contribution and significance of the long-range transport of Strategy substances. A biennial tradition in recent years, Chapter 8 presents a report of environmental indicators of progress, including monitoring data for GLBTS substances in the air over the Great Lakes and in Great Lakes fish, herring gull eggs, and sediment. Chapter 8 also discusses environmental trends in emerging chemicals of concern to the Great Lakes Basin, such as polybrominated diphenyl ethers (PBDEs). Appendix B includes a timeline of activities related to the GLBTS that have been undertaken from 1997 to 2006. Appendix C presents a summary of a GLBTS assessment of Level 1 substances.

Highlights of each chapter are presented below.

Mercury

Canada has made significant progress toward the Canadian challenge goal of a 90 percent reduction in mercury releases, achieving an estimated 85 percent reduction as of 2003 (from a 1988 baseline). The U.S. is estimated to have met the challenge goals of a 50 percent reduction in mercury use nationwide and a 50 percent reduction in national mercury emissions. Mercury collection programs continue to be held in the Basin. The Mercury chapter of this report contains details on these activities, which include household mercury collection programs and collection programs for schools. Also, in August 2006, a National Vehicle Mercury Switch Recovery Program was established in the U.S. in an effort to remove mercury from auto scrap.

PCBs

Canada has achieved an approximate 90 percent reduction of high-level PCBs in storage in Ontario. Based on preliminary analyses, nearly 70 percent of high-level PCBs in service or in use have been eliminated. However, new PCB inventory data for 2006, which are expected to become available in 2007, will provide updated information on progress toward Canada's challenge goals. New Canadian PCB regulations, which were published in the *Canada Gazette 1* on November 4, 2006, will impose mandatory phase-out dates. These regulations will facilitate achievement of Canada's challenge goal of a 90 percent reduction of high-level PCBs in service. The U.S. has made progress in reducing the amount of equipment containing >500 ppm PCBs, as evidenced by industry efforts to identify and remove PCB-containing equipment from service. US EPA continues to gather information with which to assess the status of progress toward the U.S. challenge goal of a 90 percent national reduction of high-level PCBs used in electrical equipment.

Dioxin & Furans

Canada and the U.S. have each reduced dioxin/furan emissions by approximately 89 percent, compared to reduction targets of 90 percent (Canada) and 75 percent (U.S.). The largest remaining source of dioxins/furans in both countries is backyard burning of household waste. The Burn Barrel Subgroup of the Dioxin Workgroup continues to be active in promoting outreach activities in the Great Lakes Basin. The Dioxin Workgroup continues to: explore pathway intervention opportunities, investigate opportunities to reduce agricultural waste burning, track ambient air concentrations, continue source characterization work, and seek reductions from top sources.

HCB & B(a)P

Both Canada and the U.S. have made significant reductions in emissions of HCB and B(a)P. Canada has reduced emissions of HCB and B(a)P by 68 percent and 49 percent, respectively, compared to 90 percent reduction targets. The U.S. has reduced B(a)P emissions by approximately 77 percent in the Great Lakes States from 1996 to 2001, achieving the Strategy's goal, which was to achieve reductions in releases. Actions to reduce B(a)P have focused on residential wood combustion, scrap tires, coke ovens, and diesel engines. U.S. emissions of HCB have also declined (from a 1990 baseline), thereby meeting the U.S. challenge of unspecified reductions. US EPA has commissioned an HCB inventory study to obtain better estimates of HCB releases.

Integration Workgroup Meetings/Stakeholder Forums

Four Integration Workgroup meetings were held in 2006: one in Windsor (February 16), one in Toronto (May 18), and two in Chicago (September 19 and December 7). During 2006, the Integration Workgroup kept abreast of GLBTS substance workgroup activities, the Great Lakes Water Quality Agreement review, workshops held at the 2006 State of the Lakes Ecosystem Conference (SOLEC), the Canadian Environmental Protection Act (CEPA) review of the Domestic Substances List, and other efforts related to substances of concern to the Great Lakes Basin. The Integration Workgroup also discussed the human health effects of toxic chemicals in the Great Lakes, Green Chemistry and the potential role of the GLBTS in establishing a Great Lakes Green Chemistry network, and the value of Traditional Ecological Knowledge and how it can be incorporated into the GLBTS.

During 2006, semi-annual Stakeholder Forums were held in Toronto (May 17) and Chicago (December 6). These events featured presentations by Cam Davreux, Vice President, CropLife Canada, on programs for the management of obsolete products and pesticide container recycling; Art Dungan, Chlorine Institute, on mercury reduction accomplishments in the chlor-alkali sector; and Marta Panero of the New York Academy of Sciences on "Industrial Ecology, Pollution Prevention, and the New York/New Jersey Harbor," or the Harbor Project.

Sediment Challenge

Over 400,000 cubic yards of contaminated sediment were remediated from nine U.S. sites in the Great Lakes Basin in 2005. Since 1997, over 4 million cubic yards of contaminated sediment have been remediated in the U.S. Great Lakes Basin. In 2006, with the assistance of the *Research Vessel Mudpuppy*, US EPA conducted integrated sediment assessment surveys at nine sites in the Great Lakes. Since 1997, approximately 46,000 cubic metres of contaminated sediment have been remediated from Canadian sites in the Great Lakes. In 2005, Canada made significant progress on Great Lakes sediment remediation investigations and evaluations, including the completion of sediment assessments for the Niagara River, Peninsula Harbour, and Thunder Bay AOCs. Evaluations are being conducted for the Bay of Quinte, Wheatley Harbour, Detroit River, St. Clair River, and St. Marys River AOCs.

Long-Range Transport Challenge

Canada and the U.S. continue to investigate the impact of long-range transport on the Great Lakes Basin. Chapter 7 describes a study in which EC used the Canadian Model for Environmental Transport of Organochlorine Pesticides (CanMETOP) to identify a statistically significant relationship between air concentrations of toxaphene in the southern U.S. and the Great Lakes region. Chapter 7 also describes the activities of an international Task Force on Hemispheric Transport of Air Pollutants, created by the Executive Body of the Convention on Long-range Transboundary Air Pollution.

Environmental Indicators of Progress

Monitoring environmental indicators offers a way to measure progress in reducing releases of Level 1 and Level 2 substances to the Great Lakes Basin. Monitoring efforts in the U.S. and Canada routinely collect data on concentrations of substances of concern in the environment of the Great Lakes Basin. Results indicate that concentrations of Level 1 substances in ambient air tend to be lower over Lakes Superior and Huron than over Lakes Michigan, Erie, and Ontario, which are more impacted by human activity. However, because their surface area is larger, atmospheric inputs of the Level 1 substances tend to have greater relative importance for Lakes Superior and Huron. While concentrations in ambient air are very low at rural sites, they may be much higher in "hotspots" such as urban areas.

Concentrations of historically regulated contaminants such as PCBs, DDT, and mercury have generally declined in most monitored fish species since the late 1970s. Concentrations of other contaminants, both currently regulated and unregulated, have demonstrated either slowing declines or, in some cases, increases in selected fish communities. Changes in concentrations are often lake-specific and relate to the characteristics and sources of the substances involved and the biological composition of the fish community. While concentrations of most persistent organic pollutants in top predator fish have declined, concentrations of polybrominated diphenyl ethers (PBDEs) have increased exponentially since the 1980s. Concentrations of another emerging chemical, perfluoroctanesulfonate (PFOS), in Great Lakes fish have also been shown to increase since the 1980s.

Concentrations of Level 1 substances in herring gull eggs at sites on the Great Lakes have declined from the 1970s, most notably PCBs, DDE, HCB, and octachlorostyrene (OCS). Concentrations of dioxins, furans, and mercury have not declined by as much as the compounds listed above, and an increase in furan gull egg concentrations was observed on the Niagara River from 1979 to 2005. An increase was also noted in PBDE concentrations on Gull Island, Lake Michigan, from 1981 to 2005.

Water and sediment contaminant monitoring programs provide data with which to assess trends in Great Lakes waters and sediments. Dieldrin concentrations in the open waters of the Great Lakes are higher in the lower lakes (Lakes Erie and Ontario) than in the upper lakes (Lakes Superior and Huron). Bottom sediment contaminant concentrations in the Great Lakes have generally decreased over the past 25 years, in some cases by as much as 70 to 80 percent. Mercury concentrations in suspended sediments in the Niagara River have decreased from 1984 to 2003 but appear to be leveling off. Concentrations of PFOS collected in a screening-level survey of recently deposited sediments in Canadian Great Lakes tributaries indicated relatively low PFOS concentrations that appear to be indicative of land use (i.e., elevated levels are generally found in more populated watersheds).

Looking Ahead

The year 2007 marks the 10th anniversary of the signing of the GLBTS. To signify this anniversary, a celebration of progress in implementing the GLBTS will be held in Chicago in May 2007. In conjunction with the 10-year anniversary event, a workshop on the sound management of chemicals in the Great Lakes Basin will consider broadening the current structure and mandate of the GLBTS. The recommendations resulting from the Great Lakes Water Quality Agreement review, conducted during 2006, will impact the discussions concerning the future of the GLBTS. The emerging chemicals workshop will begin a new era for the GLBTS as it moves forward into issues of emerging concern yet continues its efforts to virtually eliminate the original GLBTS Level 1 and Level 2 substances.

1.0 MERCURY

Canadian Workgroup co-chair: Robert Krauel, Edwina Lopes (acting co-chair during 2006)
U.S. Workgroup co-chair: Alexis Cain

Progress Toward Challenge Goals

U.S. Challenge: Seek by 2006, a 50 percent reduction nationally in the deliberate use of mercury and a 50 percent reduction in the release of mercury from sources resulting from human activity.

Canadian Challenge: Seek by 2000, a 90 percent reduction in the release of mercury, or where warranted the use of mercury, from polluting sources resulting from human activity in the Great Lakes Basin.

Both Canada and the U.S. have achieved reductions of mercury from sources resulting from human activity, and continue to pursue their challenge goals outlined in the Strategy. A description of the progress made by each country is provided below. The GLBTS Mercury Workgroup is active. Numerous mercury reduction activities are occurring in Canada to meet the goal of reducing releases of mercury in the Great Lakes Basin, and in the U.S. to meet the goal of reducing the deliberate use of mercury and releases of mercury nationwide.

Ontario: Progress Toward the GLBTS Challenge

In Ontario, releases of mercury have been reduced by approximately 85 percent between the 1988 baseline and 2003. Figure 1-1 illustrates the progress made toward the Canadian 90 percent reduction target.[2] This figure shows that releases in Ontario have been cut by more than 11,900 kg since 1988, based on Environment Canada's 2003 mercury inventory. Note that some sources listed in the legend of Figure 1-1 (e.g., paint, pesticides, pulp and paper) refer to the baseline year of emissions and are no longer current sources. Figure 1-2 illustrates the 2003 sources of mercury releases in Ontario. This figure shows that the primary sources of releases are electric power generation, iron and steel, municipal (primarily land application of biosolids), cement and lime, and incineration.

[2] This target is considered as an interim reduction target and, in consultation with stakeholders in the Great Lakes Basin, will be revised if warranted, following completion of the 1997 COA review of mercury use, generation, and release from Ontario sources.

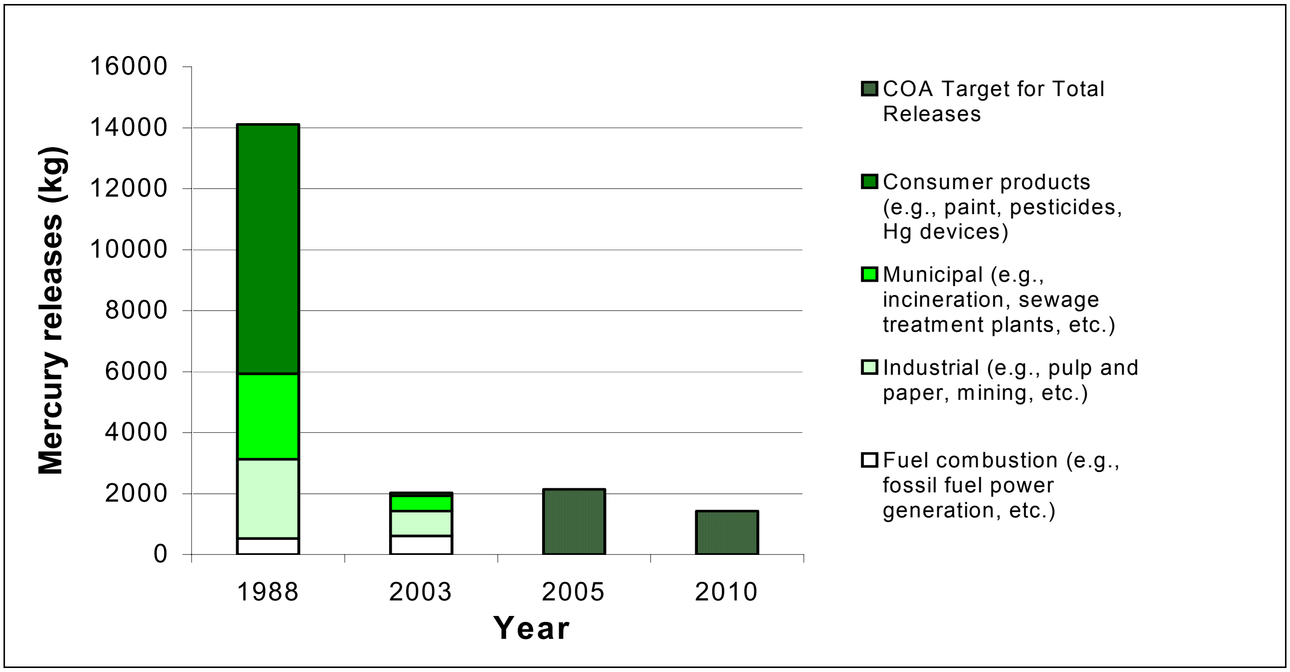

Figure 1-1. **Mercury Releases (to air and water) in Ontario from 1988 to 2003, by Sector. Source: Environment Canada, Ontario Region (2005)**

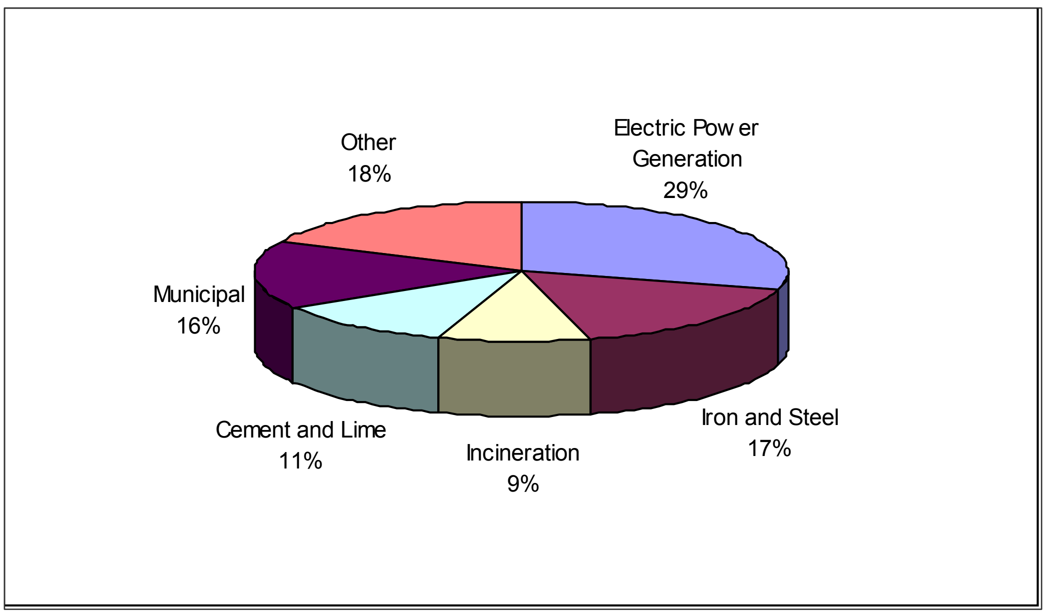

Figure 1-2. **Sources of Mercury Releases in Ontario (2003). Source: Environment Canada, Ontario Region (2005)**

United States: Progress Toward the GLBTS Challenge

Because of the potential for mercury releases to air to be transported to the Great Lakes, the Mercury Workgroup has focused on nationwide atmospheric mercury emissions in the U.S. The U.S. release challenge applies to the aggregate of air releases nationwide and of releases to water within the Great Lakes Basin.[3]

According to the most recent estimates from the National Emissions Inventory (NEI), U.S. mercury emissions decreased approximately 47 percent between 1990 and 2002 (see Figure 1-3).[4] However, actual emissions reduction has likely been larger than this estimate would indicate, because two of the biggest 2002 emissions source categories—electric arc furnaces and gold mining—are not included in the 1990 inventory. US EPA's Roadmap for Mercury (July 2006) includes preliminary 1990 emissions estimates for these categories. If these preliminary estimates are added to the 1990 baseline, mercury emissions declined from 219.9 tons in 1990 to 111.4 tons in 2002, a reduction of 49 percent. It is very likely that actions taken since 2002 have resulted in a total reduction of more than 50 percent since 1990; in particular, emissions from chlor-alkali plants have been reduced as a result of plant closures and implementation of Maximum Available Control Technology (MACT) standards since 2002, and emissions from gold mines have been reduced by additional control technology installations under a voluntary partnership among Nevada's major gold mining companies, the Nevada Department of Environmental Protection, and US EPA.

[3] This target is considered as an interim reduction target and, in consultation with stakeholders, will be revised if warranted, following completion of the Mercury Study Report to Congress.
[4] Note that there is uncertainty associated with all emissions inventories. For more discussion, see Murray and Holmes (2004).

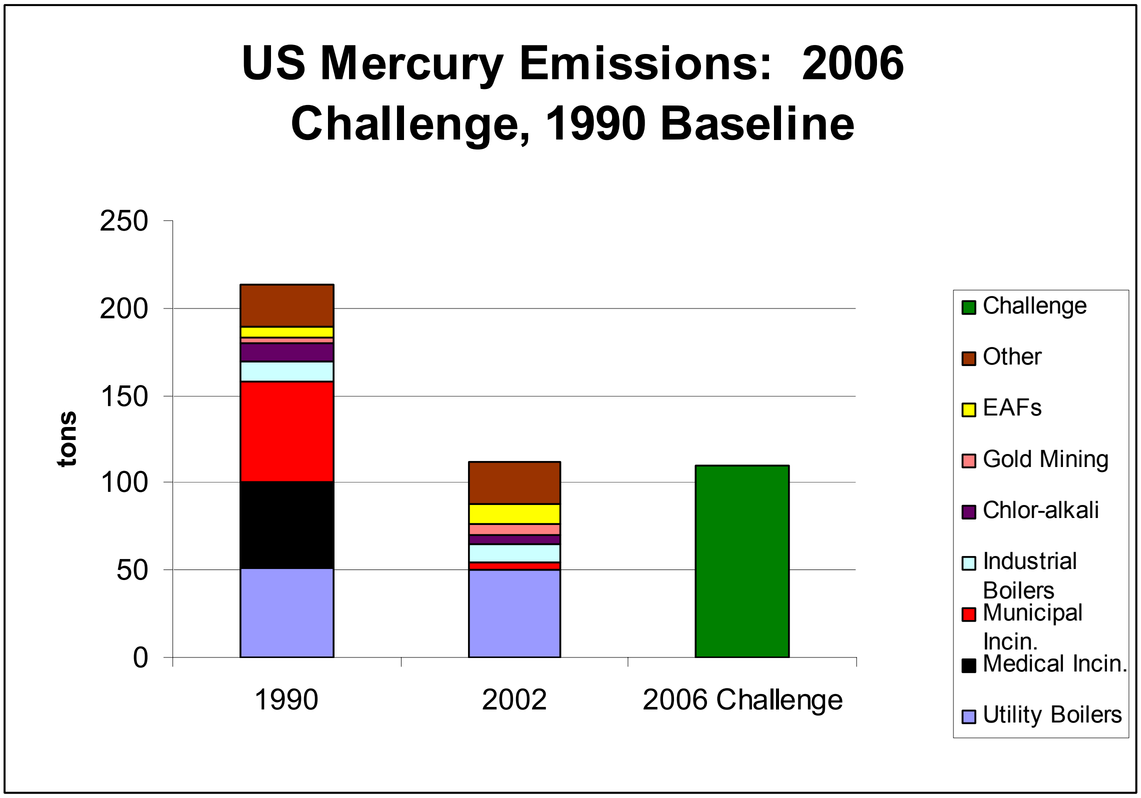

Figure 1-3. U.S. Mercury Emissions: 2006 Challenge, 2002 Estimates, and 1990 Baseline. Source: US EPA, Office of Air Quality Planning and Standards, 2002 National Emissions Inventory, EPA's Roadmap for Mercury, July 2006

Although it is clear that mercury use has decreased since 1995, the trend is difficult to quantify because the U.S. Geological Survey (USGS) stopped reporting estimated U.S. mercury consumption after 1997. However, on the basis of data reported by the chlor-alkali, lamp, and dental industries, it appears that total mercury use declined more than 50 percent between 1995 and 2003, assuming that mercury use by other sectors has remained constant since 1997 (see Figure 1-4). The chlor-alkali industry accounted for an estimated 35 percent of mercury use in 1995, and its total mercury use decreased 76 percent between 1995 and 2003 (including the impact of plant closures), and a total of 92 percent between 1995 and 2004. The fluorescent lamp industry has reported that mercury use in 2003 was six tons, compared with 32 tons estimated by the USGS for 1997 (see Table 1-1). These reductions are the result of reductions in the mercury content of lamps sold in the U.S., as well as an increase in lamp imports and a decline in U.S. fluorescent lamp production. Lamp manufacturers use mercury both in lamps themselves and in the production process.

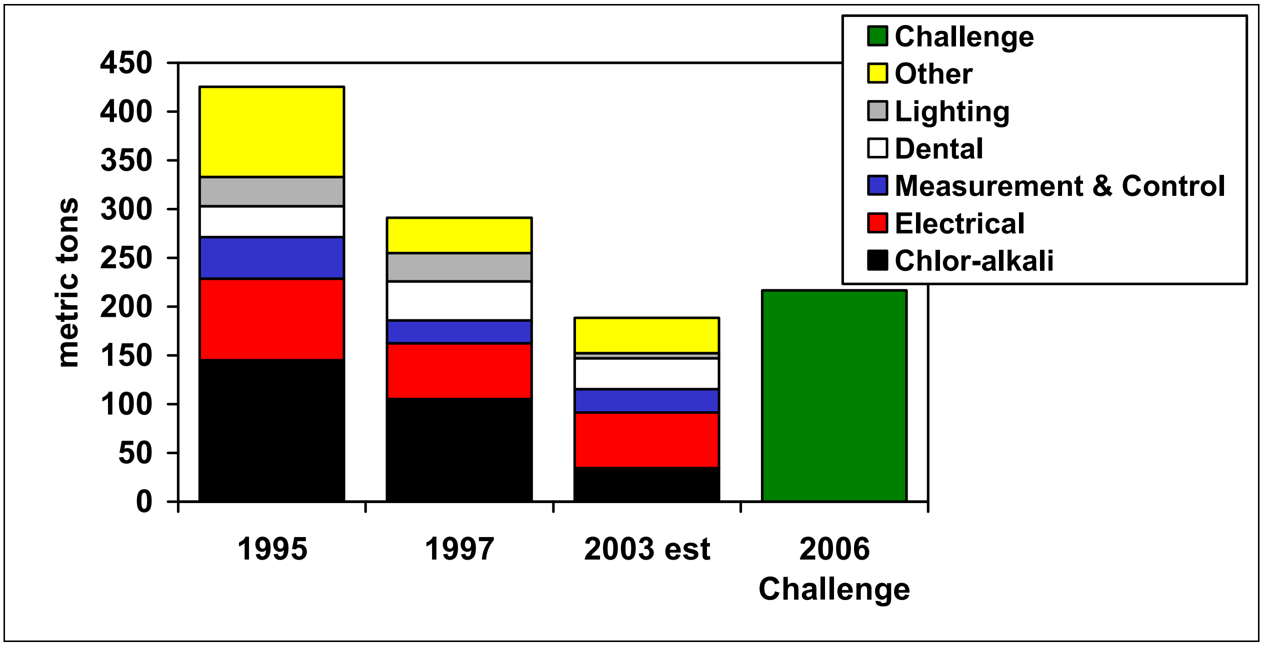

Figure 1-4. U.S. Mercury Use: 2006 Challenge, 2003 and 1997 Estimates, 1995 Baseline. Source: USGS, *Minerals Yearbook, 1995, 1997*; Chlorine Institute Annual Report to EPA, 2004; National Electrical Manufacturer's Association, direct communication, 2004

It is likely that mercury use has declined even more than portrayed in Figure 1-4, because mercury use in other categories also has decreased. For instance, evidence suggests that use of mercury in measurement and control devices and switches and relays has decreased.[5] These reductions cannot be quantified and are not visible in Figure 1-4.

Table 1-1. U.S. Mercury Use (tons)

Industry/Product Category	1995*	1997*	2003*
Chlor-alkali Production**	160	116	38
Wiring Devices and Switches	92	63	63
Measurement and Control Devices	47	26	26
Dental***	35	44	35
Lighting****	33	32	6
Other	102	40	40
Total	469	321	208

*Source for 1995 and 1997 (except chlor-alkali data): U.S. Geological Survey, *Minerals Yearbook*, 1995 and 1997 – converted to short tons. For 2003, assume that use has not changed, except in chlor-alkali, lighting, and dental categories.
**Chlorine Institute, *Seventh Annual Report to EPA*, July 22, 2004. Mercury "used" rather than mercury "purchased." Under this definition of "use," mercury purchased and placed in inventory or added to cells to increase working stock of mercury does not count as "use," although mercury added to maintain previous levels of mercury in cells does

[5] For instance, in the period since 1997, mercury switches have been phased out of automobiles and many appliances, and the widespread use of mercury-containing fever thermometers has ended.

count as “use.” The chlor-alkali industry has achieved additional reductions in mercury use beyond 2003, as discussed below.
*** Vandeven J, McGinnis SL. An Assessment of Mercury in the Form of Amalgam in Dental Wastewater in the United States. Water, Air and Soil Pollution 2005; 164:349-366.
**** Source of 2003 estimate: E-mail from Ric Erdheim, National Electrical Manufacturers Association, May 27, 2004.

Workgroup Activities

Workgroup Meetings

On December 6, 2005, the Mercury Workgroup meeting focused on improving characterization of mercury sources and on international activities to reduce mercury emissions. Presentations on source characterization included information on mercury emissions in China, global emissions from primary metals production, U.S. emissions from crematoria and from the use of mercury-containing products, and the development of a mercury emissions inventory for Michigan. In addition, the group discussed the development of global partnerships for mercury reduction in the chlor-alkali, artisanal mining, coal combustion, and mercury product sectors. The workgroup also learned about reduction efforts by the electrical products industry, a demonstration of mercury controls at a WE Energies’ power plant, and a compendium of state mercury reduction activities.

At the May 17, 2006, meeting, the Mercury Workgroup continued its focus on international activities with presentations on Canada’s and the Commission for Environmental Cooperation’s international mercury reduction activities. In addition, there were presentations on the chlor-alkali industry’s mercury reduction accomplishments, and on emissions controls for the Canadian cement and base metal smelting sectors. The workgroup also discussed mechanisms for improved recovery of mercury-containing lamps, auto switches, dental amalgam waste, and mercury-containing devices in use by industry within the Lake Superior Basin. Other presentations focused on research conducted by Canada’s Collaborative Mercury Research Network, and on trends in atmospheric mercury concentrations according to the Canadian Atmospheric Mercury Measurement Network.

Management Assessment for Mercury Completed

The workgroup co-chairs completed a Management Assessment for Mercury that incorporated comments from workgroup members. The Management Assessment for Mercury concludes that mercury should remain in Level 1 status with periodic reassessment by the GLBTS. It also finds that the Mercury Workgroup should: 1) disseminate information about removal of mercury devices in auto scrap, appliances, and industrial equipment, and on assisting state, provincial, and local governments identify cost-effective reduction approaches for mercury releases from dental offices, and 2) participate in national and international mercury reduction programs.

U.S. Reduction Activities

National Vehicle Mercury Switch Recovery Program

This program was established by an August 2006 agreement among vehicle manufacturers, steelmakers, vehicle dismantlers, automobile shredders, brokers, the environmental community, state representatives, and US EPA. Under this program, vehicle manufacturers must provide automobile dismantlers with information and supplies for mercury switch removal, collect and transport switches to retorters for proper recycling or disposal, assume liability for the switches once collected, and establish a database to track switch recovery by program participants. Dismantlers will recover mercury switches and submit them to the program. Steelmakers will encourage their suppliers to participate in the program, and will match a $2 million donation from vehicle manufacturers, establishing a three-year, $4 million implementation fund that will be used to provide incentives for switch removal to auto dismantlers.

Chlorine Industry Implements Voluntary Mercury Reductions

The Chlorine Institute released its *Ninth Annual Report to EPA*, showing a 91 percent capacity-adjusted reduction in mercury consumption by the U.S. chlor-alkali industry between 1995 and 2005. This accomplishment exceeds the sector's commitment to reduce mercury use by 50 percent by 2005. Including shutdowns of mercury cell factories, mercury use has decreased by 94 percent. The report also describes specific industry actions taken to minimize mercury releases, for instance through the use of more durable equipment that minimizes intrusive maintenance activities that cause mercury emissions and through equipment that is more successful in keeping mercury contained within the process. It also describes actions taken to meet the industry's 2004 commitments to enhance cell room mercury monitoring and to fully account for their mercury inventory. The industry could not account for 30 tons of mercury in 2003 and seven tons in 2004; this amount was reduced to three tons in 2005.

Honeywell Ceases Manufacture of Mercury Switches for Thermostats

Honeywell, the leading manufacturer of mercury thermostats, committed to US EPA's National Partnership for Environmental Priorities to end production of mercury switches for thermostats in July 2006. Honeywell had previously used more than 12 tons of mercury per year in thermostats. Manufacture of mercury-containing Honeywell thermostats will cease after Honeywell's existing stockpile of switches has been used.

Manufacturers Improve Success of Thermostat Recycling

In 2005-2006, thermostat manufacturers increased collections through the Thermostat Recycling Corporation, which seeks to limit disposal of mercury-containing thermostats in solid waste landfills. The TRC enables wholesalers and contractors across the country to collect and ship mercury thermostats without charge to an industry facility for disassembly and recycling. In 2005, the TRC recovered nearly 88,000 thermostats and thereby removed 820 pounds of mercury from the solid waste stream. If 2006 collections continue at the same pace reported for the first half of the year, TRC will be on track for a 37 percent increase in thermostat collections and a 40 percent increase in recovered mercury, relative to 2005. The number of mercury thermostats coming out of service has been estimated at more than two million annually.[6] Mercury thermostats that are not managed by the TRC or by household hazardous waste programs are either discarded in the trash or as part of construction and demolition waste.

US EPA Reaffirms Clean Air Mercury Rule

In response to petitions filed by States, Tribes, industry, and environmental groups, US EPA agreed to reconsider its regulatory determination that it was not necessary or appropriate to regulate mercury emissions from electric utility steam generating units under section 112 of the Clean Air Act, and to reconsider its decision to regulate these emissions under section 111(d) instead. This reconsideration re-affirmed these decisions, and the deadline for submission of state plans controlling mercury emissions from electric utilities was November 17, 2006.

Hospitals for a Healthy Environment Program Enlists New Partners

The Hospitals for a Healthy Environment (H2E) program, a joint project of the American Hospital Association, Health Care Without Harm, the American Nurses Association, and US EPA, is a voluntary program with 1,249 partners representing 6,064 facilities: 1,443 hospitals, 3,138 clinics, 665 nursing homes, and 818 other types of facilities. These partners are health care facilities that have pledged to eliminate mercury and reduce waste, consistent with the overall goals of H2E. This program is continuing to grow and has enlisted 171 new partners in the last year.

City of Superior Cooperates with Lake Superior Shipping Industry to Raise Awareness and Reduce the Use of Mercury

In 2006, the City of Superior, Wisconsin, began working with business owners and managers to reduce mercury use within the Lake Superior shipping industry. Examples of mercury use in the shipping industry include mercury-filled manometers to monitor ballast levels, and mercury-containing conveyor belt scales in on-shore loading facilities. With financial support from the US EPA Great Lakes National Program Office and programmatic help from the Lake Superior Binational Forum, the City offers assistance with conducting mercury inventories, developing mercury reduction plans, establishing mercury management polices and procedures and collecting, recycling, and disposing of elemental mercury and mercury-containing equipment. To date, 105 leaders representing 52 companies have been offered assistance. Three have requested additional information and/or assistance. In addition, five general information and business-specific guidance documents have been produced. As the project grows, the City and the Forum will continue to collaborate on outreach activities aimed at spreading awareness of industrial mercury use and increasing the number of inventoried facilities.

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[6] Product Stewardship Institute. Thermostat Stewardship Initiative: Final Background Research Summary. October 18, 2004.

Bowling Green State University Elemental Mercury Collection and Reclamation Program

Bowling Green State University's (BGSU, located in northwestern Ohio) Elemental Mercury Collection and Reclamation Program formally began in January 1998. The program involves the collection and recycling of uncontaminated elemental mercury that is present in a variety of devices. These sources include thermometers, manometers, barometers, sphygmomanometers (blood pressure measurement devices), mercury-containing heating thermostats, and mercury switches, as well as individual containers of elemental mercury. The program is available and free to individuals, academic institutions, small businesses, industries, medical and dental facilities, emergency response and other governmental agencies, spill response companies, and any additional entity having unwanted, uncontaminated elemental mercury.

Collaborative partners in the program include Bowling Green State University, Ohio EPA (Division of Emergency and Remedial Response), Rader Environmental Services, Toledo Environmental Services, and ESCO (Elemental Services and Consulting). The Wood County Emergency Management Agency and the Wood County Health Department have also assisted in this effort.

Since the program began, mercury has been removed from numerous sources throughout Ohio as well as from locations in Michigan, Indiana, Pennsylvania, West Virginia, Kentucky, Tennessee, Illinois, Wisconsin, Nebraska, Texas, and Georgia. Thus far, over 14,600 pounds of elemental mercury have been collected and recycled.

A more detailed explanation of BGSU's collection and reclamation program as well as a sample of a mercury vapor video filmed at BGSU can be found at the following web site: http://www.bgsu.edu/offices/envhs/page18364.html.

Development of Standards for Storing and Shipping Amalgam Waste

The American Dental Association Standards Committee on Dental Products developed American National Standards Institute/American Dental Association (ANSI/ADA) Specification No. 109, *Procedures for Storing Dental Amalgam Waste and Requirements for Amalgam Waste Storage/Shipment Containers*. The specification describes procedures for storing and preparing amalgam waste for delivery to recyclers or their agents for recycling. In addition, it gives requirements for containers for storing and/or shipping amalgam waste. The specification, approved by ANSI in October 2006, was developed by a working group consisting of users, general interest participants, and industry, with representation from US EPA, dental societies, dentists, parcel shipping companies, and amalgam waste recyclers. One purpose behind the ADA's efforts on this standard was to encourage amalgam recycling by making amalgam recycling easier and more effective for the dental office.

Development of a Mercury Product Stewardship Strategy

The Great Lakes Regional Collaboration Strategy, released on December 12, 2005, by a host of collaborators calls for: "By 2015, full phase-outs of intentionally added mercury bearing products, as possible." The strategy also states that "a basin-wide mercury product stewardship strategy should be developed to complete phase-outs of mercury uses, including a mercury waste management component, as practicable." The Council of Great Lakes Governors and the Great Lakes and St. Lawrence Cities Initiative endorsed this effort in a December 12, 2005, letter to President Bush.

In response to these recommendations, a Great Lakes Regional Collaboration Mercury Phase-Down Strategy workgroup was created in May 2006 to draft a basin-wide phase-down strategy for mercury in products and waste. The workgroup is facilitated by the Illinois Waste Management & Research Center, with a grant from the Great Lakes National Program Office. Representatives from each Great Lakes State and from Tribes are participating in the workgroup, as are representatives from US EPA. The workgroup is meeting regularly through conference calls to draft a phase-down strategy that will identify priority mercury-containing products and sectors that use mercury-containing products. Moreover, the strategy will recommend appropriate actions for each of the priority products and sectors. A draft strategy should be completed by the end of 2006.

Canadian Reduction Activities

Canada-wide Standard for Mercury Emissions from Coal-Fired Electric Power Generation Plants and Other Initiatives

On October 11, 2006, the Canadian Council of Ministers of the Environment endorsed a Canada-wide Standard (CWS) for Mercury Emissions from Coal-Fired Electric Power Generation Plants. Under the CWS, Canadian provincial and territorial jurisdictions have committed to reduce mercury emissions from coal-fired power plants by at least 60 percent by 2010 (from a 2003/2004 baseline). Ontario has been working on several other mercury reduction initiatives, including the development of CWSs for incinerators, base metal smelters, fluorescent lamps, and waste dental amalgam. Ontario continues to support several other initiatives for the diversion of mercury-containing wastes from landfills. These initiatives include collecting mercury-containing switch pellets from vehicles before they enter the waste stream. The Recycling Council of Ontario is about to launch a fluorescent lamps recycling project by the end of 2006, which aims to collect over 48,000 lamps from Toronto schools, equivalent to 0.56 kg of mercury.

Detroit River Canadian Cleanup Household Mercury Collection

A household mercury collection program was held in 2004 for residents of Windsor and Essex County, Ontario. The Detroit River Canadian Cleanup (DRCC) partnered with the City of Windsor, Town of LaSalle, EC, Ontario Ministry of the Environment (MOE), and the Essex-Windsor Solid Waste Authority to collect household mercury from residents in April 2004, during spring cleanup. The project was a resounding success, with about 200 pounds, or 90 kilograms, of mercury collected. This included about 750 thermometers, 1000 household fluorescent light bulbs, 100 thermostats, and 20 jars of mercury. As a result of the project, more members of the public are now aware that a Household Chemical Waste Depot collects household mercury along with other household hazardous waste. The scope of the project has been expanded to educate business owners about the steps they can take to ensure that they are not potential contributors of mercury to the Detroit River.

Municipal Actions to Reduce Mercury

A Municipal Waste Integration Network Conference was held in the Town of Blue Mountains, Ontario, on June 21, 2006. Approximately 50 participants received information on how municipalities can reduce mercury to the environment. The conference primarily focused on extended producer responsibility (EPR) programs and opportunities for adjacent municipalities to work together for cost efficiency in operating blue box programs[7] and other recycling strategies for non blue box recyclables. A *Municipal Actions to Reduce Mercury* booklet was given to each participant at the conference as part of workshop materials.

Mercury Clean Sweep Pilot Program for Schools in Ontario

EC, in collaboration with the MOE, launched the Mercury Clean Sweep Pilot Program for Schools in Ontario (February 20, 2006, to March 31, 2006). Over 40 secondary schools voluntarily enlisted in the program and were given the opportunity to safely dispose of mercury-containing items. A total of 9.32 kg of mercury waste was collected, which included over 1,150 mercury lab thermometers. Schools that turned in mercury lab thermometers received alcohol-filled thermometers to replace each one collected through the program.

EcoSuperior Initiatives in Thunder Bay and Surrounding Areas

The MOE is working with EcoSuperior to support educational and communication efforts to reduce mercury levels in secondary schools. The initiative includes reducing the use of mercury-containing products, using safe and proper collection and recycling methods, and encouraging the use of alternatives to mercury products (e.g., digital thermometers and thermostats). In addition, Ontario Power Generation Thunder Bay Generating Station will be involved in sponsoring the EcoSuperior program to identify mercury in schools in 2006/2007.

EcoSuperior, with support from MOE, produced a best management practices guide for mercury which was distributed to Canadian Lake Superior Basin dentists. This work built upon the *Dental Wastes Best Management Practices Guide for the Dental Community*, which provides a guide for the disposal of dental amalgam and mercury wastes, that was developed by EC, MOE, and stakeholders, including dental associations, universities and colleges, and the City of Toronto.

With funding from EC's Great Lakes Sustainability Fund and MOE, EcoSuperior leads a Thermostat Recycling Project and a Fluorescent Light Recycling Program to collect

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[7] Municipalities in Ontario are encouraged to establish "blue box programs" to achieve a 60 percent waste diversion rate from landfills (see www.ene.gov.gov.ca). Blue box waste refers to glass, metal, paper, plastic, textiles, or any combination of them, which can be recycled curbside in plastic blue boxes.

conventional fluorescent lamps from 14 industries, institutions, and municipalities located in Thunder Bay, Red Rock, Terrace Bay, and Marathon.

"Switch Out" Program – A Canadian Success Story

The Clean Air Foundation's "Switch Out" program was launched in 2001 to recover mercury switches from end-of-life vehicles before they enter the waste stream. Though the use of mercury switches for convenience lighting has been phased out, a large number of switches remain in vehicles not yet retired. The Switch Out program works with automotive recyclers across Canada to educate them on the use of mercury switches in vehicles and to instruct them on how to extract the switches. An important component of the program is a free collection and disposal infrastructure for participating automotive recyclers. To date, voluntary actions by participating auto recyclers has resulted in the collection of approximately 130,000 switches (equivalent to approximately 109 kilograms of mercury).

Environment Canada Mercury Take Back Events

EC organized two in-house Mercury Take Back Events in Downsview, Ontario, on April 20-21 as a kick-off to Earth Day, and in Burlington on June 9-10, 2005, as a wrap up to Earth Week.[8] The events were intended to provide all EC employees with a convenient site to drop off mercury-containing household items, such as fever thermometers, thermostats, and button batteries for safe disposal. Information on mercury was provided to employees. In addition, a brief survey was conducted to gauge staff knowledge on mercury. Both events proved to be great successes. In Downsview, 120 mercury-containing items (over 970 grams of mercury) were collected. Well over 100 employees visited the booth. At the Burlington event, 200 mercury-containing items (over 530 grams of mercury) were collected, and over 50 employees visited the booth.

Next Steps

The Mercury Workgroup will consider, and potentially help implement, the recommendations of the forthcoming Great Lakes mercury product stewardship strategy. In addition, the workgroup will continue to share information about cost-effective opportunities for mercury reduction, including opportunities at the international level.

References

Chlorine Institute, *Seventh Annual Report to EPA*, July 22, 2004.

Murray, M. and Holmes, S.A. (2004) Assessment of mercury emissions inventories for the Great Lakes states. *Environ. Res.* 95:282-297.

US EPA. 2006. *EPA's Roadmap for Mercury* (July 2006). Available at http://www.epa.gov/mercury/roadmap.htm.

[8] Events that occurred in 2005 are reported because collection totals did not become available until 2006.

U.S. Geological Survey, Minerals Yearbook, 1995 and 1997. Available at http://minerals.usgs.gov/minerals/pubs/myb.html.

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2.0 POLYCHLORINATED BIPHENYLS (PCBs)

Canadian Workgroup co-chair: Ken De
U.S. Workgroup co-chair: Tony Martig

Progress Toward Challenge Goals

U.S. Challenge: Seek by 2006, a 90 percent reduction nationally of high-level PCBs (>500 ppm) used in electrical equipment. Ensure that all PCBs retired from use are properly managed and disposed of to prevent accidental releases within or to the Great Lakes Basin.

Canadian Challenge: Seek by 2000, a 90 percent reduction of high-level PCBs (>1 percent PCB) that were once, or are currently, in service and accelerate destruction of stored high-level PCB wastes which have the potential to enter the Great Lakes Basin, consistent with the 1994 COA.

The U.S. and Canada have both made progress toward reaching the PCB challenge goals outlined in the Strategy. However, as described below, some data gaps exist regarding the amount of PCBs in remaining equipment and storage. Information continues to be gathered and assessed by US EPA and EC to determine whether the U.S. and Canadian PCB challenge goals have been met in their entirety. While the U.S. has made progress in reducing the amount of equipment in service containing >500 ppm PCBs, due to the lack and unavailability of information, they are still unable to determine, with accuracy, the status of progress toward the goal. Based on preliminary data received by EC Headquarters from the Canadian National Inventory system for Ontario, it appears that Canada has achieved a 90.5 percent reduction of high-level PCBs (>10,000 ppm PCB) in storage only for the Province of Ontario. The final national reductions may exceed 90 percent, but EC is still entering recently received inventory data into the National Inventory Database. Canada is unlikely to meet the 90 percent reduction goal for PCBs that are still in service or in use in PCB equipment. Based on preliminary analyses, it appears that approximately 66 to 70 percent of PCBs in use have been eliminated or destroyed. The 2006 EC inventory data will not be available until mid- to late-2007.

The PCB Workgroup is active and continues to pursue reduction opportunities and outreach activities, and plans to prioritize recommendations developed in the 2006 *Management Assessment for PCBs*.

The new Canadian PCB Regulations have undergone extensive public consultation and have been approved recently by both Ministers of Environment Canada and Health Canada. The PCB regulations were published in the *Canada Gazette 1* on November 4, 2006. Additional information on the new Canadian PCB Regulations is available on EC's PCB website at www.ec.gc.ca/PCB.

Both Canada and the U.S. are evaluating opportunities to comply with the Stockholm Convention (Canada is signatory to the Stockholm Convention), which includes international goals to phase out PCBs.

Ontario: Progress Toward the GLBTS Challenge

Environment Canada continues to update its inventory information annually and will be able to accurately state the percentage reductions achieved through 2006 by mid- to late-2007. The information below summarizes previously compiled and evaluated inventory information through 2004.

According to EC's 2004 PCB Inventory reports, about 89 percent of previously stored high-level PCB wastes had been destroyed (compared to 1993), and the number of PCB storage sites had been reduced to 420 from 1,529 in 1993 (see Table 2-1 and Figure 2-1). However, as described below, some data gaps exist regarding PCBs in remaining equipment that is still in service. In Canada, as of December 2004, there were still approximately 3,086 tonnes (in net tonnes) (6.8 million pounds) of high-level PCBs in use/service that need to be targeted for phase-out. This is a reduction of approximately 36 percent compared to the 1993 inventory and a reduction of approximately 63 percent since 1989 (see Figure 2-2).

Table 2-1. PCB Storage Sites Remaining in Ontario. Source: Environment Canada, Ontario MOE PCB Database

	Dec. 1994	April 2003	April 2004	Dec. 2004
Federal Sites	109	25	26	21
Non-Federal Sites	1429	530	407	399
Total Sites Remaining	1538	555	433	420

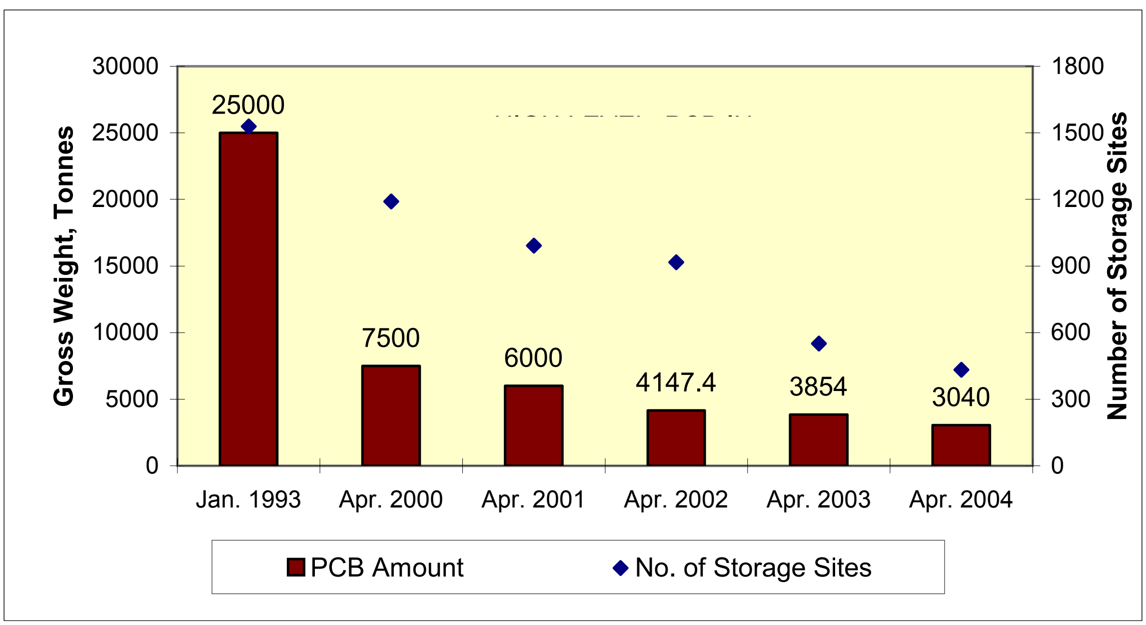

Figure 2-1. High-Level PCBs (Gross Tonnes) in Storage in Ontario. Source: Environment Canada, Ontario MOE PCB Database

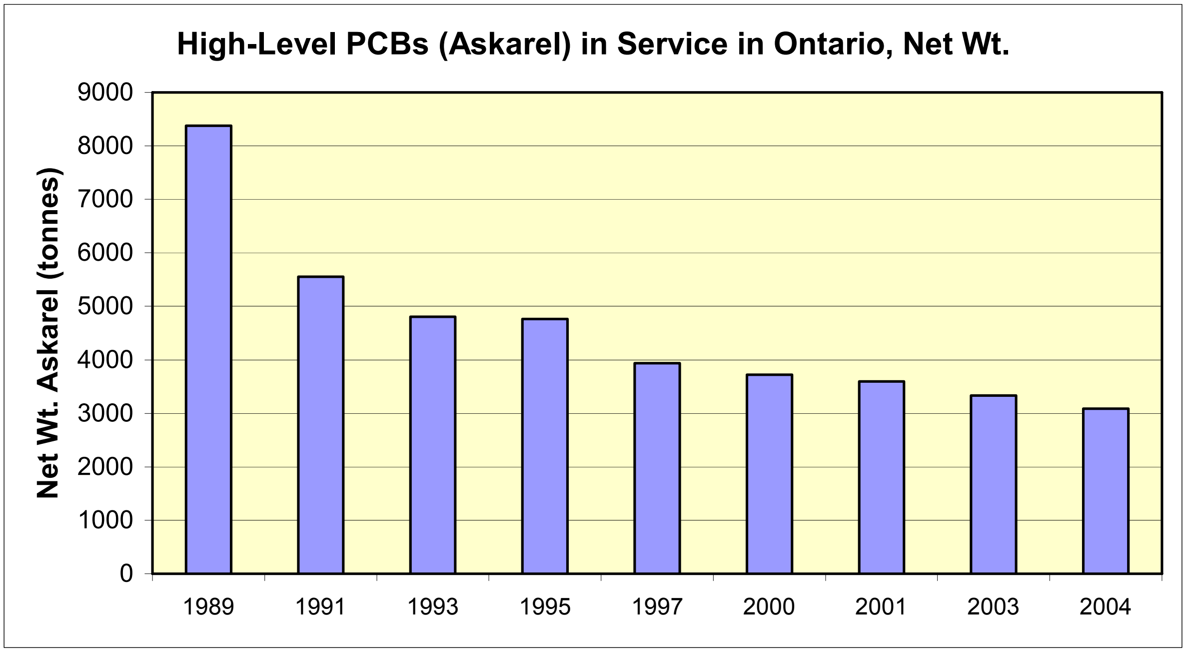

Figure 2-2. Trends in High-Level (Askarel) PCBs (Net Tonnes) in Service in Ontario. Source: Environment Canada

The figures reported for EC are based on historical data recorded in EC's database and should be accurate, with a possible time lag, based on the timing and updating of the received data in the database.

Awareness of the need to reduce PCBs continues to increase due to PCB outreach, the PCB Phase-Out Awards Program (in Canada), sector mail-out of information, and voluntary commitment letters. Newer facilities and options are now available in Ontario for PCB decontamination and destruction, in addition to the Alberta Swan Hills incinerator.

United States: Progress Toward the GLBTS Challenge

US EPA uses two sources of information to evaluate the estimated inventory of PCB transformers remaining in use: 1) annual reports submitted by PCB disposers, and 2) the PCB Transformer Registration Database. Unfortunately, the annual report data has not been compiled since 2003. Based on the annual report data thru 2003, an estimated 113,000 PCB transformers and 1,330,000 large PCB capacitors remained in use at the end of 2003. The estimates for the amount of equipment remaining in use in 2003 were obtained by abstracting the annual disposal data from the 1994 estimated baseline. However, according to the PCB Transformer Registration Database, updated in August 2006, only about 14,700 PCB transformers were registered with US EPA. Since 2000, when about 20,000 PCB transformers were registered with US EPA, the number of PCB transformers registered decreased by 25 percent, or by about 5,000. US EPA will compile PCB disposal information for 2004 and 2005 and, based on the update of the PCB transformer registrations, will re-evaluate the data gaps in the inventory.

Workgroup Activities

Workgroup Meetings

The PCB Workgroup met on December 6, 2005, in Chicago and on May 17, 2006, in Toronto. The December 2005 PCB Workgroup meeting primarily focused on the continued development of a draft *Management Assessment for PCBs*. Detailed comments were received on the Management Assessment, and the workgroup plans to respond to these comments and revise the document. A presentation was given on a program to phase out PCB transformers in the Minnesota portion of the Lake Superior Basin. The project involved a detailed survey of all potential PCB owners and the mapping of "PCB density." Efforts are now being made to target those transformers with the most potential to release PCBs to Lake Superior.

The May 2006 PCB Workgroup meeting in Toronto focused on discussion of the Lake Michigan Mass Balance (LMMB) Study, Canadian PCB regulation updates, and the revised draft *Management Assessment for PCBs.* A presentation was given on the LMMB Study of PCB deposition on and around Lake Michigan. This study was a multi-million dollar, multi-year project involving an analysis of the deposition of PCBs, mercury, atrazine, and trans-nonachlor on the Lake's basin. The project specifically:

- Studied the relative loadings of PCBs and other chemicals entering Lake Michigan;
- Determined baseline loading estimates in 1994-1995;
- Predicted environmental benefits of specific load reductions and the time to realize these benefits; and
- Predicted the PCB concentration in Lake Trout through 2052.

Information was provided on PCB concentrations in Lake Michigan trout and various Lake Michigan media from 1930 to beyond 2000. According to the LMMB study and preliminary modeling, even a 100 percent elimination of all air deposition and/or atmospheric loadings of PCBs occurred, PCB levels that would allow unlimited fish consumption would still not be reached until 2039.

Approximately 38,000 multimedia samples (with over 5,000 on PCBs alone) were collected as part of the LMMB study. Some of the main findings were:

- PCB concentrations were declining in all media;
- PCBs volatilize;
- Atmospheric deposition is the major source of PCBs to the Lake(s);
- PCB levels in Lake Trout may not reach the threshold level of 0.5 µg/g for unlimited consumption in Sturgeon Bay until 2039 and Saugatuck until 2044; and
- The Chicago urban area is a major general source of PCBs to the Lake.

A copy of the presentations on the LMMB Study given at the May 2006 PCB Workgroup meeting and the presentation on PCBs, given at the May 17, 2006, stakeholder meeting, can be found at the GLBTS website (http://www.epa.gov/glnpo/bns/reports/stakemay2006/index.html).

At the May 2006 PCB Workgroup meeting, Ken De, the Canadian co-chair, gave a presentation about the proposed amendments to the Canadian PCB regulations which were published in the *Canada Gazette 1* on November 4, 2006. The new Canadian PCB regulations will replace (with modifications) two previous regulations: 1) Storage of PCB Material Regulations (SOR/92-507), and 2) Chlorobiphenyls Regulations (SOR/91-152). Ken discussed the main features of the proposed new regulations, including permitted and non-permitted activities and mandatory phase-out dates (see the section below under Canadian Regulatory Activities).

The workgroup also discussed the *Management Assessment for PCBs* at the May 2006 meeting, specifically focusing on:

- Sources of PCBs and data needs (Management Outcome); and
- The identification of activities to continue to pursue (e.g., voluntary reduction and decommissioning and storage disposal sites).

The proposed final management outcomes for PCBs at the conclusion of the May 2006 meeting were:

- Continue active Level 1 status;
- Continue existing programs; and
- Coordinate information gathering and assessment to prioritize sources and determine trends.

PCB Management Framework

The PCB Workgroup continued to work toward finalizing the draft *Management Assessment for PCBs* in 2006. In addition to discussing the report at the May 17th meeting, an updated draft of the report was circulated to the PCB Workgroup for final review. Comments were specifically sought regarding a few outstanding issues highlighted within the report. Two sets of comments were received and are addressed in final revisions to the report. The workgroup expects to finalize the *Management Assessment for PCBs* by the December 2006 workgroup meeting.

U.S. Reduction Activities

U.S. PCB Phasedown Program

In an effort to clarify information in US EPA's PCB Transformer Registration Database, the US EPA contacted up to 2,400 entities that registered PCB transformers with the US EPA. During that effort, many entities indicated that they had already removed their PCB transformers since registering them in 2000. US EPA compiled the information and updated the PCB Transformer Registration Database in August 2006.

U.S. Stakeholders PCB Phase-out Efforts

The Utility Solid Waste Activities Group (USWAG) is committed to promoting, among its members and other users of PCB-containing equipment, voluntary efforts to identify and retire PCB-containing equipment from service. For example, USWAG shares information regarding the potential locations of PCB-containing equipment in service. USWAG is also committed to promoting strategies for members to work with their industrial and commercial customers to provide technical assistance for removing PCBs from service. Many companies have voluntarily removed all known categories of PCBs (e.g., ≥500 ppm) from their systems. Other efforts include procedures to ensure that equipment containing PCBs in concentrations ≥50 ppm that is removed from the field is either disposed of and not returned to service or retrofilled with non-PCB mineral oil before being returned to service.

Since the last update in 2004, electric and gas utility member companies of USWAG have continued with a wide range of voluntary PCB reduction efforts, both within the Great Lakes Basin and in other regions of the country. At the last USWAG PCB Committee meeting in Columbus, Ohio, in April 2006, attendees reaffirmed that most USWAG companies have procedures in place to ensure that virtually all equipment containing PCBs in concentrations >50 ppm, identified during repair/servicing, are disposed and/or retrofilled and not returned to service as PCB-regulated equipment. These reduction efforts, combined with voluntary retrofill/reclassification programs, are resulting in the continued reduction of PCB-containing equipment from utility inventories across the country. The achievements of USWAG members are significant because they help demonstrate that the U.S. is fulfilling its anticipated obligations (were it to become a signatory) under the Stockholm Convention on Persistent Organic Pollutants to "make determined efforts" to identify and remove PCB equipment (>500 ppm PCBs) from use by 2025, and to "endeavor to" identify and remove PCB-contaminated equipment (>50 but <500 ppm PCBs) from use by 2025.

In addition to the systematic retirement of PCB-containing equipment identified during repair/servicing, USWAG member companies also undertake, where practical, dedicated efforts to identify and remove PCB-containing equipment from service.

For example, **American Electric Power** (AEP), with more than 5 million customers and celebrating its 100th anniversary in 2006, continues to achieve excellent PCB use reductions in its 11-state service territory of Arkansas, Indiana, Kentucky, Louisiana, Michigan, Ohio, Oklahoma, Tennessee, Texas, Virginia, and West Virginia. Within the Great Lakes Basin, AEP has no known PCB transformers or large PCB capacitors. In calendar years 2005-2006, AEP removed from its service territories in EPA Regions 3 through 5 the following items: 207 large PCB capacitors, 544 PCB items containing ≥500 ppm PCBs (211 being PCB transformers), 3,046 PCB-contaminated articles (between 50 and 499 ppm PCBs), 25,001 non-PCB items, and 896 large non-PCB capacitors (between 2 and 49 ppm PCBs). In its EPA Region 6 territory, AEP removed 586 large PCB capacitors and 132 PCB items containing ≥500 ppm PCBs, 618 PCB-contaminated articles, 738 large non-PCB capacitors, and 22,011 non-PCB articles of electric equipment.

Duke Energy, which serves 3.8 million electric customers in North Carolina, South Carolina, Ohio, Kentucky, and Indiana, has implemented a voluntary PCB phase-down program. Duke Energy has tested all large electrical equipment in its substations, power plants, and vaults. Any equipment containing ≥50 ppm PCB oil that was identified in these areas has been: removed and replaced with units containing no PCBs; retrofilled to bring the PCB level to <50 ppm PCBs; or upgraded with spill prevention controls to prevent any release to the environment. Because of these efforts, Duke Energy currently has only a few known PCB transformers (≥500 ppm) in its system, and no large PCB capacitors. As a matter of general policy, when Duke Energy identifies any distribution type equipment containing ≥50 ppm PCBs, the company either replaces the equipment or retrofills the equipment to bring the PCB level to <50 ppm PCBs as soon as feasible. Further, in Indiana, Duke has tested all transformers on school properties (K through 12th grade), and any transformers containing ≥50 ppm found in these areas have been voluntarily removed and replaced with transformers containing no PCBs.

Another USWAG member in the Great Lakes Basin, **Consumers Energy**, has made dramatic progress in voluntarily phasing out PCB-containing equipment. In 1994, Consumers Energy entered into an agreement with EPA Region 5 to phase-out known, large PCB capacitors and large PCB transformers (i.e., substation equipment) by 2005. Consumers Energy achieved this commitment in 2000. During the last 12 years, Consumers Energy has removed from service, detoxified, and reused approximately 347,000 gallons of PCB oil, including approximately 30,900 gallons in 2005. Consumers Energy achieved additional phase-out successes in 2005, including removing 89 distribution transformers, approximately 2,000 gallons of oil containing less than 500 ppm PCBs, 327 ballasts, 336 distribution capacitors, and 33 bushings from service.

We Energies, serving more than 1.1 million electric customers in Wisconsin and Michigan, has conducted a voluntary PCB phase-down program for more than a decade. Due to the successful implementation of this program, the company has just eight known PCB transformers in service in EPA Region 5, all of which are in service at its nuclear plant. This equipment is monitored and periodically reviewed for reclassification or replacement. No other known PCB (≥500 ppm) equipment is in service in the We Energies system. Since January 1999, We Energies has removed from service more than 1,300 transformers, large capacitors, and bushings containing ≥500 ppm PCBs. It is We Energies' general practice that equipment identified as containing ≥50 ppm PCBs is either replaced or is reclassified as non-PCB prior to being returned to service.

Exelon Energy Delivery (EED), through its subsidiaries ComEd and PECO, operates in Northern Illinois and Southeastern Pennsylvania, respectively. EED's phase-out plan for equipment containing PCBs, instituted more than a decade ago, has moved the company from among the largest users of such equipment to a position of operating only a few pieces. As of November 1, 2006, EED accelerated the PCB phase-out process and removed 880 large PCB capacitors and 59 pieces of PCB or PCB-contaminated equipment from its system. In addition, EED is undergoing a voluntary multi-million dollar project to retire a substation containing PCB equipment. The project was initiated to remove 10 Askarel-filled transformers and regulators in the City of Chicago. This equipment contains approximately 4,350 gallons of Askarel. Through these voluntary efforts, EED has removed or replaced almost all PCB and PCB-contaminated sources, including all known PCB transformers in commercial buildings, all known PCB distribution equipment outside of substations, 71 percent of all PCB capacitors in PECO substations, and 96 percent of all large PCB capacitors in ComEd substations. A limited number of PCB transformers remain in service at several of Exelon's nuclear plants. This equipment is monitored, and most equipment is scheduled to be replaced or retrofilled over the next five years.

USWAG member **Xcel Energy** (Xcel), which serves customers in the northern Midwest, including Michigan, Minnesota, North Dakota, Wisconsin, and South Dakota, also has undertaken voluntary PCB phase-out efforts. During 2006, Xcel removed four known PCB transformers from service. In addition, Xcel removed 39,008 kg of PCB articles, containers, oil and equipment containing ≥500 ppm PCBs and 295,785 kg of equipment containing 50 to 499 ppm of PCBs from service.

Northern Indiana Public Service Company (NIPSCO), a subsidiary of NiSource, serves 400,000 customers in Indiana. NIPSCO has continued to implement a voluntary PCB phase-down program that began in 1994. Since the program's inception, NIPSCO has removed over 4,579 pieces of equipment that were suspected to contain PCBs, including 56 distribution transformers since 2004. Additionally, NIPSCO has removed from service over 99.9 percent of the PCB quantity present in its electrical system. NIPSCO continues to address the small number of transformers and capacitors in its system that are known or suspected to have PCB concentrations ≥50 ppm. In addition to removal and disposal, NIPSCO enhances its PCB reduction efforts by retrofilling and reclassifying large PCB or PCB-contaminated transformers to non-PCB status.

Detroit Edison, a subsidiary of DTE Energy, serves more than 2.1 million customers in southeastern Michigan. In 2005, during maintenance calls, storm response, or reliability improvement, Detroit Edison removed and disposed 82 newly identified PCB transformers and 459 pieces of PCB-contaminated equipment from distribution and/or generation facilities. In 2006, Detroit Edison continues to remove and dispose newly identified equipment through these programs. Through the third quarter of 2006, 48 pieces of PCB equipment and 353 pieces of PCB-contaminated equipment had been disposed. Detroit Edison also continues to pursue PCB reduction activities through retrofilling and reclassifying identified PCB-containing equipment.

When **GRE** was formed in 1999, with the consolidation of Cooperative Power Association and United Power Association, much of the PCB (≥500 ppm) and PCB-contaminated (≥50 to ≤499) equipment in the system had already been removed or retrofilled. Since its formation, GRE has continued to evaluate and remove or retrofill PCB and PCB-contaminated equipment in its generation and transmission systems. At this time, GRE has evaluated more than 99 percent of its testable in-service equipment. As of 2005, most of the known PCB and PCB-contaminated equipment in the Minnesota system has been removed or retrofilled. The only remaining PCB and PCB-contaminated equipment in GRE's Minnesota system are 3,099 large capacitors at GRE's DC substation. These capacitors will be removed according to a phase-out plan that is scheduled to begin in 2009 and be completed in 2011.

These PCB reduction efforts are not limited to USWAG members in the Great Lakes Basin. For example, in 2005, New York-based **Consolidated Edison** (ConEd), as part of ongoing maintenance and repair, removed 10,556 pounds of equipment containing ≥500 ppm PCBs and 217,054 pounds of equipment containing 50 to 499 ppm PCBs. Through the third quarter of

2006, ConEd completed its five-year phase-down project for rectifiers in Manhattan that formerly contained >500 ppm PCBs. This final stage removed and disposed of 49,168 pounds of equipment. Additionally, during 2006, as part of ongoing maintenance and repair, ConEd removed 8,325 pounds of equipment containing ≥500 ppm PCBs and 53,874 pounds of equipment containing 50 to 499 ppm PCBs.

USWAG member **TXU** has, since the early 1990s, aggressively pursued removal of PCBs from its system and, since 1993, has retired 3,457 pieces of PCB equipment (≥500 ppm). With the exception of a small quantity of specialized equipment, TXU has a policy of retiring all distribution equipment identified for repair or service with PCB concentrations >1 ppm. During 2005, TXU retired 149 pieces of electrical equipment containing ≥500 ppm PCBs, 713 pieces of electrical equipment that were PCB-contaminated (50 to 499 ppm PCBs), and 3,717 pieces of equipment containing 1 to 49 ppm PCBs.

National Grid continues with its ongoing efforts to reduce the number of PCB articles in its service territories in Massachusetts, New York, Rhode Island, and New Hampshire. As a result of these efforts, National Grid, whose service territory in New York includes portions of the Great Lakes Basin, has retrofilled or removed from service all known PCB (≥500 ppm PCBs) transformers. Additionally, during calendar year 2005, National Grid systematically retired or decommissioned approximately 750 pieces of PCB-contaminated or PCB electrical equipment (≥500 ppm) for a PCB reduction totaling over 162,556 kg. National Grid also removed and disposed of approximately 315,088 kg of bulk PCB-contaminated transformer oil.

USWAG member **Entergy** has also invested substantial resources in implementing a successful PCB phase-out program. In 1998, Entergy dedicated approximately $2 million for the removal of PCB transformers from its fossil generating plants. From 1999 to 2001, Entergy voluntarily opted to phase out all PCB transformers from its fossil fleet. During that span, approximately 105 PCB transformers were removed from service as well as a number of large PCB capacitors. Of Entergy's Fossil Operations in EPA Regions 4 and 6, only 17 large PCB capacitors remain in service. Fossil Operations continues to phase out PCB electrical equipment when possible. Based on analyses of PCB electrical equipment managed for repair or recycle in 2004, approximately 99 percent of this equipment was shown to be non-PCB.

Further, Entergy's Transmission and Distribution system has adopted the policy of many other USWAG members; specifically, no oil-filled electrical equipment brought in for service is returned to operation if it is found to be PCB-contaminated. Entergy's Transmission and Distribution system also has an aggressive program for phasing out large PCB capacitors in its substations. Over the past 10 years, Entergy has replaced all large PCB capacitors in its Arkansas, Texas, and Mississippi substations and has significantly reduced the number in Louisiana. Entergy's Transmission and Distribution system has replaced or taken out of service all of its known PCB transformers (i.e., containing ≥500 PCBs), with the exception of two units in Arkansas. During 2005, Entergy has taken out of service and disposed of 163,011 kg of PCB electrical equipment containing ≥50 ppm PCBs.

Vectren Corporation (parent of Southern Indiana Gas and Electric Company), which provides electric service to customers in southwest Indiana, has been phasing PCBs out of its system for over two decades. The majority of substation transformers were retrofilled or replaced between the mid-1980s to the early 1990s. As of November 1, 2006, only three pieces of oil-filled substation equipment (circuit breakers, regulators, capacitors, or transformers) are known to be PCB-contaminated, and they are scheduled to have the oil replaced in early 2007. On the distribution side, steps were taken in the past five years to remove 42 known submersible transformers from the system that typically contained oil in the range of 50-500 ppm PCBs. Two units remain in service due to the property owner's reluctance to allow for the removal, but efforts to gain access are ongoing. It is also the company's practice to not attempt repair on any unit that was manufactured prior to 1980. Any pre-1980 unit that is damaged or otherwise taken out of service is tested to determine the appropriate disposal option.

Kansas City Power and Light (KCP&L) has eliminated all known PCB equipment (≥500 ppm) from its plants and transmission and distribution systems. Based on experience from its field work, KCP&L estimates that 5 percent of its distribution equipment may be PCB-contaminated (50 to <500 ppm PCBs). When these devices are found, they are removed from service and disposed. KCP&L has been working to eliminate PCB equipment since 1980 and most recently pushed to remove the few remaining PCB-containing devices from service and inventory. All equipment not designated as non-PCB is tested when taken out of service to determine its reuse or disposal status.

In South Carolina, **South Carolina Electric & Gas** (SCE&G) has an ongoing, voluntary PCB reduction effort to remove PCBs from electrical equipment. SCE&G provides electric service to 620,000 retail and wholesale customers throughout South Carolina. Through the early 1990s, all large power transformers and regulators were retrofilled and reclassified as non-PCB (<50 ppm) or replaced with non-PCB transformers. All known PCB distribution transformers (≥500 ppm PCBs) have been removed from service for disposal.

In addition, all large PCB capacitors in SCE&G's transmission and distribution system have been replaced with non-PCB capacitors. SCE&G also has a long-standing policy to remove from service for disposal all in-stock distribution transformers (small pole and pad mount units) that are identified through testing as PCB-contaminated (≥50 to 499 ppm PCBs) and replace the equipment with units containing no PCBs. As a result of SCE&G's commitment to the phase-down policy, through time, SCE&G's inventory of more than 236,822 distribution transformers will contain fewer and fewer "unknown" but assumed to be PCB-contaminated units. In the late 1990s SCE&G had over 70,000 "unknown" transformers in service or in-stock. In 2006, fewer than 53,444 "unknowns" remain in SCE&G's inventory. SCE&G's ongoing efforts to remove PCBs when identified resulted in the disposal of 64 transformers, 54 oil-filled bushings, 60 tar-filled bushings, 12 tar-filled potential transformers, and 3 oil circuit breakers in 2005. In addition, SCE&G manages all leaking and non-leaking "unknown" small capacitors and lamp ballasts as PCB wastes.

Arizona Public Service ("APS") is Arizona's largest and longest-serving electric utility, serving more than one million customers in 11 of the State's 15 counties. APS owns, operates, and maintains more than 40,000 miles of transmission and distribution lines throughout Arizona. Over the past seven years, APS has been successful in reducing the use of PCBs in electrical equipment by targeting suspected equipment based on manufacturer name and serial numbers.

From 2000 through 2004, APS removed 3,212 pieces of PCB (≥500 ppm) or PCB-contaminated (≥50 to 499 ppm) equipment from service, resulting in the disposal of 425,336 kg of PCB material. During 2005 and 2006, APS removed an additional 6,615 pieces of PCB-containing equipment from its transmission and distribution system, representing 583,484 kg of disposed material, including the following: 5,983 large PCB capacitors (317,458 kg), 287 PCB-contaminated and PCB bushings (29,965 kg), and 345 PCB-contaminated and PCB transformers (236,061 kg).

Ameren, which serves 2.4 million customers in Missouri and Illinois, has voluntarily removed all large PCB capacitors from its system. Large oil-filled in-service electrical equipment (i.e., substation, network transformers, and generating station equipment) has been tested for PCB concentration and either replaced or reclassified to at least below 499 ppm PCBs and in most cases below 49 ppm PCBs. Large equipment in-storage for reuse has been reclassified to below 49 ppm PCBs. Large spare bushings have been tested for PCB content, if possible. The majority of the spare bushings with a PCB content over 49 ppm PCBs (both tested and assumed) were sent for disposal. Distribution electrical equipment removed from service is not placed back into service or in-storage for reuse unless it has a manufacturer-certified non-PCB label. Only verified non-PCB distribution equipment is sent for repair.

Central Maine Power Company (CMP) has continued with its voluntary multi-year effort to remove PCB-containing equipment from its system. CMP has removed all of its known PCB transformers and sources of PCB oil ≥500 ppm, as well as transformers suspected of being PCB-contaminated (50 to 499 ppm PCBs) near schools and waterways. CMP continues to actively seek out and remove transformers it believes are most likely to be PCB-contaminated. Since 1999, CMP has removed over 11,000 targeted transformers (up from the 7,700 originally planned), of which approximately half were actually PCB-contaminated.

PNM Resources (PNMR), which serves more than 680,000 customers in EPA Region 6 through its subsidiaries Public Service Company of New Mexico and Texas/New Mexico Power, has implemented a voluntary PCB phase-down program since the early 1990s. Since 2000, PNMR has removed the following items from service: three large PCB capacitors, 52 PCB transformers, and 28 other PCB articles (≥500 ppm PCBs); 435 PCB-contaminated articles (≥50 and <500 ppm PCBs); and an additional 1,530 pieces of non-regulated PCB-containing equipment (>2 and <50 ppm PCBs).

In particular, during 2004, PNMR removed four PCB transformers (≥500 ppm PCBs); 38 PCB-contaminated articles (≥50 and <500 ppm PCBs); and an additional 245 pieces of non-regulated PCB-containing equipment (>2 and <50 ppm PCBs). During 2005, PNMR removed 11 PCB transformers and one other PCB article (≥500 ppm PCBs); 99 PCB-contaminated articles (>50 and <500 ppm PCBs); and an additional 191 pieces of non-regulated PCB-containing equipment (>2 and <50 ppm PCBs). During 2006, PNMR removed five PCB transformers and one other PCB article (≥500 ppm PCBs); 91 PCB-contaminated articles (≥50 and <500 ppm PCBs); and an additional 268 pieces of non-regulated PCB-containing equipment (>2 and <50 ppm PCBs).

Potomac Electric Power Company (Pepco) is engaged in the transmission and distribution of electricity to approximately 747,000 customers in Washington, DC, and major portions of two counties in suburban Maryland. Pepco has approximately 3,300 network transformers in high-density residential areas and approximately 4,000 pad mount transformers located in urban settings. Pepco continues to phase-down PCBs by removing PCB-containing equipment, such as distribution and transmission transformers, oil circuit breakers, bushings, and large PCB capacitors from its substations. Pepco implemented a voluntary program to remove large PCB capacitors from substations and replace them with non-PCB capacitors. Since 1990, Pepco has replaced large PCB capacitors with non-PCB capacitors. There are less than 600 large PCB capacitors at substations, down from approximately 3,600 in 1990. Pepco retrofills and reclassifies PCB and PCB-contaminated transformers to non-PCB status. Pepco has also installed station service transformers containing a non-hazardous seed-based oil.

The information above provided by USWAG is extremely useful in identifying, understanding, and acknowledging efforts that facilities, particularly utilities, voluntarily undertake to remove PCB transformers and capacitors. It is not clear if the information compares to the national inventory estimates used and reported as part of the U.S. PCB challenge. It is assumed that the disposal of the PCB transformers and capacitors by the utilities would be included in the reports made by the PCB disposal companies, and therefore already included in the national estimates. However, there may be instances where this is not the case. For instance, the PCB Workgroup is lacking information on the reclassification of PCB transformers, which is a way of removing a PCB transformer that is not captured in the information submitted by the PCB disposal companies. USWAG may have more information on such activities. In addition, the reports by USWAG may have more up-to-date information on the disposal of PCB transformers that does not yet appear in US EPA's PCB Transformer Registration Database. The PCB Workgroup will evaluate these and other possible additional uses of USWAG's information in the national inventory estimates.

PCB Software – Financial Analysis of PCB Transformer Phase-Outs – A Study on the Costs and Benefits of PCB Phase-Out

Under a grant from US EPA, EMA Research & Information Center, subcontractor to the Tellus Institute, developed a spreadsheet tool to determine and compare the costs of phasing out PCB transformers against the costs of continued use. The tool was developed with the input of industry representatives and was based on actual case study information. US EPA is currently evaluating the spreadsheet tool and will be working with other industry representatives to conduct additional trial case studies on the use of the tool.

Canadian Reduction Activities

Canada has attempted to reduce PCBs in service and in storage through a mix of regulatory and voluntary programs. As described below, new PCB regulations were proposed in November 2006. Many companies have voluntarily undertaken initiatives to eliminate PCBs. To recognize these efforts and to encourage other companies to phase out PCBs, EC has awarded several companies for their efforts. Efforts by Canadian companies to reduce PCBs are presented on the following pages.

Canadian Regulatory Activities

Proposed PCB regulations were published in *Canada Gazette I* on November 4, 2006. The proposed PCB regulations amend the following regulations:

1) The Chlorobiphenyl Regulations (1991)
2) The Storage of PCB Material Regulations (1992)
3) Export of PCB Regulations (1996)
4) Federal PCB Destruction Regulations (1989).

The most significant proposed revisions to the regulations are the imposition of strict phase-out dates for certain categories of PCBs. The most important phase-out targets proposed are:

- Phase-out of all in-service high-level PCBs (>500 ppm PCB) by 2009 (except for pole-top transformers and equipment at electrical generation, transmission, and distribution facilities).
- Phase-out of all PCBs in storage sites by 2009.
- Phase-out of all "pad-mounted" (anything that is not pole-mounted) equipment with 50-500 ppm PCB by 2014.
- Phase-out of all pole-mounted transformers and all equipment at electrical generation, transmission, and distribution facilities by 2025.
- Prohibition of re-use of transformer oils with 2-50 ppm PCB (this equipment will not have to be destroyed by any specific date, but removed from service, the oil must be decontaminated to below 2 ppm PCB).

Proposed revisions to the federal PCB destruction regulations would see the strengthening of emissions release provisions to bring the federal regulations in line with existing provincial requirements. More information concerning this regulation can be accessed at: http://www.ec.gc.ca/CEPARegistry/regulations/detailReg.cfm?intReg=105.

Canadian Stakeholder PCB Phase-out Efforts

Commencing in 1999, PCB reduction commitment letters were mailed to priority industry sectors, including school boards and other sensitive sites (food, beverage, hospitals, care facilities, and water treatment industries). Additional letters were sent in 2003 and 2004. From August to November 2005, EC sent over 1,000 letters to PCB owners (of both PCBs in storage and in use) in priority industry sectors for inventory updates. Over 400 inventory updates have been completed, signed, and returned to EC, along with copies of manifests and destruction and inspection reports. EC conducted an analysis to identify priority industry sectors and major sources of high-level PCBs (both in use and in storage). The inventory updates have also been extremely useful in updating the National PCB Inventory Database.

A number of companies in the iron and steel, utilities, pulp and paper, and metals and mining sectors have voluntarily undertaken initiatives to eliminate PCBs, especially high-level PCBs in use and/or storage. EC has held personal meetings with officials of two major steel companies in

Ontario (Stelco and Dofasco) and encouraged them to destroy high-level PCBs in storage and decommission PCBs in use. For example:

1) As of September 2005, Stelco (Steel Company of Canada) in Hamilton, Ontario, had destroyed 142,687 litres of high-level PCB liquid, with approximately 8,500 litres remaining in storage. However, a substantial amount of PCBs remain in use (approximately 132 high-level PCB transformers with a weight of 228.5 tonnes).
2) Dofasco still has a major amount of high-level PCBs in use (approximately 1,473 tonnes) and approximately 390 tonnes of PCBs in storage for disposal.
3) Since 1999, Algoma Steel in Sault Ste Marie, Ontario, has destroyed approximately 75,994 litres of PCBs (with a weight of 121.5 tonnes), leaving little in storage. During 2005, Algoma destroyed 8,943 litres of PCB liquid. However, they still have 71 high-level PCB transformers, 265 high-level capacitors and 1 electromagnet in use, which they plan to eliminate by 2009.

Although the GLBTS target for stored high-level PCBs has been met, PCBs in use for the top six industry sectors are a challenge. These sectors include: 1) Steel, 2) Metals and Metal Mining, 3) Sensitive areas, 4) Utilities, 5) Non-federal governments, 6) and Pulp and Paper and Forestry. Additional companies are being identified as "PCB Free," and these will be used to update the inventory of "PCB Free" companies.

PCB Phase-out Awards Program (Canada)

The Canadian workgroup has developed a plan of outreach and recognition to try to increase awareness and the rate of PCB phase-out. The main elements of the plan are to:

- Award a plaque to each eligible company that becomes PCB free or reaches a major PCB target (90 percent reduction and above).
- Take a photograph of the award presentation and develop a case study (success story).
- Post the photograph and case study or success story on the website and make copies available for distribution.
- List the names of award winners in GLBTS, International Joint Commission (IJC), government and trade association publications.
- Make presentations at trade association meetings and conferences.

Eight Canadian companies have received PCB Phase-Out Awards to date. Four more companies have been selected to receive awards. Arrangements are being made for a special presentation of the PCB Phase-Out Awards at a breakfast seminar dedicated to PCB management issues.

Environment Canada will continue to target candidates for PCB phase-out programs and PCB awards. The strategy in 2007 will be to identify those companies with the largest PCB inventories, meet with them to discuss their phase-out strategies, explain the GLBTS goals and awards program, and attempt to obtain a commitment for prompt phase-out.

Canadian PCB Success Stories

Case studies have been written for each of the companies that have received Canadian PCB awards. The goal of the case studies is to promote the removal of PCBs by companies that have not yet done so by providing examples of beneficial factors considered when companies decided to remove their PCBs. The case studies will be posted on the GLBTS PCB website. Copies may be requested from Ken De, the Canadian PCB Workgroup co-chair, by e-mail at ken.de@ec.gc.ca or by phone at (416) 739-5870. The following is a summary of each case study.

Hydro One Inc. (formerly Ontario Hydro) is one of the largest electric utility companies in North America, delivering more than 97 percent of the electricity in Ontario and serving approximately 1.2 million retail, 80 large industrial, and some 94 municipal electrical utility customers. Hydro One has eliminated all of its high-level PCBs (those with greater than 10,000 ppm PCBs) in service and in storage, 75 percent of its low-level PCBs (less than 10,000 ppm) in service, and 38 percent of its storage site locations. Between 1995 and 2001, Hydro One shipped approximately 3,200 tonnes of PCB wastes for destruction or decontamination treatment, and chemically decontaminated an estimated 6.5 million litres of low-level mineral oil.

Enersource Corporation (formerly Mississauga Hydro) is a utility company supplying electricity to the City of Mississauga. Enersource's core electricity distribution service provides electricity to 170,000 customers. Enersource had an accumulated PCB inventory of 19,500 kg of askarel fluid, 135,000 kg of contaminated mineral oil, 106,000 kg of contaminated transformer solids, 67,000 kg of capacitors and ballasts, 13,000 kg of contaminated soil, and 1,200 kg of contaminated sludge. In 2000, Enersource conducted a massive campaign to destroy stored PCBs, and this work resulted in the elimination of all high-level PCBs. All that remains in the Enersource network is 4,500 kg of low-level contaminated oil in storage and approximately 250 low-level PCB contaminated transformers still in service, containing approximately 33,000 kg of PCB contaminated oil.

Stelco Inc. is Canada's largest and most diversified steel producer, with an annual steelmaking capability of 5.9 million tons. Stelco is involved in all major segments of the steel industry through its integrated steel business, mini-mills, and manufactured products businesses. **Stelpipe Ltd.,** a wholly owned subsidiary of Stelco Inc. located in Welland, Ontario, produces tubular steel products primarily for the construction, automotive, mining, distribution, manufacturing, fabricating, and energy market sectors. Stelco's second operating priority behind creating and maintaining healthy and safe workplaces for its people is to preserve and enhance the environment through responsible and environmentally oriented operating practices. Stelpipe successfully remediated aboveground and belowground soil contamination in phases over the period from 1987 to 2002 at a cost exceeding $6.5 million. In 1998, Stelpipe disposed of PCB cleanup wastes, except for low-level contaminated soils, at a cost of $1 million. In addition, Stelpipe replaced or eliminated 5 power transformers and 65 lighting and control transformers at a cost exceeding $0.5 million.

Canadian Niagara Power Inc. (CNP) is an electric distribution company based in Fort Erie, Ontario, that is owned by Fortis Ontario Inc. During the past decade, CNP has endeavored to sample, analyze, inventory, and decommission electrical equipment containing PCBs in concentrations of over 50 ppm. CNP has removed and destroyed 2 askarel transformers, 95 askarel capacitors, 69 contaminated mineral oil transformers, over 10,000 PCB lamp ballasts, and over 2,000 kg of contaminated solids. Some of the equipment was retrofilled with new oil and returned to service. Local industrial customers who owned PCB transformers were also invited to participate in this exercise, and CNP assisted them in transferring their PCB waste to CNP's facility for decontamination. As a result, all PCB electrical equipment, other than PCB streetlight ballast capacitors and fluorescent lighting ballasts within CNP's Fort Erie distribution system, was removed from service.

Slater Steel Inc.'s Hamilton Specialty Bar Division is a major Canadian company serving a broad variety of specialty steel bar markets throughout the world. The Hamilton Specialty Bar Division (HSB) is one of six business units of Slater Steel. The main product of SBD is carbon and alloy steel bars (round and flat) suited to numerous markets including automotive, heavy truck, off-road, mining, forging, cold finish, and the service sector. Slater's original inventory of PCBs consisted of approximately 25 tonnes of PCB contaminated solids, 16 tonnes of askarel liquid, 1.5 tonnes of contaminated mineral oil, and 7 tonnes of whole capacitors. In 1998, it was decided to completely eliminate PCBs from the facility. All PCBs in service and in storage were sent for destruction. By December of 2001 the facility was certified as PCB-free by both Environment Canada and the Ontario Ministry of the Environment.

The **City of Thunder Bay**, at the northwest end of Lake Superior, has a population of 110,000 and stretches along an arc of some 20 km along the shore of Lake Superior. The City has operated a Household Hazardous Waste Depot since 1995, diverting items such as oils, paints, pesticides, and lead batteries from the landfill. Since 2002, mercury products like thermometers, thermostat switches, and fluorescent bulbs have also been collected at the depot. Thunder Bay's PCB program began in the early 1990s with a goal of inventorying all equipment containing PCBs throughout the corporation. The final objective of the PCB program was to become PCB-free. Between 1994 and 1998, six drums of PCB power capacitors were phased out of use at the sewage treatment plant. In 1997, two barrels of power capacitors were removed from the water treatment plant. In early 2001, the total PCB contents in storage, 85 barrels in all, were sent for destruction. This left the City's facilities, approximately 60 buildings, including plants, arenas, and retirement homes, virtually PCB-free. The only PCB materials remaining are light ballasts.

General Motors of Canada Limited (GMCL) is the largest automobile manufacturer in Canada and has been in business continuously for more than 100 years. GM has numerous parts and assembly plants in Ontario, one of which is located in St. Catharines. The St. Catharines Powertrain Plant has 1.26 million square feet under roof on 22 hectares of land. The plant produces front wheel transmission final drives, differential assemblies, miscellaneous transmission components, radiator assemblies, and forgings for a number of GM vehicles. In 1994, the St. Catharines Ontario Street Plant began an initiative to remove all PCB equipment from the facility. By the end of 1999, all PCB transformers and power-factor capacitors were removed from service, leaving only PCB lighting ballasts in the plant. The transformers were replaced with air-cooled (no liquid) transformers, and the capacitors were replaced with mineral oil capacitors. The first PCB transformer was removed in 1996, and the remaining PCB transformers were removed by 1999. The St. Catharines plant has now targeted low-level PCB equipment for removal (light ballasts), and as of 2005, this initiative was 40 percent complete. GM and GMCL initiated the PCB phase-out plan as a way to eliminate risk and liability. In addition, the phase-out of PCBs was a Target and Objective of the Environmental Management System (EMS) that was formulated as part of the ISO 14001 certification that the Ontario Street Plant received in December 2001.

Ontario Power Generation Inc. (OPG) is the largest electric generation entity in Ontario. The Nanticoke Generating Station is a coal-fired facility located on the north shore of Lake Erie in Haldimand County, approximately 90 km west of Niagara Falls. In 1997 Nanticoke had 683 tonnes (gross weight) of high-level PCB equipment in service and 66 tonnes (gross weight) in storage. The in-service equipment consisted mainly of transformers (126 askarel transformers) while the in-storage inventory was a mix of bulk askarel liquid in barrels, solid PCB wastes in barrels, and some drained equipment. OPG implemented an aggressive plan to eliminate all high-level PCBs from the station in 1998, and by 2004 all PCBs had been removed and sent for destruction. A small amount of low-level PCB materials (light ballasts, PCB cables) remains at Nanticoke, and this material is being selectively phased-out as well. The elimination of PCBs at the station is driven by the company policy to manage PCBs in an environmentally responsible and cost-effective manner. This was a voluntary program established by OPG, and Nanticoke completed the work before the established target dates.

Figure 2-3 presents photos of company representatives receiving PCB Phase-out Awards from Gary Gulezian (US EPA) and Danny Epstein (EC).

Figure 2-3. Representatives of OPG Nanticoke (top left), Canadian Niagara Power (top right), General Motors (bottom left), and City of Thunder Bay (bottom right) Receive PCB Phase-Out Awards. Source: Environment Canada

<u>Inventory Improvements</u>

Source Profiles and Emissions of PCBs to Ambient Air from Transformers

A draft report on the study of PCB emissions from in-service PCB transformers was submitted to US EPA. The study, conducted by Dr. William J. Mills of the University of Illinois, collected samples of ambient air around operating PCB Askarel transformers in January and October 2004. A previous draft presentation of the results of the study showed that PCB levels in rooms with transformers were at least 1 order of magnitude higher than outside background PCB concentrations, although some interferences were noted, such as wipe samples that found PCBs on the floor.

Canadian PCB Inventory Harmonization

EC's Ontario regional staff are working to improve the quality and update the information in the PCB inventory. PCB Workgroup members have met with the Inspection and Enforcement staff who are responsible for updating and maintaining the Ontario Region's Database, and will continue to meet with them on a regular basis, to share inventory information gathered during meetings with PCB owners and from PCB commitment letters. Once the National PCB Database systems are updated with new inventory information, the PCB Workgroup will be able to provide more accurate and timely inventory information and evaluate progress toward meeting the GLBTS goals.

Next Steps

The workgroup and government agencies plan to continue seeking PCB reduction commitments and evaluate PCB Management Assessment recommendations for implementation.

PCB Reduction Commitments

The PCB Workgroup will continue seeking commitments to reduce PCBs through PCB reduction commitment letters and other PCB phase-out efforts, and to publicize voluntary achievements in PCB reduction.

PCB Management Assessment Recommendations

The *Management Assessment for PCBs* was presented in final form at the December 2006 GLBTS Stakeholder Forum. The workgroup plans to begin working on the recommendations presented in the report.

Because the workgroup has determined that several data issues exist (e.g., data quality and comparability issues) regarding PCB sources, levels, and trends in the environment, future workgroup activities will include further evaluation of the available data before final conclusions are made.

At this time, the workgroup recommends that PCBs should continue an active Level 1 status, with initial priority placed on collecting and assessing a more complete set of data on PCB sources and environmental levels. The primary goals of this exercise will be to: (1) prioritize the remaining PCB sources (better defining relative source contributions); (2) clarify PCB trends and impacts on the environment; and (3) assess the ability of the GLBTS to effect further reductions.

Work targeting PCB-containing equipment in service should continue (such as outreach to industry), due to the potential for the equipment to be a source of future releases, and should be coordinated with other efforts. Work targeting other areas, such as coplanar/dioxin-like PCBs, likely will be most efficiently and effectively addressed through referral to or coordination with other groups, such as the Dioxin Workgroup. The PCB Workgroup is currently working to identify and determine relative contributions of PCBs to the environment from known and potential sources of PCBs. Once sufficient progress on this work is made, a better determination of the activities that can be undertaken, and by whom, to reduce releases from particular sources can be made.

3.0 DIOXINS/FURANS

Canadian Workgroup co-chair: Anita Wong
U.S. Workgroup co-chair: Erin Newman

Progress Toward Challenge Goals

U.S. Challenge: Seek by 2006, a 75 percent reduction in total releases of dioxins and furans (2,3,7,8-TCDD toxicity equivalents) from sources resulting from human activity. This challenge will apply to the aggregate of releases to the air nationwide and of releases to the water within the Great Lakes Basin.

Canadian Challenge: Seek by 2000, a 90 percent reduction in releases of dioxins and furans from sources resulting from human activity in the Great Lakes Basin, consistent with the 1994 COA.

According to the most recent dioxin release data available, the U.S. has reached and Canada has made significant progress toward reaching the dioxin/furan reduction goals outlined in the GLBTS.

Ontario: Progress Toward the GLBTS Challenge

Canada has made significant progress toward meeting the goal of a 90 percent reduction in releases of dioxins and furans, achieving an 89 percent reduction (228 grams) of total releases within the Great Lakes Basin, relative to the 1988 Canadian baseline. This reduction is based on the 2005 release inventory update for Ontario sources,[9] which estimates a total annual dioxin/furan release of 28 grams. Much of the reductions achieved are attributable to the pulp and paper sector after federal regulations were impending or imposed, closure of hospital waste incinerators by the Ontario government (in anticipation of Ontario Regulation 323/02), and closure of an iron sinter plant and a municipal waste incinerator. Figure 3-1 illustrates reductions in the top Canadian (Ontario) dioxin/furan emission sources since 1998. Figure 3-2 presents the top sources of dioxin/furan release in Ontario (2005 estimates).

To meet Canada's 90 percent challenge goal, a further reduction of approximately 4 grams is needed. Several source sectors offer opportunities for potential reductions. For example, efforts by the Burn Barrel Subgroup, such as education and outreach, can help reduce emissions from household garbage burning, the largest source of dioxin emissions in Ontario. Ontario has established a phase-out plan for coal-fired power units, and emission reductions from federal waste incinerators are expected due to closures. In addition, CWS for iron sintering and electric arc furnaces are expected to reduce emissions from these source categories.

[9] Point sources are mostly based on 2005 National Pollutant Release Inventory (NPRI) data. Availability of final NPRI data is normally two years after the reporting year.

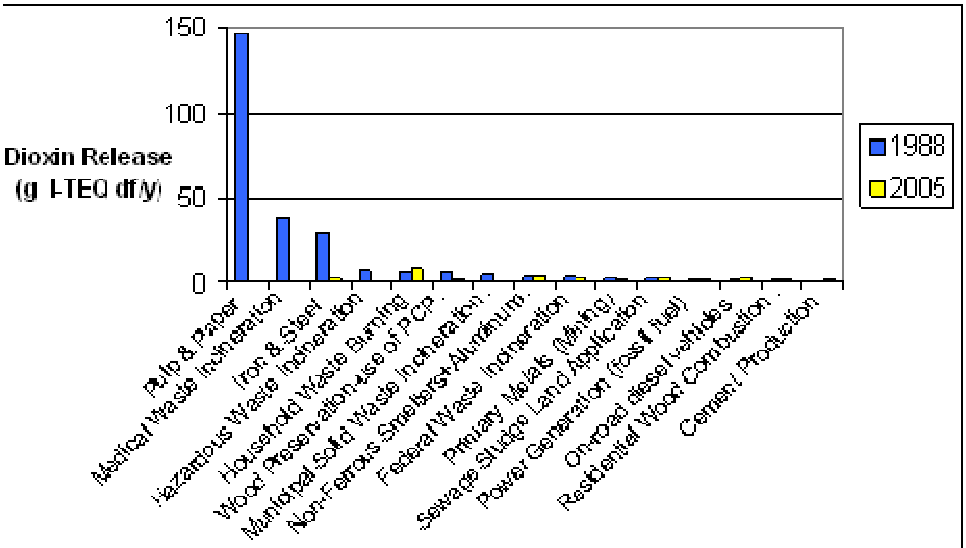

Figure 3-1. Top Canadian (Ontario Region) Dioxin/Furan Release Sources.[10] Source: Environment Canada, Ontario Region

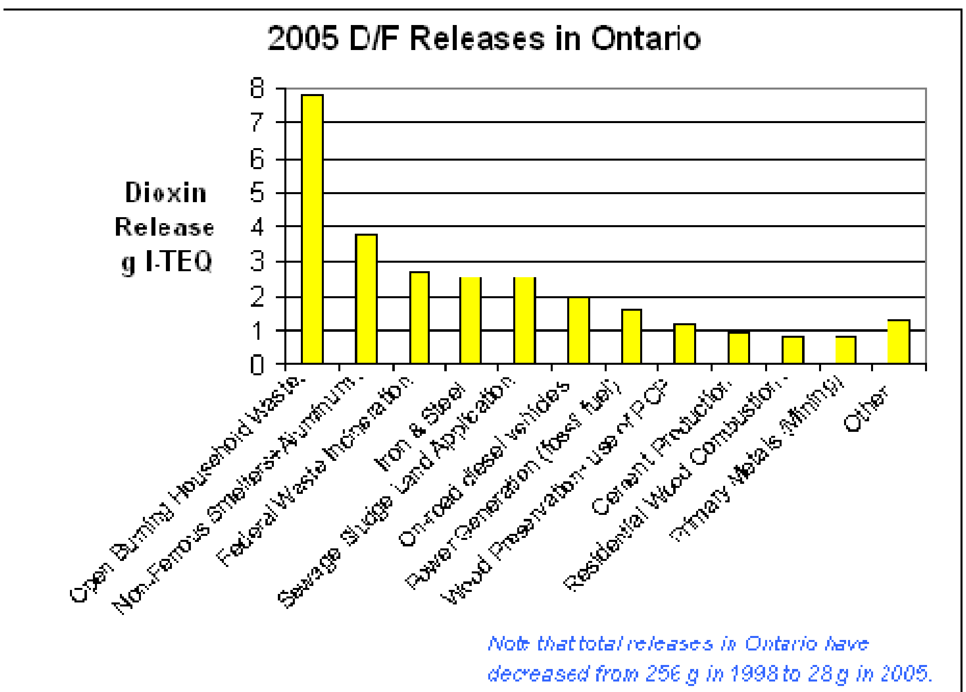

Figure 3-2. Top Ontario 2005 Dioxin/Furan Release Sources.[11] Source: Environment Canada, Ontario Region

[10] Estimates represent total releases, including releases to water, land, and air.
[11] Estimates represent total releases, including releases to water, land, and air.

United States: Progress Toward the GLBTS Challenge

According to *An Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States for the Years 1987, 1995, and 2000*, the U.S. has achieved an 89 percent reduction in dioxin releases nationally. A significant portion of those reductions are a direct result of the Maximum Available Control Technology (MACT) standards enacted under the Clean Air Act (CAA). For example, MACT standards reduced municipal waste combustion emissions from 8,905 grams TEQ (toxic equivalents) in 1987 to 83 grams in 2000. Other source categories with significant reductions resulting from the enactment of MACT standards include Medical Waste Incinerators (MWIs), hazardous waste-burning cement kilns, and secondary copper smelting. These reductions result from a combination of change in processes and equipment to comply with standards, pre-existing actions in the design and retrofitting of facilities, and facility closures. From 1987 to 2000, the total U.S. inventory for dioxin releases declined from 13,965 g to 1,422 g TEQ_{DF}-WHO_{98}/year. Figure 3-3 shows this drop in dioxin releases. Figure 3-4 provides a more detailed summary of the top inventoried dioxin sources in the year 2000. These figures, however, do not reflect full implementation of the MACT standards for medical waste incinerators. So while that source is shown as the second largest source of dioxin releases, US EPA has found substantial reductions while monitoring MACT implementation in subsequent years. It is now clear from these inventory figures that the largest source of quantified dioxin releases is household garbage burning.

The U.S. also is investigating numerous dioxin sources that have not as yet been added to the inventory. While the U.S. challenge goal for dioxin was met under the GLBTS, US EPA remains concerned about unquantified sources. Many of these sources are difficult to inventory, such as forest fires and other uncontrolled combustion sources. Acquiring data to characterize these sources remains a priority and long-term goal of the US EPA.

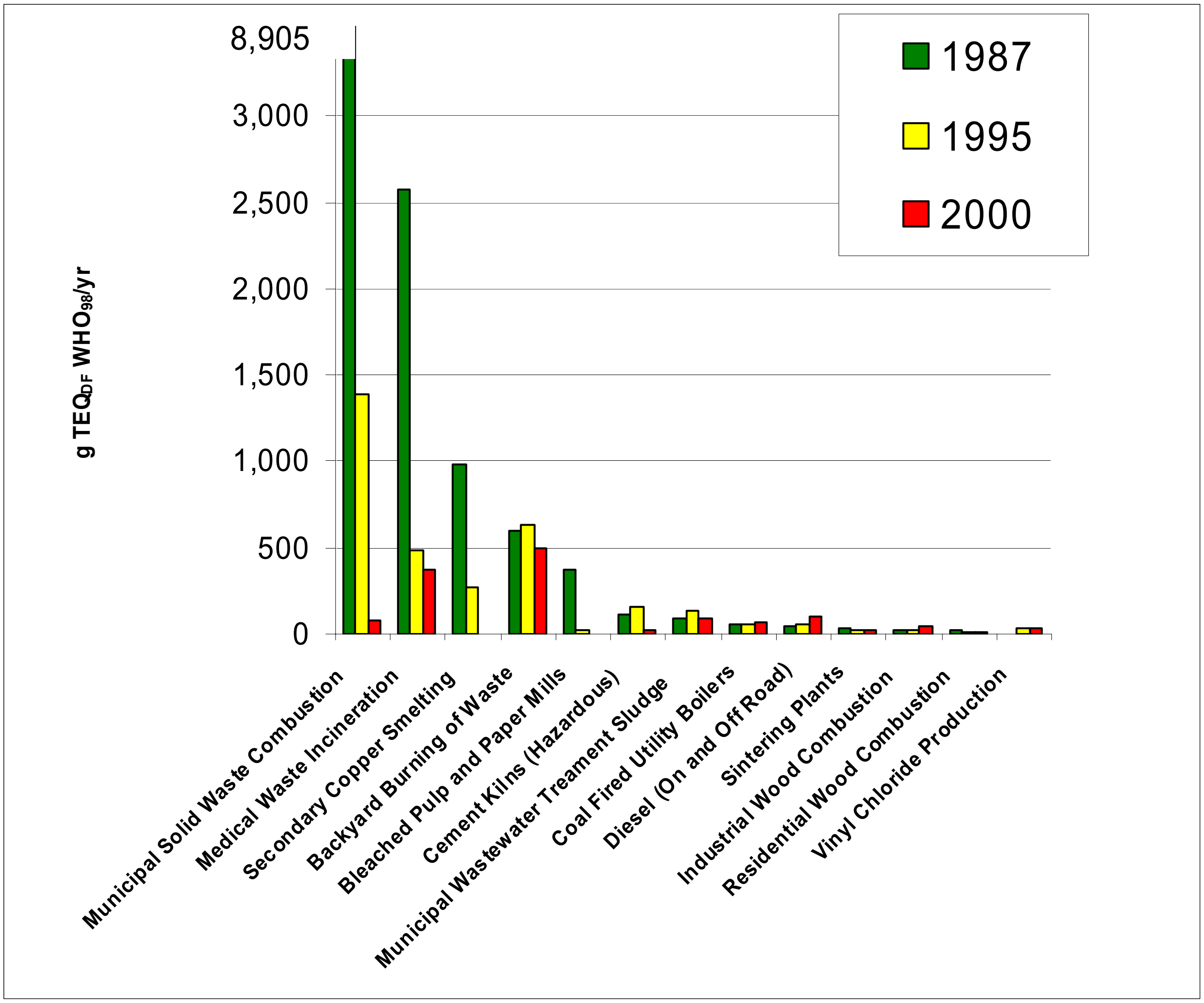

Figure 3-3. Top U.S. Inventoried Dioxin Releases[12] from Years 1987, 1995 and 2000. Source: ***An Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States for the Years 1987, 1995, and 2000*****, November 2006.**

[12] Estimates represent total releases, including releases to water, land, and air.

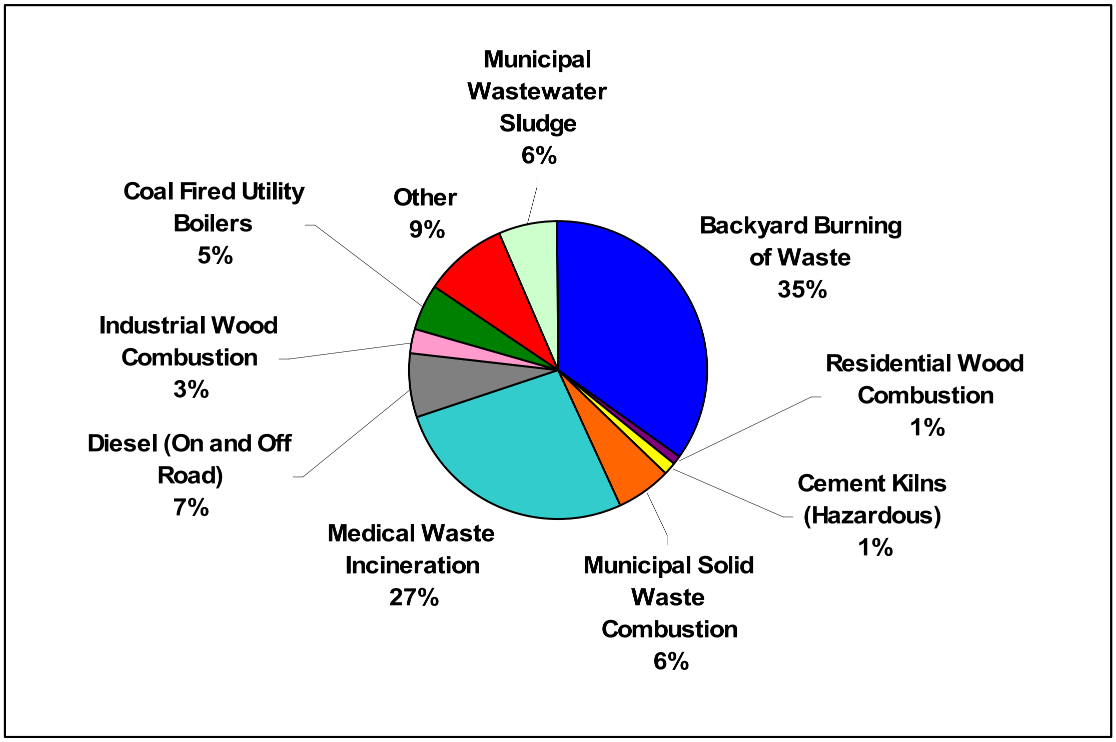

Figure 3-4. Top U.S. Inventoried Dioxin Releases[13] in 2000. Source: *An Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States for the Years 1987, 1995, and 2000*, November 2006.

Workgroup Activities

Workgroup Meetings

In the past year, the Dioxin/Furan Workgroup has conducted the following activities:

- The workgroup met on May 17, 2006, at the GLBTS Stakeholder Forum in Toronto, Ontario. The workgroup presented updates on burn barrel reduction efforts and outdoor wood-fired boilers; explored the issue of agricultural plastics and trash burning; reviewed the results of a survey investigating dioxin/furan levels in sewage biosolids; and discussed releases, including the latest inventory of emissions in the Canadian Lake Superior Basin and the Midwest Clean Diesel Initiative.
- The workgroup held a call on July 20, 2006, to discuss the issue of agricultural burning in the Great Lakes Basin and explore whether there is a role for the workgroup in addressing this issue, either through a new subgroup or through the Burn Barrel Subgroup.
- The workgroup met on December 6, 2006, at the GLBTS Stakeholder Forum in Chicago. The workgroup discussed burn barrel outreach activities, pathway intervention, agricultural burning reduction opportunities, and reviewed the Dioxin Management Framework recommendations again, including the latest release inventories. The

[13] Estimates represent total releases, including releases to water, land, and air.

workgroup also heard presentations from the U.S. Food and Drug Administration and Health Canada relating to dioxin exposure in the food system.

- The Burn Barrel Subgroup met by teleconference four times in 2006: on January 10, March 7, May 9, and September 12. Topics related to reducing the practice of open burning were discussed, including: the burning of agricultural waste and plastics; the draft Northeast States' *Joint Resolution Promoting Interstate Cooperation to Reduce Air Pollution from Open Burning of Solid Waste*, prepared by US EPA; the Burn Barrel Toolkit for local officials; opportunities for subgroup members to participate in Great Lakes Regional Collaboration outreach efforts; new data on emissions associated with burning certain types of materials; and potential grant projects to study emissions from open burning.

Reduction Activities

Burn Barrels and Household Garbage Burning

Burn barrels and other household garbage burning methods remain a high reduction priority for the workgroup. Household garbage burning is estimated to emerge as the largest source of dioxin emissions after air emissions standards for industrial sources are in place. The practice of household garbage burning typically is carried out in old barrels, open pits, wood stoves, or outdoor boilers. The Burn Barrel Subgroup, led by Bruce Gillies of EC, is addressing this issue. The subgroup maintains a website for information sharing at www.openburning.org.

US EPA developed a Burn Barrel Toolkit which provides resources for local officials to reduce trash burning in their communities. The toolkit includes individual fact sheets for each State and case studies of efforts to reduce household garbage burning in various communities. In 2006, US EPA began a series of presentations, using the toolkit, to local officials in the Great Lakes Basin. The following presentations were given in 2006:

- October 2, 2006 – *Illinois Counties Solid Waste Management Association Starved Rock State Park*
- October 16, 2006 – *Wisconsin Towns Association Meeting, La Crosse, WI*
- November 3, 2006 – *State of the Lakes Ecosystem Conference (SOLEC), Milwaukee, WI*

In Ontario, open burning information has been distributed to farms and rural landowners. Environment Canada is working with Conservation Authorities in four watersheds, in an *Adopt a Watershed Pilot Project*, to promote community working group activities and stewardship initiatives to reduce open burning in rural areas. The Environment Canada brochure on dioxins from open burning, "*What goes up must come down*" is being distributed. A workshop for rural landfill operators, with a focus on the toxics emitted by burning, and local material recycling alternatives, was organized by EcoSuperior Environmental Programs in Thunder Bay, Ontario, on March 30, 2006.

A summary of 23 burn barrel case studies prepared to date is available on the Burn Barrel Subgroup's website. These case studies include alternatives to burning in eight counties, six

Tribes, four States, three cities, and two solid waste districts across the U.S. The case studies highlight various approaches to reduce the practice of household garbage burning, including education and outreach, regulation, enforcement, incentives, infrastructure building, and voluntary efforts. The compilation of additional burn barrel case studies also began during 2006.

US EPA continues to maintain a website of burn barrel information at www.epa.gov/msw/backyard.

During 2006, the Burn Barrel Subgroup discussed the merits of drafting a Great Lakes Resolution on open burning of garbage similar to a resolution developed by the Northeast Waste Management Officials' Association (NEWMOA) and signed by the Northeast States. US EPA prepared a Draft Great Lakes Resolution with input from subgroup members. EC decided to work through existing organizations to spread the resolution's message (i.e., rather than signing and formally participating in the resolution). US EPA is proceeding to brief the US EPA Region 5 Regional Administrator on the Draft Great Lakes Resolution and determine whether to recommend that U.S. Great Lakes States endorse it.

Great Lakes States (including Illinois, Indiana, Minnesota, New York, Michigan, and Wisconsin) and Tribes are continuing activities, consistent with the Burn Barrel Subgroup's Household Garbage Burning Reduction Strategy, to educate and influence behavioral change, supported by infrastructure and the institution of local by-laws. For example, in February 2006, the Leech Lake Band of Ojibwe passed an updated *Open Burning, Burn Barrel, and Fire Prevention Ordinance*. The updated ordinance details new burning practices that make backyard burning an action that requires a permit and burn barrel certification. This also includes a fee for the permit. There are many options for waste disposal, as well as tribal/county recycling programs. However, awareness of these options is limited, and outreach is a major goal of the Leech Lake Air Program. Since the ordinance took effect on April 1, 2006, the Leech Lake Air Program has conducted 10 different venues for outreach on backyard burning both on and off the Leech Lake Reservation. In Spring 2006, Leech Lake initiated a burn barrel trade-out program in which residents may trade in burn barrels for two 18 gallon recycling bins; program participants also vow not to burn household garbage. Leech Lake held two collection events during 2006 in which 20 burn barrels and their contents were collected from residences, barrels were recycled if possible, and the contents of collected burn barrels were properly disposed at a certified transfer station. To further increase awareness and to stop the burning of household trash, Leech Lake highlighted their accomplishments in local newspapers.

Inventory Improvements

US EPA maintains and annually updates the Toxics Release Inventory (TRI), a publicly available database that contains information on toxic chemical releases and other waste management activities. Due to the high toxicity of dioxins and furans to humans, as of 2000, US EPA requires facilities to report these compounds to the TRI. However, most of the reporting data is for disposal quantities and not for environmental releases. More information is available on the TRI website at www.epa.gov/tri.

In addition to the TRI, the eight Great Lakes States and the Province of Ontario maintain a regional emissions inventory for hazardous air pollutants, including dioxins and furans. US EPA also continues to update the National Dioxin Emissions Inventory, which indicates that more than 90 percent of all dioxin releases in the U.S. are from air sources. US EPA is separately tracking emission reductions from the MACT program requirements for MWCs and MWIs.

Beginning with the reporting year 2000, polychlorinated dibenzo-para-**dioxins** (PCDDs) and polychlorinated dibenzo**furans** (PCDFs), as a group, are included in the list of substances required to be reported under EC's National Pollutant Release Inventory (NPRI). The reported information is available to the public on an annual basis through the EC website at www.ec.gc.ca/pdb/npri. EC will use the NPRI data to update the point source information in the Ontario Dioxin/Furan Release Inventory. In 2005, 10.5 grams and 64.0 grams of total releases of dioxins and furans were reported in Ontario and Canada, respectively. There is a slight decrease in releases reported, compared to 2004.

Ambient Air Monitoring

US EPA conducts air monitoring for dioxin under the National Dioxin Air Monitoring Network (NDAMN), in order to track fluctuations in atmospheric deposition levels. NDAMN was initiated in 1998. Results for years 1998 through 2001 currently are available (see Figure 3-4). No clear trends over time are apparent from the NDAMN data.

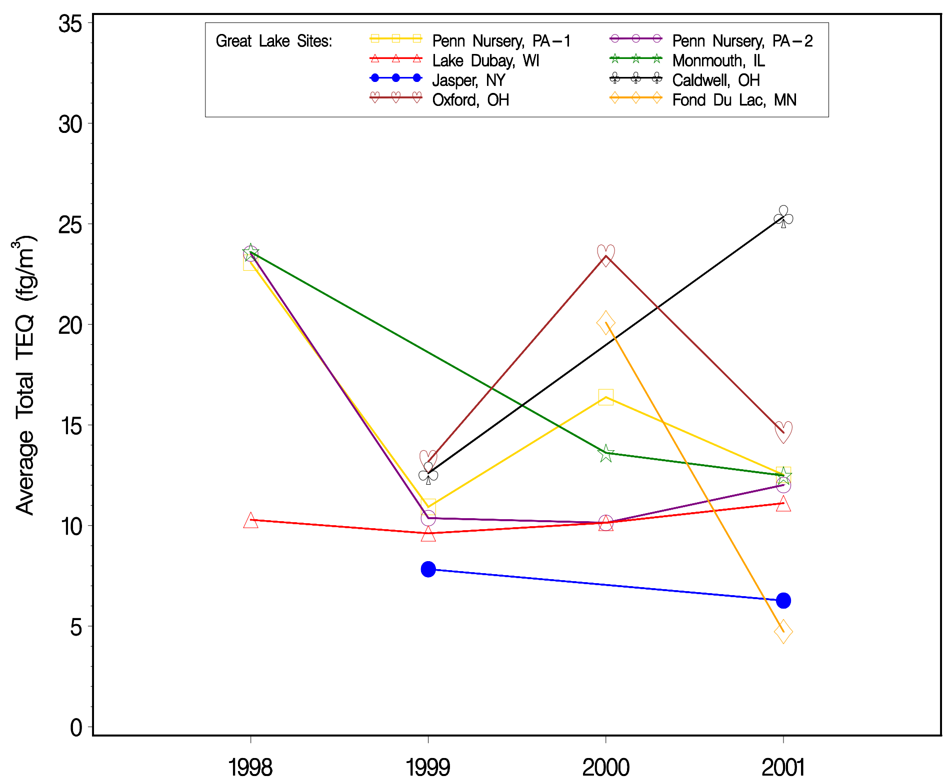

Figure 3-4. NDAMN Average Total TEQ Concentrations, including Dioxins, Furans, and Dioxin-like PCBs, for Sites in the Great Lakes Region, 1998-2001. Source: US EPA

Ambient air monitoring of GLBTS substances has been conducted in Canada since 1996 through the National Air Pollution Surveillance Network (NAPS) (see Figures 3-5 and 3-6). These figures show dioxin and furan concentrations throughout Canada. Dioxins and furans have been monitored at 12 stations in Ontario, comprised of eight urban and four rural sites. The Ontario urban sites are located in Toronto and Hamilton while the Ontario rural sites are at Burnt Island, Simcoe, Point Petre, and Egbert. Results show elevated levels at urban sites compared to rural sites, but there is a decreasing trend in ambient air levels from 2003 to 2005 in the urban areas. All concentrations remain below the Ontario MOE ambient air quality criterion of 5 picograms per cubic metre (TEQ), 24-hour average.

From 2003 to 2005, the highest PCDD TEQ (54 femtograms per cubic metre) was recorded at the Toronto site (see Figure 3-5) while the highest PCDF TEQ (1500 femtograms per cubic metre) concentration was recorded at the Hamilton site (see Figure 3-6). In August 2003, PCDD/PCDF sampling began at an Integrated Atmospheric Deposition Network (IADN) site located at Burnt Island. In addition, measurement of coplanar PCBs began in 2005 at Ontario sites (see Figure 3-7). Similar to PCDD and PCDF, the concentrations of dioxin-like PCBs measured at urban sites are elevated compared to rural sites.

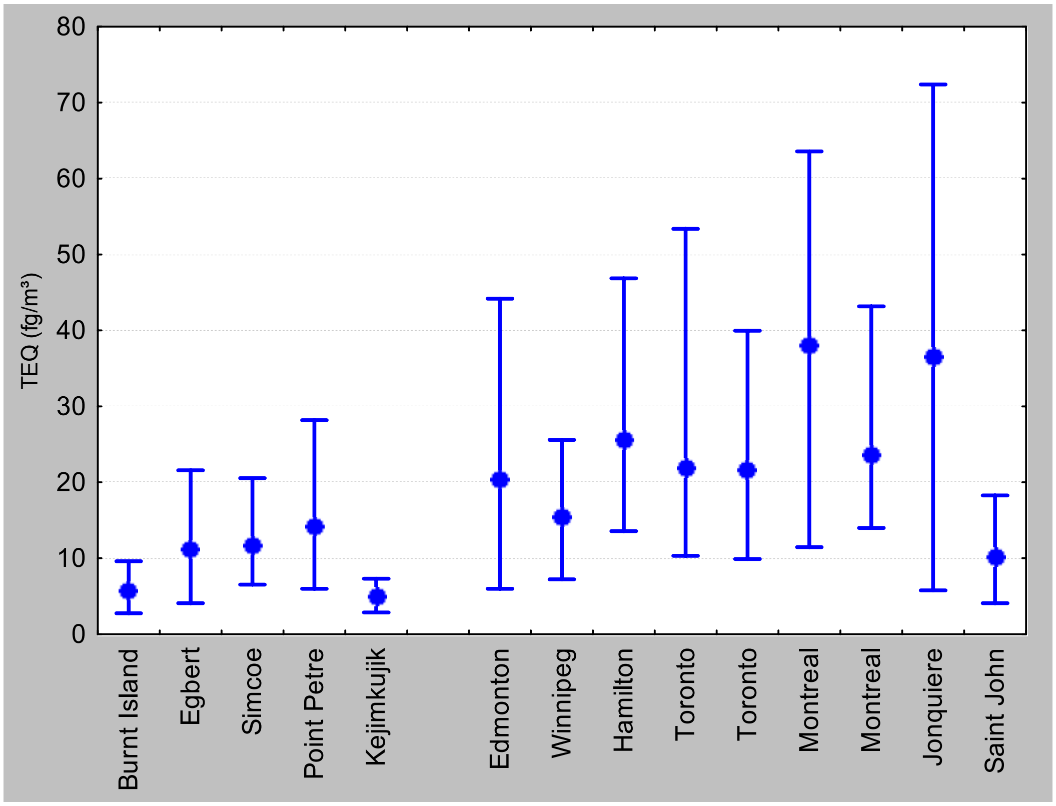

Figure 3-5. 2,3,7,8-TCDD TEQ Concentrations (fg/m³) 2003-2005 (Mean, 10th and 90th percentiles). Source: Environment Canada [14]

[14] Presentation "Measurement of Potentially Toxic Air Pollutants in the National Air Pollution Surveillance (NAPS) Network" by Tom Dann, Environment Canada. 2006.

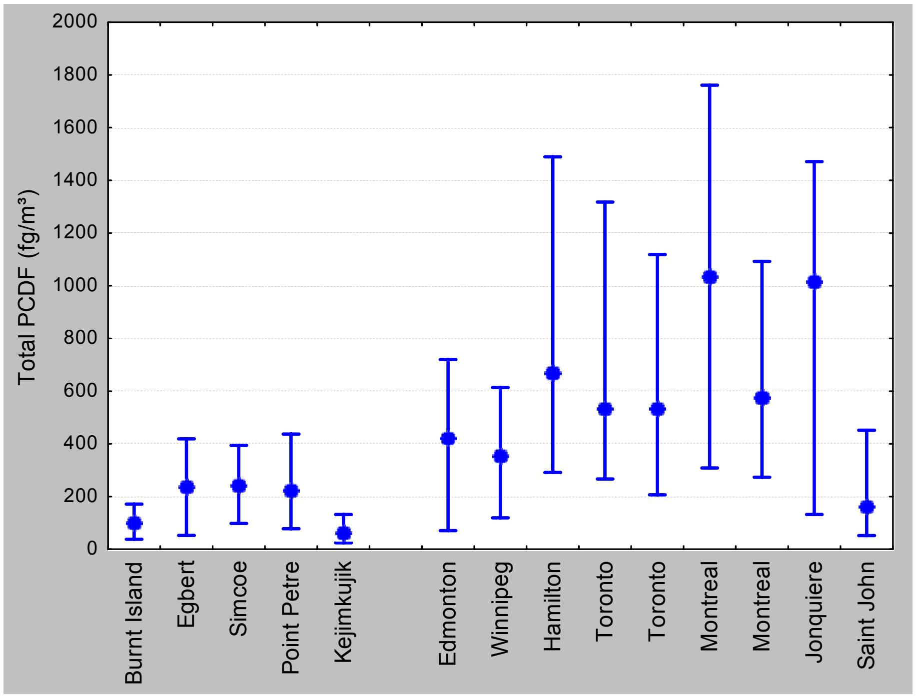

Figure 3-6. Total PCDF Concentrations (fg/m³) 2003-2005 (Mean, 10th and 90th percentiles). Source: Environment Canada[15]

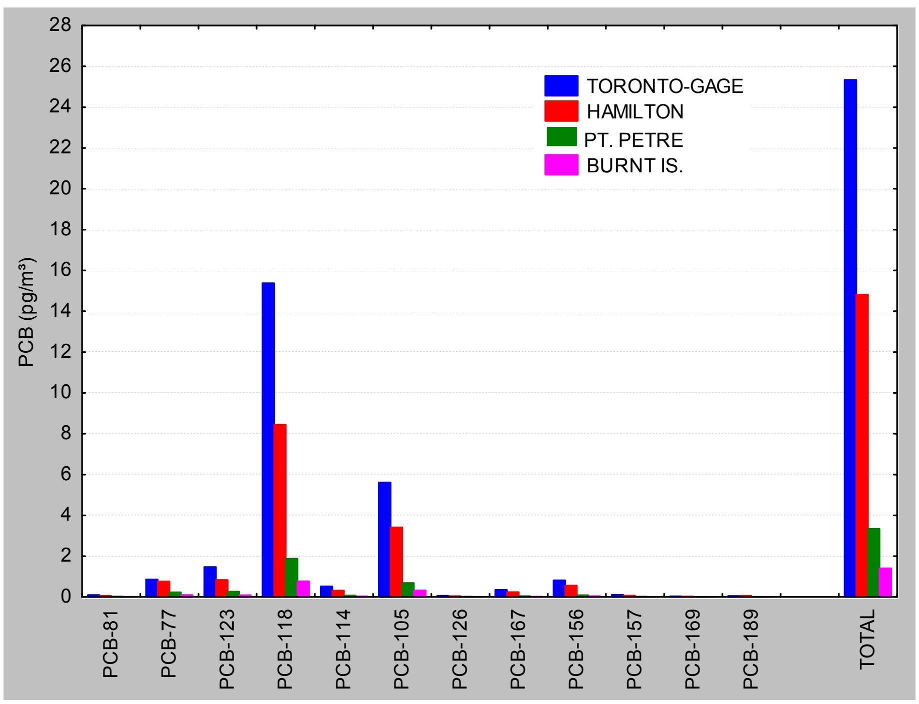

Figure 3-7. Concentration (pg/m³) of Dioxin-Like PCB at Selected Ontario Sites (2005) Source: Environment Canada[16]

[15] Presentation "Measurement of Potentially Toxic Air Pollutants in the National Air Pollution Surveillance (NAPS) Network" by Tom Dann, Environment Canada. 2006.

Joint Priorities with Other GLBTS Workgroups

The Dioxin Workgroup has been coordinating efforts with the HCB/B(a)P Workgroup on issues that concern both chemical workgroups. The two workgroups held a joint meeting on May 17, 2006, to share information on common issues of concern including household garbage burning, outdoor wood-fired boilers, agricultural plastics and trash burning, and diesel emissions. The two workgroups will continue to update members with new information and identify opportunities for joint work on common sources.

Next Steps

Education of the public and local officials on approaches to reduce household garbage burning will continue to be the workgroup's principal effort. Future workgroup efforts are expected to include:

- Continuing Burn Barrel Subgroup activities
- Investigating opportunities to reduce agricultural waste burning
- Continuing source characterization work
- Tracking releases and ambient air concentrations
- Exploring pathway intervention

[16] Presentation "Measurement of Potentially Toxic Air Pollutants in the National Air Pollution Surveillance (NAPS) Network" by Tom Dann, Environment Canada. 2006.

4.0 HEXACHLOROBENZENE/BENZO(a)PYRENE (HCB/B(a)P)

Canadian Workgroup co-chair: Tom Tseng
U.S. Workgroup co-chair: Steve Rosenthal

Progress Toward Challenge Goals

U.S. Challenge: Seek by 2006, reductions in releases, that are within, or have the potential to enter the Great Lakes Basin, of HCB and B(a)P from sources resulting from human activity.

Canadian Challenge: Seek by 2000, a 90 per cent reduction in releases of HCB and B(a)P from sources resulting from human activity in the Great Lakes Basin, consistent with the 1994 COA.

The U.S. and Canada have both made significant reductions in HCB/B(a)P emissions to the Great Lakes Basin.

Ontario: Progress Toward the GLBTS Challenge

HCB Reduction

From a 1988 baseline, Canada has reduced HCB emissions to the Great Lakes Basin by approximately 68 percent in 2004. Figure 4-1 shows the release estimates and progress achieved toward meeting the 90 percent reduction target.[17] Over 80 percent of the reductions achieved to date are due to:

- Lower residual HCB levels in pesticides and reduced usage of certain pesticides known to contain HCB;
- Implementation of a CWS for waste incinerators and the closure of solid waste incinerators, such as Hamilton's Solid Waste Area Reduction Unit (SWARU);
- Reductions reported by the iron and steel sector and the closure of Algoma's Wawa sintering facility; and
- Process changes within Ontario's chlorinated chemical manufacturing sector.

Canada's 2004 HCB releases in the basin are estimated at 37 lbs (17 kg). Major non-point sources include pesticide application, open burning, and the use of products containing trace HCB levels, which account for about 70 percent of Ontario's HCB releases. Significant remaining point sources include primary metals, steel, and cement production facilities. These sources account for approximately 15 percent of Ontario's HCB releases.

[17] Based on "Hexachlorobenzene Sources, Regulations and Programs for the Ontario Great Lakes Basin 1988, 1998 and 2000 Draft Report (No. 1), July 13, 2000" prepared for Environment Canada by Benazon Environmental Inc., with releases updated by Environment Canada - Ontario Region, based on NPRI facility release data, recent sector release assessments, and pesticide application release information received from Health Canada's Pest Management Regulatory Agency on August 29, 2005.

B(a)P Reduction

From a 1988 baseline, Canada has reduced B(a)P emissions to the Great Lakes Basin by approximately 49 percent in 2004. Figure 4-2 shows the release estimates and progress achieved toward meeting the 90 percent reduction target.[18] Most of the B(a)P reductions achieved to date have resulted from the following activities:

- Iron and steel sector's implementation of a best practices manual entitled "Environmental Best Practice Manual for Coke Producers – Controlling and Reducing Emissions of Polycyclic Aromatic Hydrocarbons (PAH) from Metallurgical Coke Production in the Province of Ontario", which is consistent with EC's "Environmental Code of Practice for Integrated Steel Mills";[19]
- Decrease in estimated wood consumption; however, reliance on wood heat is expected to increase due to rising oil and gas costs;
- Implementation of control technologies by the petroleum refining sector; and
- Decreased creosote-treating activities and shutdown of the Northern Wood Preservers Inc. facility in Thunder Bay.

The Ontario B(a)P inventory, for both 2004 and 1988, has been updated with new activity data and methodologies for some sectors, including residential wood combustion and creosote railway ties. As a result, Canada's 2004 B(a)P releases in the basin from anthropogenic sources are estimated at 20,350 lbs (9,250 kg), representing a 49 percent reduction from 1988. This does not include 9,020 lbs/yr (4,100 kg/yr) of B(a)P released annually from forest fires (wildfires), based on a 2004 estimate.[20] Major non-point sources include residential wood combustion, use of creosote-treated railway ties, motor vehicle emissions, and open burning (prescribed and household waste burning), which account for about 60 percent of Ontario's B(a)P releases. The major point source is cokemaking in the steel manufacturing sector, which accounts for 30 percent of Ontario's B(a)P releases.

United States: Progress Toward the GLBTS Challenge

From a 1990 baseline, the U.S. has reduced releases of HCB from approximately 8,519 lbs in 1990 to 2,911 lbs in 1999. From 1999 to 2002, HCB emissions were reduced by an additional 28 percent. Figure 4-3 shows national HCB release estimates and progress achieved between 1990 and 2002.[21] This reduction is mainly attributed to lower residual HCB levels in pesticides, along with reduced HCB emissions from chlorinated solvent production and pesticide manufacture. These three categories combined account for roughly 5,000 lbs/yr of HCB reductions.

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[18] Based on "B(a)P/PAH Emissions Inventory for the Province of Ontario 1988, 1998 and 2000 Draft Report (No. 1), May 16, 2000" prepared for Environment Canada by Benazon Environmental Inc., with releases updated by Environment Canada - Ontario Region, based on NPRI facility release data and recent sector release assessments.
[19] Available at http://www.ec.gc.ca/nopp/docs/cp/1mm7/en/toc.cfm
[20] Toxic Emissions from Wildfires and Prescribed Burning, Issue Paper March 31, 2004, prepared for Environment Canada by Environmental Health Strategies.
[21] Based on EPA's 1990 National Toxics Inventory (with 1999 open burning estimates added) and 2002 National Emissions Inventory.

Differences in the 1990 and the 2002 emission inventories and source categories complicate the determination of the exact emission reductions that have occurred. The inventories represent the best emission estimates that are available and provide a useful snapshot of HCB emissions from several source categories in 1990 and 2002. However, due to inconsistencies in the sources included in the two inventories, they cannot be used to establish a specific reduction in HCB emissions between 1990 and 2002. During 2006, US EPA commissioned work on an HCB Inventory, similar to US EPA's 2000 Dioxin Inventory.

Figure 4-4 shows B(a)P release estimates and reduction progress within the U.S. Great Lakes Basin from 1996 to 2001.[22] B(a)P emissions from the eight Great Lake States have been reduced by approximately 77 percent during that time, with annual emissions in 2001 estimated at 43,700 lbs. Since the 2001 inventory was prepared, B(a)P emissions from the petroleum refinery sector have been essentially eliminated due to process changes/controls, and emissions from primary aluminum manufacture and coke ovens substantially reduced. Residential wood combustion remains the largest B(a)P emission source in the Great Lakes.

Data from the 2002 Great Lakes Regional Air Toxic Emissions Inventory became available in 2006. Total B(a)P emissions from the eight Great Lake States were estimated at 87,115 (see Figure 4-5). Estimated annual B(a)P emissions were substantially higher in the 2002 inventory than in the 2001 inventory, primarily due to improvements in the inventory which captured a greater number of sources. The Great Lakes Commission plans to investigate the B(a)P estimates in the Great Lakes Regional Air Toxic Emissions Inventory. The report of the 2002 Inventory of Toxic Air Emissions is available at www.glc.org/air/inventory/2002/.

[22] Based on the Great Lakes Regional Air Toxic Inventory for 1996 through 2001, with Ontario emissions removed and petroleum refining emissions reduced to approximately 5 lbs beginning in 1997, per revised estimates provided by the American Petroleum Institute (API, 2001).

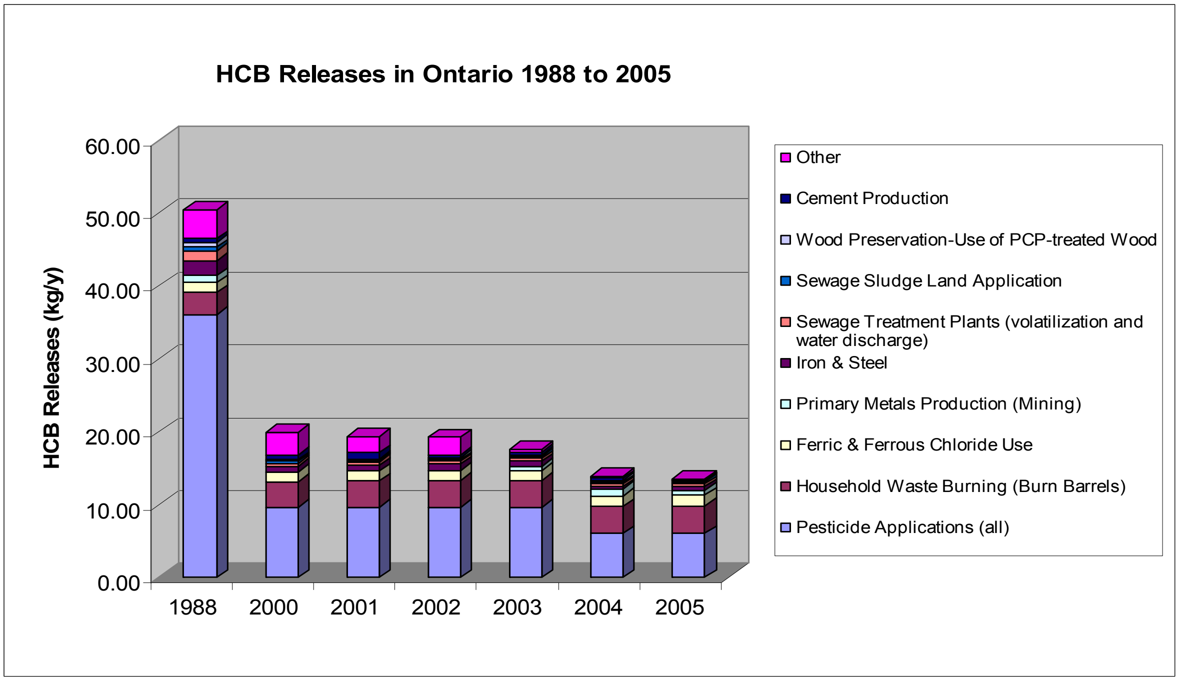

Figure 4-1. Estimated HCB Releases (to air and water) in Ontario by Sector, 1988-2005. Source: Environment Canada (Environmental Protection Operations Division – Ontario Region) Inventory as of Nov. 2006, with an update on releases from pesticide application received from Health Canada's Pest Management Regulatory Agency (Letter dated April 11, 2005)

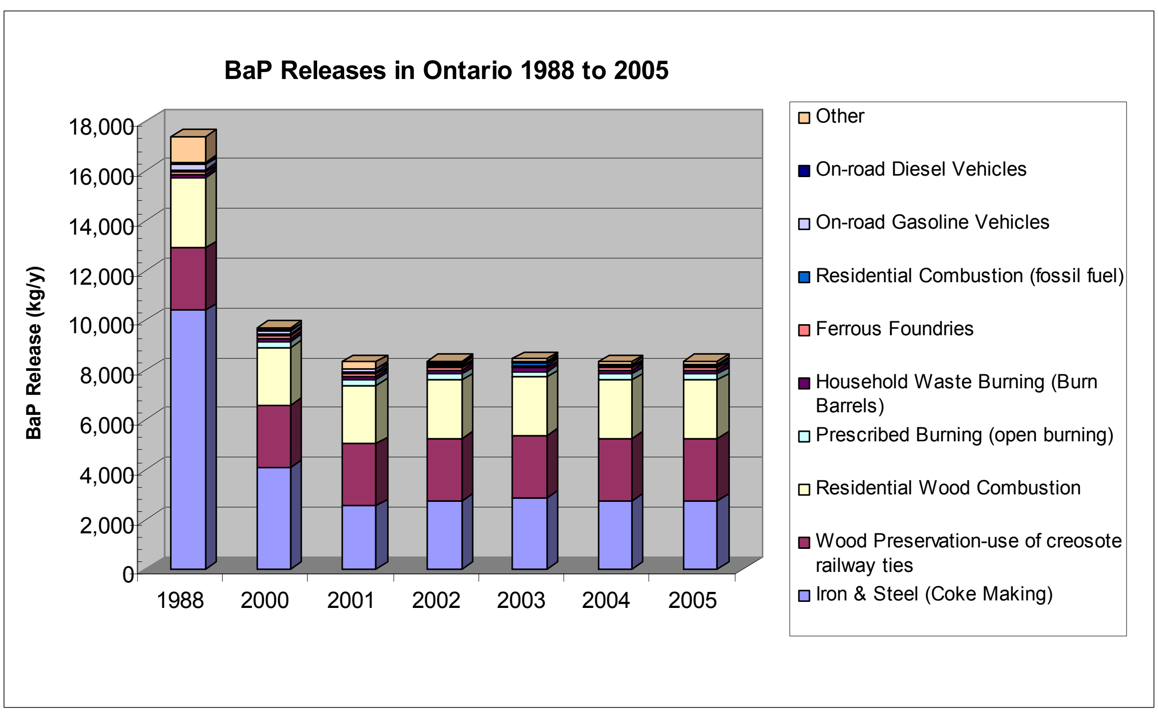

Figure 4-2. Estimated B(a)P Releases in Ontario by Sector, 1988-2005. Source: Environment Canada (Environmental Protection Operations Division – Ontario Region) Inventory as of Nov. 2006

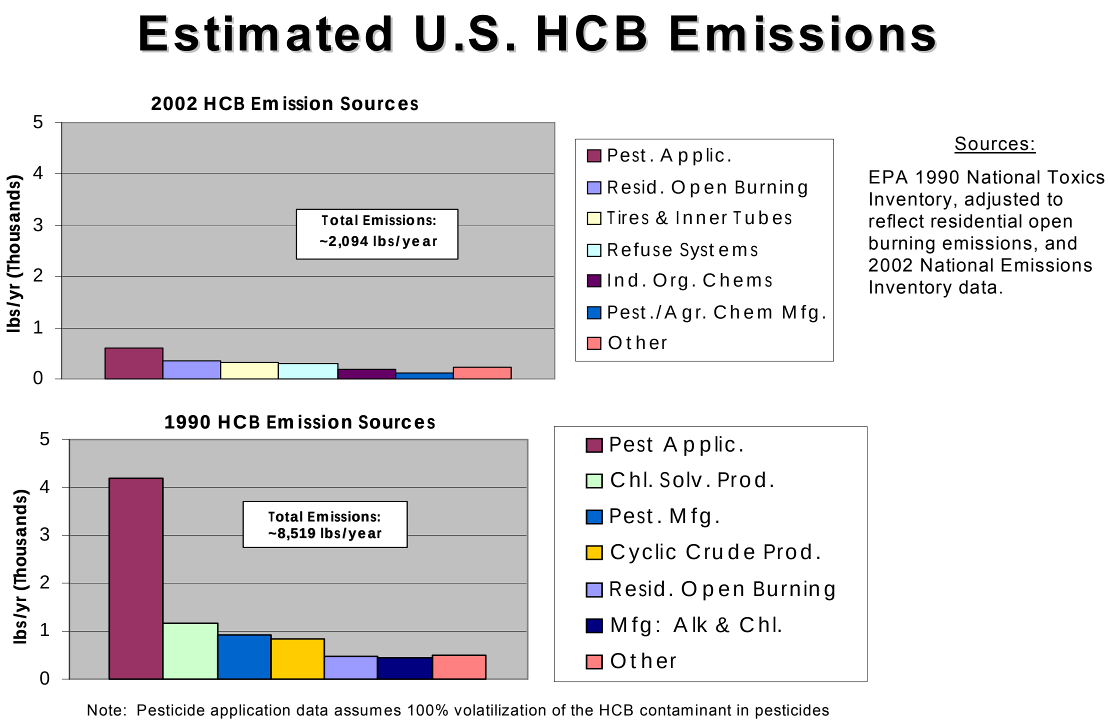

Figure 4-3. **Estimated U.S. HCB Releases for 1990 and 2002 (lbs/year) Source: US EPA 1990 National Toxics Inventory, adjusted to reflect residential open burning emissions, and 2002 National Emissions Inventory data**

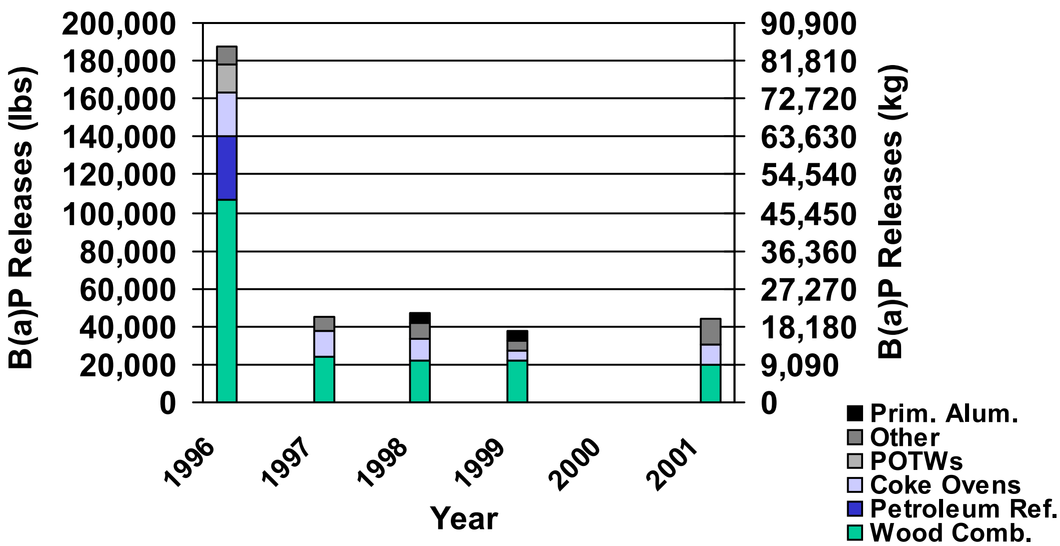

Figure 4-4. **B(a)P Releases from the U.S. Great Lakes States, 1996-2001.[23]**

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[23] Based on the Great Lakes Regional Air Toxic Emissions Inventory for 1996 through 2001, with Ontario emissions removed and petroleum refining emissions reduced to approximately 5 lbs beginning in 1997, per revised estimates provided by the American Petroleum Institute (API, 2001).

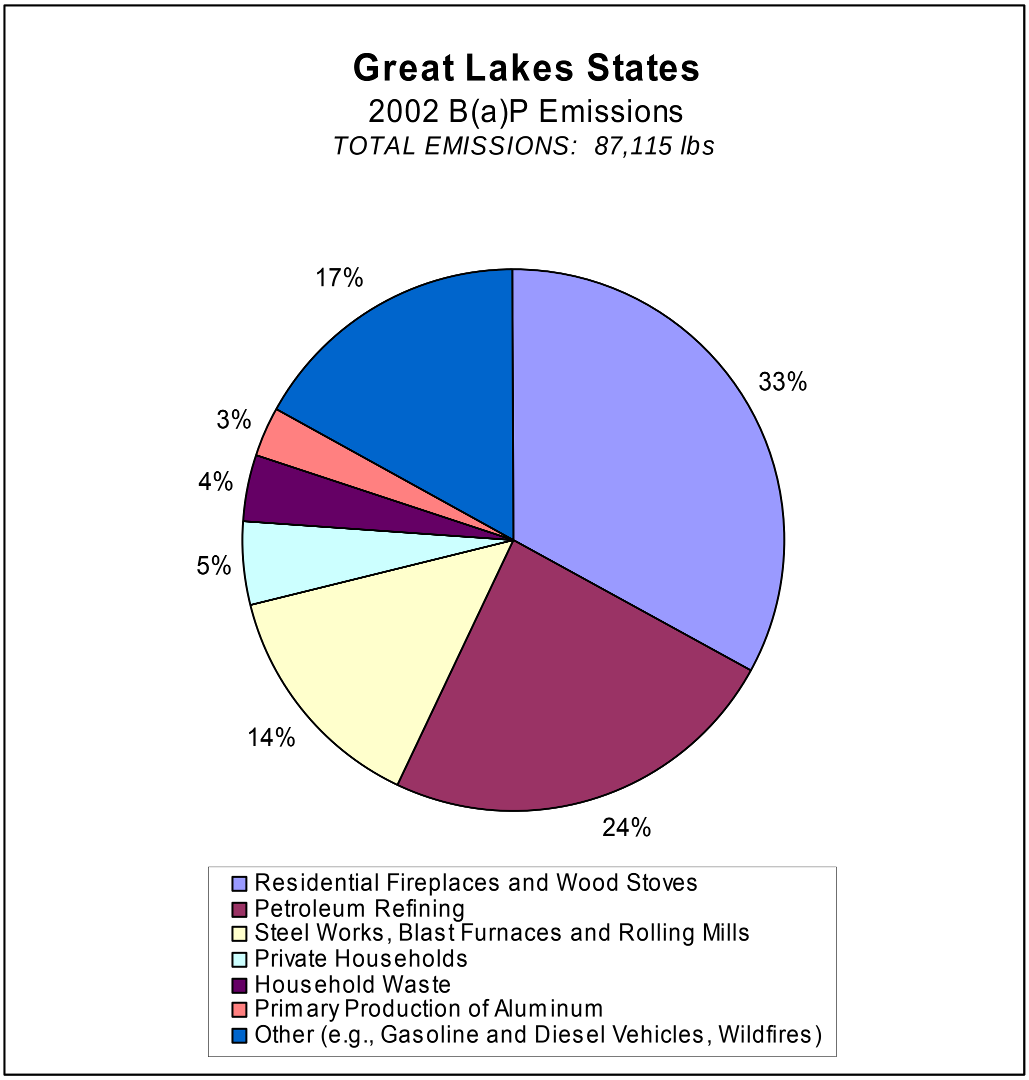


Figure 4-5. B(a)P Releases from the U.S. Great Lakes States, 2002.[24]
Source: Great Lakes Commission, 2002 Inventory of Toxic Air Emissions For the Great Lakes Region

Workgroup Activities

Workgroup Meetings

In the past year, the HCB/B(a)P Workgroup has conducted the following activities:

- The workgroup met on May 17, 2006, at the GLBTS Stakeholder Forum in Toronto. There was a joint meeting with the Dioxins/Furans Workgroup for updates on household waste burning, agricultural plastics and trash burning, sewage treatment and sludge, and

[24] The 2002 inventory does not include updated emission estimates provided by the American Petroleum Institute (API, 2001) which show that petroleum refining emissions have been reduced to approximately 5 lbs per year.

Lake Superior inventory information. The workgroup then met separately and was presented with updates on HCB modeling, Ontario B(a)P mapping, residential wood combustion including outdoor wood-fired boilers, B(a)P reduction activities, chemical manufacturing, and the US Midwest Clean Diesel Initiative.

- The workgroup met on December 6, 2006, at the GLBTS Stakeholder Forum in Chicago. The workgroup was presented with updates on release inventories, the Great Lakes Commission update of 2002 inventory information, ambient air monitoring results, residential wood combustion including outdoor wood boilers, scrap tires, coke ovens, chemical manufacturing, HCB modeling, US Midwest Diesel Initiative, and Canadian wood preservation.

U.S. Reduction Activities

Midwest Clean Diesel Initiative

- The Midwest Clean Diesel Initiative (MCDI) is a collaboration of federal, state, and local agencies, along with communities and private companies, working together to reduce emissions from diesel engines in the Midwest (US EPA Region 5).[25] The MCDI reduces diesel emissions through retrofitting, reducing idling, refueling, repowering, and replacing diesel engines in the Midwest. Diesel retrofits have been performed on school buses and garbage trucks. The installation of Advanced Truck Stop Electrification systems provides diesel trucks the opportunity to "plug in" rather than keep their diesel engines idling for auxiliary power, and US EPA's SmartWay Transport Partnership promotes voluntary measures that will reduce fuel use and emissions. As of September 2006, the MCDI had impacted 352,173 diesel engines (in a way that would reduce their emissions), at least 40 percent of which occurred in 2006. The MCDI goal is to reduce emissions from 1 million diesel-powered engines by 2010.

Wood Stove/Fireplace Initiatives in Progress

- A wood stove/fireplace website (www.epa.gov/woodstoves/index.html) has been developed to provide consumers with information on the health effects of wood smoke, benefits of using US EPA-certified stoves, and how to burn efficiently and safely. This website also provides a guide for implementing a wood stove changeout campaign. A wood stove changeout campaign provides information and incentives (e.g., rebates or discounts) to encourage people to replace their old, conventional wood stove with a US EPA-certified wood-burning appliance that burns more cleanly and efficiently, including pellet, gas, and propane appliances.
- A wood stove changeout fact sheet has been developed that explains the problems with using older, higher polluting wood stoves and discusses the quantity and type of emissions from residential wood combustion, the adverse health effects from wood smoke, and a way to address the problem by facilitating the replacement of old and

[25] See the MDCI website at http://www.epa.gov/midwestcleandiesel.

inefficient wood stoves with newer, more efficient and cleaner burning technologies through education, outreach, and incentives (e.g., cash rebates).

- The *Greater Dayton Woodstove Changeout Program* was held in the Dayton, Ohio, metropolitan area from mid-July through mid-September 2006. This program was aimed at encouraging people with an old wood stove to upgrade to a new gas, pellet, or wood stove that has been certified by US EPA. It was estimated that there are 15,000 to 20,000 old stoves in the Dayton area. Rebates of $300 to $400 were offered to anyone in this area with a pre-1992 wood stove. This program provided extensive outreach via television and radio interviews and press articles. Approximately 100 stoves were changed out during this program

Tribal "Burn-it Smart" Workshops

- In September 2006, US EPA staff traveled with Canadian First Nation instructors to Minnesota, Wisconsin, and Michigan to provide four *Burn It Smart!* workshops for Region 5 Tribes. The workshops explained proper burning practices; the environmental and energy benefits of using a US EPA-certified stove; proper fuel use, including the storage and preparation of firewood; and the need for professional installation and annual inspections. Key points emphasized to reduce emissions were: 1) the only fuel used should be seasoned wood, and 2) overloading the stove will cause excessive and unnecessary wood smoke. Safety practices such as proper disposal of ashes and the use of smoke alarms and energy efficiency were also emphasized. The training sessions were supplemented with outdoor comparisons of conventional and US EPA-certified stoves to reinforce the benefits of US EPA-certified stoves, which have little or no visible smoke. The workshops were attended by Tribal air representatives, members of the Midwest Branch of the Hearth, Patio and Barbeque Association (HPBA), and state agencies. Overall, the workshops were a success and of great value to US EPA staff in gaining better communication and understanding of wood stove and burning issues of concern to Region 5 Tribal representatives.
- *Burn It Smart!* workshops were held in Sault Ste. Marie and Romeo, Michigan, in February, 2006. At each location workshops were held for the general public in the evening and for wood stove professionals during the day. Wood-burning displays took place at each workshop.

Outdoor Wood-Fired Boilers

- Outdoor wood boilers have combustion chambers in small sheds outside of the home. Burning occurs in the shed with no emission control devices, and emissions are vented through a small stack (generally less than 12 feet). The cyclic nature of the boiler operation does not allow for complete combustion, which results in much higher emissions than from wood stoves. The use of outdoor wood boilers is increasing, with about 500,000 expected to be in place nationwide by 2010, primarily in the Northeast and Midwest, including the Great Lakes area. Although US EPA is not adopting regulations to address outdoor wood boilers, it is taking the following steps: (1) development of a test method specific to outdoor wood boilers is nearly complete; and (2) a voluntary incentive program has resulted in an agreement with the major outdoor wood boiler manufacturers. As a result of this agreement, wood boilers sold after April 2007, will emit 70 percent less emissions (primarily particulate matter, but PAHs are expected to be reduced similarly), with further reductions in subsequent years. In addition, a model rule is being developed for states and local agencies that will include emission limits, zoning, stack height, operation and maintenance, labels, and notices to buyers.

Scrap Tire Mapping and Inventory Initiative

- Under a *Scrap Tire Pile Mitigation Support Project*, the US EPA finished developing a scrap tire pile inventory for the Great Lakes States, along with Geographic Information System (GIS) mapping of large tire piles (>500 tires).
- In April 2006, Best Practices training was held for the States of Pennsylvania, Maryland, New Jersey, and Delaware.
- Scrap tire forums were held in Chicago, Illinois, Lansing, Michigan, and Philadelphia, Pennsylvania.
- In January 2006, US EPA completed a best practices *Scrap Tire Cleanup Guidebook* on how to manage scrap tire piles.

Scrap Tire Market Report

The 8th biennial scrap tire market report was published by the Rubber Manufacturers Association in November 2006. The report presents scrap tire market and stockpile data for 2005 and ranks state programs for effectiveness and most improved status. In 2005, 87 percent of scrap tires went to end use markets. Since 2003, waste tire stockpiles are down 30 percent; however, approximately 188 million tires remain in stockpiles. State programs range widely in funding, quality, and effectiveness. Some state scrap tire programs are facing a loss of funds.

US EPA Promulgates Final Rule for Coke Ovens

- Amendments to the 1993 MACT standards for coke ovens, which contain more stringent emission limits for coke oven doors, charge port lids and offtake piping on 17 percent of U.S. coke batteries, were promulgated in April 2005. This action, which addressed "residual risk," was the first of its kind by US EPA. In April 2006, new MACT rules went into effect for coke plant emission points, not included in the 1993 rules, for pushing, combustion stacks and quench towers. These MACT rules apply to all U.S. coke plants.

Industry Reduces HCB Releases Reported to TRI

- Syngenta Crop Protection (St. Gabriel, LA) reduced stack HCB emissions by 96 percent, from 253 lbs in 2000 to 10 lbs in 2004. HCB emissions are expected to remain in the 10-20 lb/yr range depending on production volumes.
- Dow Chemical Louisiana Division (Plaquemine, LA) reported a consistent decline in fugitive HCB air emissions from 74 lbs in 2001 to 19 lbs in 2004.
- DuPont Johnsonville Plant (New Johnsonville, TN) reported a decline in HCB water releases from 160 lbs in 2000 to 1 lb in 2004.

- Solutia Inc. Delaware Riverplant (Bridgeport, NJ) reported reductions in fugitive HCB air emissions from 42 lbs in 2000 to 2.5 lbs in 2004.

Canadian Reduction Activities

North American HCB Modeling Project to Look at Long-Range Transport Impacts

- Canada initiated work on developing a national HCB inventory to be used in a long-range transport modeling project. In conjunction with U.S. HCB data, the project will improve the understanding of the major pathways and sources of HCB entering the Great Lakes atmosphere and water bodies.

Ongoing Burn Barrel Subgroup Efforts

- Co-benefits of HCB reduction are gained from the efforts of the Burn Barrel Subgroup of the Dioxin/Furan Workgroup.

Residential Wood Combustion

- Health, fire safety, and wood burning experts conducted 17 *Burn-it-Smart!* workshops in February 2006. This included Wood Energy Technology Transfer (WETT) training, which promotes safe and efficient use of wood burning systems. Four workshops were held in First Nation and tribal communities, nine in rural Ontario, and four in two U.S. border towns (Romeo, Michigan, and Sault Ste. Marie, Michigan). Approximately 220 people attended the workshops.

- EC developed a plan for distributing residential wood combustion educational materials: fact sheets on *Good Firewood, Wood Burning in the City*, and *Don't Burn Garbage,* along with videos on wood stove operation and clean firewood.
- EC provided *Burn-it-Smart!* information at Home Hardware's national sales meetings in St. Jacobs, Ontario. This offered a unique opportunity, as only invited vendors could display their products to Home Hardware retail store representatives for all of Canada. In 2006, EC participated in both the spring and fall meetings. Many retailers visited the *Burn-it-Smart!* display and learned about EPA-certified stoves.

- A DVD, developed by EC, containing three videos (*Advanced Technology Woodstoves - EPA, Firewood Preparation*, and *Woodstove Operation*) has become very popular among retailers and other interest groups. US EPA intends to use parts of these videos to develop additional videos.
- EC produced a brochure to provide First Nations education on wood-burning practices. This brochure became available for distribution in 2006.
- EC entered into a partnership with Puget Sound Clean Air Agency to evaluate emissions from burning Duraflame® wax firelogs and regular cordwood. This work supported the study of wax firelogs conducted by US EPA and provided more information on the burning characteristics of these wax firelogs. The emission factors (in grams per kg of fuel, on a dry basis) of most substances monitored in the study were higher from burning Duraflame® wax firelogs than cordwood.[26] However, the emission rates (grams per hour) of NOx (namely nitrous dioxide), VOCs, CO, respirable particles, total particles, 7-PAHs, 16-PAHs, benzene, and formaldehyde were higher from burning Douglas fir cordwood than from burning Duraflame® wax firelogs.
- EC partnered with the HPBA to conduct a study to evaluate the emission characteristics of five conventional wood stoves. The results are not significantly different than expected and confirm the AP-42 emission factors published by US EPA.
- *Burn-it-Smart!* outreach activities were conducted at the 2006 Spring Cottage Life Show in Toronto and the International Plow Match (IPM) in Peterborough. These shows attract large crowds and different audiences; for example, the IPM show attracted approximately 60,000 people during the four-day event.

- EC and the HPBA of Canada have been working together to gather information on outdoor wood boiler usage in Ontario and other provinces through a survey. Results are expected in 2007.

[26] These include emission factors for particulate matter (PM), PAHs, volatile organic compounds (VOCs), carbon monoxide (CO), and nitrogen oxides (NOx).

Iron & Steel Sector

- Ontario's four integrated steel mills are on track to meet coke oven PAH targets set out in environmental codes of practice, with reductions being achieved through rigorous coke oven battery maintenance and by implementation of innovative battery operating practices and procedures. From a 1988 base year, the sector had reduced B(a)P emissions by approximately 73 percent in 2004.

Ontario Tire Stewardship (OTS) Program

- On December 17, 2004, a proposed *Scrap Tire Diversion Program* was posted on the Ontario MOE's website for public comment. In a speech at the Waste Diversion Ontario annual general meeting on April 20, 2006, the Ontario Minister of the Environment announced that the finalization of a used tire program was being deferred beyond the immediate future.

Great Lakes Basin B(a)P Mapping Project

- EC undertook a Great Lakes Basin B(a)P Mapping project that included adding Ontario local releases to Great Lakes States information to create a Great Lakes Basin map of B(a)P emissions; analyzing sources of B(a)P in high-emitting regions; and comparing emission information with ambient air monitoring data in Ontario. The B(a)P inventories used for the mapping project originated from US EPA's 1999 NEI and EC's 2003 Ontario inventory. Figure 4-5 shows the B(a)P map for the Great Lakes States and the Province of Ontario. Approximately 59,500 lbs (27,000 kg) of B(a)P releases from anthropogenic sources in the Basin were mapped: 30 percent of the releases were from Ontario and 70 percent were from the eight Great Lakes States. The Basin was divided into 280 grid cells (each 100 km by 100 km) using a high-resolution GIS mapping tool. The map shows that five grid cells, with emissions of 1,000 to 2,000 kg/year, are higher than the other cells, with emissions of 10 to 1,000 kg/year. These five grid cells are located in Ontario, Ohio, Illinois, and Indiana. This agrees with the higher ambient B(a)P concentrations detected in the Chicago, Hamilton, and Toronto areas of these Province/States in the past 15 years. The green bars on the map locate the major stations of the IADN and NAPS programs and their 2003 annual average B(a)P concentrations, with the highest B(a)P concentration measured in Chicago. The length of the green bars indicates the relative magnitude of their B(a)P concentrations compared to the concentration measured in Chicago.

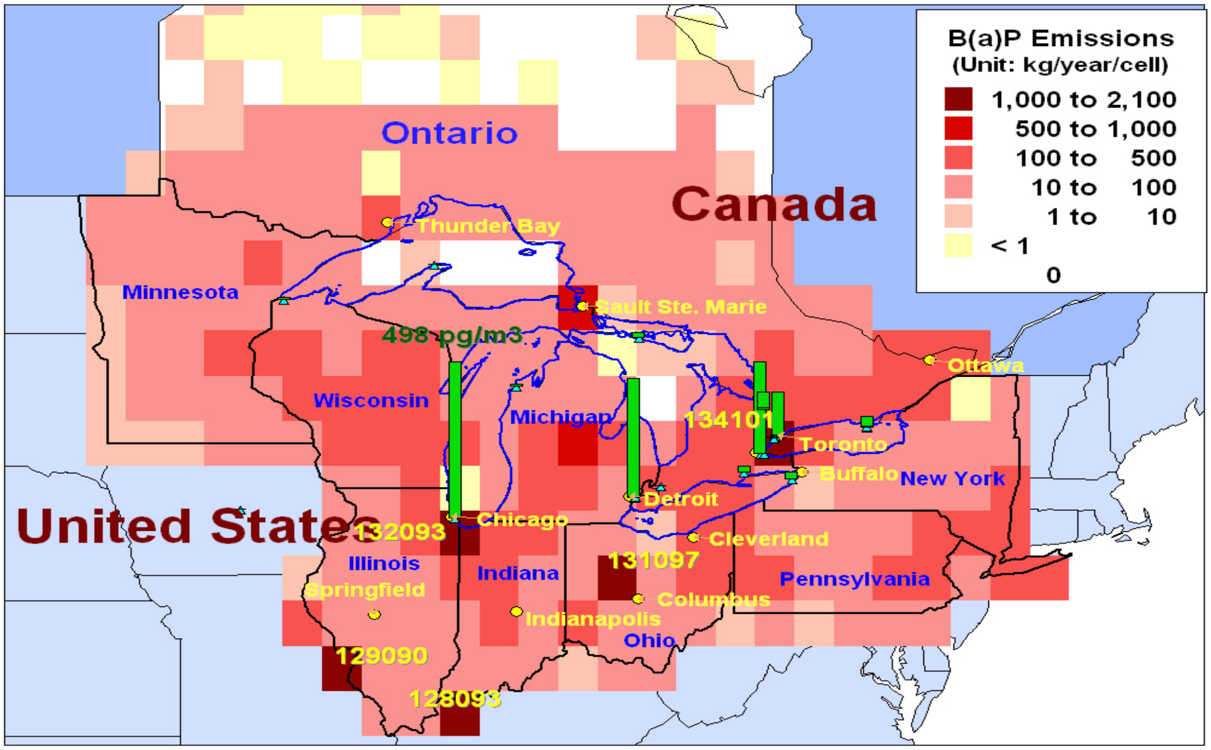


Figure 4-5 . Gridded B(a)P Emissions in the U.S. (1999) and in Ontario (2003). Source: Environment Canada (Environmental Protection Operations Division – Ontario Region), 2006

Improved B(a)P Release Inventory

- EC completed a Mobile 6C Modeling project with Carleton University in 2006. This project improved the PAH emission estimates from Ontario motor vehicles. The approach used in the project is consistent with the approach used to estimate U.S. emissions for the same sector.
- In 2006, EC and the Ontario MOE worked together to resolve differences between their Ontario B(a)P air emission estimates, which are consistent for point sources but require additional reconciliation for area and mobile source emission estimates.

Next Steps

The workgroup will continue ongoing efforts to improve the accuracy of the U.S. and Canadian HCB and B(a)P emission inventories to ensure that all significant emission sources have been identified and included. The focus of the workgroup's inventory efforts include the following source sectors: application of pesticides, use of creosote-treated wood products, use of PCP-treated wood products, residential wood combustion, wastewater releases from sewage treatment plants, and motor vehicles. The workgroup will continue to pursue emission reduction activities from significant B(a)P source sectors, namely:

- Residential Wood Combustion – *Burn it Smart!* initiative, wood stove change-out programs, testing EPA-certified stoves, and planned reduction activities for wood boilers;
- Scrap Tires – *US EPA Best Practices Guidebook* and additional training materials, scrap tire pile mapping, and inventory initiatives.

The workgroup will also support other actions and ideas that impact HCB releases to the Great Lakes Basin, including:

- Actions to reduce releases from HCB-containing pesticides;
- Household Garbage Burning Strategy (Burn Barrel Subgroup of Dioxin/Furan Workgroup);
- Full life-cycle management of PCP-treated wood products;
- Collection of data on HCB levels in the environment;
- Emission inventory and multiple pathways modeling of HCB to the Great Lakes from North American sources; and
- Continued solicitation of voluntary HCB reductions by chemical companies.

The workgroup will consider expanding its scope to track other GLBTS substances closely associated with HCB and B(a)P, namely, chlorobenzenes and PAHs.

5.0 INTEGRATION WORKGROUP

Ten-Year Perspective

During 2005, the GLBTS prepared a summary of overall program reviews of the Level 1 substances and two non-substance-specific GLBTS goals. This summary is presented in Appendix C. In February 2006, the GLBTS presented the summary assessment to the Binational Executive Committee (BEC) along with proposed paths forward for the GLBTS, which included finishing the job of virtually eliminating existing GLBTS Level 1 substances and promoting P2 actions for Level 2 substances; hosting a 10th anniversary workshop in 2007; and exploring a number of roles that the GLBTS could play in the future. The BEC supported a GLBTS 10th anniversary workshop in 2007 and expressed general support for exploring the proposed paths forward for the GLBTS.

Integration Workgroup Meetings

Brief summaries of the Integration Workgroup meetings held over the past year are presented below.

Integration Workgroup Meeting – February 16, 2006, Windsor

The first Integration Workgroup meeting discussed the concept of Green Chemistry and its application. Updates provided at this meeting included: a State of the Lakes Ecosystem Conference (SOLEC) Chemical Integrity Workshop; Great Lakes Regional Collaboration (GLRC) near-term projects; and outcomes of a February 8-9, 2006, Binational Executive Committee (BEC) meeting. The meeting included presentations on GLWQA chemical articles and annexes that relate to persistent toxic substances, an overview of the general process for the GLWQA review, and perspectives on the GLWQA public consultation process. The Integration Workgroup also continued a discussion of the future focus of the GLBTS begun in December 2005.

Presentations at this meeting included:

- *Great Lakes Regional Collaboration Toxic Pollutant Strategy Near-Team Projects* – Ted Smith, US EPA
- *Green Chemistry and the Great Lakes BTS - Exploring Alternatives to Managing Toxic Contamination of the Great Lakes* – Lin Kaatz Chary, representing Great Lakes United
- *SOLEC Chemical Integrity Workshop* – Dale Phenicie, Council of Great Lakes Industries
- *Report out on Binational Executive Committee Meeting Presentation* – Danny Epstein, EC
- *Great Lakes Water Quality Agreement Articles and Annexes Related to Persistent Toxic Substances* – Tricia Mitchell, EC
- *General Process of Great Lakes Water Quality Agreement Review* – Mark Elster, US EPA
    - Public Perspectives – John Gannon and Karen Vigmostad, IJC

- *Follow-through on the Discussion Paper on Future Role of GLBTS* – Ted Smith, US EPA.

Integration Workgroup Meeting – May 18, 2006, Toronto

The focus of second Integration Workgroup meeting was on the human health impacts of toxic substances in the Great Lakes. EC presented information on their review of the Canadian Environmental Protection Act (CEPA) Domestic Substances List. EC also shared information on the GLWQA Review process. The meeting also included a discussion of Green Chemistry and how the principles of Green Chemistry can be applied to reduce releases of toxic substances to the Great Lakes.

Presentations at this meeting included:

- *Canadian Environmental Protection Act Review of Domestic Substances List* – Nicole Davidson, EC
- *Summary Report of Canada-Ontario Agreement (COA) Workshop on New Chemicals* – Julie Schroeder, Ontario Ministry of Environment
- *Great Lakes Human Health Panel*
    - Dr. Heraline Hicks, Agency for Toxic Substances and Disease Registry (ATSDR)
    - Dr. Bruce Newbold, Director of the McMaster Institute of Environment and Health at McMaster University
- *Green Chemistry Panel*
    - *Introduction to Green Chemistry* – Dr. John Warner, Director of the Center for Green Chemistry at the University of Massachusetts, Lowell
    - *Green Chemistry: Systematically Dealing with Toxics* – Dr. Terry Collins, Carnegie Mellon Institute for Green Oxidation Chemistry
    - *Green Chemistry: Our Future Challenges in Chemical Synthesis* – Dr. C.J. Li, McGill University
    - *Tools of Green Chemistry* – Mr. Robert Giraud, DuPont
- *GLWQA Review Update* – Monica Lim, EC.

Integration Workgroup Meeting – September 19, 2006, Chicago

A number of Great Lakes initiatives were discussed at the third Integration Workgroup meeting, including a Mercury Phase-Down Strategy being developed as a result of the GLRC, Great Lakes Cities initiatives, and the GLWQA Review process. A presentation summarizing a Federal Advisory Committee on chemical screening tools was made. The meeting also featured a Traditional Ecological Knowledge panel to share the perspectives and experiences of Indian Tribes.

Presentations at this meeting included:

- *Great Lakes Regional Collaboration Mercury Phase-Down Strategy* – Alexis Cain, US EPA

- *Great Lakes Cities Burn Barrels, Pharmaceuticals, E-Waste Initiatives* – Elizabeth Hinchey Malloy, Illinois/Indiana Sea Grant program
- *Federal Advisory Committee on Screening Chemicals* – Michael Murray, National Wildlife Federation
- *GLWQA Review Update* – Ted Smith, US EPA
- *Traditional Ecological Knowledge Panel*
    - Dr. Dean Jacobs, Chiefs of Ontario
    - Chief Zane Bell, Chief of the Algonquin Woodland Métis Aboriginal Tribe
    - Alesia Maltz, Antioch College.

Integration Workgroup Meeting – December 7, 2006, Chicago

The final meeting of the year for the Integration Workgroup included updates from the co-chairs of the active substance workgroups (mercury, dioxin, PCBs, and HCB/B(a)P) on the previous day's workgroup meetings. The Integration Workgroup heard summary presentations on the Lake Superior Lakewide Management Plan (LaMP) 2005 Chemical Milestones Report, a Michigan Dioxin Exposure Study that analyzed dioxin levels in the residents and environment of the Midland/Saginaw area of Michigan, a PCB software tool for conducting financial analyses of PCB transformer phaseouts, the Canadian Environmental Protection Act (CEPA) Domestic Substances List (DSL) post-categorization, and workshops held at the 2006 SOLEC on Chemical Integrity. The Integration Workgroup also discussed the potential role of the GLBTS in establishing a Great Lakes Green Chemistry network.

Presentations at this meeting included:

- *Substance Workgroup Reports*
    - *PCBs* – Tony Martig, US EPA
    - *Mercury* – Alexis Cain, US EPA
    - *HCB & B(a)P* – Steve Rosenthal, US EPA
    - *Dioxin & Furans* – Anita Wong, EC
- *Lake Superior 2005 Chemical Milestones Report* – Carrie Lohse-Hanson, Minnesota Pollution Control Agency
- *Michigan Dioxin Exposure Study* – David Garabrant, University of Michigan
- *SOLEC Conference Summary*
    - Lin Kaatz Chary, Northwest Indiana Toxics Action Project
    - Melissa Hulting, US EPA
    - Ted Smith, US EPA
- *PCB Software - Financial Analysis of PCB Transformer Phaseouts* – Deborah E. Savage, EMA Research & Information Center
- *Canadian Environmental Protection Act – Domestic Substances List Post-Categorization and Relevance to the GLBTS* – Nicole Davidson, EC.

Stakeholder Forum Highlights 2006

A GLBTS Stakeholder Forum is convened biannually with the purpose of highlighting issues and initiatives of relevance to the Strategy, and to allow the workgroups to meet. Brief summaries of these Stakeholder Forum meetings are presented below.

Stakeholder Forum – May 17, 2006, Toronto

At the first Stakeholder Forum meeting, Cam Davreux, Vice President, CropLife Canada, provided the keynote address. Mr. Davreux described CropLife Canada's stewardship initiatives, including programs for the management of obsolete products and pesticide container recycling. Following Mr. Davreux's presentation, Art Dungan, Chlorine Institute, described mercury reduction accomplishments in the chlor-alkali sector. In May 2006, the chlor-alkali industry submitted its Ninth Annual Progress Report to U.S EPA. The chlor-alkali industry exceeded its commitment to the GLBTS, reducing mercury use by greater than 50 percent since 1990, and the use of mercury per pound of chlorine capacity declined by approximately 90 percent since 1990. The workgroup leaders also reported on progress toward the Strategy challenge goals for mercury, dioxins and furans, PCBs, and HCB/B(a)P.

Stakeholder Forum – December 6, 2006, Chicago

The second Stakeholder Forum meeting of 2006 featured a keynote address by Marta Panero of the New York Academy of Sciences. Ms. Panero, Project Director, described "Industrial Ecology, Pollution Prevention, and the New York/New Jersey Harbor" (the Harbor Project). The Harbor Project seeks to develop pollution prevention strategies for contaminants in the New York/New Jersey Harbor that are similar to the contaminants addressed by the GLBTS.

The workgroup leaders also reported on progress toward the Strategy challenges for mercury, dioxins and furans, PCBs, and HCB/B(a)P. The forum was followed by substance workgroup break-out sessions for mercury, PCBs, dioxins and furans, and HCB/B(a)P.

6.0 SEDIMENTS CHALLENGE

Under the Great Lakes Binational Toxics Strategy, EC and US EPA committed to:

> *"Complete or be well-advanced in remediation of priority sites with contaminated bottom sediments in the Great Lakes Basin by 2006."*

Highlights of sediment assessment and remediation activities undertaken in the U.S. and Canada are described below.

2006 Sediment Assessments with US EPA's *Research Vessel Mudpuppy*

Contaminated sediments are a significant concern in the Great Lakes Basin. Although toxic discharges have been reduced over the past 30 years, high concentrations of contaminants still remain in the sediments of many rivers and harbors. These sediments are of potential risk to the health of aquatic organisms, wildlife, and humans.

To assist in determining the nature and extent of sediment contamination at these polluted sites, US EPA's GLNPO provides the *Research Vessel (R/V) Mudpuppy*. The *R/V Mudpuppy* is a 32-foot-long, flat-bottom boat that is specifically designed for sampling sediment deposits in shallow rivers and harbors. The boat is able to sample at water depths between 2 feet and 50 feet. Using a vibrocoring unit, the *R/V Mudpuppy* can take sediment core samples of up to 15 feet in depth.

To adequately characterize a site, GLNPO uses an integrated sediment assessment approach. This involves collecting data for sediment chemistry, toxicity, and the benthic community at a specific site, and then using the results to determine the extent of contamination that could be impacting the aquatic ecosystem.

Since 1993, the *R/V Mudpuppy* has conducted surveys at 39 locations, including 27 of the 31 Great Lakes Areas of Concern (AOCs) located within the U.S. or shared with Canada. In 2006, the following surveys have been conducted with the assistance of the *R/V Mudpuppy:*

- **Ashtabula River, Ashtabula, OH** – Collected baseline data for GLNPO to generate a pre-dredging characterization of Ashtabula River sediments by evaluating sediment chemistry, toxicity, and bioaccumulation potential.

- **Trenton Channel, Trenton, MI** – Assisted US EPA with sampling to investigate the nature and extent of contamination at two US Steel sites on the Detroit River.

- **Saginaw River, Saginaw, MI** – Assisted the Michigan Department of Environmental Quality (MDEQ) with sampling to characterize the visual distribution of strata in sediments of the Saginaw River.

- **Muskegon Lake, Muskegon, MI** – Assisted MDEQ with sampling to determine the extent and magnitude of sediment contamination near the Division Street Outfall.

- **St. Louis River, Superior, WI** – Conducted a sediment thickness survey in support of a Great Lakes Legacy Act project to determine sediment depositional areas for future sampling.

- **Indiana Harbor, East Chicago, IN** – Collected samples to support university-sponsored research to evaluate the existing PCB partitioning between air, water, and sediment matrices and assisted U.S. Army Corps of Engineers with sampling to investigate sediment contamination.

- **Grassy Island, Detroit River, MI** – Assisted the US Fish and Wildlife Service and USGS with sampling to determine the magnitude of the sediment contamination adjacent to Grassy Island.

- **Lake Macatawa, Holland, MI** – Assisted MDEQ with sampling to determine the extent and magnitude of sediment contamination in Lake Macatawa.

- **Milwaukee Harbor, Milwaukee, WI** – Assisted University of Wisconsin-Milwaukee and University of Washington researchers with sampling to field-test innovative sampling equipment, which utilizes x-ray spectroscopy to assess and quantify metals concentrations.

Great Lakes Sediment Remediation Projects - 2005[27]

In 2005, over 400,000 cubic yards of contaminated sediment were remediated from nine U.S. sites in the Great Lakes Basin. Three of these sites were Great Lakes Legacy Act sediment remediation projects. Of the three, two of these sites initiated work for the first time in 2005 (Newton Creek/Hog Island Inlet and Ruddiman Creek), and two of these sites completed their remedial actions in 2005 (Black Lagoon and Newton Creek/Hog Island Inlet). Three US EPA Superfund sites made significant progress towards completing their remedial actions. The Alcoa Grasse River Superfund site completed a Remedial Options Pilot Study. This pilot evaluated dredging, thin layered capping, and armored capping.

While no remedial actions were conducted in Canada in 2005, significant progress was made on further sediment investigations and evaluations.

U.S. Report

National Sediment Remediation Guidance Issued

In December 2005, US EPA's Office of Solid Waste and Emergency Response issued the final *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*. The guidance is designed to assist US EPA staff managing sediment sites by providing a thorough overview of

[27] Sediment remediation data for 2005 are presented because data lag a year behind in reporting (i.e., 2006 data will become available in 2007).

methods that can be used to reduce risk caused by contaminated sediment. The guidance is written primarily for Superfund and Resource Conservation and Recovery Act (RCRA) project managers, including those in other federal agencies and states. Many aspects of the guidance may also be useful to other governmental organizations and potentially responsible parties that may be conducting a sediment cleanup (even when conducted under different regulatory authorities).

In general, the guidance focuses on how to evaluate alternative remedies for contaminated sediment, including the three major alternatives of monitored natural recovery, in-situ capping, and dredging. Aspects related to site characterization, risk assessment, modeling, and monitoring of contaminated sediment sites are also addressed. The guidance encourages project managers to consider a number of factors during cleanup of contaminated sediment, such as:

- Identifying and controlling the sources of sediment contamination and identifying the pathways of contaminant exposure, prior to cleanup;
- Using a technical team approach and involving the community and other stakeholders throughout the cleanup process;
- Considering all three major approaches to management of contaminated sediment (monitored natural recovery, in-situ capping, and dredging) and considering alternatives which combine approaches;
- Validating models used to support sediment decisions and considering model uncertainty and sensitivity;
- Considering how contaminated sediment alternatives manage or reduce risks, including consideration of residual risks; and
- Monitoring the effectiveness of remedies at contaminated sediment sites.

The final guidance may be found at:
http://www.epa.gov/superfund/resources/sediment/guidance.htm.

Remediation Update

The following is a list of details relating to remediation sites in the U.S. Great Lakes Basin.

Newton Creek/Hog Island Inlet, Wisconsin – This remedial action resulted from a Great Lakes Legacy Act project jointly funded by US EPA GLNPO and the Wisconsin Department of Natural Resources (WDNR). PAHs and lead drove the cleanup at this site, and the cleanup goal set for PAHs was 2.6 ppm total PAHs. Approximately 46,288 cubic yards were removed by dry excavation and disposed of in a local landfill. Sediments with concentrations above 50 ppm lead were disposed of in the landfill, and sediments with lead levels below 50 ppm were used as cover at the landfill.

Lower Fox River and Green Bay, Wisconsin, Operable Unit (OU) 1 – The joint Superfund and Natural Resource Damage Assessment (NRDA) OU-1 (Little Lake Butte des Morts) project is in its second year of cleanup of the Lower Fox River and Green Bay site. Approximately 88,000 cubic yards of PCB-contaminated sediment were removed and disposed of in a state-licensed landfill. A spud barge with swinging ladder dredge was used to remove the sediments.

Sediments were successfully dewatered using geotubes. The OU-1 project has a 1 ppm action level for PCBs and a surface weighted average concentration (SWAC) standard of 0.25 ppm. If these risk standards are not met, the contractor has the option of dredging more sediment or placing a sand cover over the area.

Hayton Area Remediation Project, Wisconsin – The Hayton Area Remediation Project (HARP) is a PCB-contaminated site on Hayton Mill Pond and its tributaries near Chilton, Wisconsin. Since 2001, Tecumseh Products Company, with WDNR oversight and a small financial contribution from the State and US EPA, has removed approximately 16,300 cubic yards and 1,180 kg of PCBs in OU-1 and upper OU-2. In 2005, approximately 1,100 cubic yards of contaminated sediment were removed from the downstream end of upper OU-2. Contaminated sediments were removed by dry excavation to achieve a cleanup target of 1 ppm PCBs. Sediments with concentrations at 50 ppm PCBs or greater were transported to a Toxic Substances Control Act (TSCA) landfill in Oklahoma, and sediment with concentrations less than 50 ppm PCBs were transported to a local landfill. Approximately 60,000 cubic yards remain in lower OU-2, OU-3, and OU-4.

Moss-American, Wisconsin – Moss-American is a US EPA Superfund National Priorities List (NPL) site in Milwaukee, Wisconsin. The primary sediment contaminants of concern are PAHs from former creosote activity. Remediation was conducted to execute the provisions of a 1990 Record of Decision, which called for several phases of work at the Moss-American site; one of which was sediment management work. A site-specific cleanup goal is 15 mg/kg carcinogenic PAH. Approximately 5 miles of the Little Menomonee River downstream of the former creosote facility were believed to have been contaminated. Stream segment 1 underwent remediation in 2002 and 2003; during 2004, stream segments 2 and 3 were remediated. From November to December 2005, approximately 3,400 cubic yards of sediment were dredged from Segment 4 and transported from the Moss-American site to the Peoria Disposal facility in Peoria, Illinois.

Ruddiman Creek, Michigan – Ruddiman Creek is located within the boundaries of the Muskegon Lake AOC. This Great Lakes Legacy Act project, jointly funded by GLNPO and MDEQ, will remediate Ruddiman Creek sediments contaminated with cadmium, chromium, lead, PCBs, and benzo(a)pyrene at concentrations that exceed site-specific sediment quality criteria for protection of human health and the environment. Approximately 35,900 cubic yards of contaminated sediment were mechanically dredged from the main branch of Ruddiman Creek and Pond. This material was solidified on-site and transported to a Type II landfill in the area. Confirmation samples collected within selected locations of the dredge area will verify that the goals of the project are met. Once the project is completed, MDEQ will work with GLNPO to develop a long-term monitoring program to gauge the overall success of the project.

Velsicol Chemical/Pine River, Michigan – The Velsicol Chemical/Pine River site is an NPL site. US EPA signed a removal action memorandum in 1998 and a Record of Decision in 1999 for the DDT-contaminated Pine River sediments (OU-2 of the site). Sediment removal from the river using dry excavation methods has been ongoing since 1999, first as a Superfund removal action, then as a Superfund remedial action. The removal action addressed a “hot spot” cell in the river and removed sediments with concentrations greater than 3,000 ppm total DDT. The remedial action is addressing sediments contaminated with total DDT at levels greater than 5 ppm. In 2005, approximately 143,000 cubic yards of contaminated sediment and 4,536 kg of DDT were removed and disposed offsite in landfills. It is anticipated that the remedial action will be completed in 2006 with the remediation of an additional 28,000 cubic yards of contaminated sediment.

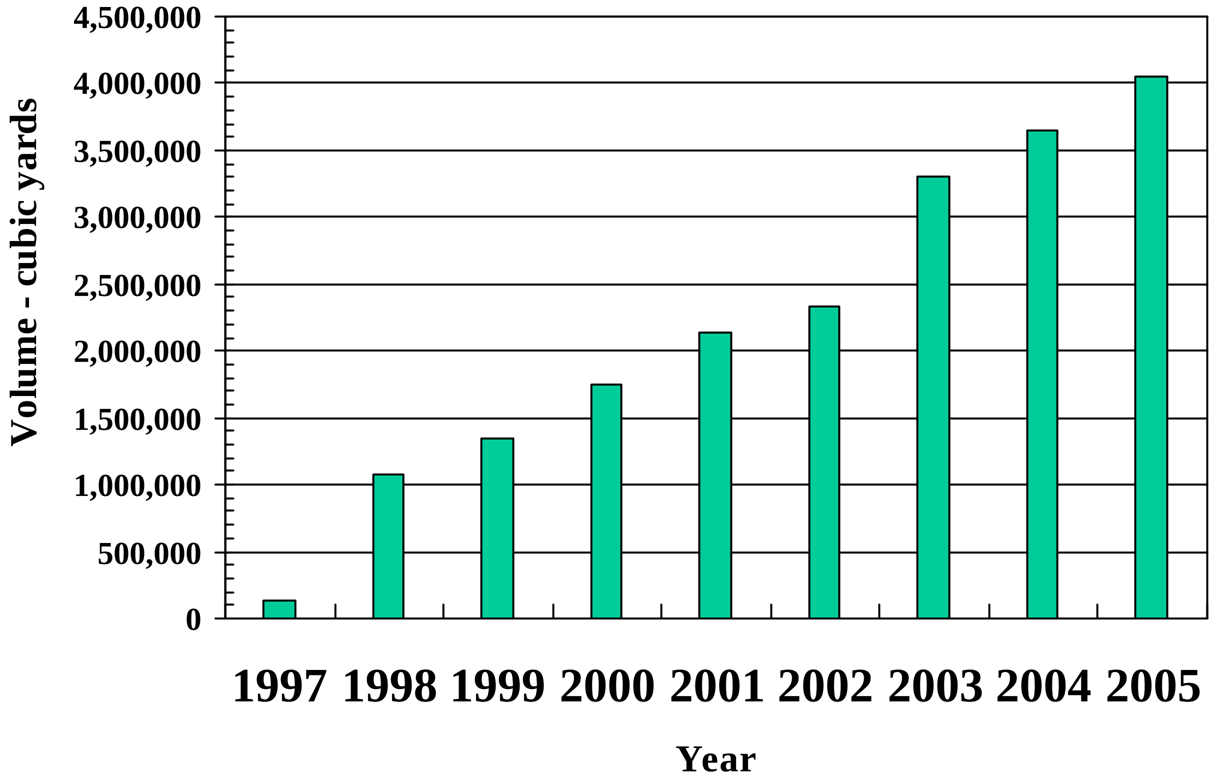
Shiawassee River, Michigan – US EPA Superfund removed 63 cubic yards of PCB-contaminated sediment from the Shiawassee River in Howell, Michigan, to meet the site cleanup target for PCBs of 5 ppm for river sediments. This action resulted in a surface-weighted average concentration of 1 ppm immediately after remediation. Longer term recovery will result in lower concentrations. Over the next two years, MDEQ expects to remediate an additional 5,000 cubic yards of contaminated sediment to a site-specific cleanup target of 0.33 ppm total PCBs and dispose of the sediment in a landfill.

Detroit River, Trenton Channel, Black Lagoon, Michigan – The Black Lagoon is located within the Trenton Channel of the Detroit River, part of the Detroit River AOC. This cleanup was the result of a two-year Great Lakes Legacy Act project jointly funded by GLNPO and MDEQ. PCBs, oil and grease, and heavy metals, including mercury, were the contaminants of concern. In 2005, approximately 60,000 cubic yards of the contaminated sediment were dredged from the Black Lagoon, a layer of sand and gravel was placed over the affected area, and sediments were disposed of in the Pointe Mouille Confined Disposal Facility. A post-remediation study is planned to verify that all site-specific criteria have been met and to measure the success of the remediation.

Alcoa Grasse River, New York, Remedial Options Pilot Study – Alcoa Inc., with oversight from US EPA, conducted a Remedial Options Pilot Study (ROPS) during 2005 for a stretch of the lower Grasse River near its Massena West Plant in Massena, New York. The primary objectives of the ROPS were to evaluate remedial options; develop site-specific information to address outstanding issues regarding remedy effectiveness and remedy implementation to support future decision making related to the final remedy for the site; and consequently make progress towards the overall remediation of PCBs. Approximately 24,400 cubic yards of sediment were dredged out of the main channel area using a hydraulic horizontal auger, and 1,600 cubic yards of sediment were mechanically excavated from the northern near-shore area. All material removed from the river was disposed in Cell 3 of Alcoa's Secure Landfill. The ROPS also included placement of a thin-layer cap in the southern near-shore area and implementation of a one acre armored cap designed to withstand the forces of an ice jam-related scour event.

Presque Isle Bay, Pennsylvania – [*placeholder for summary*].

Figure 6-1 presents the cumulative volume of sediment remediated in the U.S. Great Lakes Basin since 1997. Information in the bar graph includes quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the *Great Lakes Sediment Remediation Project Summary Support*, Quality Assurance Project Plan.[28] Detailed project information is available upon request from project managers.



Information included in Figure 6-1 is quantitative as reported by project managers. No attempt has been made to evaluate chemical data quality or verify calculations of mass removed.

Figure 6-1. Cumulative Volume of Sediment Remediated in the U.S. Great Lakes Basin Since 1997. Source: US EPA – Great Lakes National Program Office[29]

[28] US EPA Great Lakes National Program Office. 2006. Quality Assurance Project Plan for "Great Lakes Sediment Remediation Project Summary Support." Unpublished. Available from Mary Beth G. Ross (ross.marybeth@epa.gov).

[29] US EPA Great Lakes National Program Office. 2006. Quality Assurance Project Plan for "Great Lakes Sediment Remediation Project Summary Support." Unpublished. Available from Mary Beth G. Ross (ross.marybeth@epa.gov).

Canadian Report

Sediment Remediation Policy

Decision-Making Framework for Contaminated Sediments – A risk-based decision-making framework for contaminated sediments has been completed under the *Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem* (COA). Agency reviews have been completed, and the final document has been placed on the Province of Ontario Environmental Registry for the public comment period November 21, 2006, to January 20, 2007. Using the COA framework to evaluate the need for management actions, sediment assessments were completed in the Niagara River, Peninsula Harbour, and Thunder Bay AOCs. The Bay of Quinte, Wheatley Harbour, Detroit River, St. Clair River, and St. Marys River AOCs are still under evaluation and will have assessments completed by 2007.

Remediation Update

The following is a list of details relating to remediation sites in the Canadian Great Lakes Basin.

St. Lawrence River (Cornwall) – Investigations on mercury contaminant levels and distribution, benthic community impairment, sediment toxicity, and bioaccumulation/ biomagnification potential were employed in a Canada-Ontario risk-based decision-making framework for contaminated sediments. It was concluded that the mercury contaminated sediments posed no risk to the aquatic environment; they will be left in place for natural recovery. A seven-party administrative controls protocol has been developed with stakeholder involvement to ensure that the deeper sediments remain undisturbed by human activities.

Hamilton Harbour (Randle Reef) – Work on project feasibility and engineering is continuing for PAH contaminated sediments at the Randle Reef, with completion scheduled for 2007. A dry cap engineered containment facility about 9.5 hectares in size has been proposed to cover 130,000 cubic metres of sediments *in-situ* and contain 500,000 cubic metres of contaminated sediment dredged from the impacted area surrounding the facility.

Thunder Bay (North Harbour) – Assessments of mercury bioaccumulation and organic enrichment continued at this site in 2005. The technical assessments are being used as the basis for consultations with local stakeholders to determine the need to assess sediment management options.

Peninsula Harbour – Assessments of mercury bioaccumulation at this site continued in 2005. An ecological risk assessment was started in the fall of 2006 and will be completed in 2007 to determine the need for sediment management intervention.

St. Marys River (Bellevue Marine Park and Algoma Boat Slip) – Algoma Steel Inc. completed an assessment of PAH contaminated sediment in its boat slip during 2005. The dredging and disposal on-site of 4,000 to 4,400 cubic metres of sediment began in 2006 and will be completed in 2007. Further assessments of sediment contamination at the Bellevue Marine

Park location were initiated in the fall of 2006 to determine the cause of site-specific toxicity and the need for sediment management.

Bay of Quinte (Trent River) – Elevated levels of dioxins and furans were found in sediments at the mouth of the Trent River in 2004-2005. A human health risk assessment was completed in 2006, and an ecological risk assessment is planned for 2007 to assess the significance of the findings and the need for sediment management interventions. Source trackdown is ongoing at this site.

Supporting Table and Graphics

Table 6-1 reports progress on sediment remediation projects at both AOCs and non-AOCs in the U.S. and Canada, from 1997 through 2005. Efforts were not made to quantify the amount of contaminants removed at all sites. The absence of data for some sites in Table 6-1 does not necessarily indicate that contaminants were not present at those sites. The maps on the following pages illustrate the progress and achievements made in sediment remediation activities in the Great Lakes Basin from 1997 through 2005. Information included in the tables and maps are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the *Great Lakes Sediment Remediation Project Summary Support* Quality Assurance Project Plan. Detailed project information is available upon request from project managers. On occasion, project managers may submit to GLNPO updated sediment remediation estimates on projects previously reported on. Always refer to the most current version of the GLBTS Progress Report for the most up-to-date sediment remediation estimates.

Table 6-1. Progress on Sediment Remediation in the Great Lakes since 1997*

Site/AOC/non-AOC (*)	Cumulative Mass of Contaminant Remediated (kg)												Cumulative Volume Sediments Remediated 1997 thru 2005 (cy)	Volume Sediments Remediated 2005 (cy)	Ultimate Disposition
	aldrin/ dieldrin	benzo(a) pyrene	chlordane	DDT (+DDE/DDD)	hexachloro benzene	alkyl-lead	mercury & compounds	mirex	octachloro styrene	PCBs	Dioxins and Furans	toxaphene			
U.S. Sites															
Alma Iron and Metal/Smith Farms Property*													15,904		Encapsulated on-site
Ashtabula River, OH															
Black River-S. Branch, MI*															
Black River, OH															
Black River, MI* - CR 681													25,000		Landfilled
Buffalo River, NY															
Clinton River, MI															
Cuyahoga River, OH															
Deer Lake - Carp River, MI															
Detroit River, MI - Monguagon Creek - Black Lagoon													**140,000** 25,000 115,000	60,000	Confined Disposal Facility
Eighteenmile Creek, NY															
Fields Brook Superfund, OH*													53,094		Landfilled
Fox River, Green Bay, WI - Deposit 56/57 - Deposit N - OU 1										**459** 950 51 18			**192,500** 80,300 7,200 105,000	88,000	Landfilled Landfilled
Grand Calumet, IN - U.S. Steel/Gary Works - U.S.S. Lead							369			7,193	.03		**812,200** 802,200 10,000		Corrective Action Mgmt. Unit Corrective Action Mgmt. Unit
Kalamazoo River, MI - Bryant Mill Pond										10,000			150,000		Landfilled
Manistee Lake, MI*															
Manistique River, MI										4,771			186,162		Landfilled

Table 6-1. Progress on Sediment Remediation in the Great Lakes since 1997*

Site/AOC/non-AOC (*)	Cumulative Mass of Contaminant Remediated (kg)												Cumulative Volume Sediments Remediated 1997 thru 2005 (cy)	Volume Sediments Remediated 2005 (cy)	Ultimate Disposition
	aldrin/ dieldrin	benzo(a) pyrene	chlordane	DDT (+DDE/DDD)	hexachloro benzene	alkyl-lead	mercury & compounds	mirex	octachloro styrene	PCBs	Dioxins and Furans	toxaphene			
Manitowoc River, WI* - HARP										1,180			17,400	1,100	Off-site TSCA facility and landfilled
Maumee River, OH - Fraleigh Creek (Unnamed Tributary)										25,400			8,000		Landfilled
Menominee River, MI/WI - Ansul Eighth Street Slip													13,000		Landfilled/ awaiting further management
Milwaukee Harbor, WI - North Ave. Dam - Moss American													**29,960** 8,000 21,960	 3,400	 Landfilled Landfilled
Muskegon Lake, MI - Ruddiman Creek													35,900	35,900	Landfilled
National Gypsum* - Alpena, MI															
Niagara River, NY - Scajaquada Creek - Buffalo Color - Area D - Gill Creek - Cherry Farm/River Road - Niagara Transformer													**130,870** 17,500 45,000 14,870 42,000 11,500		Landfilled/ capped
Paw Paw River, MI* - Aircraft Components													349		Landfilled
Pine River, MI* - Velsicol Chemical SF Site - TPI Petroleum, Inc.				330,215									**735,201** 687,100 48,101	 143,000	 Landfilled Landfilled
Presque Isle Bay, PA															

Table 6-1. Progress on Sediment Remediation in the Great Lakes since 1997*

Site/AOC/non-AOC (*)	Cumulative Mass of Contaminant Remediated (kg)												Cumulative Volume Sediments Remediated 1997 thru 2005 (cy)	Volume Sediments Remediated 2005 (cy)	Ultimate Disposition
	aldrin/ dieldrin	benzo(a) pyrene	chlordane	DDT (+DDE/DDD)	hexachloro benzene	alkyl-lead	mercury & compounds	mirex	octachloro styrene	PCBs	Dioxins and Furans	toxaphene			
River Raisin, MI - Ford Monroe Outfall - Consolidated Packaging Corporation										16,795			**57,000** 27,000 30,000		On-site TSCA facility sanitary landfill & TSCA landfill
Rochester Embayment, NY															
Rouge River, MI - Evan's Product Ditch - Newburgh Lake										**250,000** 4,000 246,000			**406,900** 6,900 400,000		Off-site TSCA facility and landfilled
Saginaw River/Bay, MI										4,500			342,433		Off-shore Confined Disposal Facility
Sheboygan Harbor, WI															
Shiawassee River, MI*													63	63	Landfilled
St. Clair River, MI															
St. Lawrence River, NY - Reynolds Metals/Alcoa E. - Alcoa Grasse River ROPS										10,000			**112,000** 86,000 26,000	26,000	Landfilled/ capped Landfilled
St. Louis River/Bay, MN/WI - Newton Creek/Hog Island Inlet - Interlake/Duluth Tar													**121,143** 52,143 69,000	46,288	Landfilled Capped
St. Marys River, MI													3,000		Landfilled
Ten Mile Storm Drain* - St. Clair Shores, MI													18,500		Landfilled
Torch Lake, MI															
Waukegan Harbor, IL															
Waxdale Creek, WI*															

Table 6-1. Progress on Sediment Remediation in the Great Lakes since 1997*

White Lake, MI - Tannery Bay - Occidental Chemical Corp.					495†					495†			**105,500** 95,000 10,500		 Landfilled Landfilled
Willow Run Creek, MI*										200,000			450,000		On-site TSCA facility
Wolf Creek - Unnamed Tributary, MI*													1,948		Landfilled
TOTALS				**330,215**	**495†**		**369**			**530,793†**	**0.03**		**4,164,027**	**403,751**	

† Mass displayed is the combined total of PCBs and HCB

Information included in the matrix are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the "Great Lakes Sediment Remediation Project Summary Support" Quality Assurance Project Plan (GLNPO, March 2006). Detailed project information is available upon request from project managers.

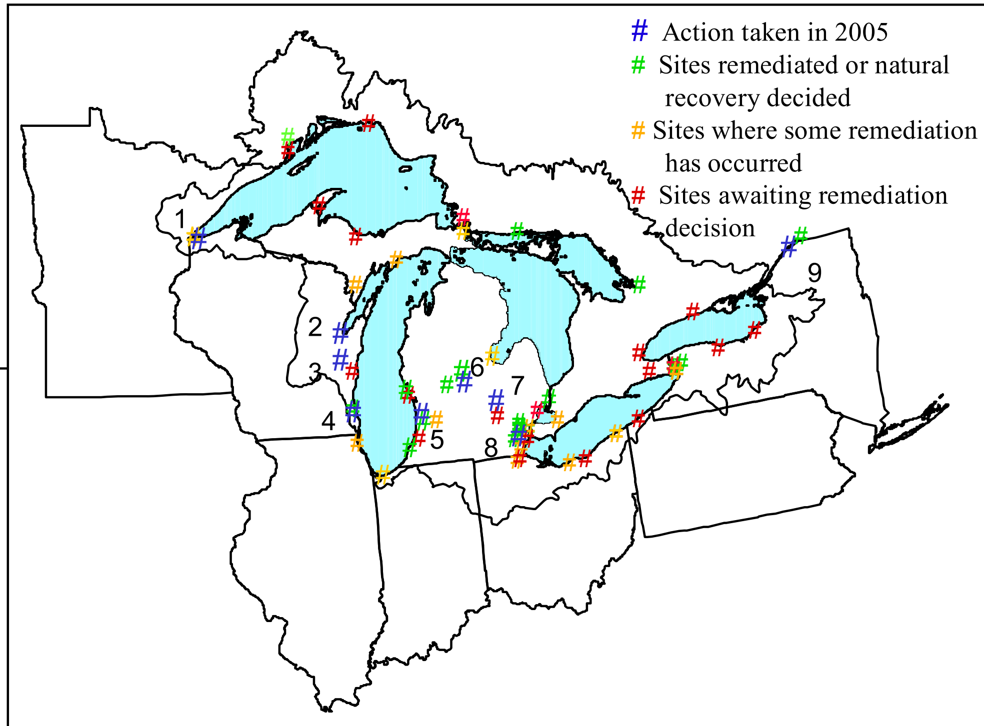
Table 6-1. Progress on Sediment Remediation in the Great Lakes since 1997*

Site/AOC/non-AOC	Cumulative Mass of Contaminant Remediated (kg)												Cumulative Volume Sediments Remediated 1997 thru 2005 (cm)	Volume Sediments Remediated 2005 (cm)	Ultimate Disposition
	aldrin/ dieldrin	benzo(a) pyrene	chlordane	DDT (+DDE/DDD)	hexachloro benzene	alkyl-lead	mercury & compounds	mirex	octachloro styrene	PCBs	Dioxins and Furans	toxaphene			
Canadian Sites															
Thunder Bay - Northern Wood Preservers		2,700											11,000 21,000		Thermal treatment Berm enclosure & capped
Nipigon Bay															
Jackfish Bay															
Peninsula Harbour															
St. Marys River															
Spanish River															
Severn Sound															
St. Clair River							19.3						13,690		Landfilled
Detroit River															
Wheatley Harbour															
Niagara River (Ontario)															
Hamilton Harbour															
Metro Toronto															
Port Hope															
Bay of Quinte															
St. Lawrence River (Cornwall, Ontario)															
TOTALS		**2,700**					**19.3**						**45,690**		

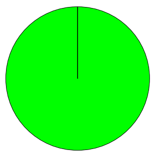
Information included in the matrix are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the "Great Lakes Sediment Remediation Project Summary Support" Quality Assurance Project Plan (GLNPO, March 2006). Detailed project information is available upon request from project managers.

Great Lakes Sediment Remediations in 2005*

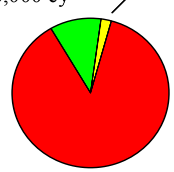
*Information included in the pie charts are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the "Great Lakes Sediment Remediation Project Summary Support" Quality Assurance Project Plan (GLNPO, March 2006). Detailed project information is available upon request from project managers.



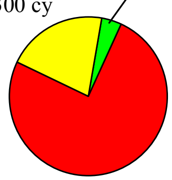
1. Newton Creek / Hog Island Inlet
Superior, Wisconsin



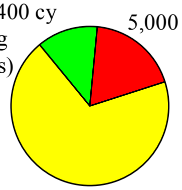
2. Lower Fox River & Green Bay, OU1 – Wisconsin



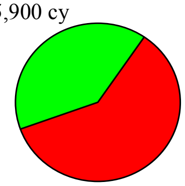
3. Hayton Area Remediation Project
Wisconsin



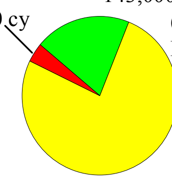
4. Moss-American
Milwaukee, Wisconsin



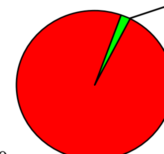
5. Ruddiman Creek
Muskegon, Michigan



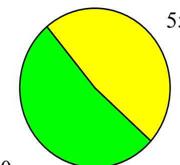
6. Velsicol Chemical
St. Louis, Michigan



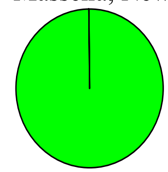
7. Shiawassee River
Howell, Michigan



8. Detroit River, Black Lagoon
Trenton, Michigan



9. Alcoa Grasse River –
Remedial Options Pilot Study
Massena, New York

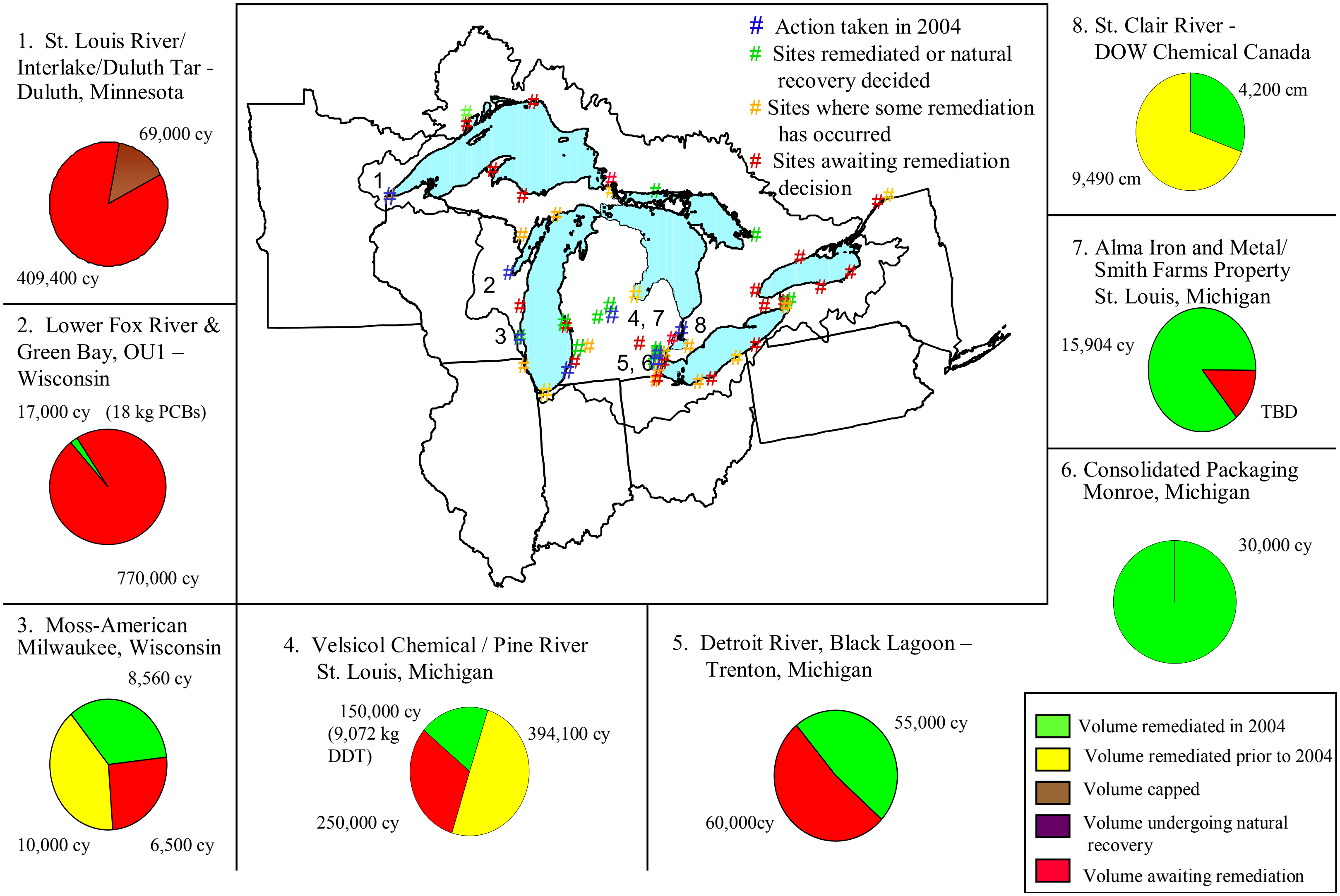


Remedy not yet selected for this site.

- Volume remediated in 2005
- Volume remediated prior to 2005
- Volume capped
- Volume undergoing natural recovery
- Volume awaiting remediation

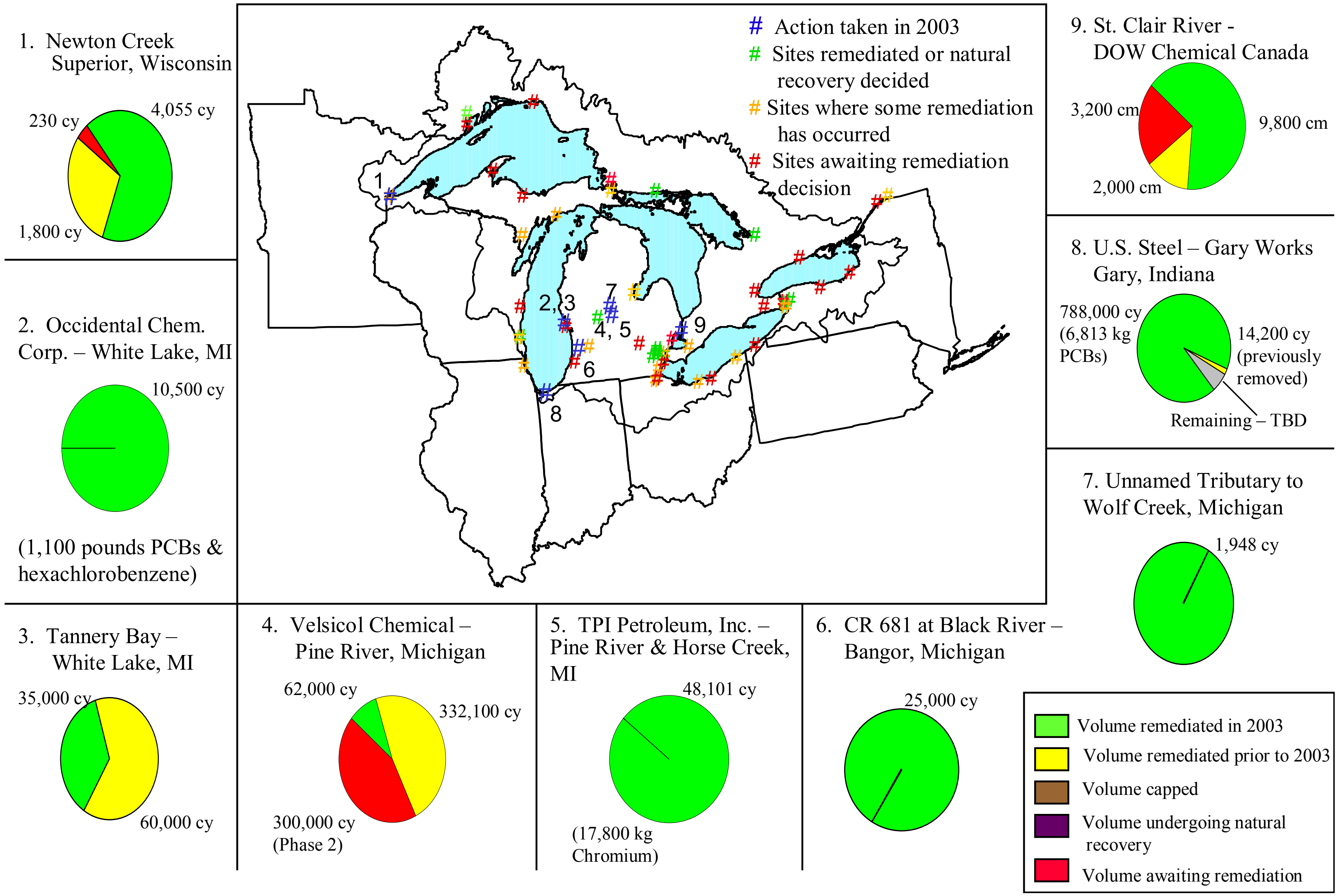
Great Lakes Sediment Remediations in 2004*

*Information included in the pie charts are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the "Great Lakes Sediment Remediation Project Summary Support" Quality Assurance Project Plan (GLNPO, March 2006). Detailed project information is available upon request from project managers.



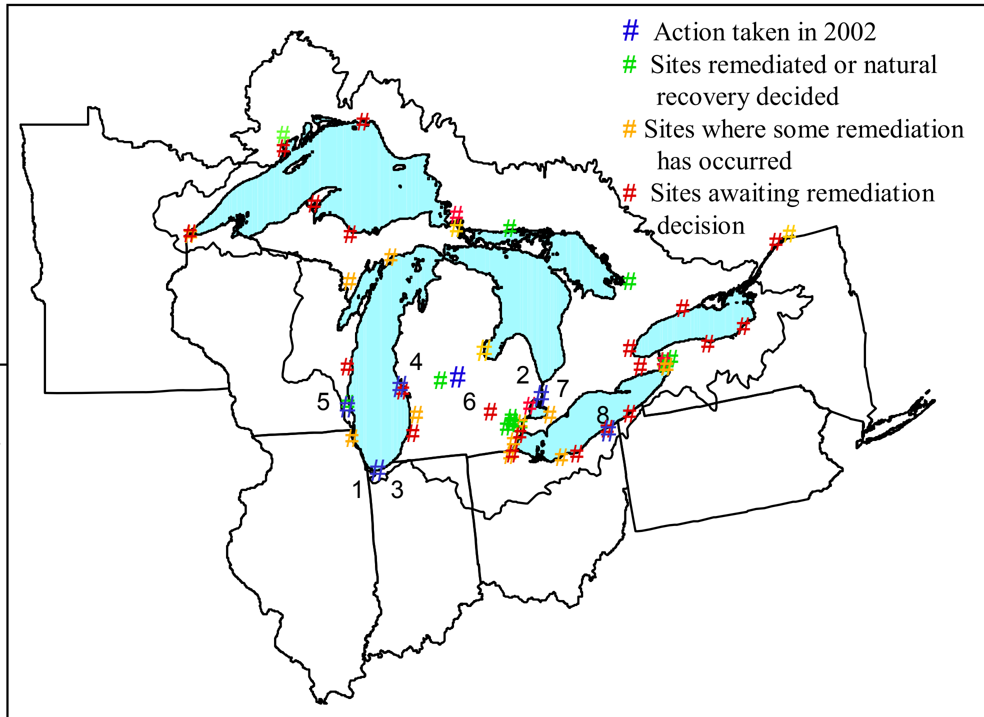
Great Lakes Sediment Remediations in 2003*

*Information included in the pie charts are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the "Great Lakes Sediment Remediation Project Summary Support" Quality Assurance Project Plan (GLNPO, March 2006). Detailed project information is available upon request from project managers.

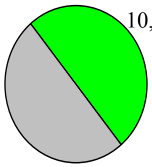


Great Lakes Sediment Remediations in 2002*

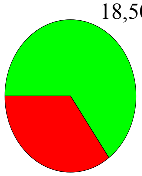
*Information included in the pie charts are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the "Great Lakes Sediment Remediation Project Summary Support" Quality Assurance Project Plan (GLNPO, March 2006). Detailed project information is available upon request from project managers.



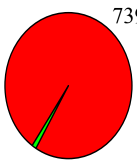
1. U.S.S. Lead Refinery Inc. - East Chicago, IN



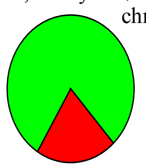
2. Ten Mile Storm Drain - St. Clair Shores, Michigan



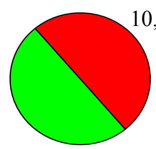
3. U.S. Steel-Gary Works - Gary, Indiana



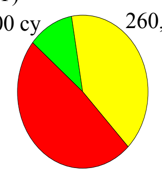
4. Tannery Bay – White Lake, Michigan



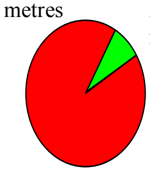
5. Moss American Milwaukee, WI



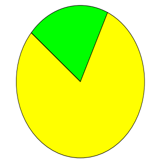
6. Pine River, Michigan



7. St. Clair River - DOW Chemical Canada



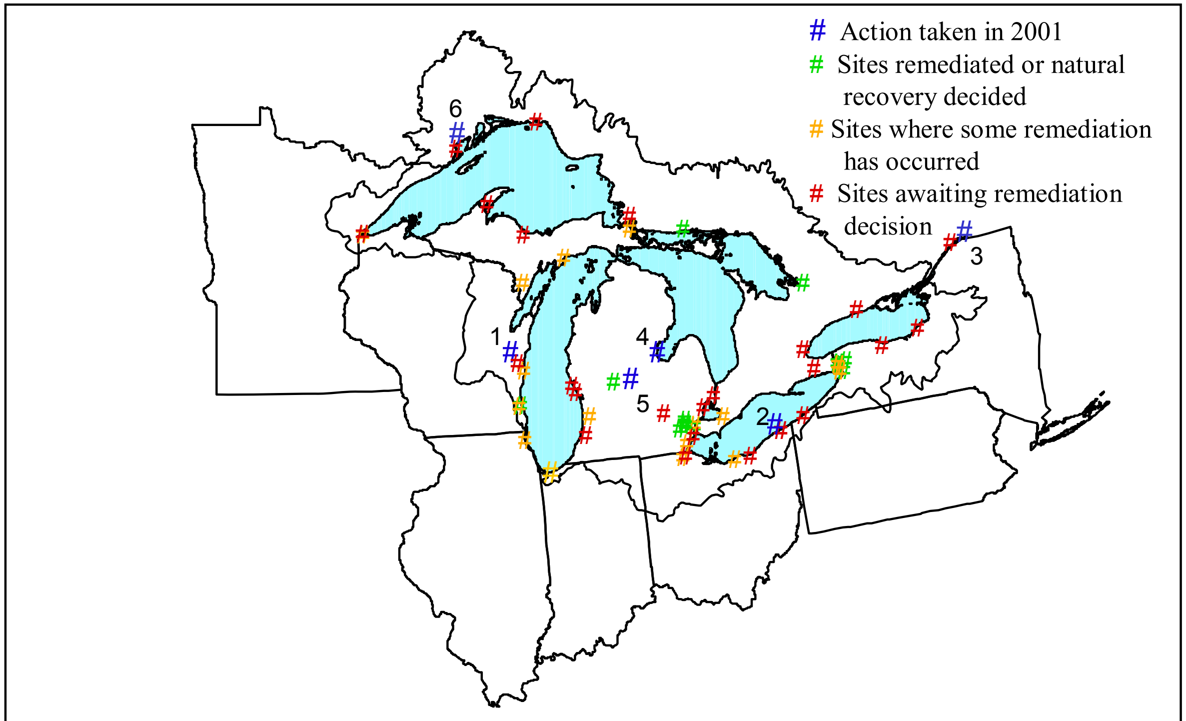
8. Fields Brook Superfund Site – Ashtabula, Ohio



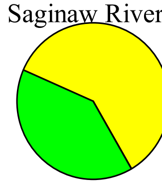
- Volume remediated in 2002
- Volume remediated prior to 2002
- Volume capped
- Volume undergoing natural recovery
- Volume awaiting remediation

Great Lakes Sediment Remediations in 2001*

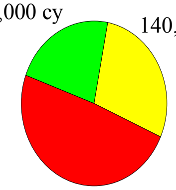
*Information included in the pie charts are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the "Great Lakes Sediment Remediation Project Summary Support" Quality Assurance Project Plan (GLNPO, March 2006). Detailed project information is available upon request from project managers.



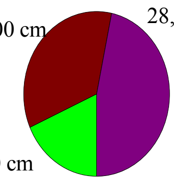
4. Saginaw River & Bay



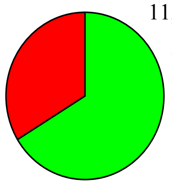
5. Pine River, Michigan



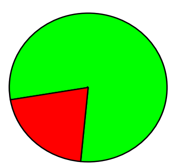
6. Thunder Bay – Northern Wood Preservers, Ontario



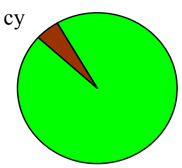
1. Hayton Area Remediation Project - OU1 – Source Abatement, Wisconsin



2. Fields Brook Superfund Site, Ohio



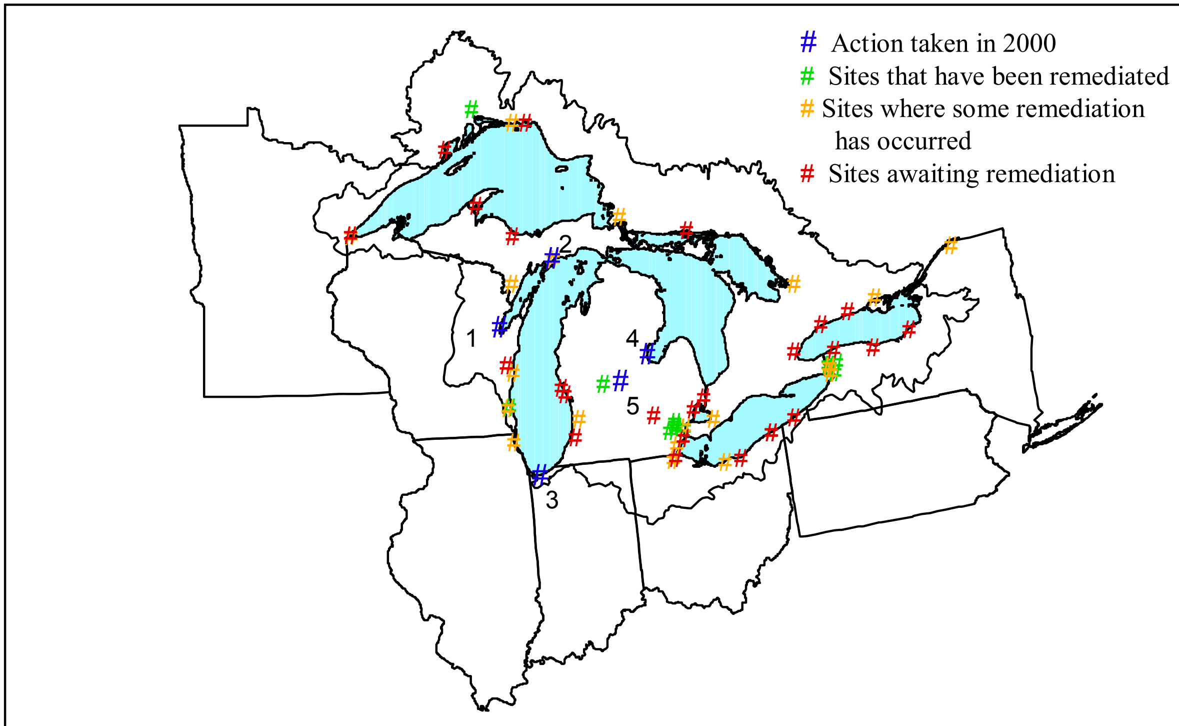
3. Reynolds Metals/Alcoa East St. Lawrence River



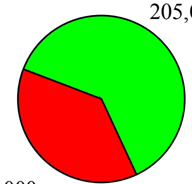
- Volume remediated in 2001
- Volume remediated prior to 2001
- Volume capped
- Volume undergoing natural recovery
- Volume awaiting remediation

Great Lakes Sediment Remediations in 2000*

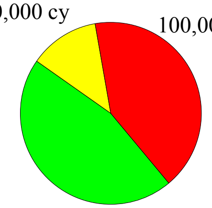
*Information included in the pie charts are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the "Great Lakes Sediment Remediation Project Summary Support" Quality Assurance Project Plan (GLNPO, March 2006). Detailed project information is available upon request from project managers.



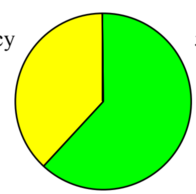
4. Saginaw River & Bay



5. Pine River

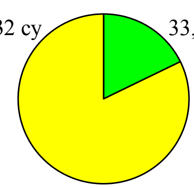


1. Fox River – Deposit 56/57



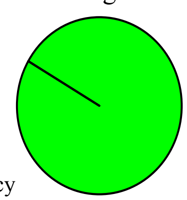
10,900,000 cy total in Fox River

2. Manistique River & Harbor Emergency Removal



(10,600 pounds of PCBs)

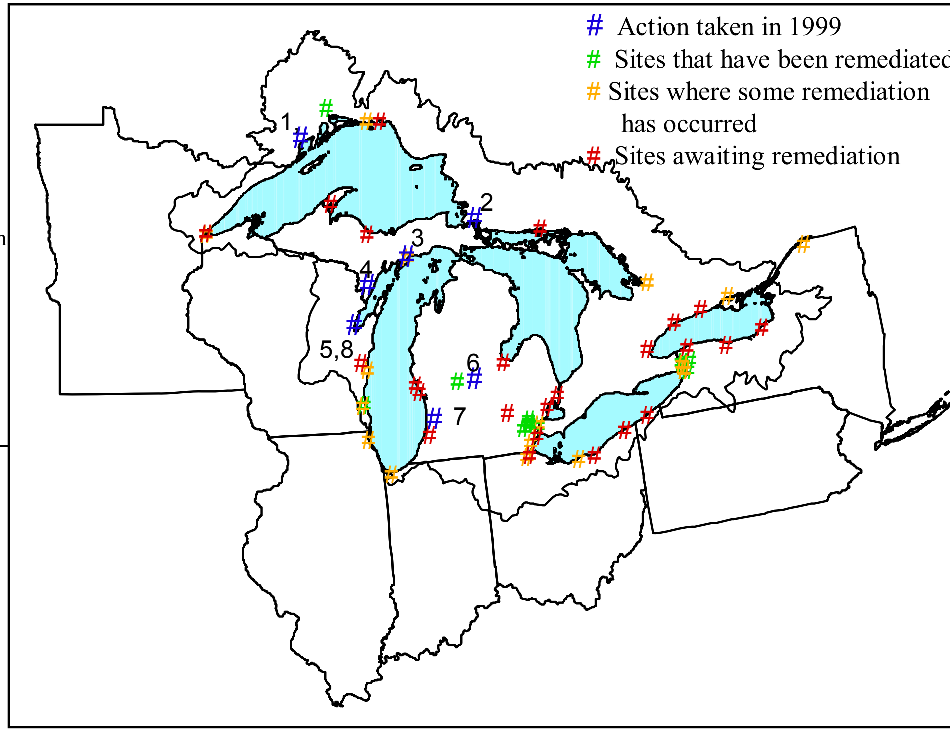
3. USX Vessel Slip Project – Lake Michigan



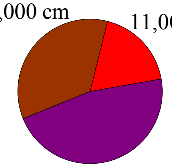
- volume remediated in 2000
- volume remediated prior to 2000
- volume awaiting remediation

Great Lakes Sediment Remediations in 1999*

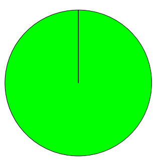
*Information included in the pie charts are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the "Great Lakes Sediment Remediation Project Summary Support" Quality Assurance Project Plan (GLNPO, March 2006). Detailed project information is available upon request from project managers.



1. Thunder Bay – Northern Wood Preservers

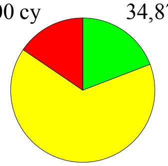


2. St. Marys River

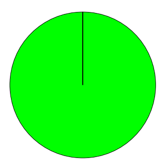


Remainder of contaminated sediments undergoing natural attenuation

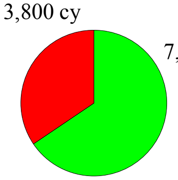
3. Manistique River and Harbor



4. Menominee River - Ansul Eighth Street Slip

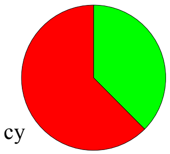


5. Fox River -Deposit N



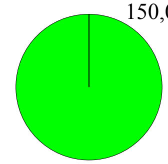
10,900,000 cy total in Fox River

8. Fox River - Deposit 56/57



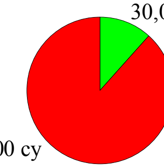
10,900,000 cy total in Fox River

7. Kalamazoo River - Bryant Mill Pond



7,000,000 cy total in Kalamazoo River

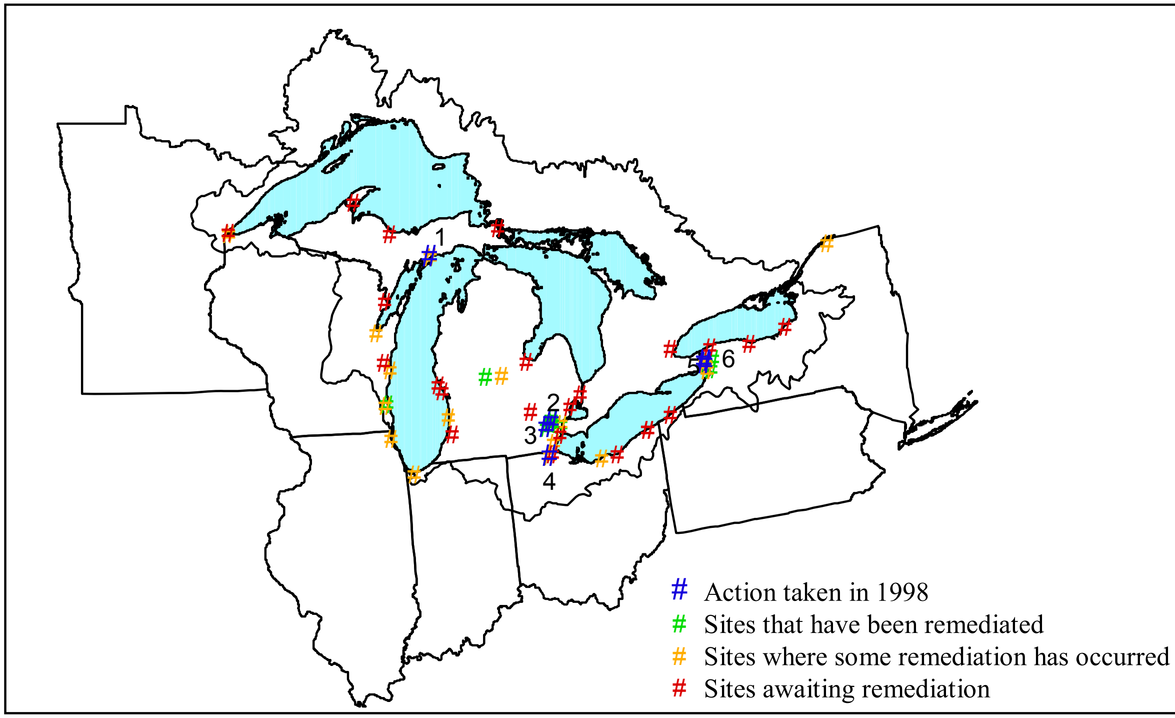
6. Pine River



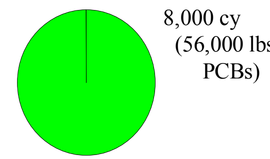
- Volume remediated in 1999
- Volume remediated prior to 1999
- Volume capped
- Volume undergoing natural recovery
- Volume awaiting remediation

Great Lakes Sediment Remediations in 1998*

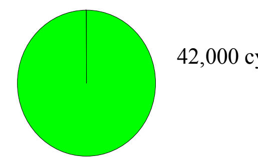
*Information included in the pie charts are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the "Great Lakes Sediment Remediation Project Summary Support" Quality Assurance Project Plan (GLNPO, March 2006). Detailed project information is available upon request from project managers.



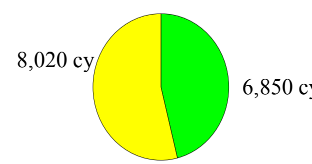
4. Ottawa River - Unnamed Tributary



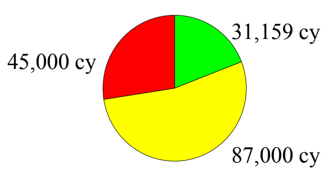
5. Niagara Mohawk - Cherry Farm/River Road



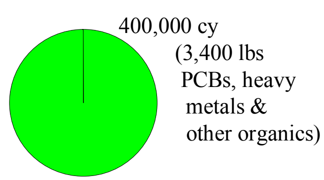
6. Gill Creek



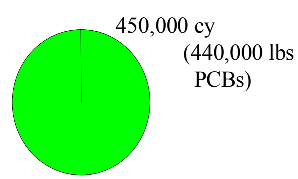
1. Manistique River and Harbor

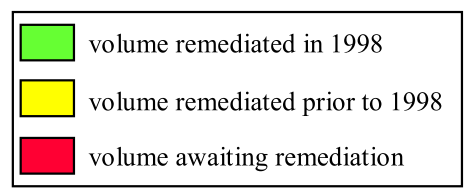


2. Newburgh Lake



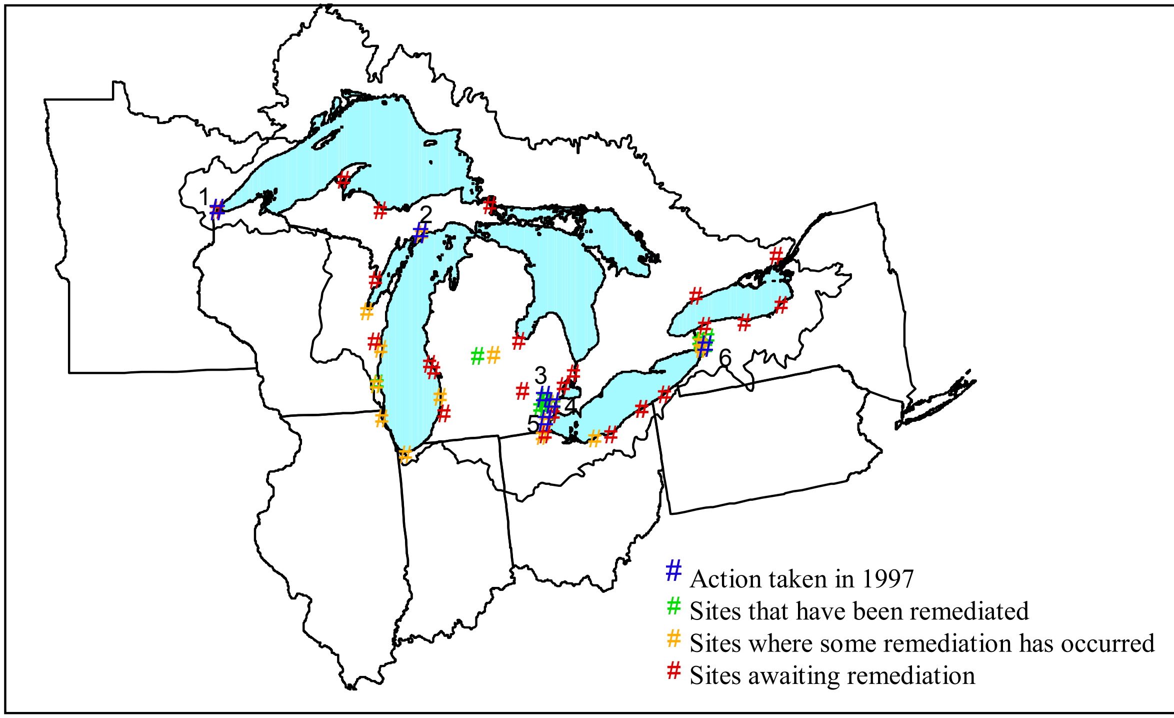
3. Willow Run Creek



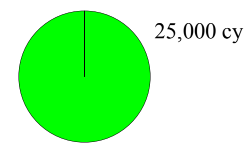


Great Lakes Sediment Remediations in 1997*

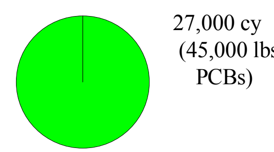
*Information included in the pie charts are quantitative estimates as reported by project managers. Data collection and reporting efforts are described in the "Great Lakes Sediment Remediation Project Summary Support" Quality Assurance Project Plan (GLNPO, March 2006). Detailed project information is available upon request from project managers.



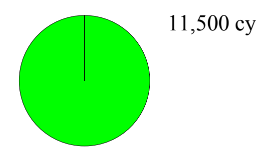
4. Monguagon Creek



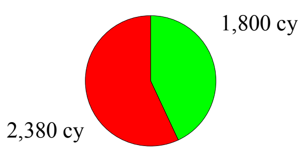
5. River Raisin –
Ford Monroe Outfall



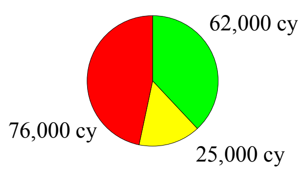
6. Niagara Transformer



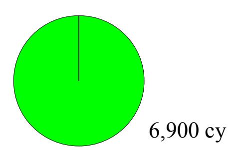
1. Newton Creek/
Hog Island Inlet



2. Manistique River and
Harbor



3. Evans Product Ditch –
Upper Rouge River



- volume remediated in 1997
- volume remediated prior to 1997
- volume awaiting remediation

7.0 LONG-RANGE TRANSPORT CHALLENGE

Canadian Workgroup co-chair: S. Venkatesh
U.S. Workgroup co-chair: Todd Nettesheim

Under the Great Lakes Binational Toxics Strategy, EC and US EPA committed to:

> *"Assess atmospheric inputs of Strategy substances to the Great Lakes. The aim of this effort is to evaluate and report jointly on the contribution and significance of long-range transport of Strategy substances from worldwide sources. If ongoing long-range sources are confirmed, work within international frameworks to reduce releases of such substances."*

The following Canadian and U.S. activities describe efforts undertaken in support of the above challenge.

Canadian Activities

Further Modeling Evidence of Long-Range Transport of Toxaphene from the Southern United States to the Great Lakes Basin

Principal Investigator: Jianmin Ma, Air Quality Research Division, Science and Technology Branch, Environment Canada, Toronto

Extensive use of toxaphene in the southern U.S. from the 1950s through the 1970s and its strong persistence in air has the potential to cause long-range transport of toxaphene from its source region to the Great Lakes, where toxaphene has not been used. Such transport has been reported and demonstrated through air monitoring results and numerical investigations. EC has conducted a further numerical assessment of the long-range transport of toxaphene from the southern U.S. to the Great Lakes to: 1) reveal further evidence of such long-range transport; and 2) explore the significance of the southern U.S. as a major source region for many legacy and currently used pesticides to their fate over the Great Lakes region and the Arctic. In this study, the CanMETOP (Canadian Model for Environmental Transport of Organochlorine Pesticides) was employed and integrated from 1976, the year when the use of toxaphene saw a marked reduction, to 2003 in order to identify a statistically significant relationship between the air concentrations of toxaphene in the southern U.S. and the Great Lakes region.

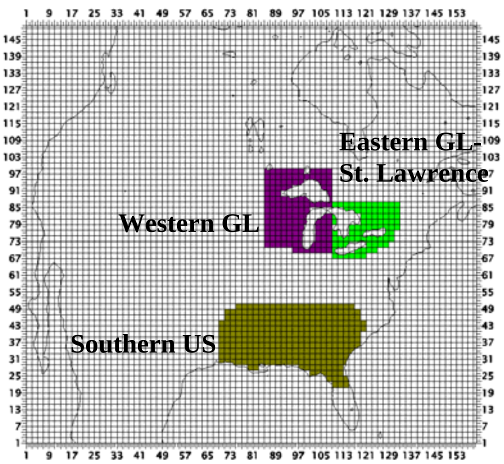


Figure 7-1. Sub-domains in the Southern U.S., Western Great Lakes and Eastern Great Lakes-St. Lawrence Regions. Source: Environment Canada

Predicted monthly averaged daily air concentrations at 35 km × 35 km grids covering North America from 1976 through 2003 were produced by the CanMETOP. To investigate the impact of the southern U.S. source on the Great Lakes region, several sub-domains were selected. These included the southern U.S., the eastern Great Lakes-St. Lawrence River region, and the western Great Lakes region, as shown in Figure 7-1. The reason that the Great Lakes region is separated into two is that these regions often have different responses to the interannual climate variability. As shown in Figure 7-1, each sub-domain includes several hundred grid points, thereby forming a high dimensionality problem. The Principal Components Analysis (PCA) technique is a statistical technique commonly used to depict an overall characteristic (e.g., by the first principal component) of such a high dimensionality data set.

Figure 7-2 illustrates the first principal component (PC1) using the monthly average toxaphene air concentrations in the southern U.S. and western Great Lakes region for January, April, July and October, representing each season of a year, from 1977 to 2003. In applying the PCA in this study, the first principal component accounts for much of the variability of toxaphene air concentrations in each sub-domain. The results showed that, in most cases, the PC1 explains over 90 percent of total variance of toxaphene air concentrations at all grid points in the three sub-domains; hence, the PC1 can be regarded as the best representation of the long-term trend of air concentrations in each sub-domain. As shown in Figure 7-2, the long-term variation of the PC1 in the western Great Lakes region agrees reasonably well with the PC1 in the southern U.S. for all seasons. A linear regression between the two PC1s in the two regions yields correlation coefficients of 0.70 in January, 0.82 in April, 0.87 in July, and 0.54 in October. Figure 7-3 displays the PC1s in the southern U.S. and the eastern Great Lakes – St. Lawrence River region for the same months from 1977 through 2003. Again, there are good correlations between the PC1s in the two regions, as shown in Figure 7-3 and by the correlation coefficients of 0.65 in January, 0.78 in April, 0.79 in July, and 0.63 in October.

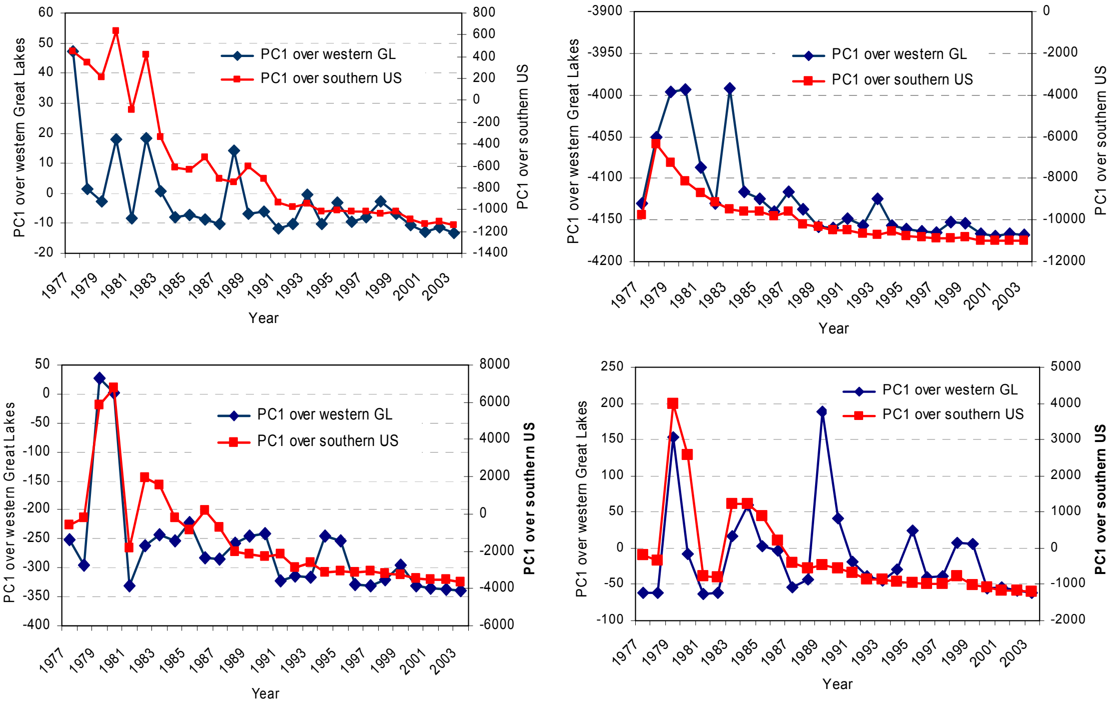


Figure 7-2. First Principal Component (PC1) using the Date of Monthly Averaged Air Concentration of Toxaphene in January (top left), April (top right), July (bottom left), and October (bottom right) from 1977 to 2003 in the Western Great Lakes and Southern U.S. Region.[30] Source: Environment Canada

The first principal component presented in Figures 7-1, 7-2, and 7-3 almost completely explains the total variance of toxaphene air concentrations at all model grid points of each sub-domain. The study results suggest that the long-term variation of toxaphene air concentrations over the Great Lakes region was associated strongly with changes in the substance over the southern U.S. Relatively low correlations of the PC1s between the Great Lakes and the southern U.S. are observed for the colder months of January and October compared to April and July. This is likely due to weak volatilization of toxaphene in the source region over the southern U.S. during the period of cold weather, thereby leading to lower air concentrations, which are then more easily dissipated during long-range transport.

[30] The X-axis denotes year, and the right and left y-axes denote PC1 for variation of monthly averaged air concentrations of toxaphene over the southern U.S. and western Great Lakes, respectively.

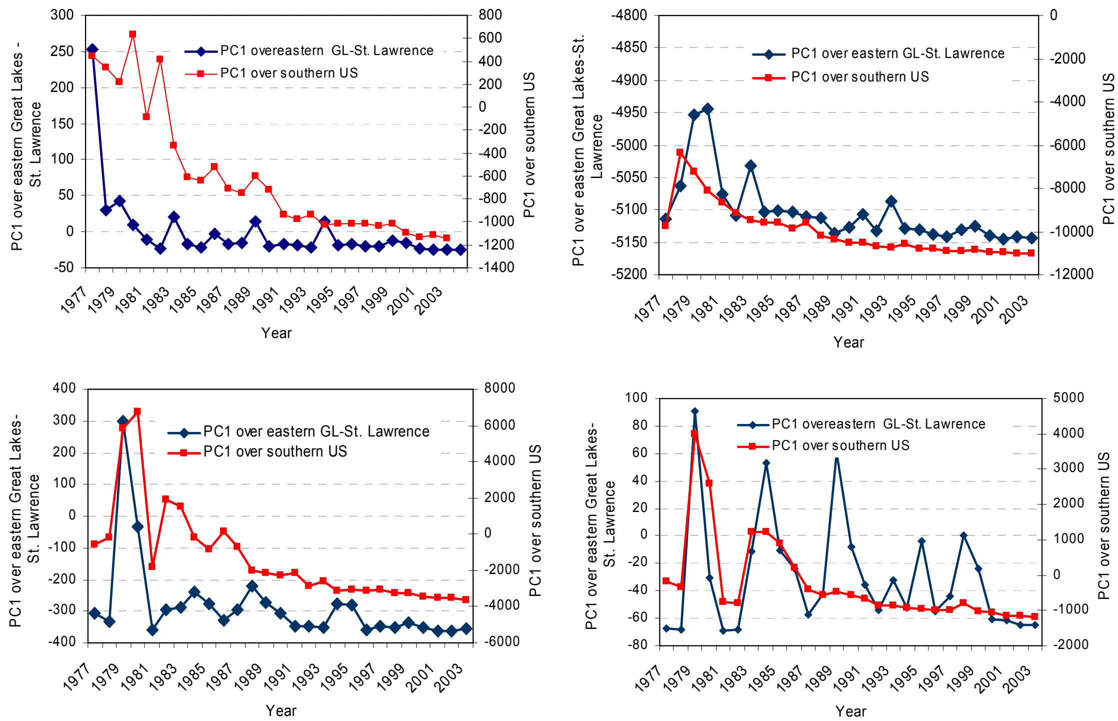


Figure 7-3. First Principal Component (PC1) using the Date of Monthly Averaged Air Concentration of Toxaphene in January (top left), April (top right), July (bottom left), and October (bottom right) from 1977 to 2003 in the Eastern Great Lakes-St. Lawrence Region and Southern U.S. Region.[31] Source: Environment Canada

Following the success of CanMETOP in modeling the transport of toxaphene, further research on numerical assessments of HCB in North America using CanMETOP is being conducted. Although HCB has been banned or restricted in North America and worldwide since the 1970s, it still remains one of most abundant toxic substances in the atmosphere in the Great Lakes Basin. Little is known about major sources and atmospheric pathways of HCB to the Great Lakes region. A recent CanMETOP numerical modeling study using HCB release data from the US EPA Toxics Release Inventory (TRI) showed that modeled U.S. HCB air concentrations were about two to three orders of magnitude lower than measurements across the Great Lakes. Given that the CanMETOP model used here has been evaluated with observations and found to be reasonable, this suggests that there must be other sources of HCB that have not been accounted for in the current HCB emission inventories. Efforts are being made to investigate potential sources of HCB across the North American continent. Because the soil residues and emissions of HCB accumulated from historical pesticide application in North America are likely a major source of this toxic compound to the Great Lakes region, a modeling investigation using CanMETOP will be conducted to study and calibrate atmospheric transport and sources of HCB

[31] The X-axis denotes year, and the right and left y-axes denote PC1 for variation of monthly averaged air concentrations of toxaphene over the southern U.S. and eastern Great Lakes-St. Lawrence regions, respectively.

from 1970 to 2000 that may have contaminated the Great Lakes ecosystem. Results are expected to be reported in the near future.

International Activities

Task Force on Hemispheric Transport of Air Pollutants

The Executive Body of the Convention on Long-range Transboundary Air Pollution (LRTAP) created the Task Force on Hemispheric Transport of Air Pollutants (TF HTAP) to plan and conduct the technical work necessary to:

- Develop a fuller understanding of hemispheric and intercontinental transport of air pollution in the northern hemisphere, and
- Estimate the hemispheric transport of specific pollutants for use in the review of LRTAP protocols.

The Task Force will serve as a forum for international scientific communication and collaboration and as a bridge between the international research community and the international policy community. The Task Force will work to combine the international research efforts of EMEP (Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe) together with national and international research efforts at the regional, hemispheric, and global scales. Such collaboration will help to develop a better understanding of air pollution transport in the northern hemisphere.

The air pollutants of interest to the Task Force include ozone and its precursors, fine particles and their precursors, acidifying deposition, mercury, and persistent organic pollutants. To focus their efforts, the Task Force has identified a series of policy-relevant science questions that it will seek to address. These "focus questions" can be found at http://www.htap.org/activities/TF%20HTAP%20Science%20Questions%20c.pdf. The focus questions will be addressed through a series of technical workshops, cooperative analyses, and assessment reports. The Task Force plans to develop an interim report by 2007 and a full assessment report by 2009.

In 2006, the Task Force convened three workshops and meetings to provide input to the assessment reports. In January, a workshop was held on the organization of intercomparison of intercontinental models in Washington, D.C. In June, a second meeting of the Task Force was held in Moscow, Russia, to further explore the intercomparison of intercontinental models for persistent organic pollutants and mercury. In October, a workshop was held on emission inventories and projections in Beijing, China. Agendas, presentations, and reports for these workshops can be found at http://www.htap.org/index.htm.

The Task Force also initiated a series of model evaluation and intercomparison studies of chemical transport models used to describe and quantify intercontinental transport and hemispheric pollution. The intercomparison studies will provide some estimates of intercontinental source-receptor relationships; improve our understanding of the variability and uncertainty in current model estimates; and guide future model developments to decrease uncertainties in source-receptor relationships.

The model intercomparison and evaluation efforts are open to all interested participants. Interested experts can register to participate and obtain more detailed information on the complete set of model experiments, including guidance for input and requested output, at http://aqm.jrc.it/HTAP/.

8.0 ENVIRONMENTAL INDICATORS OF PROGRESS

The efficacy of efforts to reduce GLBTS Level 1 and 2 substances is ultimately measured by corresponding trends of levels of these substances in the environment. In conjunction with the 2006 State of the Lakes Ecosystem Conference (SOLEC), a conference hosted by US EPA and EC every two years in response to reporting requirements under the GLWQA, environmental indicators of progress are presented in this report. SOLEC conferences provide a forum for the exchange of information among Great Lakes decision makers on the state of the Great Lakes and the major factors impacting that ecosystem.

This section presents monitoring data for environmental indicators in the air over the Great Lakes and in Great Lakes fish, gull eggs, and sediment. Trends in atmospheric concentrations are described by ambient air monitoring data collected by the Integrated Atmospheric Deposition Network (IADN), the National Air Pollution Surveillance (NAPS) network, the Canadian Atmospheric Mercury Measurement Network (CAMNet), and the Mercury Deposition Network (MDN). Levels in fish tissue are illustrated by data collected from the Great Lakes Laboratory for Fisheries & Aquatic Sciences, the Department of Fisheries & Oceans, and US EPA's Great Lakes Fish Monitoring Program. Progress in reducing GLBTS substances is evidenced in Great Lakes herring gull eggs collected and analyzed by the Canadian Wildlife Service. Spatial and temporal trends in Great Lakes sediment are described by data collected from various water and sediment contaminant monitoring programs operating in the Great Lakes.

These environmental monitoring programs are maintained by official government agencies and other organizations. To address potential problems with consistency and completeness of the data, the Great Lakes Observing System (GLOS) was formed to provide access to real-time and historic data on the hydrology, biology, chemistry, geology, and cultural resources of the Great Lakes, its interconnecting waterways, and the St. Lawrence River. More information about GLOS can be found at http://www.glos.us/.

Trends in Ambient Air

Ambient Air Monitoring of Great Lakes Toxics
Submitted by
Melissa Hulting,
US EPA Great Lakes National Program Office

Tracking atmospheric inputs is important because the air is a significant pathway by which PBTs enter the Great Lakes. Several air monitoring networks have collected measurements in the Great Lakes Basin. This report compiles data from those efforts.

Levels of PBT chemicals in air tend to be lower over Lakes Superior and Huron than over the other three Lakes, which are more impacted by human activity. However, because their surface area is larger, atmospheric inputs of PBT chemicals tend to have greater relative importance for Lakes Superior and Huron. While concentrations of some PBTs are very low at rural sites, they may be much higher in "hotspots" such as urban areas. Lakes Michigan, Erie, and Ontario have greater inputs from urban areas.

Integrated Atmospheric Deposition Network (IADN)

The Integrated Atmospheric Deposition Network (IADN) is a joint United States/Canada atmospheric monitoring network that has been in operation since 1990. The IADN consists of five master stations, one near each of the Great Lakes, and several satellite stations, including two urban stations in Chicago and Cleveland. Concentrations of PCBs, organochlorine pesticides, polycyclic aromatic hydrocarbons (PAHs), and trace metals are measured in air (gas phase) and precipitation and on suspended particles at each station. These data are used to examine spatial and temporal trends of toxic contaminants and to calculate atmospheric loadings to the Great Lakes.

In the figures of IADN data that follow, the master stations are represented by Lake names: "Lake Superior" represents data collected at Eagle Harbor, "Lake Michigan" represents data collected at Sleeping Bear Dunes, "Lake Huron" represents data collected at Burnt Island, "Lake Erie" represents data collected at Sturgeon Point, and "Lake Ontario" represents data collected at Point Petre (see Figure 8A-1).

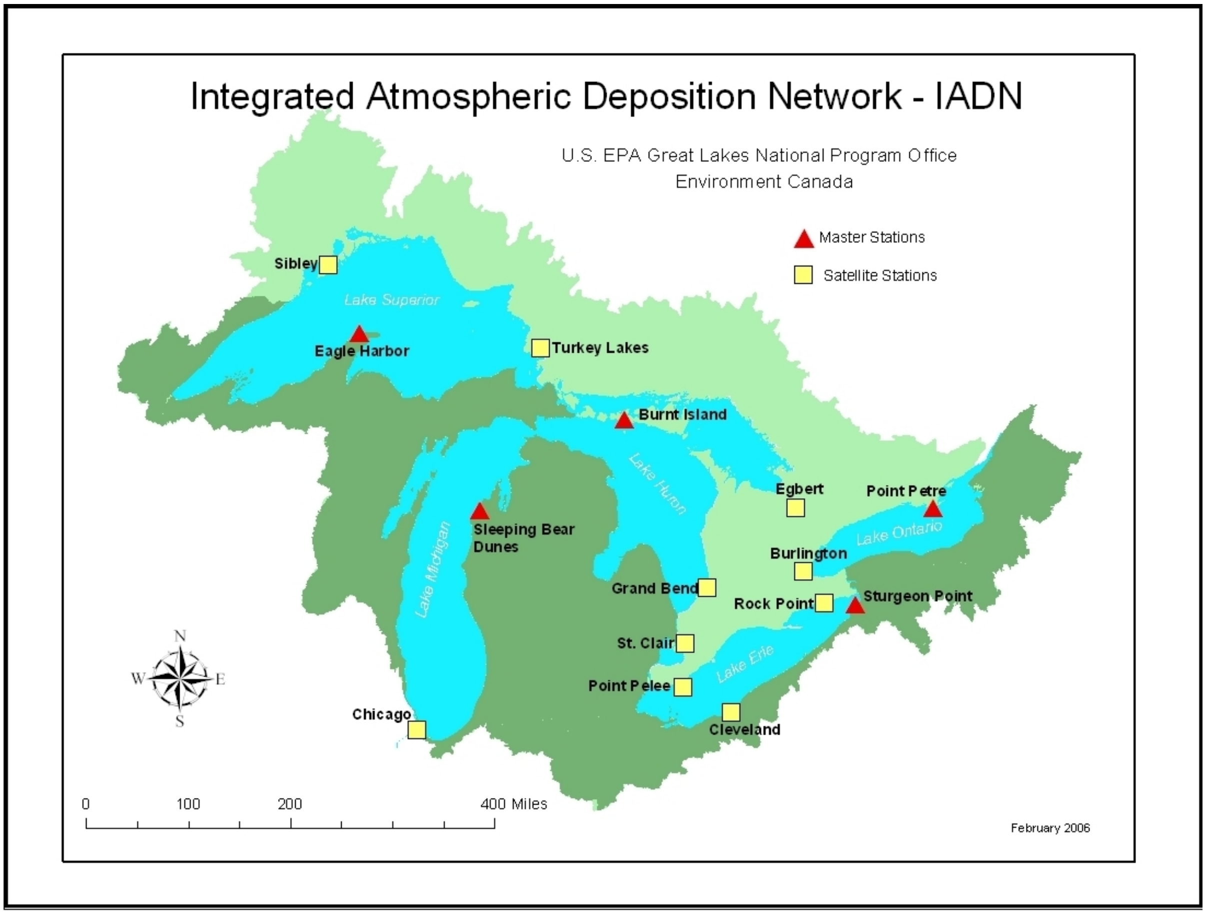


Figure 8A-1. Map of IADN Monitoring Stations

PCBs. Figure 8A-2 illustrates that there has generally been a decline in total PCB concentrations in Great Lakes air over the past 30 years. Half-lives for temperature-corrected IADN data (data since 1992) for gas-phase PCBs are 7 to 27 years; the longer half-lives are for the more remote sites on Lakes Superior and Huron (Sun et al., in press).

It is assumed that PCB concentrations will continue to decrease slowly. However, as concentrations decrease, the absolute size of subsequent decreases will diminish, as shown by the fairly consistent values from the mid-1990s to the present. Further data will confirm whether concentrations continue to decline and whether remaining sources of PCBs, including legacy sources in the United States and long-range transport from other countries, may be contributing to the relative stability of PCB levels in the Great Lakes region.

The Lake Erie master station consistently shows higher PCB concentrations compared to the other master stations. Back-trajectory analyses have shown that this is due to possible influences from upstate New York (the site is 20 km southwest of Buffalo) and the East Coast (Hafner and Hites, 2003). PCB concentrations at the satellite station in Chicago are about 10 times higher than those at the more remote master stations. It is expected that PCB concentrations should be elevated in the Chicago urban area because of the widespread use of PCBs in industrial applications in the mid-20th century. Back-trajectory analyses have revealed that the influence of the Chicago urban area as a source of PCBs may reach as far away as Lake Superior (Hafner and Hites, 2003). Data from the Cleveland station, where monitoring began in 2003, indicate that PCB levels in that city are lower than those in Chicago, but higher than at the master stations.

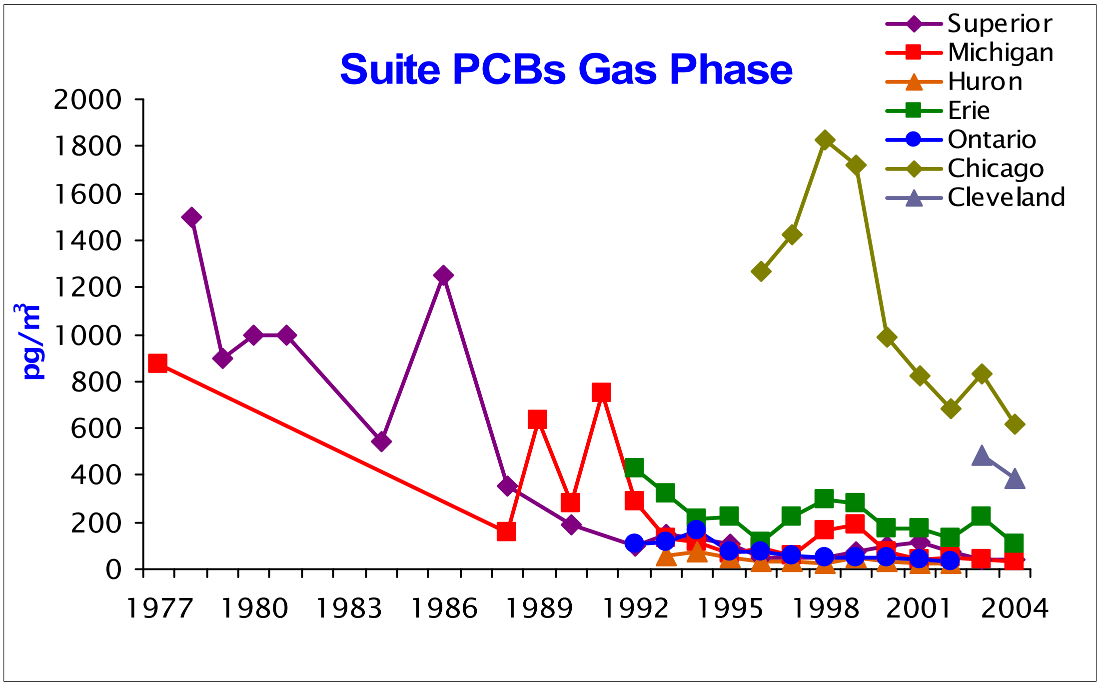


Figure 8-A2. Long-term Gas-Phase Annual Average Total PCB Concentrations (pg/m^3)[32]

HCB. IADN data for HCB from the three U.S. master stations on Lakes Superior, Michigan, and Erie show decreasing trends with half-lives of 12 to 18 years (Sun et al., in press). However, like PCBs, HCB concentrations increased somewhat during the late 1990s (see Figure 8A-3), perhaps due to atmospheric circulation phenomena such as El Nino (Ma et al., 2004). The longer half-lives may be due to continued releases of HCB into the environment as a byproduct of manufacturing processes. HCB also has an atmospheric lifetime of about 2 ½ half years (Brubaker and Hites, 1998), making it capable of global transport and therefore making the Great Lakes susceptible to inputs from global emissions.

[32] IADN Steering Committee, unpublished data, 2006. Sources for pre-1992 PCB data: Achman et al., 1993; Baker and Eisenreich, 1990; Cotham and Bidleman, 1995; Doskey and Andren, 1981; Eisenreich et al., 1981; Eisenreich, 1987; Hornbuckle et al., 1993; Hornbuckle et al., 1994; Manchester-Neesvig and Andren, 1989; Monosmith and Hermanson, 1996.

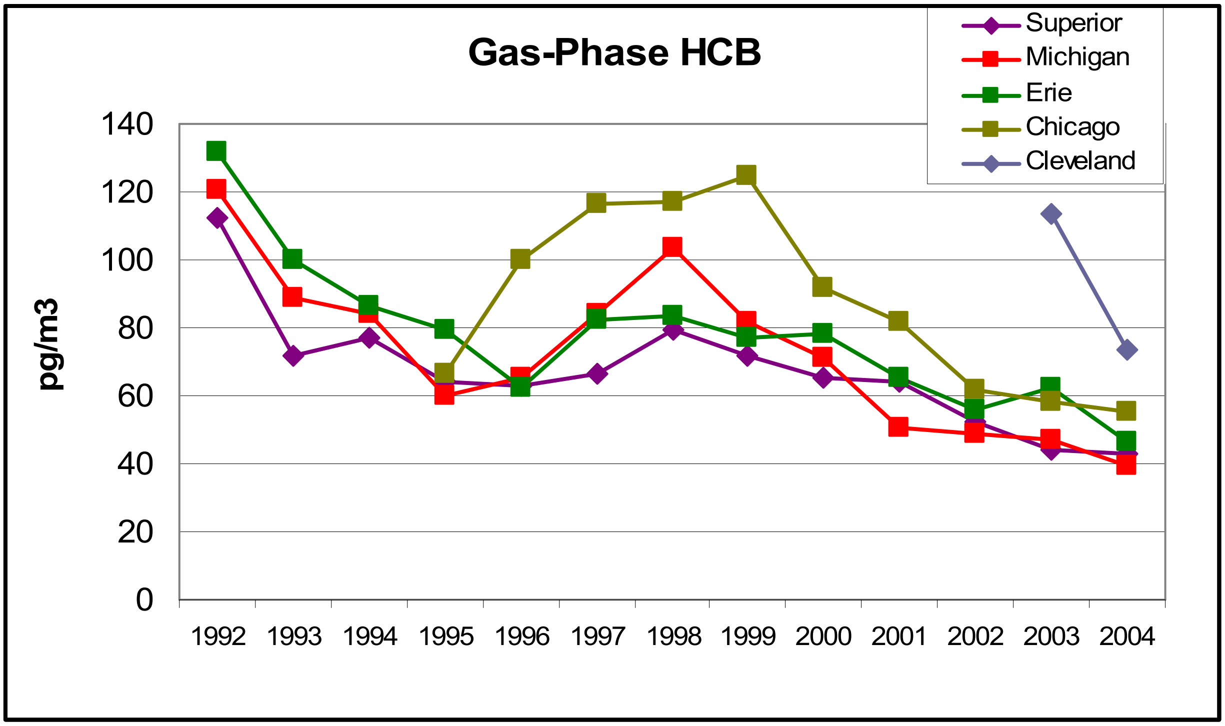


Figure 8-A3. Annual Average Gas-Phase Hexachlorobenzene Concentrations (U.S. sites only) (pg/m^3)[33]

[33] IADN Steering Committee, unpublished data, 2006. HCB data not available for Canadian stations due to breakthrough on polyurethane foam (PUF) sampling media.

Organochlorine Pesticides. In general, gas-phase concentrations of banned or restricted pesticides measured by the IADN are decreasing over time in the air, with half-lives generally between 4 and 9 years (Sun et al., 2006b). Figures 8A-4 and 8A-5 present data for alpha-HCH and DDT. These declining trends correlate well with declining global use of these pesticides. Some pesticides, including chlordane and DDT, are found at higher levels in urban areas. This is demonstrated for DDT in Figure 8A-5. Chlordane was used as a termiticide in buildings, and DDT was sprayed in urban areas in the U.S. to control mosquitoes (and is still used in some other countries for malaria control).

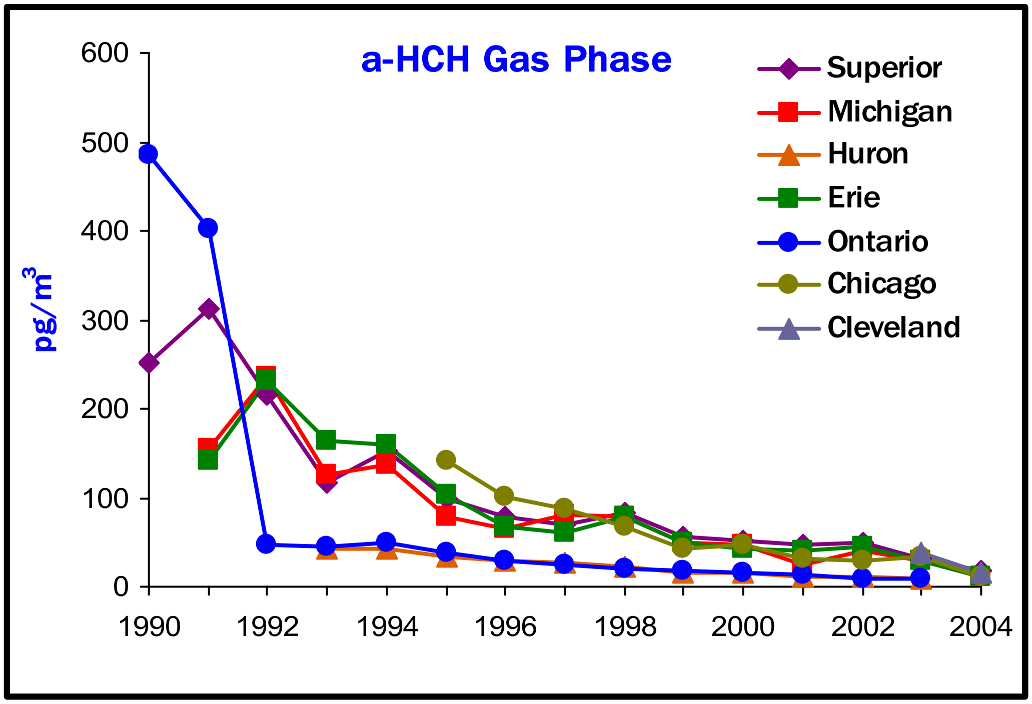


Figure 8A-4. Annual Average Gas-phase Concentrations of Alpha-HCH (pg/m^3)[34]

[34] IADN Steering Committee, unpublished data, 2006.

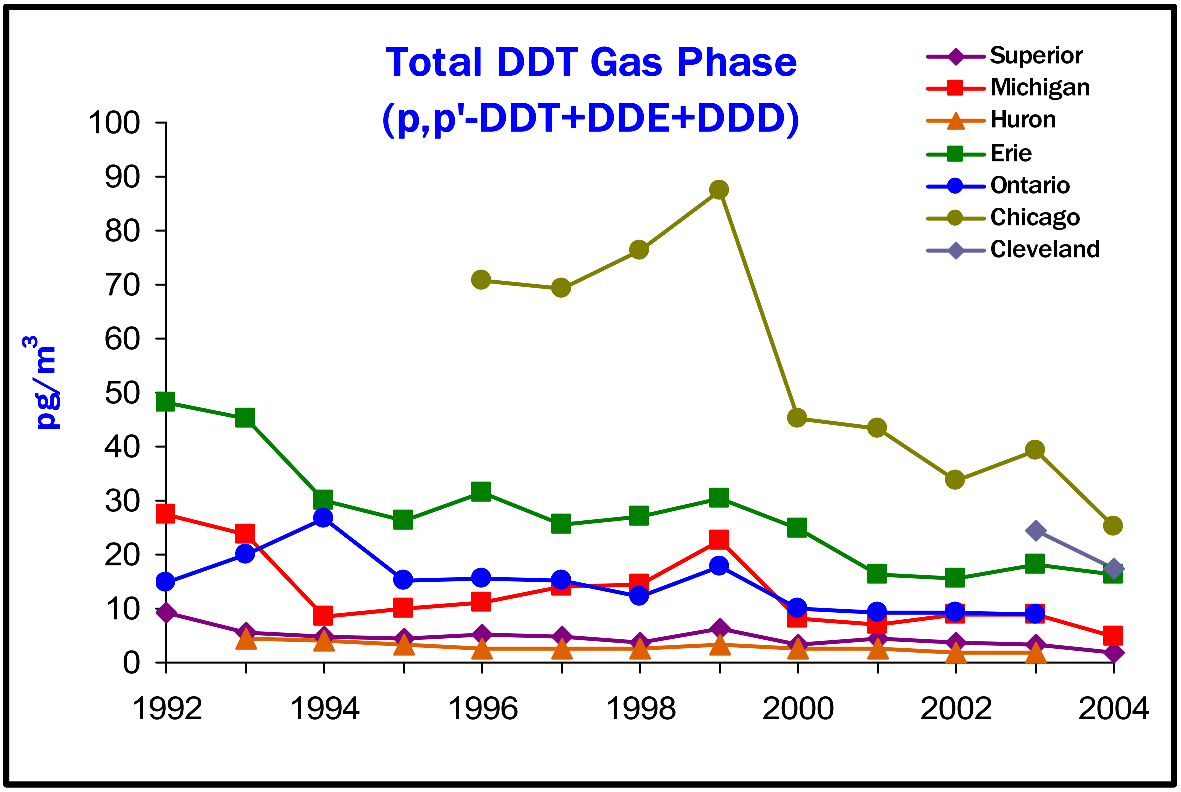


Figure 8A-5. Annual Average Gas-phase Total DDT (p,p'-DDT+DDE+DDD) Concentrations (pg/m^3)[35]

Vapor-phase concentrations of lindane (g-HCH) at Chicago, Sleeping Bear Dunes, and Sturgeon Point were similar but significantly higher than concentrations at Eagle Harbor, Point Petre, and Burnt Island (Sun et al., in press). Lindane was used in Canada through 2004. On January 1, 2005, Canada withdrew registration of lindane for agricultural pest control. U.S. registrants agreed to a voluntary cancellation of the registrations for lindane in December 2006, which was ratified by the U.S. Office of Pesticide Programs in January 2007. Use of existing stocks for seed protection in the U.S. can continue until October 2009. Levels of lindane at IADN sites have decreased in recent years (Figure 8A-6), and it is expected that this trend will continue as use ends in North America. Lindane concentrations have generally peaked in the summer in concordance with agricultural usage.

Endosulfan concentrations show significant decreases at some sites in some phases, but no decrease in the vapor phase at Eagle Harbor, Sleeping Bear Dunes, or Sturgeon Point (Sun et al., in press). Higher endosulfan concentrations were observed at Point Petre, Sturgeon Point, and Sleeping Bear Dunes in all phases, which could be explained by agricultural usage in surrounding areas (Hoh and Hites, 2004). Similar to lindane, concentrations of endosulfan are also generally higher in the summer following use.

[35] Ibid.

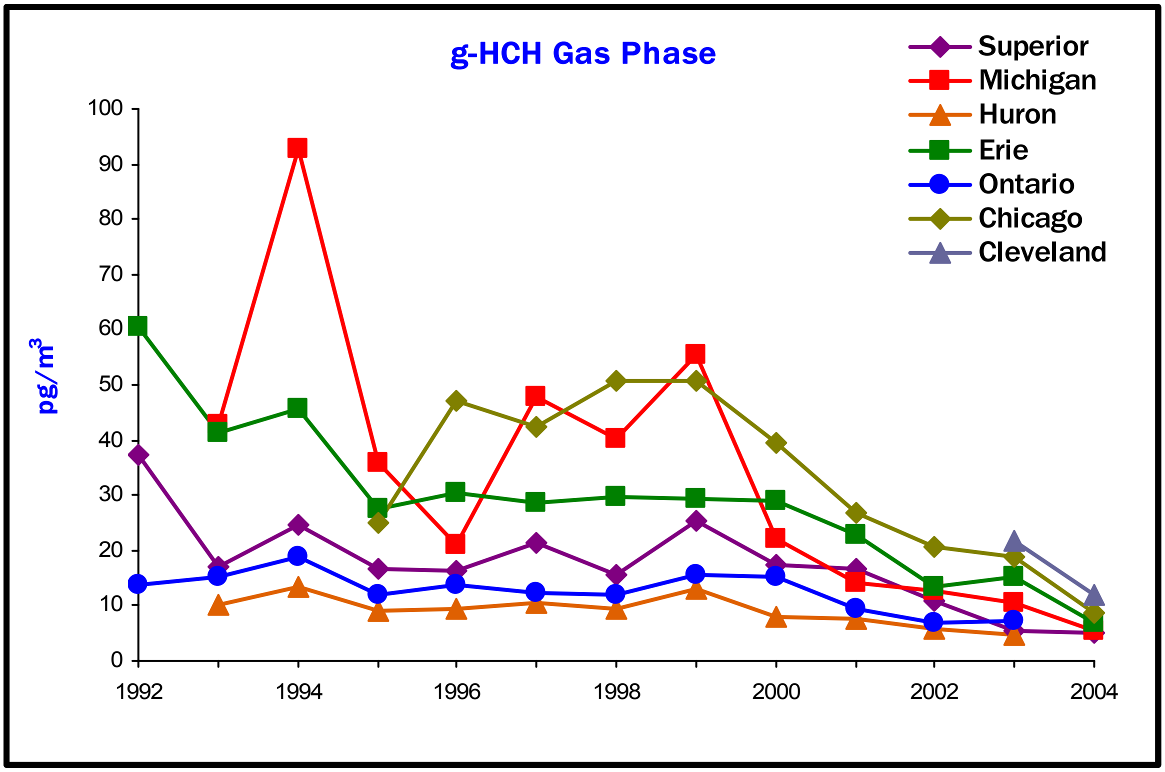


Figure 8A-6. Annual Average Gas-Phase Concentrations (pg/m3) of Lindane (gamma-HCH)[36]

PAHs. In general, concentrations of PAHs can be roughly correlated with population, with the highest levels observed in Chicago and Cleveland and lower concentrations at the remote master stations (Sun et al., in press). In general, PAH concentrations in Chicago and Cleveland are about 10 to 100 times higher than at the master stations.

Concentrations of PAHs in the particle and gas phase are decreasing at Chicago, with half-lives of 3 to 10 years in the gas phase and 5 to 15 years in the particle phase. At the other sites, most gas phase PAH concentrations showed significant, but slow, long-term decreasing trends (half-lives >15 years). For most PAHs, decreases in PAHs measured on particles and in precipitation were only found at Chicago (Sun et al., 2006c; Sun et al., 2006a).

Figure 8A-7 shows the annual average particle-phase concentrations of B(a)P as an example of PAH concentrations.

[36] Ibid.

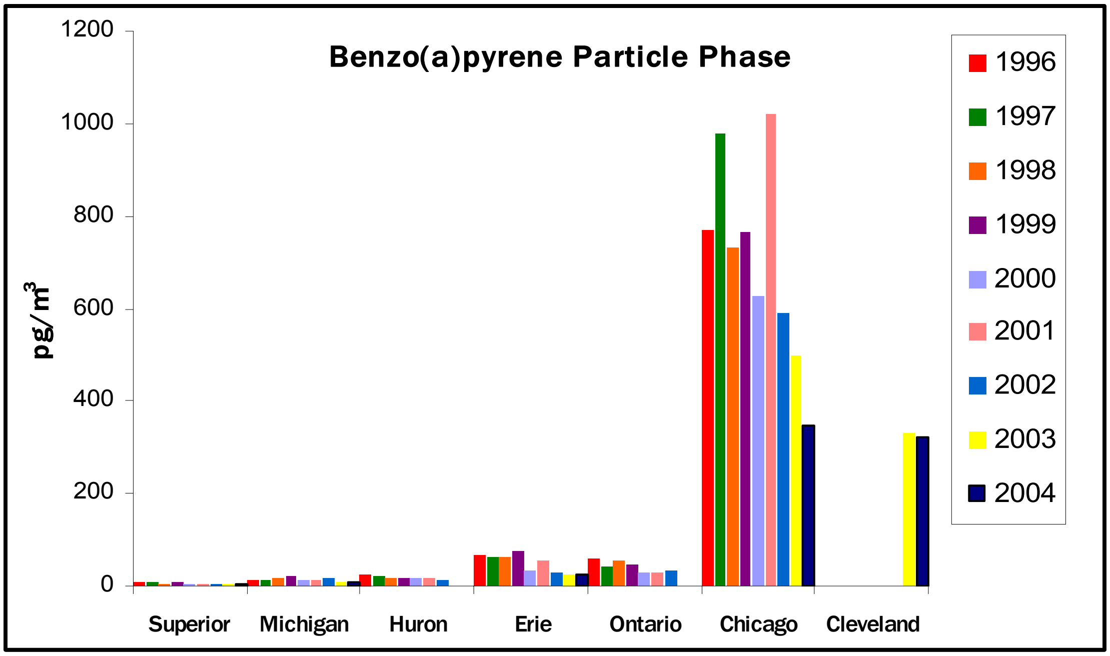


Figure 8A-7. Annual Average Particle-phase B(a)P Concentrations (pg/m^3)[37]

Gas-phase octachlorostyrene (OCS) data, available for the U.S. stations only, is shown in Figure 8A-8. OCS concentrations are low, in the single pg/m^3 range, and appear to be decreasing. Initial data from Cleveland indicate that concentrations of OCS are higher there than at the remaining stations, including Chicago, suggesting nearby sources in that metropolitan area.

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[37] Ibid.

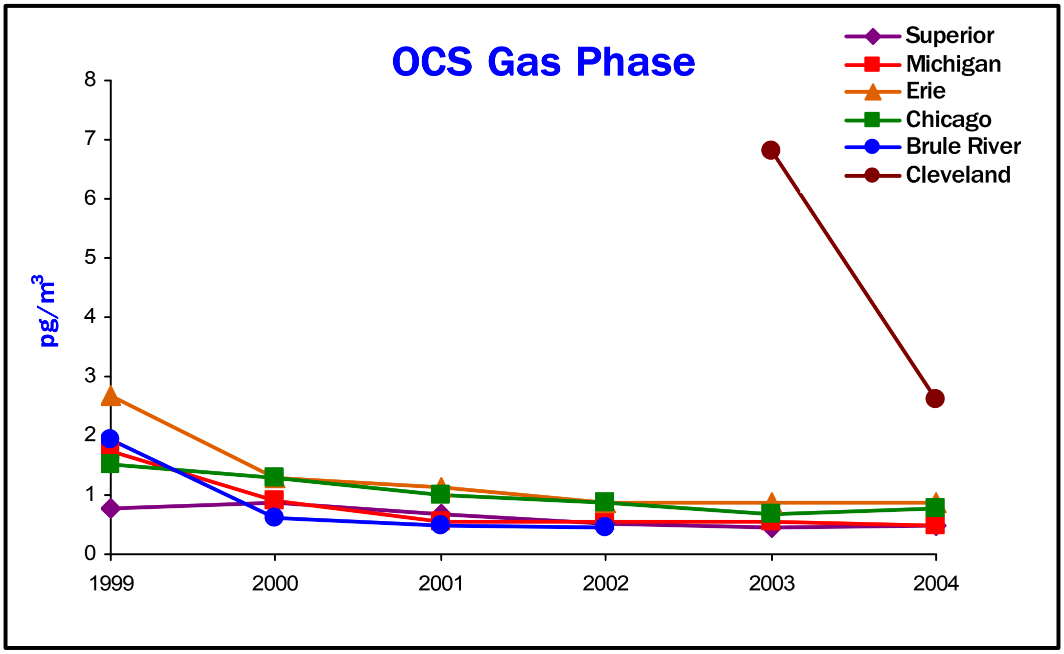

Figure 8A-8. Annual Average Gas-phase Octachlorostyrene Concentrations (pg/m^3)[38]

PBDEs. Polybrominated diphenyl ethers (PBDEs) are a group of brominated flame retardant chemicals used in products, including furniture and electronics, and growing evidence suggests that PBDEs possess PBT properties. PBDEs have been found in the Great Lakes environment, including in air at the IADN stations. Total PBDE concentrations in air during 2003-2004 were in the single pg/m^3 range for the rural master stations and in the 50-100 pg/m^3 range for the urban stations (Venier et al., 2006). U.S. manufacturers of penta- and octa-PBDEs phased out production in 2004, but deca-PBDEs are still being produced. Future data will help to elucidate trends in PBDEs in the air of the Great Lakes.

IADN data is used to calculate the amounts of monitored chemicals deposited to the Great Lakes from the atmosphere, called atmospheric loadings. For many banned or restricted substances that IADN monitors, net atmospheric inputs to the Lakes are headed toward equilibrium; that is, when the amount going into a Lake equals the amount volatilizing out.

A report on the atmospheric loadings of monitored PBTs to the Great Lakes for data through 2004 will be published in early 2007. It will be available online at: http://www.epa.gov/glnpo/monitoring/air/iadn/iadn.html**.**

National Air Pollution Surveillance (NAPS) Network

Through the National Air Pollution Surveillance (NAPS) network, data are collected on ambient air levels of a variety of toxics at rural, suburban, city-centre, and industrial sites in Canada. This effort is conducted in cooperation with provincial environmental and municipal agencies.

[38] Ibid.

The program includes measurement of volatile organic compounds (VOC), including toxics and ground-level ozone precursors; polar volatile organic compounds (PVOC) such as aldehydes and ethers; components of fine particulate matter (PM), including metals and inorganic and organic ions; and persistent, toxic semi-volatile organic compounds (SVOC), such as B(a)P and polychlorinated dibenzo-p-dioxins (PCDDs) and furans (PCDFs). One of the purposes of the monitoring effort is to provide data on trends in air concentrations of toxics and thus measure the success of initiatives carried out under the Toxic Substances Management Policy (TSMP) and the Canada-Ontario Agreement (COA) respecting the Great Lakes Basin Ecosystem.

Some examples of trends in selected species are shown in Figures 8A-9 to 8A-12. The box plots show median, 25th and 75th percentiles, and non-outlier minimum and maximum.

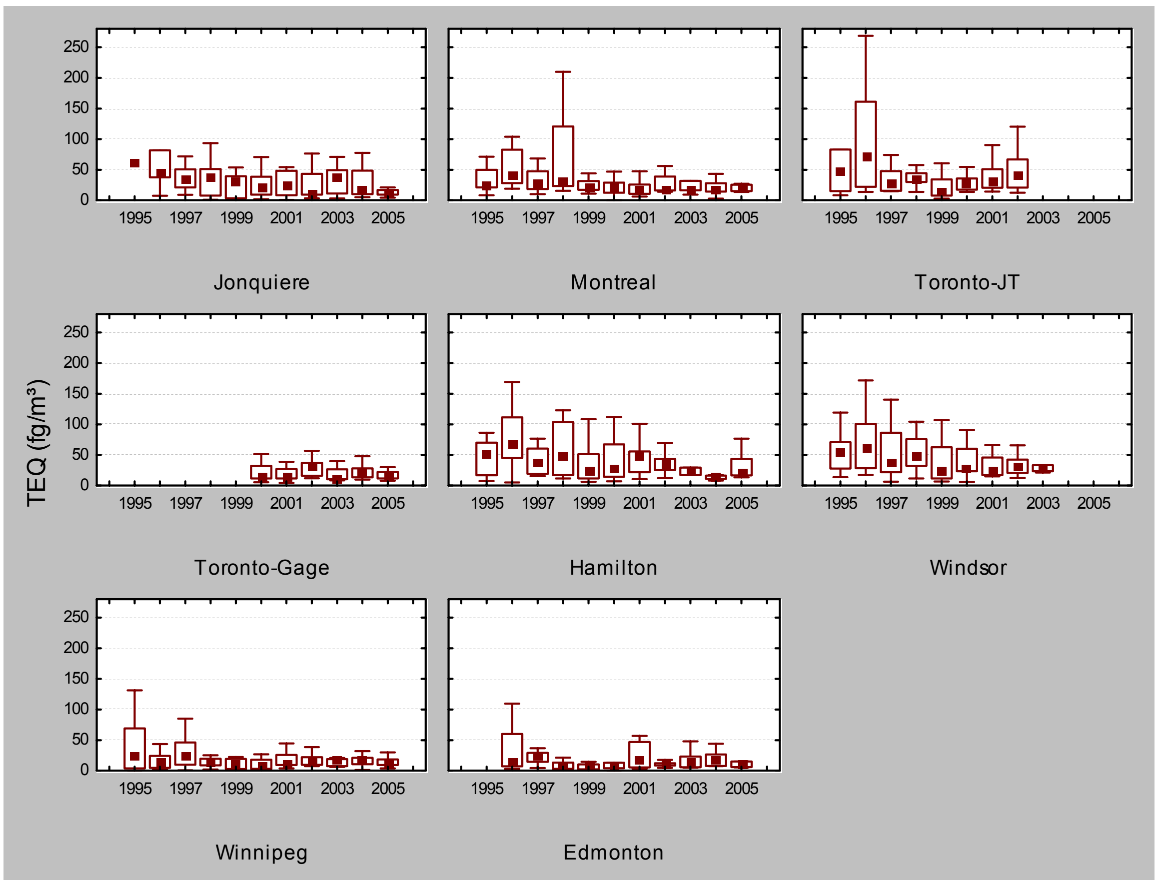

Figure 8A-9. Trends in 2,3,7,8-TCDD Toxic Equivalents (TEQ) (fg/m^3) (1995-2005) at Urban Sites[39]

[39] Unpublished data, Tom Dann, Environment Canada.

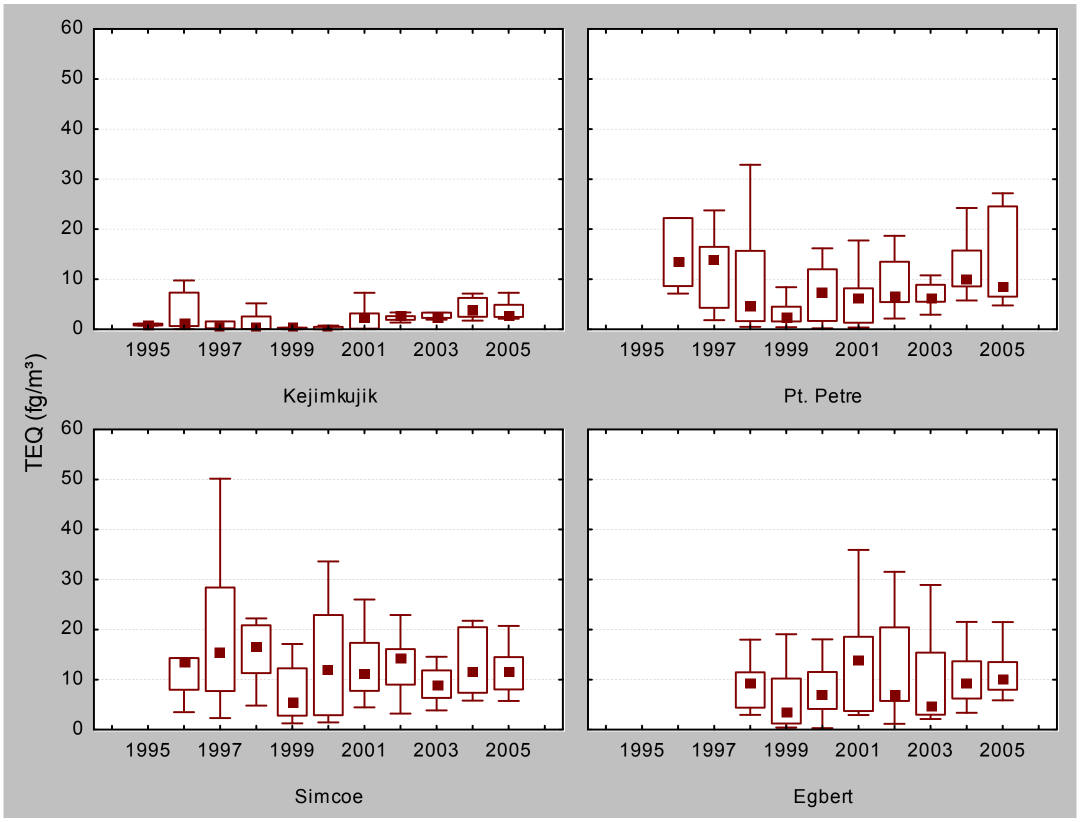

Figure 8A-10. Trends in TEQ Concentrations (fg/m^3) (1995-2005) at Rural Sites[40]

[40] Ibid.

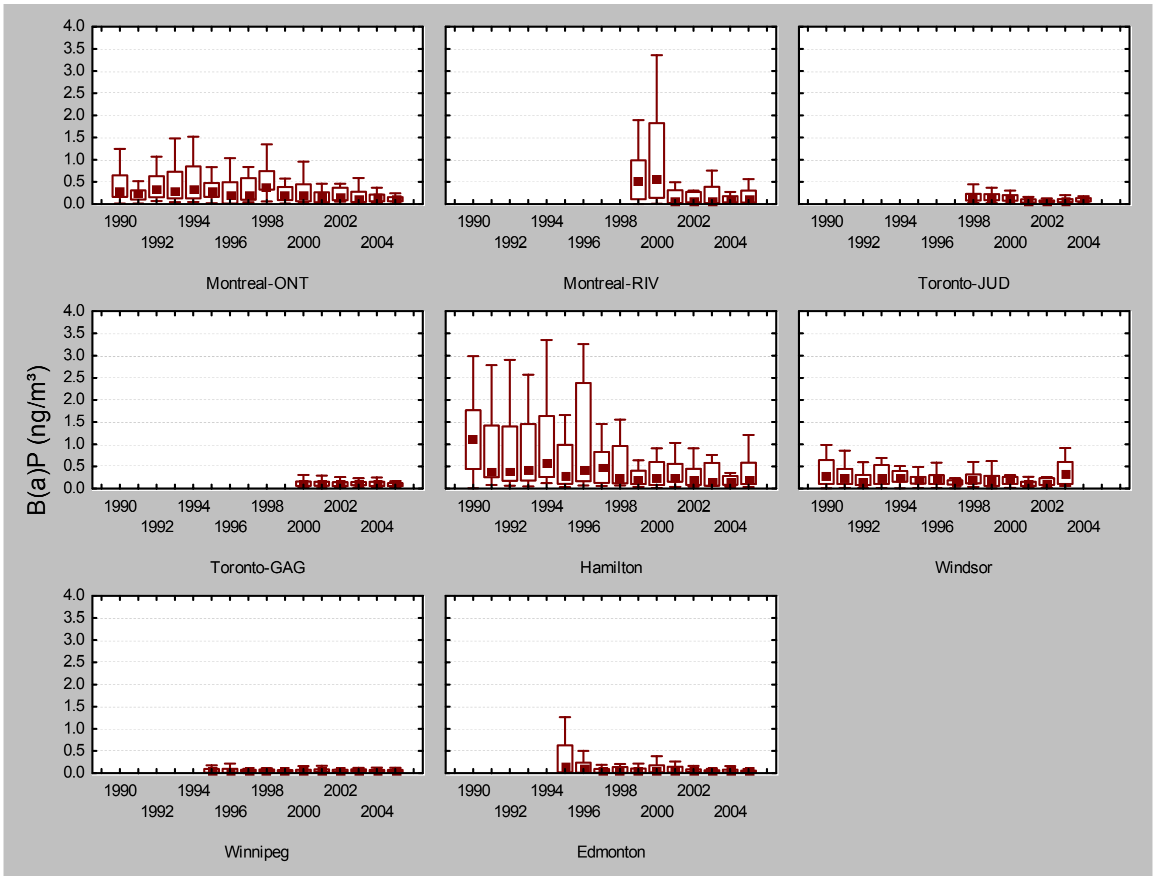

Figure 8A-11. Trends in Benzo(a)pyrene Concentrations (ng/m^3) (1990-2005) at Urban Sites[41]

[41] Ibid.

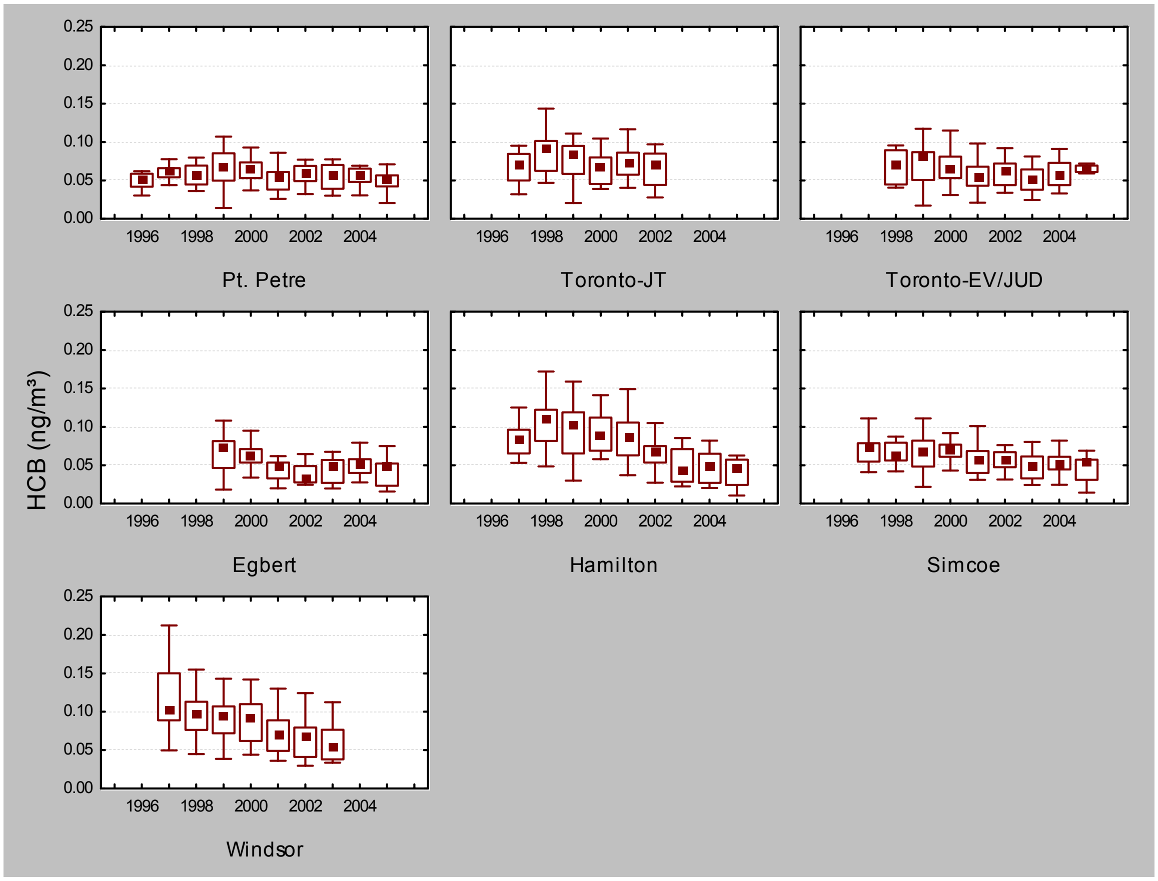

Figure 8A-12. Trends in HCB Concentrations (ng/m^3) at Ontario Sites (1996-2005)[42]

Ambient concentrations of dioxins, furans, and coplanar PCBs, represented as TEQ, have decreased over time (Figures 8A-9 and 8A-10), with the largest declines in areas with the highest concentrations (Dann, 2006). Like the IADN data, the NAPS data show a slight decrease over time in B(a)P concentrations, most notably in urban areas (Figure 8A-11), where levels are about 2 to 5 times higher than in rural areas. HCB concentrations appear to be declining slowly, again mirroring the trend in the IADN data (Figure 8A-12).

Canadian Atmospheric Mercury Measurement Network (CAMNet)

In 1996, Environment Canada initiated the Canadian Atmospheric Mercury Measurement Network (CAMNet) to provide a better understanding of mercury trends and processes in the environment. CAMNet stations measure total gaseous mercury (TGM), mercury in precipitation, and reactive gaseous mercury and particulate mercury, though not all parameters are measured at each station.

CAMNet data for the IADN stations at Egbert, Point Petre, and Burnt Island show decreases in TGM concentrations between 1995 and 2004, with more of the decrease occurring in the 2000-2004 time

[42] Ibid.

period (Figure 8A-13). At these stations, median TGM concentrations decreased by 7-19 percent from 2000 to 2004 (Temme et al., 2006).

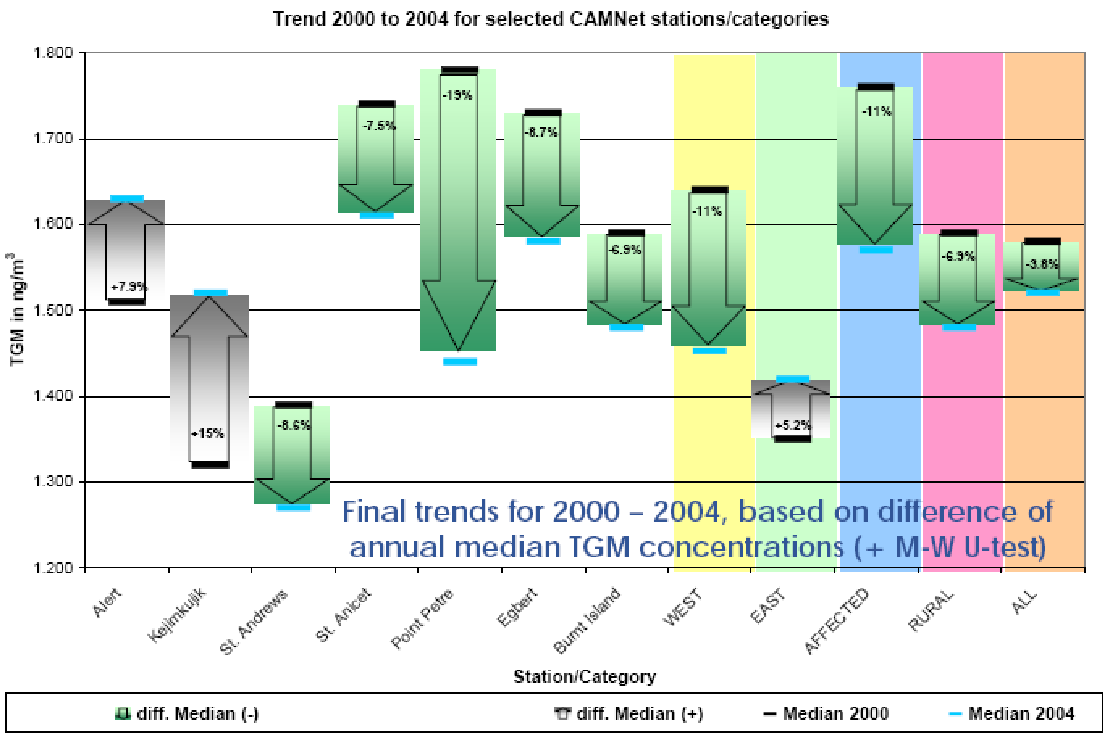

Figure 8A-13. Trends in Median Concentrations of Total Gaseous Mercury (ng/m^3) at CAMNet Stations, 2000 to 2004[43]

Mercury Deposition Network (MDN)

Another important North American monitoring network is the Mercury Deposition Network (MDN), which is part of the National Atmospheric Deposition Program (NADP). This program began monitoring pH and major inorganic ions related to "acid rain" in the United States in 1978. In 1995, NADP began an experimental monitoring program for wet deposition of mercury, the MDN. This program has grown into an international network with sites in the U.S., Canada, and more recently, Mexico (Figure 8A-14). MDN collects weekly precipitation samples and analyzes them for total mercury and, at the option of the sponsoring agency, for methylmercury. MDN data show that concentrations of total mercury in precipitation are decreasing for much of the U.S., but there is no trend for the stations in the upper Midwest (Figure 8A-15) (Gay et al., 2006).

[43] Temme et al., 2006

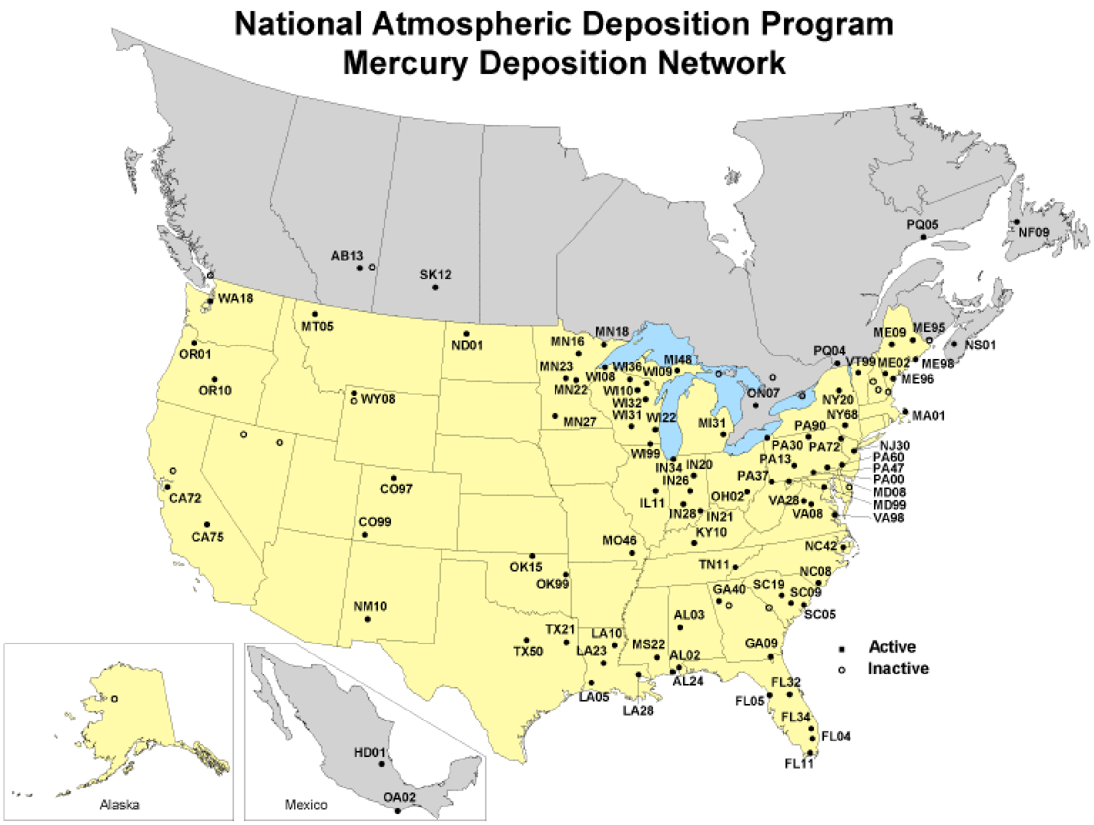

Figure 8A-14. Mercury Deposition Network Sites[44]

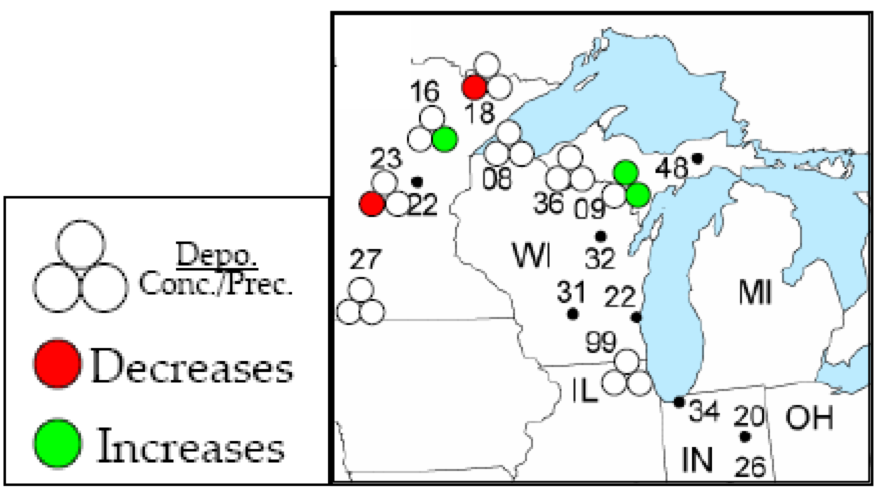

Figure 8A-15. Trends in Wet Deposition of Total Mercury, Concentration in Precipitation, and Amount of Precipitation from the Mercury Deposition Network[45]

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[44] http://nadp.sws.uiuc.edu/mdn/sites.asp.
[45] Gay et al., 2006.

Acknowledgements

Melissa Hulting of the US EPA GLNPO coordinated this section of the report with support from the IADN Steering Committee. Tom Dann of Environment Canada provided updated figures for the NAPS section. Christian Temme of Environment Canada provided material for the CAMNet section. MDN data was provided by David Gay of the Illinois State Water Survey.

For additional information, see:

- The IADN website: http://www.msc.ec.gc.ca/iadn/
- US EPA GLNPO Atmospheric Deposition Environmental Indicator: http://www.epa.gov/glnpo/glindicators/air/airb.html
- IADN information resources page:
- http://www.epa.gov/glnpo/monitoring/air/iadn/iadn.html
- State of the Great Lakes Reports (Indicator #117): http://binational.net/solec/pub_e.html
- Draft 2006 report at:
- http://www.solecregistration.ca/en/indicator_reports_contamination.asp
- The NAPS website: http://www.etcentre.org/naps/
- The CAMNet website: http://www.msc-smc.ec.gc.ca/arqp/camnet_e.cfm
- The MDN website: http://nadp.sws.uiuc.edu/mdn/

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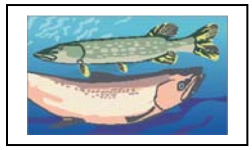
Trends in Great Lakes Fish



Open Lake Fish Contaminants Monitoring Program – Great Lakes: Contaminants in Whole Fish

Submitted by
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Sean Backus, Environment Canada

The Great Lakes Fish Monitoring Program (operated by US EPA GLNPO) and the Great Lakes Fish Contaminant Surveillance Program (operated by EC[46]) both monitor contaminant burdens in open water fish species from throughout the Great Lakes. These programs provide data to describe temporal and spatial trends of bioavailable contaminants as an indicator of ecosystem health. The two monitoring programs annually monitor the burden of a suite of toxic chemicals in fish and fish communities throughout the Great Lakes. They were developed in direct response to the needs of Annex 11 (Surveillance & Monitoring) of the GLWQA (1978), which states the need "To provide information for measuring local and whole lake response(s) to control measures using trend analysis and cause/effect relationships and to provide information which will assist in the development and application of predictive techniques for assessing the impact of new developments and pollution sources." Annex 11 also contains a requirement for the identification of emerging problems and provides support for the development of Remedial Action Plans (RAPs) at Areas of Concern and Lakewide Management Plans (LaMPs) for Critical Pollutants pursuant to Annex 2 of the GLWQA.

The programs also address requirements of GLWQA Annex 12, Persistent Toxic Substances. They provide the specific monitoring capabilities required in section 4 (a-d) of the Annex plus an early warning system capability (section 5a) and the development and maintenance of a biological tissue bank (section 5e) to permit retrospective analysis of recently identified compounds.

Since its inception in 1997, significant progress had been made towards the GLBTS challenge goals. In order to ensure that this pathway of progress continues into the future, Canada and the U.S., with help from the many partners involved in the GLBTS, continue to identify opportunities to reduce GLBTS substances on the road to virtual elimination. To further this effort, a number of actions have been undertaken, including, but not limited to, continued

[46] In the spring of 2006, Environment Canada assumed the responsibilities of the Department of Fisheries and Ocean (DFO) Fish Contaminant Surveillance Program. All data included in this report were produced by DFO.

monitoring in air, water, sediment, and biota, and the consideration of impacts to the Great Lakes Basin ecosystem from Level 2 substances and other potential chemicals of concern.

Program Background Information

Long-term (>25 yrs), basin-wide monitoring programs that measure whole body concentrations of contaminants in top predator fish (lake trout and/or walleye) and in forage fish (smelt) are conducted by US EPA GLNPO through the Great Lakes Fish Monitoring Program and by EC through the Great Lakes Fish Contaminants Surveillance Program (GLFCSP).

The U.S. program annually monitors contaminant burdens in similarly sized lake trout (600-700 mm total length) and walleye (Lake Erie, 400-500 mm total length) from alternating locations by year in each lake. The Canadian program annually monitors contaminant burdens in similarly aged lake trout (4+ to 6+ year range), walleye (Lake Erie), and in smelt. The program monitors approximately 10 Great Lakes sites annually. On Lake Ontario, four stations (Niagara, Port Credit, Cobourg, Eastern Basin) are monitored annually, while Lake Erie has sites in both the eastern and western basins. There are traditionally two sites per year monitored each on Lake Superior and Lake Huron. The two annual sites are rotated among four indicator stations on each of the Lakes (on Lake Superior: Thunder Bay, Jackfish Bay, Marathon, Whitefish Bay–Sault Ste. Marie; on Lake Huron: North Channel, French River, Meaford, Goderich) with the intent of collecting two consecutive years of data at any single site every three to four years. Lake trout (or walleye for western Lake Erie) are collected at each site, and elements of the food web (alewife/sculpin/smelt + invertebrate diet items) are collected at a subset of the 10 sites annually. Approximately 450 individual (top predator) and composite (forage species) fish samples are analyzed annually.

While both the Great Lakes Fish Monitoring Program and the GLFCSP collect and analyze contaminant burdens in Great Lakes fish on an annual basis, differences in the programs' collection and analytical methods do not allow for direct comparisons between the two programs. However, although the programs differ, they both show the same general declining trend for legacy contaminants.

Great Lakes Top Predator Fish Contaminant Concentrations

Since the late 1970s, concentrations of historically regulated contaminants such as PCBs, dichlorodiphenyl-trichloroethane (DDT), and mercury (Hg) have generally declined in most monitored fish species. The concentrations of other contaminants, both currently regulated and unregulated, have demonstrated either slowing declines or, in some cases, increases in selected fish communities. The changes are often lake-specific and relate to the characteristics and sources of the substances involved and the biological composition of the fish community. For example:

- Lake Superior – Contaminants in Lake Superior are typically atmospherically derived. The dynamics of Lake Superior allow for the retention of contaminants much longer than any other lake.

- Lake Michigan – Food web changes are critical to Lake Michigan contaminant concentrations, as indicated by the failure of the alewife population in the 1980s and the presence of the round goby. Aquatic invasive species, such as asian carp, are also of major concern to the lake due to the connection of Chicago Sanitary and Ship canal and the danger they pose to the food web.
- Lake Huron – Contaminant loadings to Saginaw Bay in Lake Huron continue to be reflected in fish tissue contaminant concentrations.
- Lake Erie – Aquatic invasive species are of major concern to Lake Erie because of the potential to alter the pathways and fate of persistent toxic substances. This results in differing accumulation patterns, particularly near the top of the food chain.
- Lake Ontario – Historic point sources of mirex and octachlorostyrene (OCS) in Lake Ontario continue to be reflected in fish tissue contaminant concentrations.

Monitored Contaminants

∑ PCBs. In general, total PCB concentrations in Great Lakes top predator fish have declined since their phase out in the 1970s (Figures 8F-1 and 8F-2). However, rapid declines are no longer observed, and concentrations in fish remain above the US EPA wildlife protection value of 0.16 ppm (US EPA, 1995) and the GLWQA criteria of 0.1 ppm for the protection birds and animals that eat fish. Concentrations remain high in top predator fish due to the continued release of uncontrolled sources and their persistent and bioaccumulative nature.

∑ DDT. In general, total DDT concentrations in Great Lakes top predator fish have declined since the chemical was banned in 1972 (Figures 8F-3 to 8F-4). However, large declines are no longer observed; rather, very small annual percent declines predominate, indicating near steady-state conditions. The concentrations of this contaminant remain below the GLWQA criteria of 1.0 ppm. There is no US EPA wildlife protection value for total DDT because the PCB value is more protective. The Canadian Council of Ministers of the Environment (CCME) guideline for the protection of wildlife consumers of aquatic life is 14.0 ppm for total DDT.

Mercury. Concentrations of mercury are similar across all fish in all lakes (Figure 8F-5). It is assumed that concentrations of mercury in top predator fish are atmospherically driven. Current concentrations in GLNPO top predator fish in all lakes remain above the GLWQA criteria of 0.5 ppm, and Canadian smelt have never been observed to be above the GLWQA criteria. Mercury was only recently added to the GLNPO routine analyte list, in year 2001.

∑ Chlordane. Concentrations of total chlordane have consistently declined in whole top predator fish since its ban in the late 1980s (Figures 8F-6 and 8F-7). Total chlordane is composed of *cis* and *trans*-chlordane, *cis* and *trans*-nonachlor, and oxychlordane, with *trans*-nonachlor being the most prevalent of the compounds. While *trans*-nonachlor was the minor component of the total chlordane mixture, it is the least metabolized and predominates within the Laurentian Great Lakes aquatic food web (Carlson and Swackhamer, 2006).

Mirex. Concentrations of mirex are highest in Lake Ontario top predator fish due to its historical and continued release from sources near the Niagara River (Figures 8F-8 and 8F-9).

Dieldrin. Concentrations of dieldrin in lake trout appear to be declining in all Lakes and are lowest in Lake Superior and highest in Lake Michigan (Figures 8F-10 and 8F-11). Concentrations in Lake Erie walleye were the lowest of all lakes. Aldrin is readily converted to dieldrin in the environment. For this reason, these two closely related compounds (aldrin and dieldrin) are considered together by regulatory bodies.

Toxaphene. Decreases in toxaphene concentrations have been observed throughout the Great Lakes in all media following its ban in the mid-1980s. However, concentrations have remained the highest in Lake Superior due to its longer retention time, cold temperatures, and slow sedimentation rate. It is assumed that concentrations of toxaphene in top predator fish are atmospherically driven (Hites, 2006).

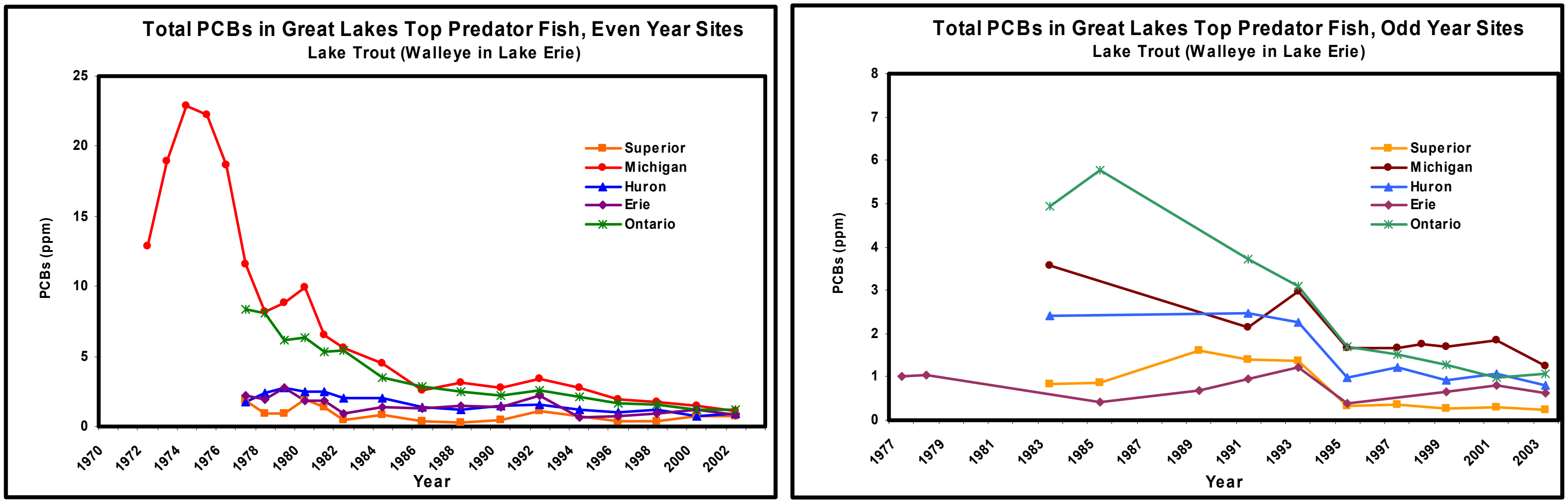


Figure 8F-1. Total PCBs in Great Lakes Top Predator Fish, Even Year (left) and Odd Year (right) Sites. Source: US EPA GLNPO Great Lakes Fish Monitoring Program

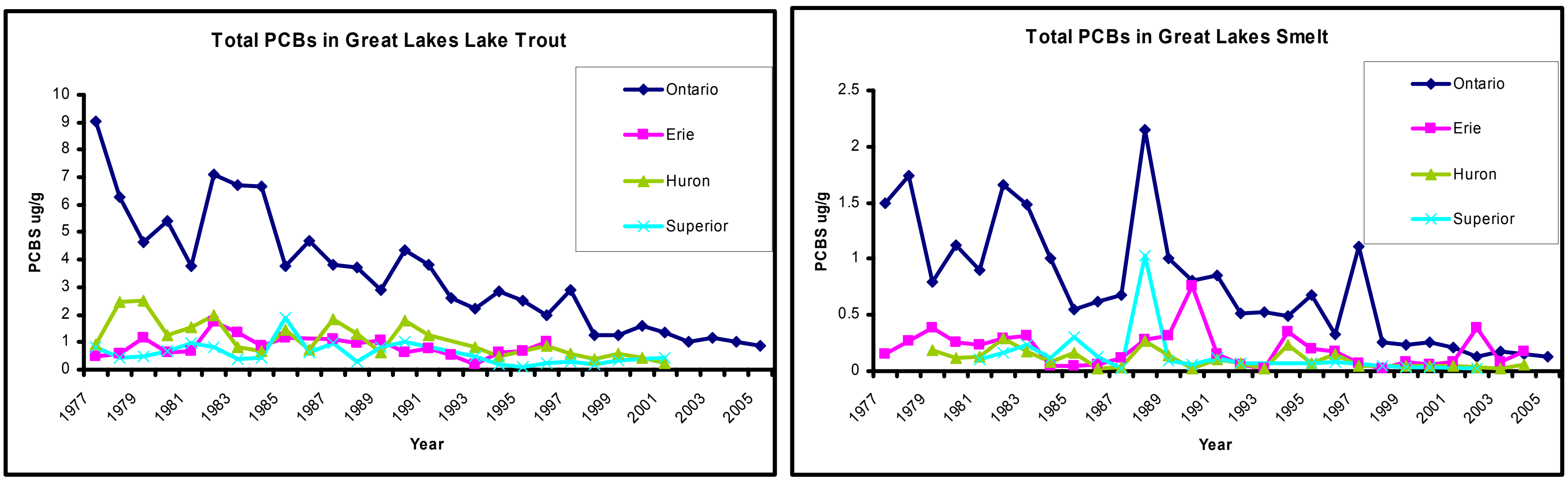
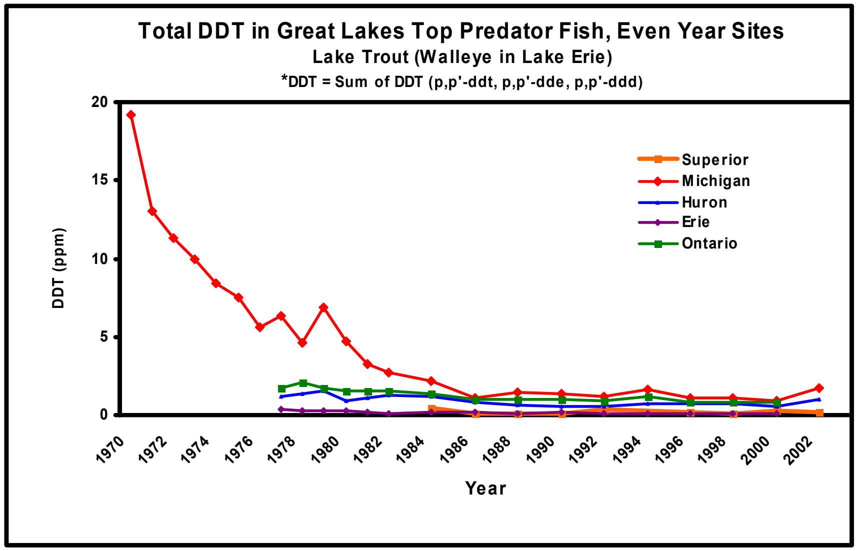


Figure 8F-2. Total PCBs in Great Lakes Lake Trout (left) and Great Lakes Smelt (right). Source: Environment Canada Great Lakes Fish Surveillance Program



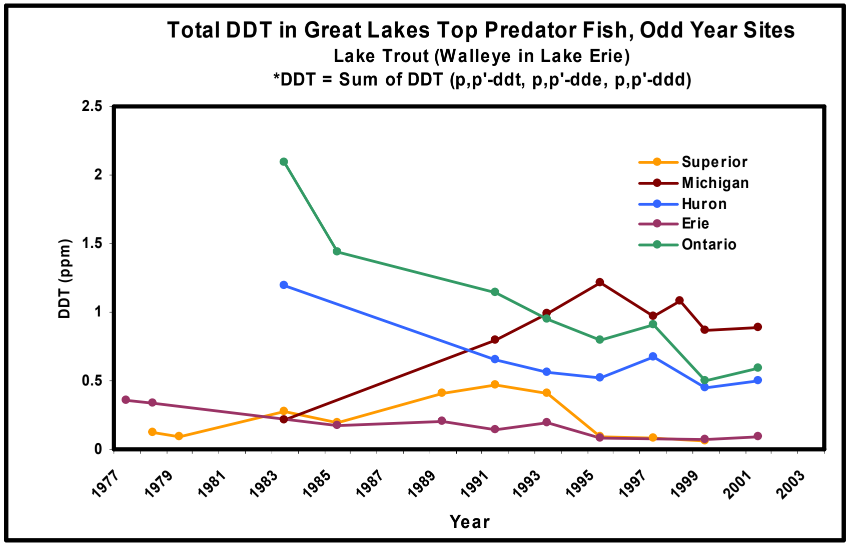
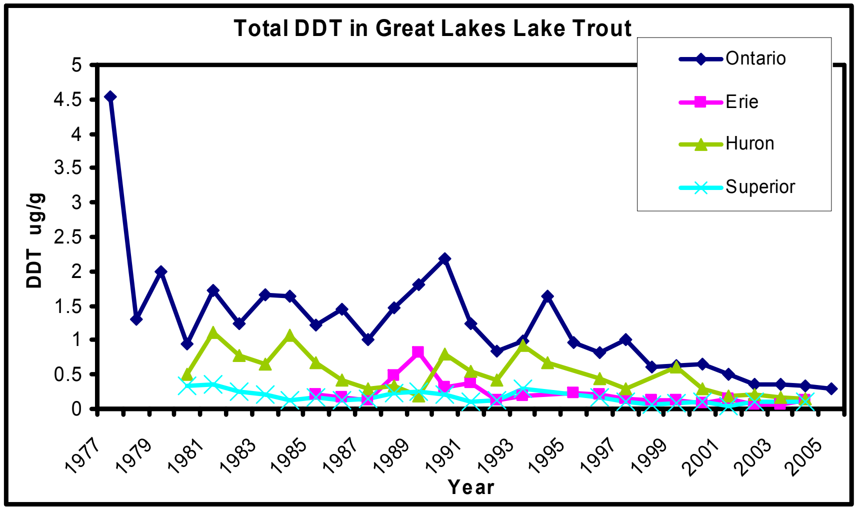


Figure 8F-3. Total DDT in Great Lakes Top Predator Fish, Even Year (left) and Odd Year (right) Sites. Source: US EPA GLNPO Great Lakes Fish Monitoring Program



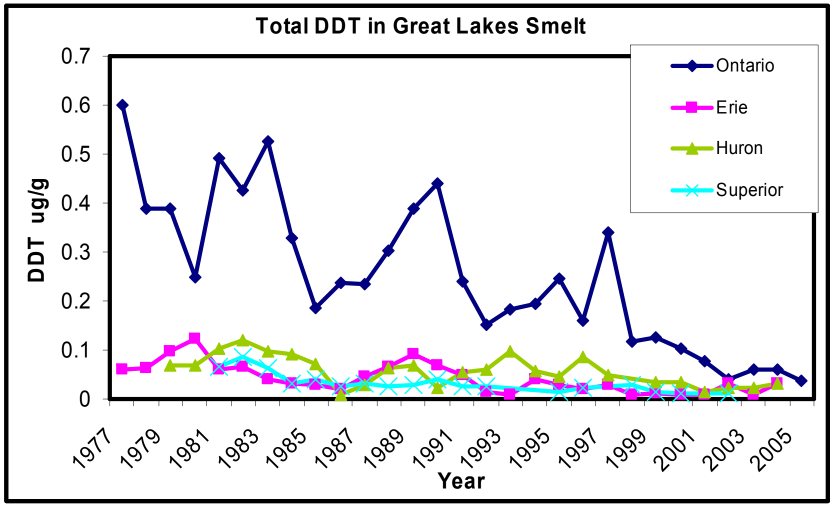
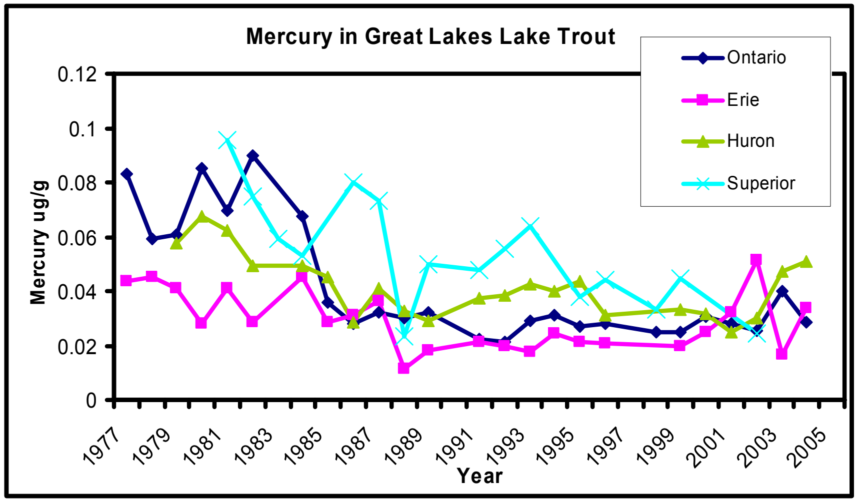


Figure 8F-4. Total DDT in Great Lakes Lake Trout (left) and Great Lakes Smelt (right). Source: Environment Canada Great Lakes Fish Surveillance Program



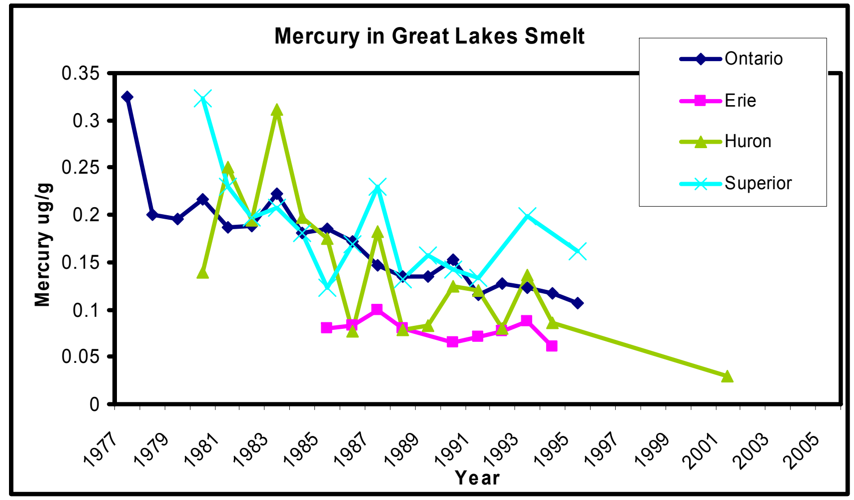


Figure 8F-5. Mercury in Great Lakes Lake Trout (left) and Great Lakes Smelt (right). Source: Environment Canada Great Lakes Fish Surveillance Program

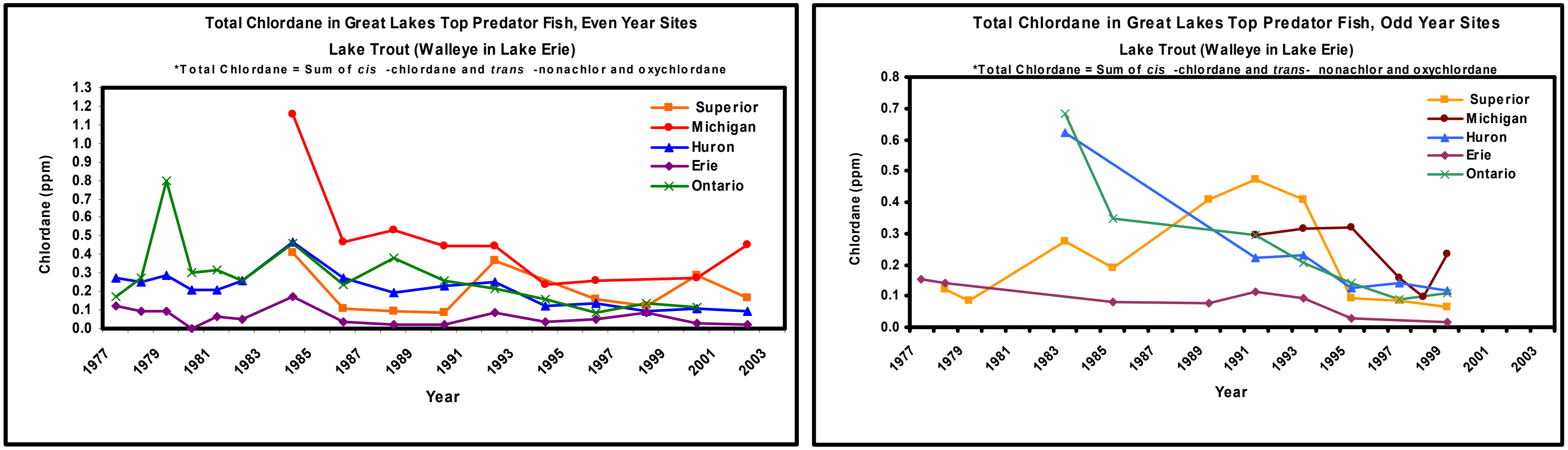


Figure 8F-6. Total Chlordane in Great Lakes Top Predator Fish, Even Year (left) and Odd Year (right) Sites. Source: US EPA GLNPO Great Lakes Fish Monitoring Program

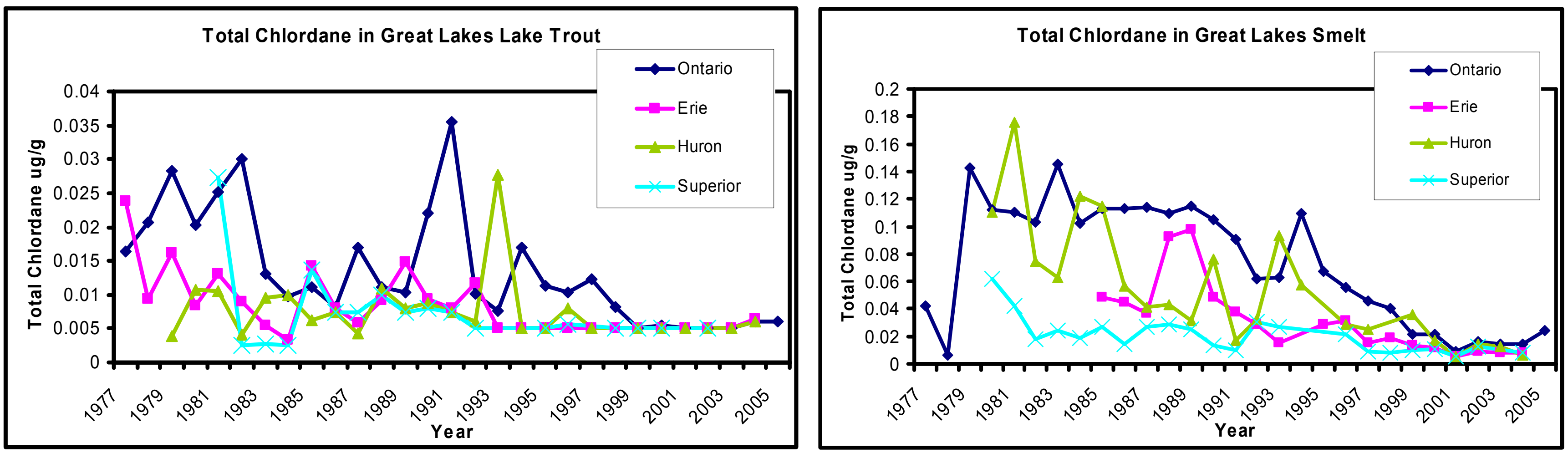
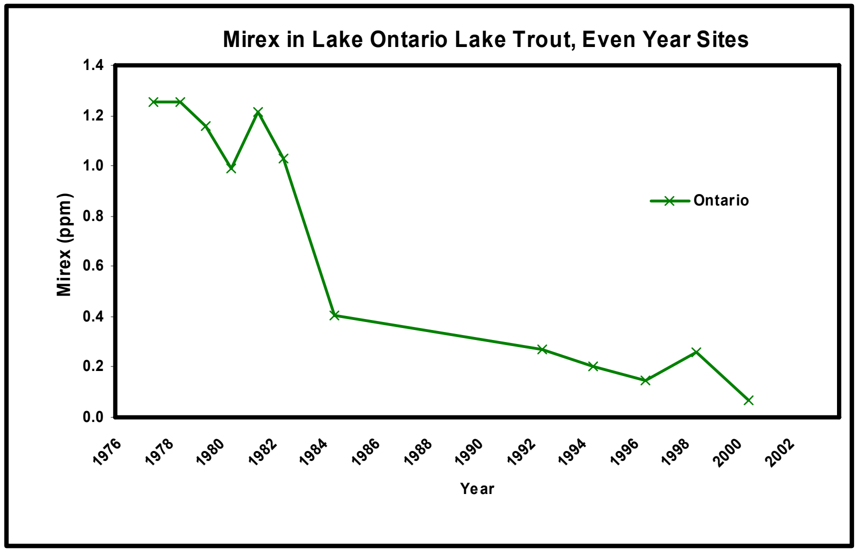


Figure 8F-7. Total Chlordane in Great Lakes Lake Trout (left) and Great Lakes Smelt (right). Source: Environment Canada Great Lakes Fish Surveillance Program



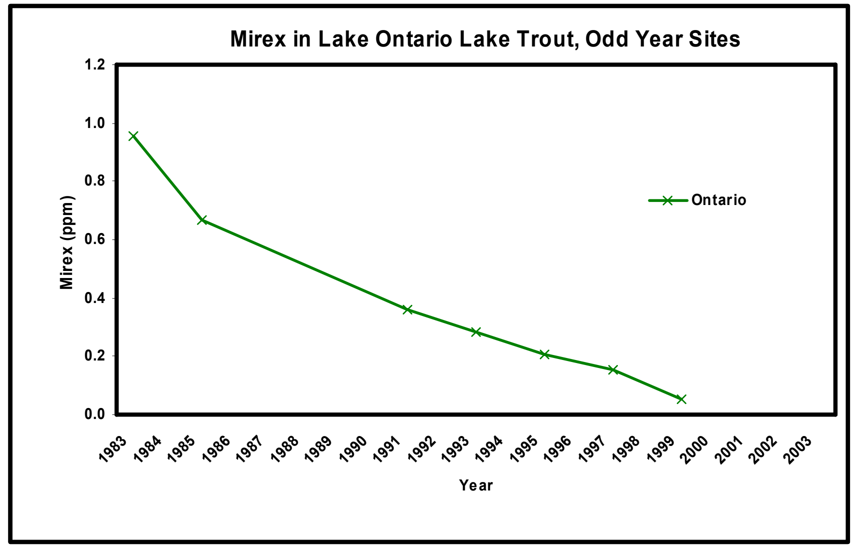
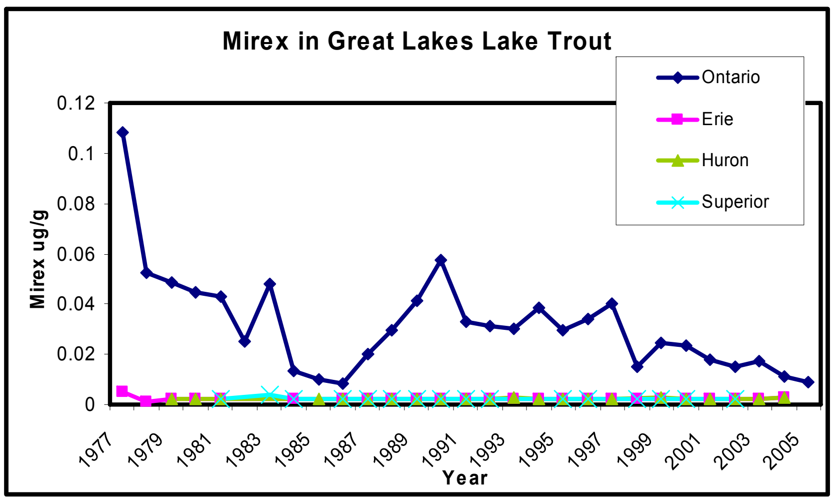


Figure 8F-8. Mirex in Lake Ontario Lake Trout, Even Year (left) and Odd Year (right) Sites. Source: US EPA GLNPO Great Lakes Fish Monitoring Program



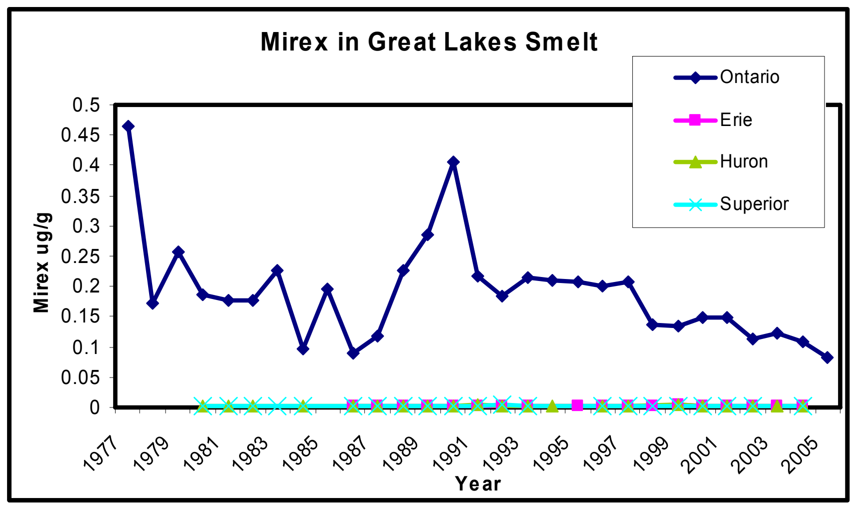


Figure 8F-9. Mirex in Great Lakes Lake Trout (left) and Great Lakes Smelt (right). Source: Environment Canada Great Lakes Fish Surveillance Program

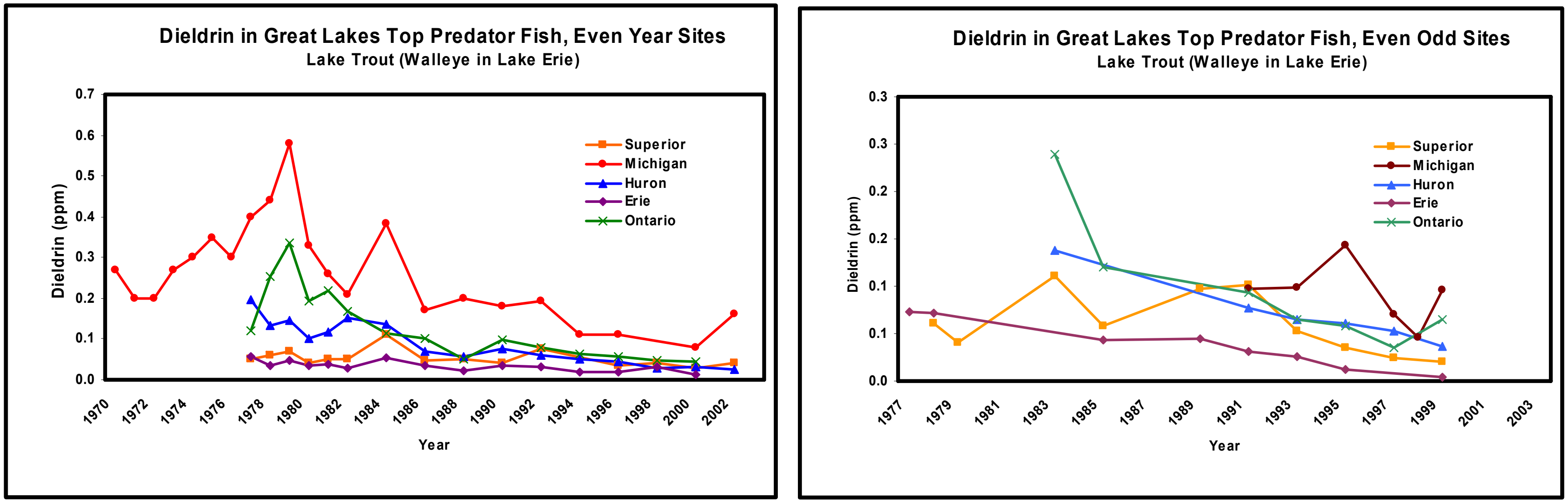


Figure 8F-10. Dieldrin in Great Lakes Top Predator Fish, Even Year (left) and Odd Year (right) Sites. Source: US EPA GLNPO Great Lakes Fish Monitoring Program

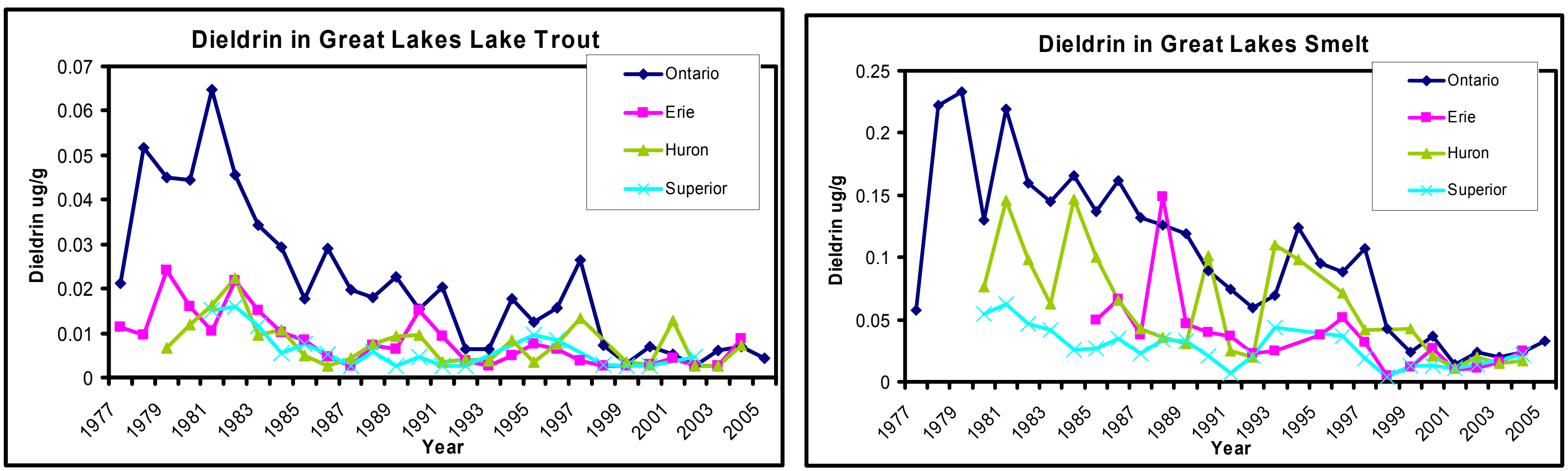


Figure 8F-11. Dieldrin in Great Lakes Lake Trout (left) and Great Lakes Smelt (right). Source: Environment Canada Great Lakes Fish Surveillance Program

Current Contaminants of Concern

There are a number of chemicals of current concern within the Great Lakes Basin. Several of these have been detected in Great Lakes fish. The foremost is the group of brominated flame retardants (BFRs), which include polybrominated diphenyl ethers (PBDEs) and hexabromocyclododecane (HBCD). Perflurochemical compounds (PFCs) are another class of chemicals of concern in the Great Lakes. These contaminants have been reported in fish tissues for several years throughout the Great Lakes Basin, and retrospective analyses have been conducted on archived tissue samples.

PBDEs. Both the U.S. and Canada analyze for PBDEs in whole top predator fish. PBDEs are used in everyday items, such as furniture upholstery and foam, to make them difficult to burn. Retrospective analyses of archived Canadian samples confirm the continuing increase in concentrations of PBDEs in lake trout from Lake Ontario. Concentrations have increased exponentially from 0.54 ng/g in 1988 to 190 ng/g wet weight in whole fish samples collected in 2002 (Whittle et al., 2004). Figure 8F-12 illustrates temporal trends in total PBDE concentrations in Lake Ontario lake trout from 1978 to 2002. The concentrations of most other persistent organic pollutants in top predator fish have declined, while PBDEs continue to increase.

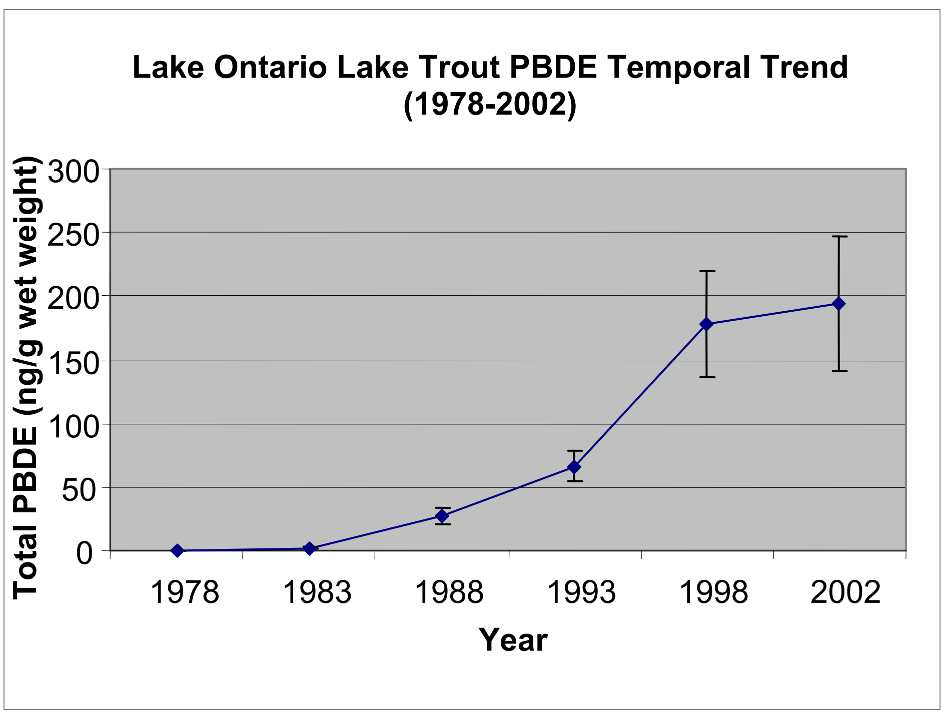


Figure 8F-12. Temporal Trends in Total PBDE Concentrations in Lake Ontario Lake Trout (1978-2002). Source: Great Lakes Laboratory for Fisheries & Aquatic Sciences, Dept of Fisheries & Oceans

A retrospective analysis of PBDEs in archived GLFMP lake trout samples from Lakes Superior, Michigan, Huron, and Ontario and walleye from Lake Erie, collected during the period of 1980-2000, was conducted by Hites et al. (2006). The study explored the geographical distribution and temporal trends of PBDEs in the Great Lakes. As depicted in Figure 8F-13, total PBDE concentrations in fishes from the five Lakes increased exponentially with time, doubling every 3 to 4 years. Also, the relative proportion of BDE47, BDE99, and BDE100 compared to BDE153 and BDE154, increased significantly as a function of time (see Figure 8F-14). This trend highlights the shift of increased production of penta-BDE versus octa-BDE over the years (Zhu and Hites, 2004).

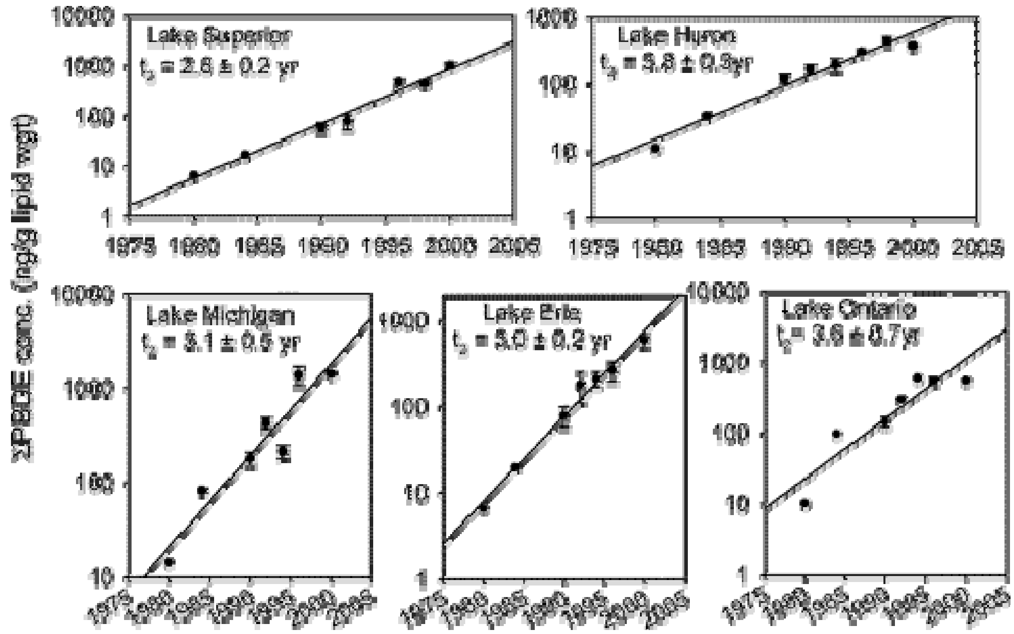


Figure 8F-13. Temporal Trend of Total PBDE Concentrations in Fishes from the Great Lakes.[47] Source: Zhu and Hites, 2004

[47] The fitted exponential curves are shown, the slope of which was used to calculate the doubling time (t2 ± 1 standard error) for each Lake.

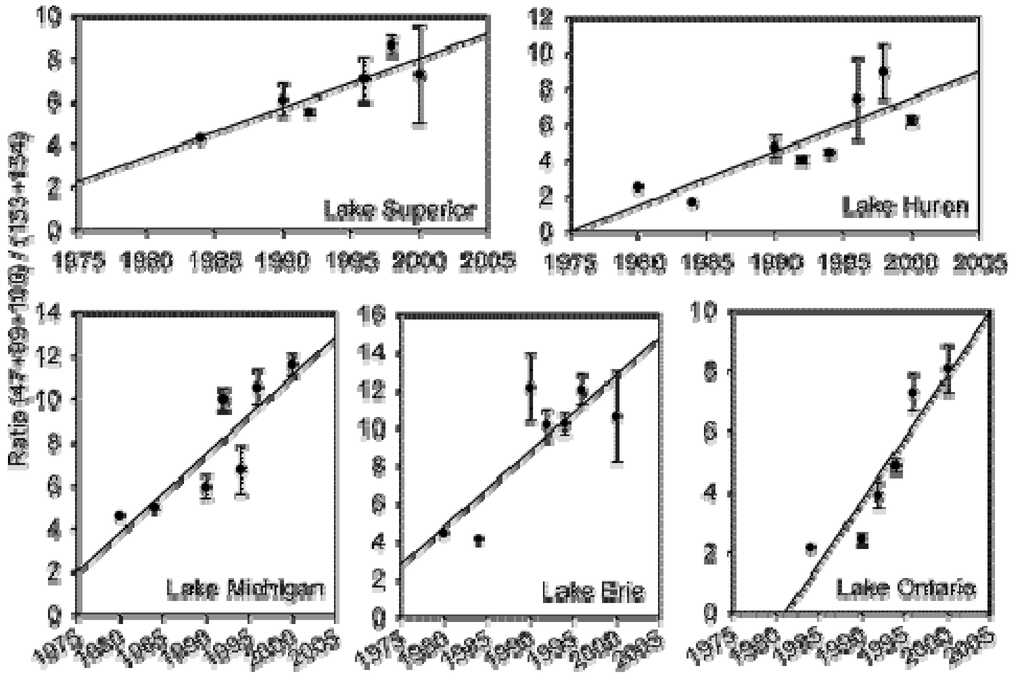


Figure 8F-14. Temporal Trends of the Ratio of the Sum of Concentrations of BDE47 + BDE99 + BDE100 to the Sum of the Concentrations of BDE153 + BDE154 in Fishes from the Great Lakes.[48] Source: Zhu and Hites, 2004

HBCD. One of the most widely used BFRs is HBCD. This chemical is mainly used as a flame retardant in polystyrene insulation boards and the back coating of upholstery fabric. Based on its use pattern, as an additive BFR, it has the potential to migrate into the environment from its application site. Recent studies in Lake Ontario (Tomy et al., 2004) have confirmed that HBCD isomers do bioaccumulate in aquatic ecosystems and do biomagnify as they move up the food chain. Table 8F-1 presents total HBCD concentrations (α and γ isomers) for various species in the Lake Ontario food web.

PFCs. Perfluoroctanesulfonate (PFOS) has also been detected in fish throughout the Great Lakes and has also demonstrated the capacity for biomagnification in food webs. PFOS is used in surfactants such as water repellent coatings (e.g., Scotchguard®) and fire suppressing foams. PFOS has been identified in whole lake trout samples from all the Great Lakes at concentrations from 3 ng to 139 ng (wet weight) (Stock et al., 2003). In addition, retrospective analyses of archived lake trout samples from Lake Ontario have identified a 4.25-fold increase (from 43 to 180 ng/g wet weight, whole fish) from 1980 to 2001 (Martin et al., 2004).

The toxicological effects of these compounds are not yet completely known. However, the evidence of exponential increases in concentration over time, the ability to biomagnify in aquatic

[48] The fitted lines have correlation coefficients (r2): Superior, 0.797; Huron, 0.714; Michigan, 0.757; Erie, 0.674; and Ontario, 0.855. All of these correlations are significant; two outliers from 1980 were omitted.

food webs, and the documented presence in fish throughout the Great Lakes make these compounds prime candidates for toxic chemical monitoring program parameters of interest.

Table 8F-1. Lake Ontario Food Web Bioaccumulation of HBCD Isomers

SPECIES	ΣHBCD (α+γ isomers) (ng/g wet wt ±S.E.)
Lake Trout	1.68± 0.67
Sculpin	0.45± 0.10
Smelt	0.27± 0.03
Alewife	0.13± 0.02
Mysis	0.07± 0.02
Diporeia	0.08 ±0.01
Plankton	0.02± 0.01

From Tomy et al., 2004

Emerging Issues

Invasive Nuisance Species. The impact of invasive nuisance species on toxic chemical cycling in the Great Lakes is still an expanding topic. The numbers of both exotic invertebrates and fish species proliferating in Great Lakes ecosystems continue to increase in temporal and spatial manners. Changes imposed on the form and function of native fish communities by exotics will subsequently alter ecosystem energy flow. As a consequence, the pathways and fate of persistent toxic substances will be altered, resulting in different accumulation patterns, particularly at the top of the food web. The proliferation of zebra mussels witnessed in Lake Erie illustrates one example. Some contaminant concentrations peaked for short periods in fish and subsequently decreased. Each of the Great Lakes is currently experiencing changes in the structure of the aquatic community, and henceforth, there may be periods of increases in contaminant burdens of some fish species.

A 15-year Great Lakes study showed that lake trout embryos and sac fry are very sensitive to toxicity associated with maternal exposures to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and structurally related chemicals that act through a common aryl hydrocarbon receptor (AHR)-mediated mechanism of action (Cook et al., 2003). The increase in contaminant load of TCDD may be responsible for declining lake trout populations in Lake Ontario. The models used in this study can be used in the remaining Great Lakes.

Additional Stressors. Added stressors in the future will arise from the issue of climate change, with the potential for warming effects to change the availability of Great Lakes critical habitats, to change the productivity of some systems, to accelerate movement of contaminants from abiotic sources into the biological community, and to further affect the composition of biological communities. In addition, associated changes in water concentrations and aquatic ecosystem reproductive success are also factors influencing contaminant trends of the Great Lakes in the future.

Emerging Contaminants. Recent research has identified chemicals that have the chemical-physical properties to be contaminants of concern, with respect to persistence and bioaccumulative potential (Muir and Howard, 2006). Research is also being conducted on the toxic potential of human and veterinary pharmaceuticals to aquatic organisms and the potential for selected pharmaceuticals and personal care products to bioaccumulate in the aquatic food web. As more work is conducted on the topic of emerging contaminants in the future, state, federal, provincial, and tribal governments will need to be prepared to provide sound management of these issues.

Management Implications

Much of the current basin-wide persistent toxic substance data that are reported focus on legacy chemicals whose use has been previously restricted through various forms of legislation. There are a variety of current chemicals that are reported in the literature as having been observed at various locations throughout the Great Lakes. There is a need for a comprehensive basin-wide assessment program to acquire data on the presence and concentrations of these recently identified compounds in the Great Lakes ecosystems and the potential for other emerging contaminants to enter the food chain. Long-term specimen archives (>25 years) in both Canada and the U.S. have allowed for the establishment of trends for current contaminants of concern in the Great Lakes. Retrospective analyses of samples contained in these archives can also define whether concentrations of recently detected contaminants are changing and identify whether further control legislation is required for the management of specific chemicals.

Acknowledgments

Contributors:
- Michael J. Keir, Environment Canada
- J. Fraser Gorrie, Bio-Software Environmental Data
- Cameron MacEachen, Environment Canada

Data Sources:
- US EPA GLNPO Great Lakes Fish Monitoring Program
- EC Great Lakes Fish Contaminant Surveillance Program

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Trends in Great Lakes Herring Gull Eggs

Temporal Trends in Contaminant Levels in Herring Gull Eggs from Great Lakes Colonies

Submitted by
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Canadian Wildlife Service
Environment Canada, Ontario Region

The Canadian Wildlife Service (CWS) has analyzed temporal and spatial trends in contaminant levels in herring gull eggs from 15 colony sites on the Great Lakes. Eggs have been collected since the early 1970s from the surroundings of up to eight water bodies within the Great Lakes Basin: the St. Lawrence, Niagara, and Detroit Rivers and Lakes Ontario, Erie, Huron, Michigan, and Superior. Key questions to be addressed include whether trends in contaminant concentration levels are continuing to decline, which sites are the most (and least) contaminated, and the impact, if any, of recent changes to the lower food web on the contaminants being monitored. Recent results have addressed each of these questions and are available in Pekarik and Weseloh (1998), Weseloh et al. (2003, 2005, 2006), Hebert and Weseloh (2006), Hebert et al. (2006), and Hebert et al. (In press).

Study Areas and Methods

The methods and protocol for the Herring Gull Egg Monitoring Program (HGEMP) have been described previously (Mineau et al., 1984; Ewins et al., 1992; DiMao et al., 1999). Briefly, 10 to 13 fresh herring gull eggs were collected, one per completed clutch per year, from each of 15 sites around the Great Lakes. Collections were made in late April and early May. Eggs were sent to the CWS National Wildlife Research Centre, where they were refrigerated, prepared, and analyzed by gas chromatography within 8 weeks of collection (Won et al., 2001). Prior to 1986, all eggs were analyzed individually. Although eggs are still prepared individually, since 1986 a sub-sample from each egg has been taken to form a single site pool, which is then analyzed.

Compounds presented in this report are total PCBs (estimated 1:1 ratio of Aroclors 1254:1260, based on levels of PCB 138), DDE, HCB, OCS, total mercury, 2,3,7,8-TCDD (dioxin), and 2,3,7,8-TCDF (furan). Concentrations are given in µg/g (wet weight) for all compounds except 2,3,7,8-TCDD and -TCDF (pg/g, wet weight). Temporal trends from the beginning of the study were determined by linear regression and by change-point (piecewise) regression (Draper and Smith, 1981; Pekarik and Weseloh, 1998). In addition, data for mercury were also analyzed by linear regression for the time period 1992-2003. Individual annual data for all compounds and sites, and data for Figures 8H-2 through 8H-7, can be found in Bishop et al. (1992), Pettit et al. (1994), Pekarik et al. (1998), and Jermyn et al. (2002; CWS unpublished report). To determine spatial trends, mean values of seven major contaminants in herring gull eggs were calculated for all sites for the five-year period 1998-2002. The sites were ranked according to the concentrations of each compound relative to fish flesh criteria for the protection of piscivorous wildlife, and a single overall rank was calculated for each site (Weseloh et al., 2006).

Herring gull eggs were collected from the following sites (Figure 8H-1):

- St. Lawrence River (SLR) – Strachan Island (near Cornwall) (site 1)
- Lake Ontario (LO) – Snake Island (near Kingston), Tommy Thompson Park (Toronto Harbour) and Neare Island (Hamilton Harbour) (sites 2-4)
- Niagara River (NR) – an unnamed island 300 m above Niagara Falls (site 5)
- Lake Erie (LE) – Port Colborne Lighthouse and Middle Island (sites 6-7)
- Detroit River (DR) – Fighting Island (site 8)
- Lake Huron (LH) – Chantry Island, Double Island (North Channel), and Channel-Shelter Island (Saginaw Bay) (sites 9-11)
- Lake Michigan (LM) – Gull Island and Big Sister Island (Green Bay) (sites 12-13)
- Lake Superior (LS) – Agawa Rocks and Granite Island (Black Bay) (sites 14-15).

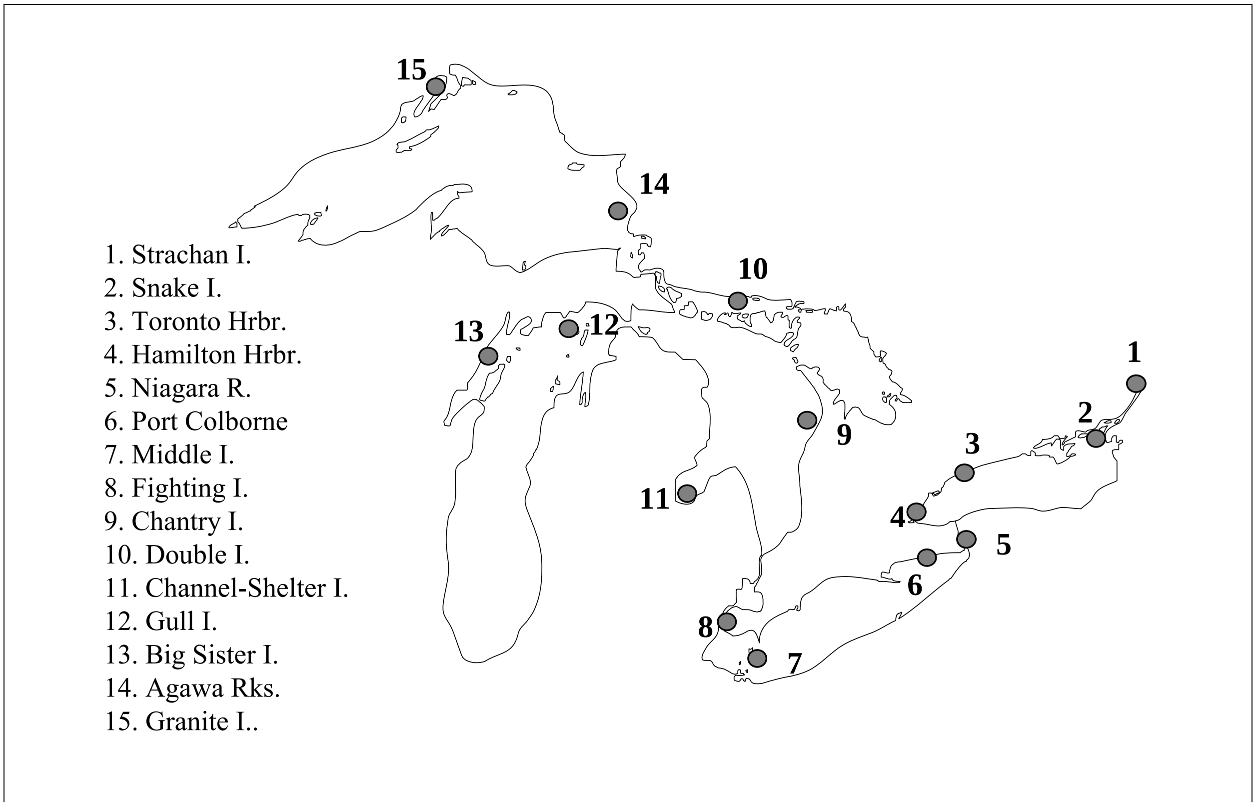

Figure 8H-1. Locations of the 15 Herring Gull Colonies Sampled in This Study

Current concentrations of seven contaminants and percentage change during the study period were calculated as the average value of the sites within each water body (Table 8H1). One site in Lake Ontario (Hamilton Harbour, site 4) and one in Lake Huron (Saginaw Bay, site 11) were not included for this calculation because their time series were not continuous with the two other sites from each of those lakes.

Results

Temporal Trends

Concentrations of PCBs, DDE, HCB, and OCS in herring gull eggs have declined by between 78.2 percent and 99.5 percent on all water bodies since they were first measured. They have declined by more than 90 percent for 87.5 percent of the site-year comparisons (Table 8H-1). Concentrations of 2,3,7,8-TCDD, 2,3,7,8-TCDF, and mercury have not declined as much and range from a 42.5 percent increase (TCDF on the Niagara River) to an 81.9 percent decline. However, more than half of these comparisons have declined by 60 percent or more.

Regression analysis was conducted on the temporal data for five compounds (PCBs, DDE, HCB, OCS, and TCDD) at 15 sites. More than 91 percent of these 75 contaminant-site comparisons showed significant declines. Data for each of these compounds from representative sites are shown graphically in Figures 8H-2 through 8H-6. In a separate analysis, the only compound showing an increasing trend from among the contaminants measured was PBDE (Figure 8H-7). Change-point regression analyses are available in Pekarik and Weseloh (1999) and Weseloh et al. (2003, 2005).

Spatial Trends

Based on the weighted ranking scheme (see Study Areas and Methods), PCBs, 2,3,7,8-TCDD, and DDE contributed the most (60.2%, 30.5%, and 8.5%, respectively) to the overall ranking. Channel-Shelter Island (Saginaw Bay, Lake Huron), Strachan Island (St. Lawrence River), and Gull Island (northern Lake Michigan) ranked as the three most contaminated sites. Agawa Rocks (eastern Lake Superior), Chantry Island (southern Lake Huron), and Port Colborne (eastern Lake Erie) ranked as the three least contaminated sites (Weseloh et al., 2006; Table 8H-2).

Table 8H-1. Percentage Decline in Concentrations of Seven Contaminants in Herring Gull Eggs from 1974 (or year of first analysis*) to 2005[a]

Water Body	Year	PCBs	DDE	HCB	OCS[b]	Mercury[c]	2,3,7,8-TCDD[d]	2,3,7,8-TCDF[e]
Lake Superior n=2	1974	62.75	16.72	0.253	0.0052	0.36	16.00	4.00
	2005	3.71	0.20	0.003	0.0005	0.14	9.87	1.41
	% decline	**94.1%**	**98.8%**	**99.0%**	**90.3%**	**61.7%**	**38.3%**	**64.9%**
Lake Michigan n=2	1977*	107.99	29.17	0.128	0.0047	0.42	15.00	6.00
	2005	7.33	0.60	0.003	0.0005	0.12	2.72	1.44
	% decline	**93.2%**	**97.9%**	**97.8%**	**89.4%**	**71.9%**	**81.9%**	**76.1%**
Lake Huron n=2	1974	71.01	17.40	0.383	0.0052	0.22	29.00	3.50
	2005	2.31	0.16	0.002	0.0005	0.09	11.48	0.95
	% decline	**96.7%**	**99.1%**	**99.5%**	**90.4%**	**58.5%**	**60.4%**	**72.9%**
Detroit River n=1	1978*	115.09	9.44	0.281	0.055	0.21	33.00	3.00
	2005	16.48	0.28	0.003	0.003	0.16	19.16	2.13
	% decline	**85.7%**	**97.0%**	**99.1%**	**94.5%**	**25.7%**	**41.9%**	**29.0%**
Lake Erie n=2	1974	72.46	7.13	0.291	0.017	0.217	22.00	4.00
	2005	9.38	0.15	0.003	0.001	0.09	6.68	1.75
	% decline	**87.0%**	**97.9%**	**99.0%**	**92.9%**	**57.2%**	**69.7%**	**56.3%**
Niagara River n=1	1979*	50.47	4.01	0.173	0.0052	0.24	41.00	2.00
	2005	3.98	0.16	0.003	0.0005	0.09	14.71	2.85
	% decline	**92.1%**	**95.9%**	**98.1%**	**90.4%**	**60.9%**	**64.1%**	**-42.5%**
Lake Ontario n=2	1974	153.03	22.35	0.580	0.017	0.48	80.50	1.50
	2005	8.33	0.45	0.009	0.002	0.13	27.55	0.42
	% decline	**94.6%**	**98.0%**	**98.5%**	**91.2%**	**72.1%**	**65.8%**	**72.0%**
St. Lawrence River n=1	1986*	28.90	3.59	0.052	0.026	0.30	57.00	1.00
	2005	6.29	0.35	0.002	0.001	0.17	18.46	0.65
	% decline	**78.2%**	**90.2%**	**95.4%**	**95.8%**	**43.0%**	**67.6%**	**35.0%**

[*] First year of analysis.

[a] All concentrations reported in µg/g wet weight except TCDD and TCDF, which are in pg/g wet weight. The average contaminant levels were calculated from the sites for each water body as listed under Study Areas and Methods, except for Lake Ontario, where only samples from Snake Island and Tommy Thompson Park (Toronto Harbour) were used, and Lake Huron, where only samples from Chantry and Double Islands were used.

[b] OCS first analysed in 1987 at all sites except at Strachan Island, St. Lawrence River (1st yr = 1988).

[c] First year of mercury analysis on Lake Michigan was 1982; on Detroit River was 1981; and on Niagara River was 1981.

[d] TCDD and TCDF first analyzed in 1984 at all sites except at Strachan Island, St. Lawrence River (1st yr = 1986). The most recent data for these contaminants are for 2003.

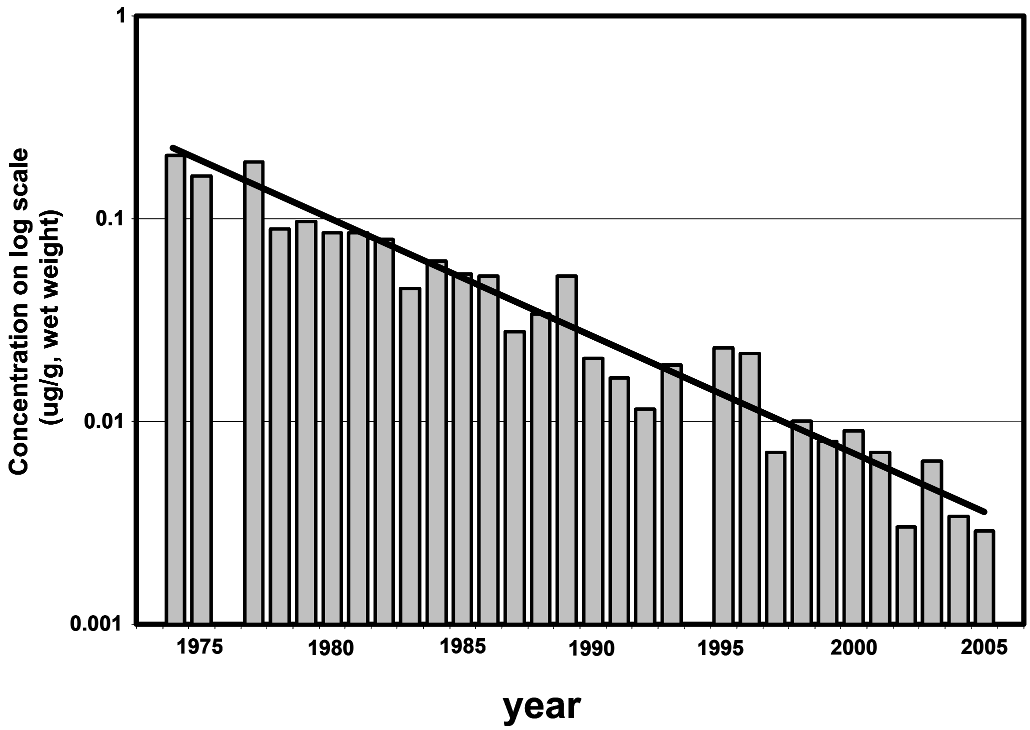

Figure 8H-2. **HCB in Herring Gull Eggs, Port Colborne Lighthouse, Lake Erie, 1974-2005. Source: CWS (see Study Areas and Methods)**

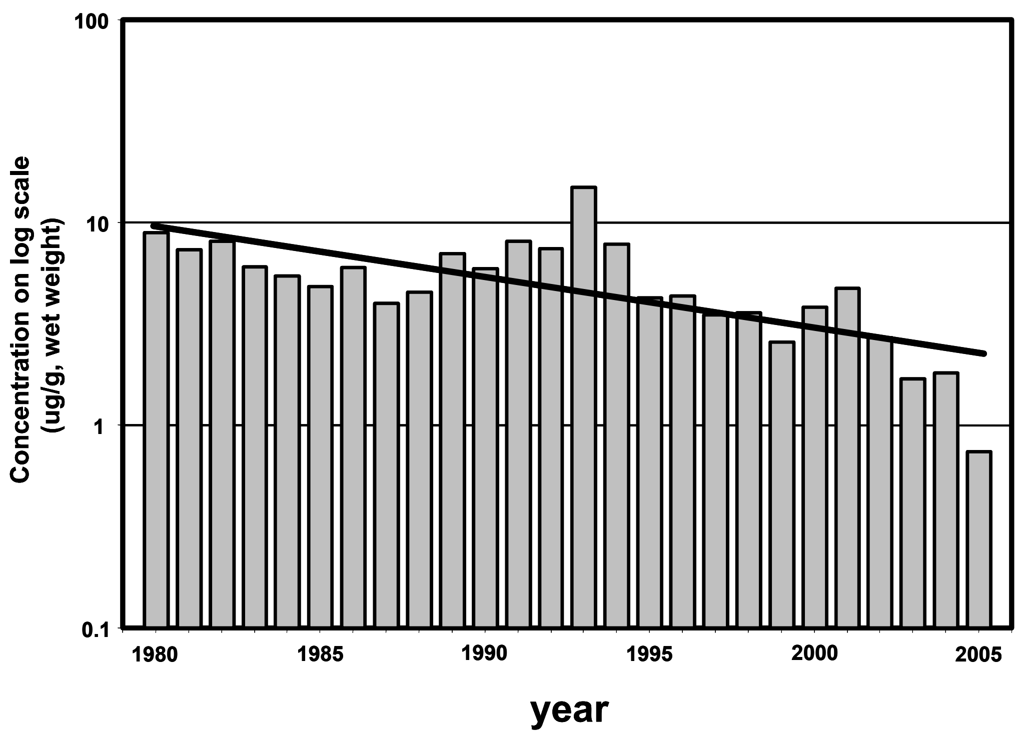

Figure 8H-3. **DDE in Herring Gull Eggs, Channel-Shelter Island, Saginaw Bay, Lake Huron, 1980-2005. Source: CWS (see Study Areas and Methods)**

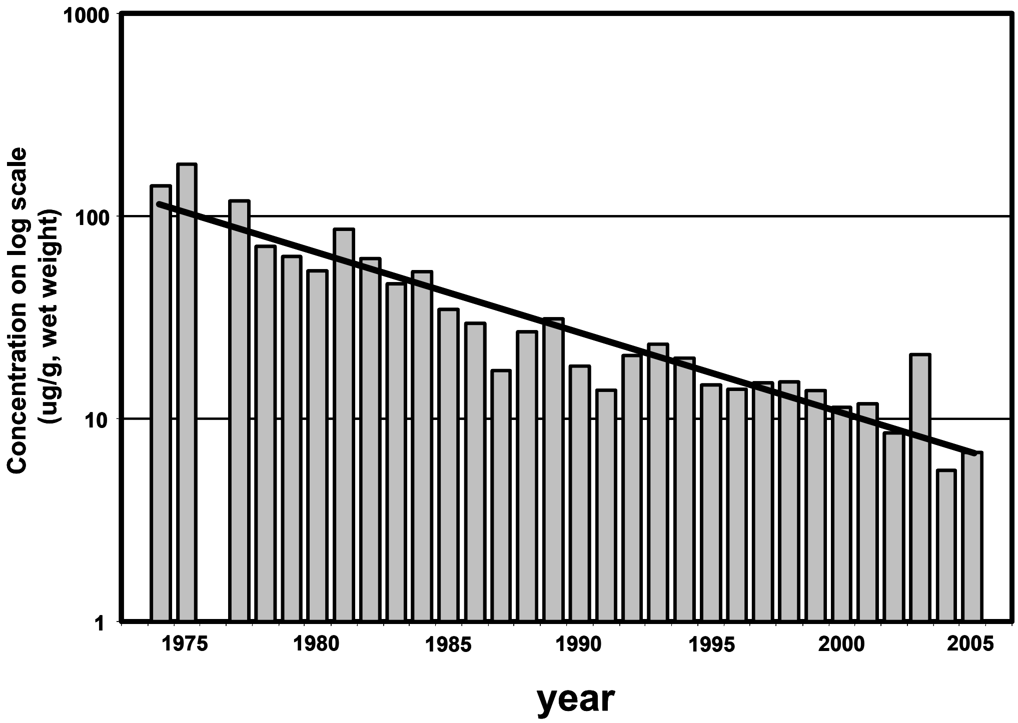

Figure 8H-4. PCBs in Herring Gull Eggs, Snake Island, Lake Ontario, 1974-2005. Source: CWS (see Study Areas and Methods)

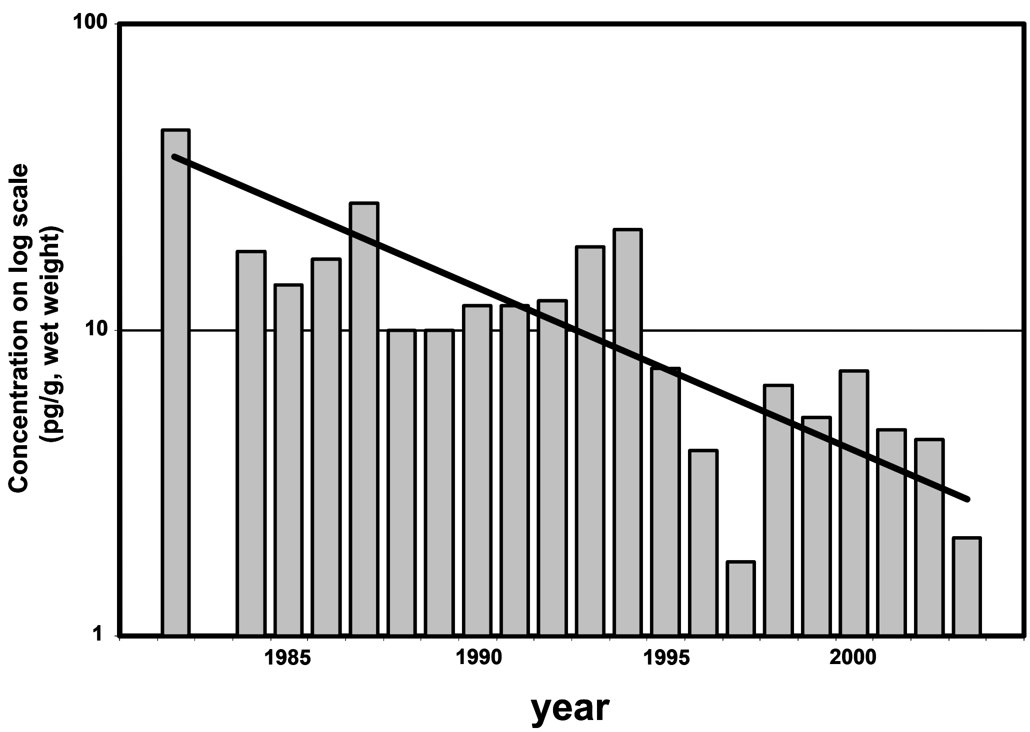

Figure 8H-5. TCDD in Herring Gull Eggs, Big Sister Island, Lake Michigan, 1984-2003. Source: CWS (see Study Areas and Methods)

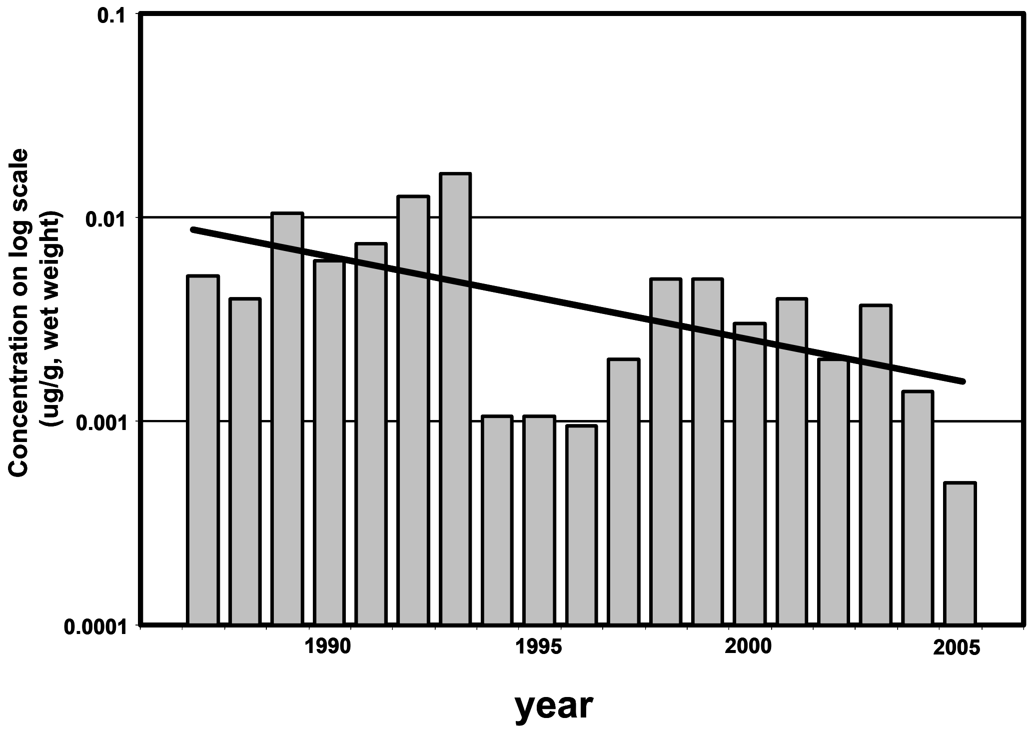

Figure 8H-6. OCS in Herring Gull Eggs, Niagara River, 1987-2005. Source: CWS (see Study Areas and Methods)

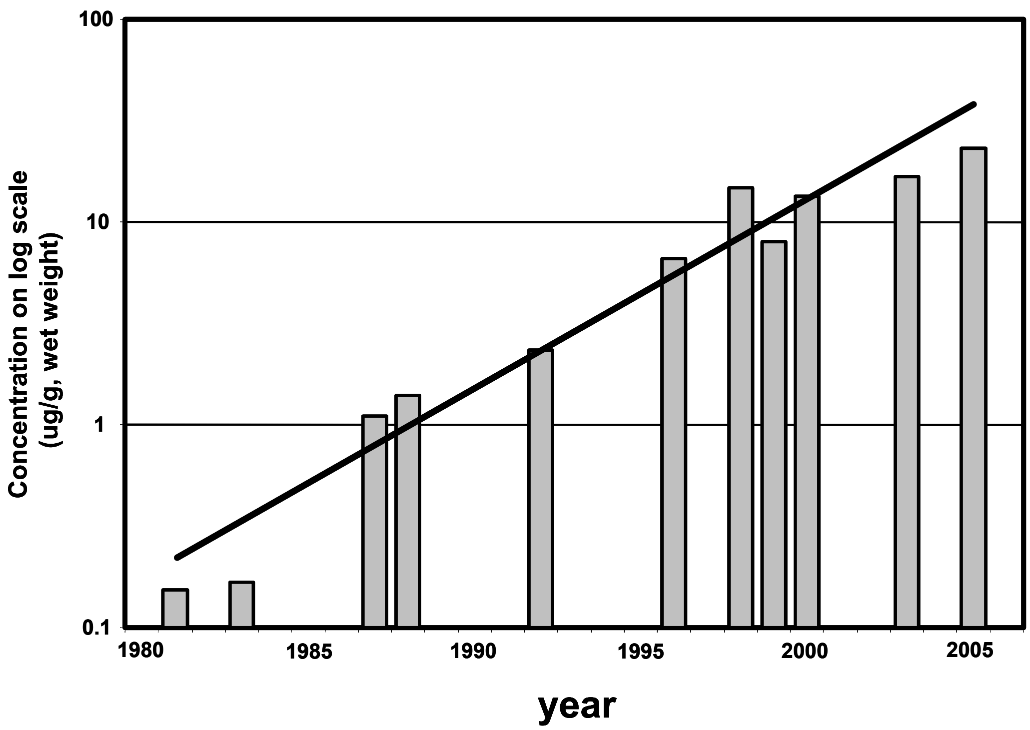

Figure 8H-7. PBDE in Herring Gull Eggs, Gull Island, Lake Michigan, 1981-2005. Source: Norstrom et al. 2002; CWS (see Study Areas and Methods)

TABLE 8H-2. Mean Weighted Rank of Each Site, 1998-2002 (arranged from most to least contaminated) and Range in Rank (1 = most, 15 = least contaminated site). Data from Weseloh et al. (2006)

Colony (Water Body)	Mean weighted rank	Most contaminated rank for this site	Least contaminated rank for this site	Homologous groups[1]
Channel-Shelter I. (LH)*	1.22	1	8	A
Strachan I. (SLR)*	5.19	2	15	B
Gull I. (LM)	5.28	1	11	B
Fighting I. (DR)*	5.81	2	14	B
Snake I. (LO)	5.82	1	13	B
Hamilton Hrbr. (LO)*	6.21	4	12	B
Middle I. (LE)	6.64	4	15	BCD
Toronto Hrbr. (LO)*	7.38	3	14	BC
Big Sister I. (LM)	7.50	2	14	BCD
Granite I. (LS)*	9.31	3	10	BCDE
Niagara River*	9.85	2	14	BCDE
Double I. (LH)	11.26	5	14	CDE
Agawa Rocks (LS)	12.02	4	13	DE
Chantry I. (LH)	12.73	6	15	E
Port Colborne (LE)*	13.78	12	15	E

The ranks were weighted with a measure of contaminant toxicity using the ratio between mean egg concentrations of each compound and the corresponding fish flesh criteria for the protection of piscivorous wildlife (Newell et al., 1987).

* In or within herring gull feeding range of an Area of Concern.

[1] Colonies with the same letter are not significantly different (SNK test, $\alpha = 0.05$).

Discussion

The contaminant concentrations and their spatial and temporal trends shown in herring gull eggs presented in this section follow, to some extent, the data from fish monitoring programs in the Great Lakes (Carlson and Swackhamer 2006; Murphy et al. 2006). For example, DDE values were greatest in samples from Lake Michigan, mirex and OCS were greatest in Lake Ontario, and mercury values did not vary significantly at sites from across the Great Lakes water bodies. The gull data differ from the fish data in that most of the sites that had the greatest concentrations of various contaminants were located in Lake Ontario and most of the sites with the least contaminated gull eggs were in Lake Huron. For the fish data, the areas of greatest and least contamination were Lake Michigan and Lake Superior, respectively. Part of the difference for the least contaminated lake may be because many of the herring gulls that breed on Lake Superior spend the winter on the lower lakes or the south end of Lake Michigan (Hebert et al. 1998), where they are exposed, temporarily, to more elevated contaminant concentrations.

In addition to the results shown here, the gull egg data have been analyzed by change-point regression (Pekarik and Weseloh 1998; Weseloh et al. 2003, 2005; Hebert et al., in press). This analysis allows researchers to search a data time series for its component trends, answering the question, "Are there multiple trends within a given time series?" This has further allowed us to identify contaminants and sites where concentrations are changing (e.g., declining) more slowly than previously, more rapidly than previously, at a constant rate, or are showing no temporal trend at all. For these results and discussions, the reader is referred to the above publications.

Fishery and gull research both show that the food webs in the Great Lakes are changing due to the presence of non-native species (Hebert et al., 2006; Hebert and Weseloh, 2006; Murphy et al., 2006). The net result of this is that, in many cases, organisms are now feeding at a lower trophic level, or have a more compressed diet, than previously. Feeding lower in the food web may cause the rate of contaminant decline to appear artificially increased, when in fact the upper trophic organism has simply switched its diet to a less contaminated source. While this may be good for the organism (its contaminant levels have declined), it gives a false impression of the true situation in the environment with respect to overall contaminant load.

Future studies with the HGEMP include continuation of the annual monitoring and tracking of spatial and temporal contaminant trends and further research into the use of stable isotopes, fatty acids, and other ecological tracers to give more detailed meaning to the trends.

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Trends in Great Lakes Sediments and Surface Waters

Spatial and Temporal Trends in
Selected Pollutants in Great Lakes Waters and Sediments

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Water and sediment contaminant monitoring programs began in the late 1970s to the mid-1980s and are ongoing in the open waters and interconnecting channels of the Great Lakes (Figures 8S-1a and b). Due to the comprehensive nature of these programs, spatial and temporal trends can be assessed over the breadth of the entire Great Lakes Basin and can illustrate the response in the ambient environment to toxic reduction initiatives at local and regional scales. Meanwhile, threat assessment studies can provide additional information on the occurrence of persistent toxic substances or emerging chemicals of concern. For example, depositional sediments from Great Lakes tributaries can screen watersheds for potential upstream sources of legacy persistent toxics and emerging chemicals (Figure 8S-1c), while sediment cores and archived sediment samples can hind-cast trends.

Marvin et al. (2003) and Marvin et al. (2004) have reported on spatial and temporal trends in legacy persistent toxic substances from Environment Canada and U.S. EPA programs. For example, dieldrin and atrazine concentrations in open waters of the Great Lakes, and the associated temporal trends in the interconnecting channels, are shown in Figure 8S-2 and Figure 8S-3, respectively. Concentrations of dieldrin in Lakes Superior (2001, lakewide average 0.13 ng/L) and Huron (2002, 0.069 ng/L) were lower, compared with Lakes Erie (2002, 0.15 ng/L) and Ontario (2001, 0.16 ng/L). Atrazine concentration differences between the upper and lower Great Lakes were more pronounced with lakewide averages in Lake Superior and Lake Huron of 3.21 and 9.49 ng/L, respectively, and 39.2 ng/L and 47.3 ng/L in Lake Erie and Lake Ontario, respectively. Current loadings of dieldrin and atrazine to Lakes Superior and Huron result primarily from atmospheric deposition. The relatively higher concentrations in the lower lakes are the result of a combination of sources, including historical usage in the watersheds, loadings from the upstream lakes and connecting channels, and atmospheric deposition. The current use of atrazine in the agricultural regions of the Great Lakes accounts for the large difference in concentrations between the upper and lower lakes.

The annual mean whole water concentrations of dieldrin at both Fort Erie and Niagara-on-the-Lake showed distinct downward trends over the period 1986-2001; concentrations declined by roughly 70 percent over this period (Table 8S-1). Data from the upstream/downstream stations in the St. Clair River and a monitoring station at Wolfe Island in the St. Lawrence River showed a similar trend. The best sources for temporal trends are the interconnecting channels programs in the Niagara, St. Clair, and the St. Lawrence (at Wolfe Island) rivers. Most contaminants have decreased in concentration over time, typically in the 50-90 percent range.

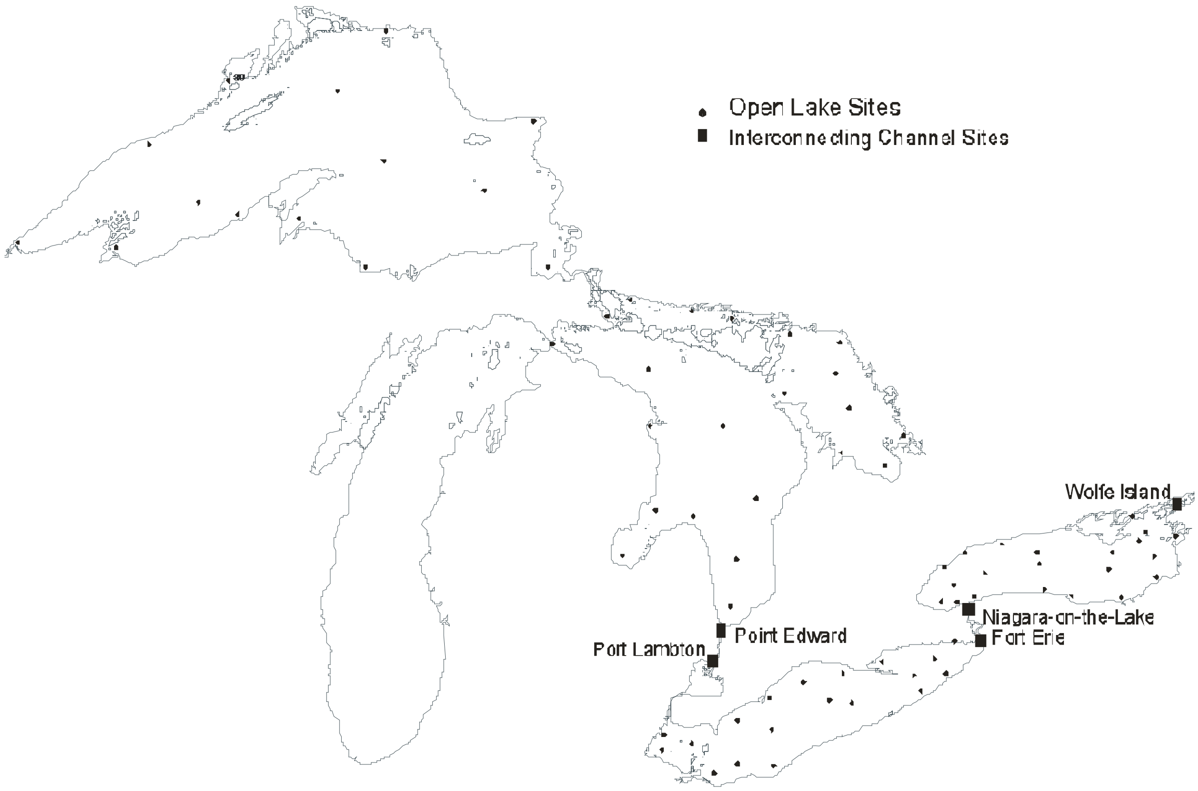

Figure 8S-1a. Open-lake and Interconnecting Channel Water Quality Sites Monitored for Persistent Toxic Substances. Source: Environment Canada

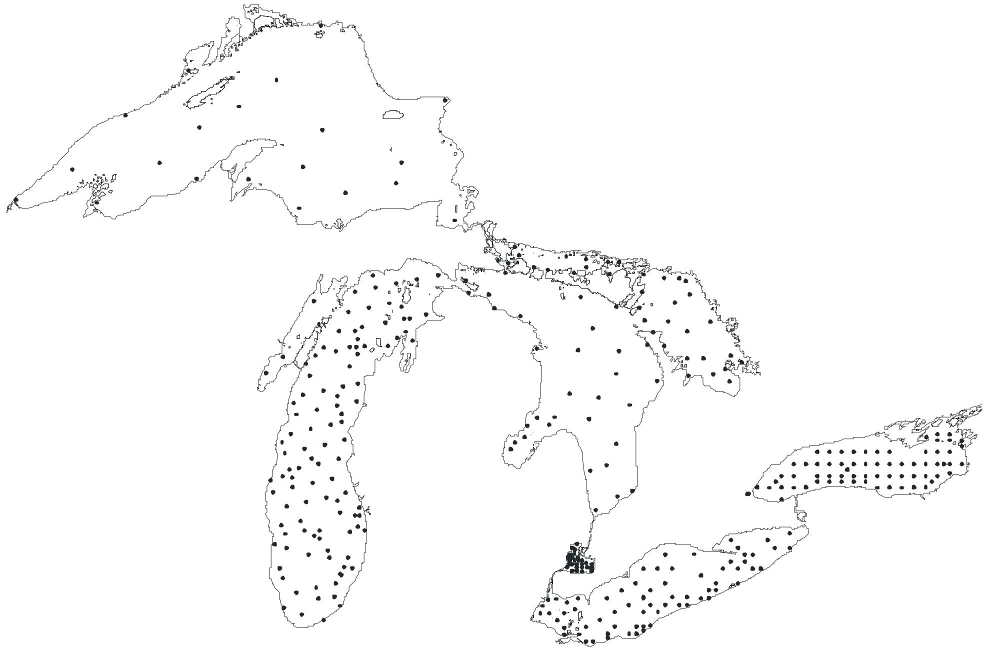

Figure 8S-1b. **Open-lake Bottom Sediment Sites Monitored for Persistent Toxic Substances. Source: Environment Canada**

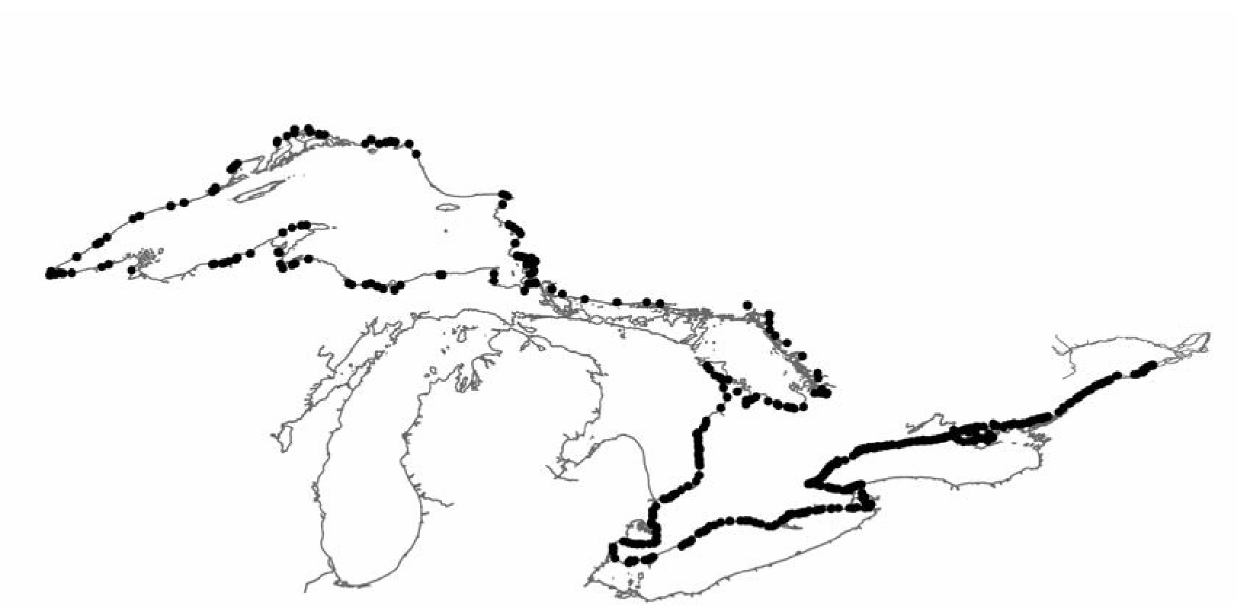

Figure 8S-1c. **Tributary Screening Sites for Bottom Sediment Contaminant Study. Source: Environment Canada**

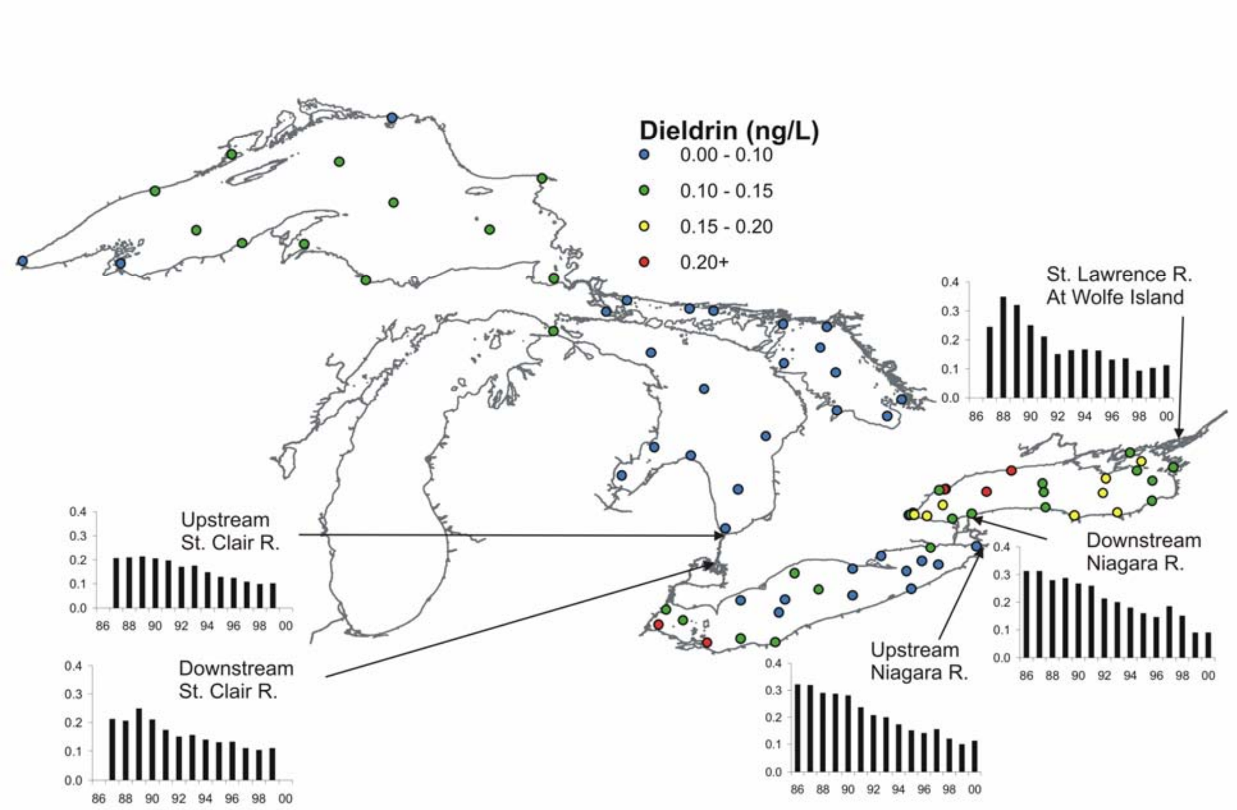

Figure 8S-2. Distribution of Dieldrin in Surface Water (dissolved phase in ng/L), and Annual Mean Concentrations (ng/L) in the Interconnecting Channels from 1986 to 2000 (whole water in ng/L). Source: Environment Canada

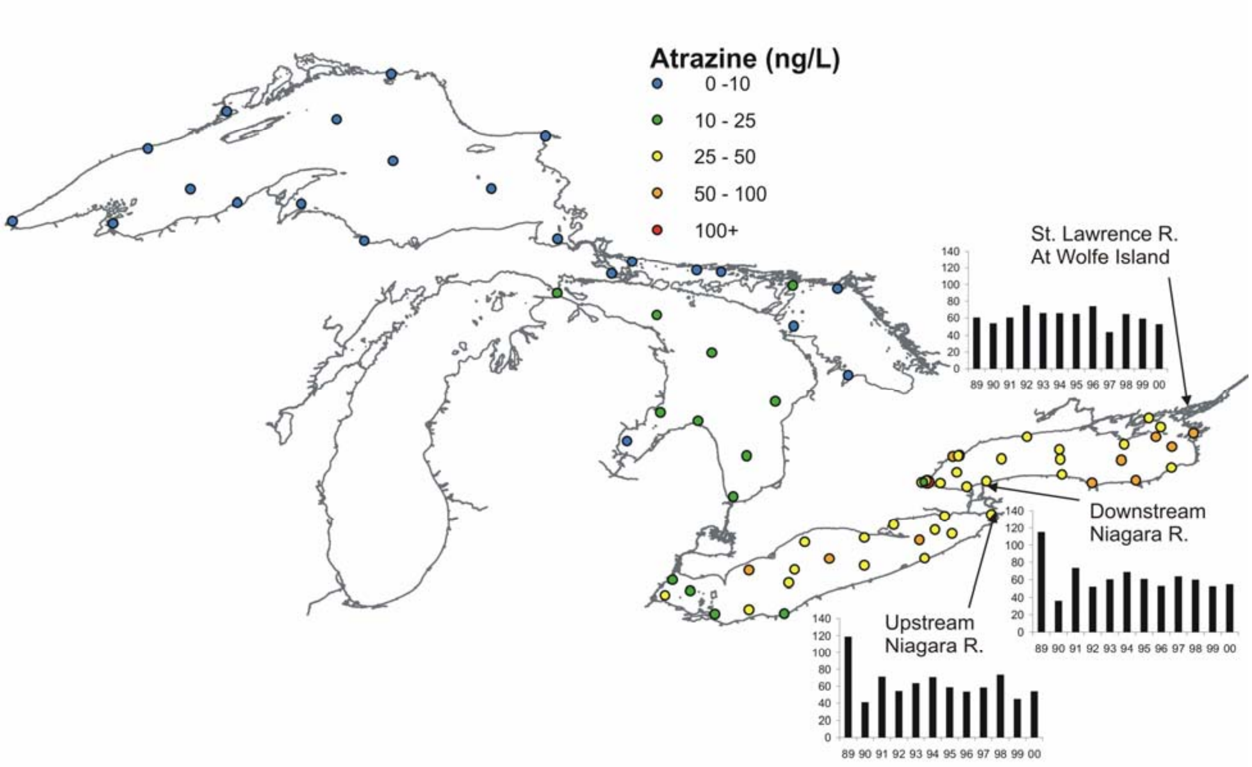

Figure 8S-3. Distribution of Atrazine, a Current Use Pesticide, in Surface Water (dissolved phase in ng/L), and Annual Mean Concentrations (ng/L) in the Interconnecting Channels from 1986 to 2000 (whole water in ng/L). Source: Environment Canada

Table 8S-1 shows the change in whole water concentration of the "Priority Toxics" from the base year (1986/1987) to the most recently reported year (2000/2001). These results are based on a ratio of annual maximum likelihood estimates and should not be considered an analysis of trends. Results indicate a significant decrease (>70%) in concentration for most of the toxics. Notable exceptions are the percent changes in concentrations of B(a)P and benzo(b/k)fluoranthene, which suggest a slight increase at the Fort Erie station.

Bottom sediment contaminant surveys conducted in the Great Lakes from 1968 to 1974 and from 1997 to 2002 provide a good illustration of the spatial distribution of contaminants, and the impacts of local historical sources and, in concert with sediment cores, also illustrate the response to management initiatives. Comparisons of surficial sediment contaminant concentrations with sub-surface maximum concentrations indicate that contaminant concentrations have generally decreased by more than 35 percent and, in some cases, by as much as 80 percent. Table 8S-2 presents percentage reductions in contaminant concentrations (surface vs sub-surface) in Lakes Ontario, Erie, Huron, Superior, and St. Clair from available sediment core data.

Table 8S-1. Percent Change in Whole Water Concentrations from 1986/87 to 2000/01 Based on Annual Maximum Likelihood Estimates

Chemical	Period of Record	% Change in Whole Water	
		Fort Erie	Niagara-on-the-Lake
Hexachlorobenzene	1986-2001	-54.8	-77.7
a-chlordane	1986-2001	-90.5	-94.7
g-chlordane	1986-2001	-73.2	-86.3
p,p'-DDT	1986-2001	-88.4	-75.5
o,p'-DDT	1986-2001	-95.5	-93.0
p,p'-TDE	1986-2001	-78.0	-60.7
p,p'-DDE	1986-2001	-83.9	-73.7
Dieldrin	1986-2001	-65.1	-71.4
Mirex	1986-2001	ND	-60.5
PCBs[1]	1986-2001	-94.0	-80.7
Benz(a)anthracene	1986-2000	-74.5	-52.4
Benzo(a)pyrene	1986-2000	40.2	-12.6
Benzo(b/k)fluoranthene	1986-2000	20.6	-2.9
Chrysene-triphenylene	1986-2000	-70.8	-51.7
Octachlorostyrene	1989-1990	ND	-93.4
Trace Metals in Whole Water			
Lead	1986-2001	-67.7	-51.5
Arsenic	1986-2001	-4.9	-23.3
Mercury[2]	1986-1997	-	-

Notes:
ND - Not Detected
[1] PCBs are for the sediment fraction only
[2] Analysis of mercury in water was discontinued in 1996/97 pending achievement of a more sensitive detection limit.

Table 8S-2. Percentage Reductions in Contaminant Concentrations Estimated from Sediment Cores

Parameter	Ontario	Erie	St. Clair	Huron	Superior
	%Reduction	%Reduction	%Reduction	%Reduction	%Reduction
Mercury	73	37	89	82	0
PCBs	37	40	49	45	15
Dioxins	70	NA	NA	NA	NA
HCB	38	NA	49	NA	NA
Total DDT	60	42	78	93	NA
Lead	45	50	74	43	10

Notes:
NA - Not Available

Open-lake bottom sediment contaminant information has been collected for all of the Great Lakes. For example, Marvin et al. (2003) described mercury trends in bottom sediments from all of the Great Lakes (Figure 8S-4). Lakes Huron, Michigan, and Superior exhibited relatively low mercury concentrations, while the western basin of Lake Erie and Lake Ontario exhibited the highest levels. Sources of mercury contamination in Lakes Erie and Ontario are primarily attributed to loadings from historical sources, including chlor-alkali production in the Detroit, St. Clair, and Niagara Rivers. The spatial distributions of mercury in sediments of Lakes Huron and Superior suggest that natural geochemical factors are an influence. Surficial sediment mercury concentrations have decreased markedly. Figure 8S-5 shows the trend in mercury concentrations from the Niagara River stations. The figure shows that the concentrations have decreased since 1984; although there is considerable yearly variation in concentrations, the polynomial trend lines suggest that concentrations appear to be leveling off. It is important to note that the concentrations at both stations are now consistently below the CCME (Canadian Council of Ministers of the Environment) sediment quality guideline. These results are evidence of the effectiveness of binational initiatives to reduce discharges of toxic contaminants (e.g., GLWQA, Niagara River Toxics Management Plan, and GLBTS).

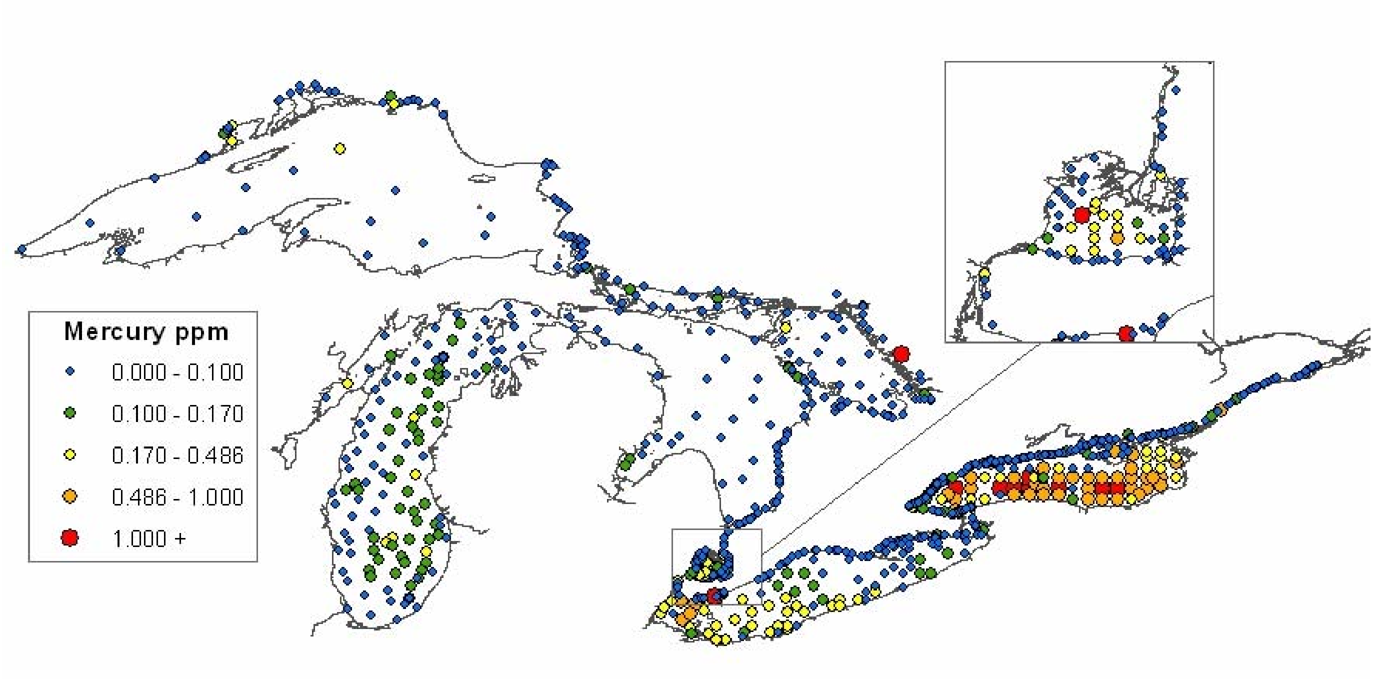

Figure 8S-4. Open-lake Bottom Sediment Mercury Concentrations (µg/g or ppm) and Surficial Tributary Sediment. Source: Environment Canada

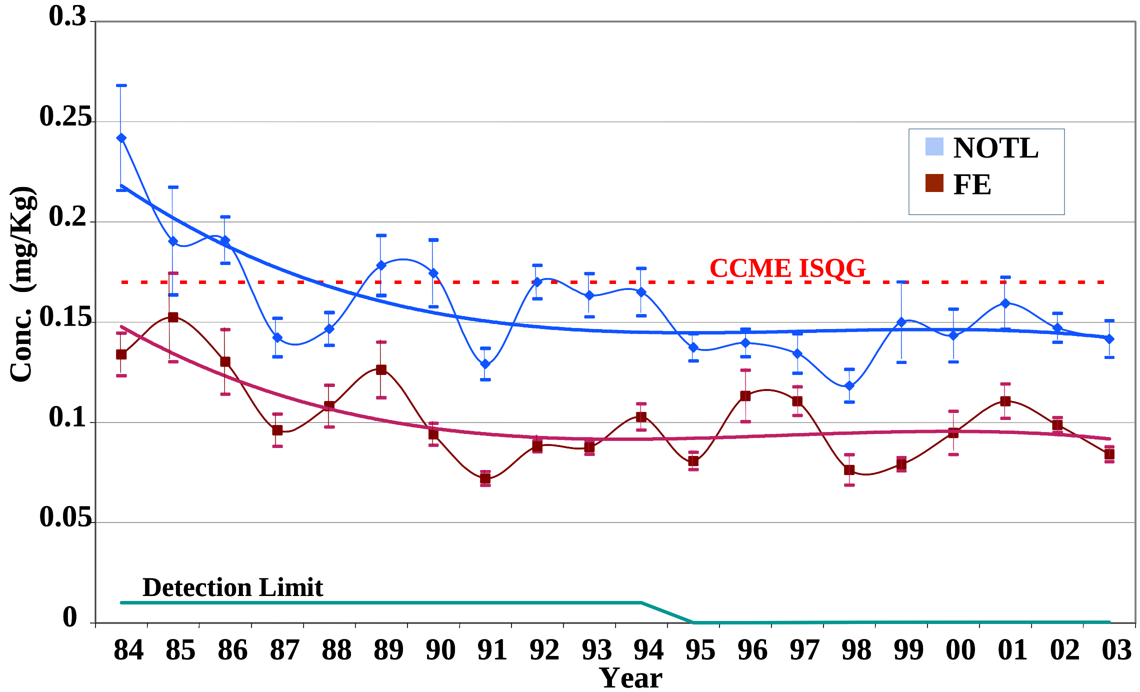

Figure 8S-5. Annual Mean (±SE) Mercury Concentrations in Suspended Sediments in the Niagara River, 1984-2003.[49] Source: Environment Canada

A screening-level survey of recently deposited sediments was undertaken for Canadian Great Lake tributaries over a five-year period from 2001 to 2005 (Figure 8S-1c). The geographical scope of the program was from the Quebec provincial border on Lake Ontario in the east to the Canadian/U.S. border on Lake Superior in the northwest. A total of 431 tributaries were sampled and analyzed for 52 organic compounds and 27 metals. This screening program was designed to identify sources of contaminants to the Great Lakes from the surrounding watersheds. Integrating open lake and tributary data can reveal impacts from local sources. The screening for perfluorooctane sulfonate (PFOS), a surfactant used in both industrial and commercial products, at the tributary level was one of the first monitoring programs to analyze for this compound in sediment (Figure 8S-6). While concentrations appear to be low, the relative levels are indicative of land use where, in general, elevated levels are found in more populated watersheds.

At the local scale, an EC water column and suspended sediment contaminant study in the St. Clair River/Detroit River corridor further refines our knowledge of localized sources. Figure 8S-7 illustrates mercury concentrations in water, lake, and tributary bottom sediments and suspended sediments within the corridor. Integration of the open-lake, tributary screening and suspended sediment contaminant information enables a weight-of-evidence approach to the assessment of contaminants in the Great Lakes Basin.

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[49] CCME ISQG = Canadian Council of Ministers of the Environment Interim Sediment Quality Guideline. NOTL= Niagara-on-the-Lake, and FE = Fort Erie.
NOTE: the trend lines represent polynomials fitted through the data.

The presence of new persistent toxics represents an emerging threat to the health of the Great Lakes ecosystem. These compounds include both PFOS and the brominated flame retardants (BFRs), the latter of which are heavily used globally in the manufacturing of a wide range of consumer products and building materials. The BFRs have been found to be bioaccumulating in Great Lakes fish and in breast milk of North American women. Assessment of the occurrence and fate of these new compounds has recently been incorporated into the surface water, suspended sediment, and bottom sediment monitoring programs. For example, archived suspended samples from the Niagara River upstream/downstream program have been used to establish the temporal trend in the occurrence of PBDEs, a major class of BFRs. There is a trend toward increasing levels of PBDEs since the late 1980s (Figure 8S-8), which is similar to the trend for PBDEs in Lake Trout in the Great Lakes.

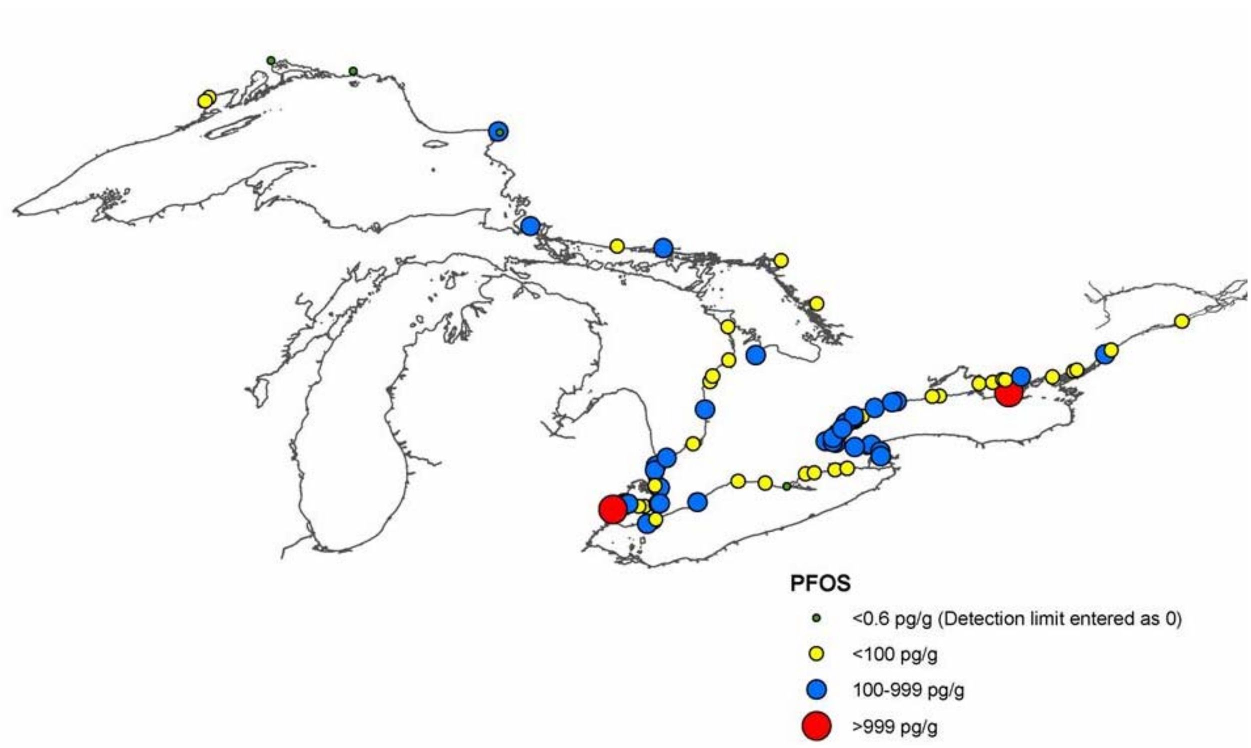

Figure 8S-6.   Levels of PFOS in Surficial Sediments of Canadian Tributaries to the Great Lakes, 2001-2005. Source: Environment Canada

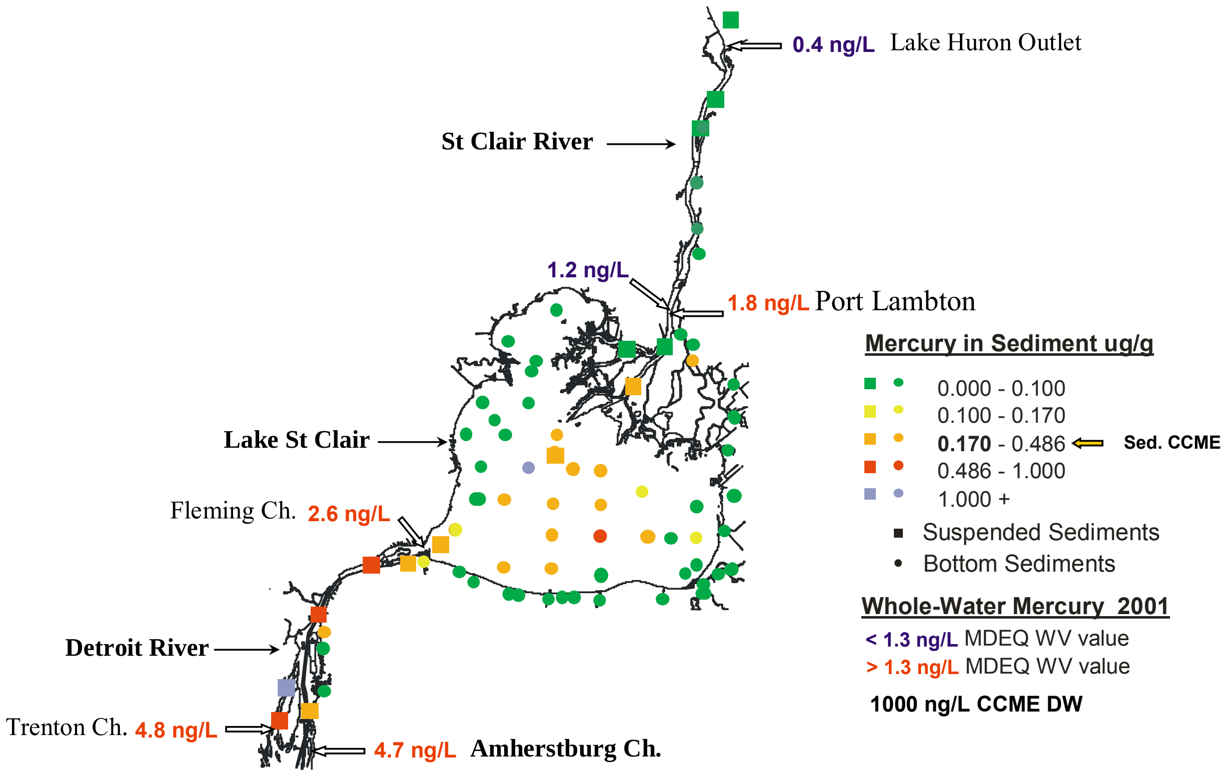

Figure 8S-7. Mercury Concentrations in Sediments (ng/g) and Whole Water (ng/L) in the St. Clair / Detroit River Corridor.[50] Source: Environment Canada

[50] CCME DW – Canadian Council of Ministers of the Environment Drinking Water Guidelines: Maximum acceptable concentration for a substance found in water for consumption.
MDEQ WV – Michigan Department of Environmental Quality Wildlife Value: Maximum value for the protection of wildlife.

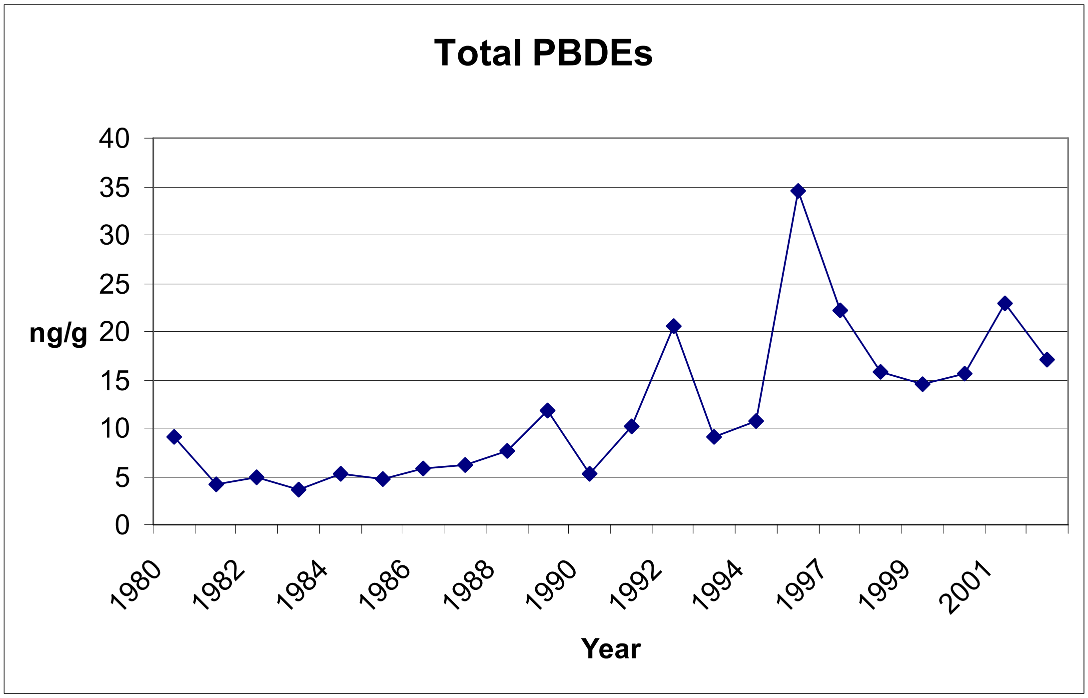

Figure 8S-8. Concentrations of PBDEs (ng/g) in Niagara River Suspended Sediments Over the Period 1980-2002 at Niagara-on-the-Lake. Source: Environment Canada and Ontario Ministry of the Environment

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APPENDIX A

GREAT LAKES BINATIONAL TOXICS STRATEGY STAKEHOLDERS

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Tom Beidler
Netta Benazon
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Terry Bidleman
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Douglas Bley
Dave Bloomberg
Michael Blumenthal
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Matthew Bramley
Marty Bratzel
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Pat Costner
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Timothy Lehman
Dennis Leonard
Sandro Leonardelli
Lois Levitan
Steve Levy
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Nicholas Lewis
Raymond Lewis
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Victor Li
Yi-Fan Li
David Liebl
Marianne Lines
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Robert Lipnick
Rich Liroff
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Simon Llewellyn
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Candace Sellar
Vic Shantora
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Griff Sherbin
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Cathy Simon
Robert Simon
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Peter Skinner
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Ken Smith
Lisa Smith
Paula Smith
Ted Smith
Kurt Soderberg
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APPENDIX B

GREAT LAKES BINATIONAL TOXICS STRATEGY (GLBTS) PROGRESS OVERVIEW 1997 – 2006

GREAT LAKES BINATIONAL TOXICS STRATEGY (GLBTS)
PROGRESS OVERVIEW 1997 – 2006

GLBTS Development, Integration Workgroup, and Stakeholder Forum

1997

- 4/7/97 U.S. and Canada sign the *GLBTS: Canada-United States Strategy for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes*
- 6/26/97 Stakeholders invited to workshop to develop a draft GLBTS Implementation Plan
- 12/97 GLBTS Implementation Plan distributed and Substance participation solicited
- 12/97 GLBTS Website is developed

1998

- 3/23/98 Kick-off implementation meeting in Chicago to form seven substance workgroups
- 6/19/98 The first GLBTS Integration Workgroup meeting is convened in Romulus, Michigan
- 6/98 GLBTS Website is redesigned; PCBs and Mercury Workgroup pages added
- 7/98 GLBTS Website is redesigned; Integration, Dioxins, Pesticides, HCB/B(a)P, Alkyl-lead, and OCS Workgroup pages added
- 10/21-23/98 GLBTS display and presentation (including GLBTS handouts, a brochure, Website cards, GLBTS progress timeline and activity sheets) at SOLEC in Buffalo, NY
- 11/16/98 The first GLBTS Stakeholder Forum is convened in Chicago, IL
- 11/16/98 The first GLBTS Progress Report is distributed

1999

- 1/26/99 GLBTS Integration Workgroup meets in Windsor, Ontario
- 4/27/99 GLBTS Stakeholder Forum is held in Toronto, Ontario
- 4/28/99 GLBTS Integration Workgroup meets in Toronto, Ontario
- EC and US EPA develop draft communications strategy, present it to Integration Workgroup, and revise strategy based on stakeholder comments
- 8/24/99 GLBTS Integration Workgroup meets in Detroit, Michigan
- 9/23-26/99 US EPA, EC and invited speakers give GLBTS session presentation at the IJC Great Lakes Water Quality Forum in Milwaukee, WI
- 9/24/99 A preliminary draft GLBTS Progress Report issued at IJC meeting in Milwaukee, WI
- 10/99 GLBTS main and Mercury Workgroup web pages are redesigned
- 10/7/99 A Canadian GLBTS *Report on Level II Substances* is posted on the GLBTS Website
- 11/18/99 GLBTS Stakeholder Forum is held in Chicago, IL
- 11/19/99 GLBTS Integration Workgroup meets in Chicago, IL
- 12/99 Preliminary planning initiated for a PCP Workshop (to include the GLBTS pesticides, HCB and Dioxin/Furan Workgroups)
- 12/3/99 a U.S. *GLBTS Report on Level II Substances* is posted on the GLBTS Website
- 12/15/99 Draft (Full) 1999 GLBTS Progress Report issued
- 1999 (various dates) Development of a Canadian GLBTS communications plan

GLBTS Development, Integration Workgroup, and Stakeholder Forum
2000
- 1/28/00 Municipal Solid Waste and Incineration Workgroup planning conference call - 2/11/00 Municipal Solid Waste and Incineration Workgroup planning conference call - 2/15/00 GLBTS Integration Workgroup meets in Windsor, Ontario - 5/15/00 Protecting the Great Lakes, Sources of PBT Reductions Workshop on Municipal Solid Waste Management is held in Toronto, Ontario - 5/16/00 GLBTS Stakeholder Forum is held, with the theme "Meeting the Challenge" - 9/22/00 GLBTS Integration Workgroup meets in Chicago, IL - 2000 (various dates) GLBTS communications plan is finalized by EC; "key messages" finalized; various communications products in development (brochure, business cards, display unit, letterhead, Website improvements, success stories)
2001
- 2/20/01 GLBTS Integration Workgroup meets in Windsor, Ontario - 2/21/01 GLBTS 2000 Progress Report is posted to GLBTS Website - 5/17/01 GLBTS Stakeholder Forum is held in Toronto, Ontario - 5/18/01 GLBTS Integration Workgroup meets in Toronto, Ontario - 6/18/01 GLBTS Sector Subgroup begins a series of conference calls to select a short list of sectors for a pilot effort - 8/28/01 GLBTS Integration Workgroup meets in Chicago, IL - 9/19/01 GLBTS Sector Subgroup begins information-gathering phase focusing on the short list of sectors - 11/14/01 GLBTS Stakeholder Forum is held in Chicago, IL, with the theme "Implementation – Partners in Progress" - 11/15/01 GLBTS Integration Workgroup meets in Chicago, IL - 11/16/01 GLBTS/LaMP Workshop in Chicago, IL, with the theme of "Program Synergies – Partners in Progress, Exploring how we can mutually support the pollutant reduction needs and efforts of each program synergistically"
2002
- 1/25/02 GLBTS Sector Subgroup begins summarizing findings - 2/26/02 GLBTS Sector Subgroup presents summary of findings to Integration Workgroup - 2/26/02 GLBTS Integration Workgroup meets in Windsor, Ontario - The GLBTS EC/US EPA Website "binational.net" is created - 5/29/02 GLBTS Stakeholder Forum and Five-Year Anniversary event are held in Windsor, Ontario - 5/29/02 GLBTS Five-Year Perspective report issued - 5/30/02 GLBTS Integration Workgroup meets in Windsor, Ontario - 9/16/02 GLBTS Sector Subgroup holds conference call to discuss a pilot sector project - 9/18/02 GLBTS Integration Workgroup meets in Chicago, IL - 12/3/02 GLBTS Stakeholder Forum is held in Chicago, IL - 12/3/02 Draft GLBTS 2002 Progress Report issued - 12/4/02 GLBTS Integration Workgroup meets in Chicago, IL

GLBTS Development, Integration Workgroup, and Stakeholder Forum
2003
- 2/25/03 GLBTS Integration Workgroup meets in Windsor, Ontario - 3/01/03 GLBTS Binational.net bookmark created as a marketing tool - 4/01/03 GLBTS CD ROM containing the Strategy, annual progress reports (1998, 1999, 2000, 2001, & 2002), Five-Year Perspective, and various Strategy Updaters (all in both French and English) is created and 5,000 copies are sent to basin stakeholders and Washington and Ottawa government officials - 4/03/03 GLBTS presentation to the Lake Superior LaMP Forum in Duluth, Minnesota - 5/05/03 GLBTS presentation to International Pulp and Paper Conference in Portland, Oregon - 5/13/03 GLBTS presentation to Commission for Environmental Cooperation, Sound Management of Chemicals (SMOC) meeting in Windsor, Ontario - 5/14/03 Final GLBTS 2002 Progress Report posted at www.epa.gov/glnpo/bns and binational.net - 5/14/03 GLBTS Stakeholder Forum held in Windsor, Ontario, in conjunction with CEC SMOC public meeting - 5/15/03 GLBTS Integration Workgroup meets in Windsor, Ontario - 6/01/03 GLBTS Update prepared, as well as GLBTS displays in French, Spanish, and English - 6/11/03 GLBTS presentation to Canadian P2 Roundtable in Calgary, Alberta - 6/16/03 Conference call with Agricultural Subgroup of Integration Workgroup - 6/23/03 GLBTS presentation to IAGLR in Chicago, Illinois - 7/31/03 GLBTS Public outreach tent set up at Chicago Tall Ships event in Chicago, Illinois - 8/11/03 GLBTS presentation at Emerging Chemicals Workshop in Chicago, Illinois - 8/19/03 Conference call with LaMP leads to discuss GLBTS/LaMP Crosswalk of priorities - 9/01/03 *GLBTS 2003 Activity Update* prepared - 9/04/03 Conference call held with small number of Integration Workgroup members to discuss draft GLBTS Level I Substance Assessment Process - 9/11/03 GLBTS Integration Workgroup meets in Toronto, Ontario - 9/11/03 *GLBTS Fall 2003 Workgroup Activity Update* distributed - 9/18/03 GLBTS attendance at the IJC Public Forum in Ann Arbor, Michigan - 10/24/03 GLBTS presentation to European delegation at EU REACH Program in Chicago, Illinois - 11/25/03 Conference call with LaMP and GLBTS Stakeholders to discuss GLBTS Level I Substance Assessment Process - 12/02/03 GLBTS presentation to Lake Superior LaMP Task Force in Thunder Bay, Ontario - 12/16/03 GLBTS Stakeholder Forum is held in Chicago, IL - 12/16/03 Draft *GLBTS 2002 Progress Report* issued - 12/17/03 GLBTS Integration Workgroup meets in Chicago, IL

GLBTS Development, Integration Workgroup, and Stakeholder Forum
2004
- 2/04 Final *GLBTS 2003 Progress Report* posted at www.epa.gov/glnpo/bns and binational.net - 4/13/04 – 4/15/04 GLBTS Management Framework Workshop in Chicago, Illinois - 6/17/04 GLBTS Stakeholder Forum is held in Toronto, Ontario - 6/18/04 GLBTS Integration Workgroup meets in Toronto, Ontario - 10/07/04 GLBTS Integration Workgroup meets in Toronto, Ontario: Draft *Management Assessment for OCS* and *Management Assessment for Dioxin and Furans* presented - 10/07/04 GLBTS Fall 2004 Workgroup Activity Update distributed - 11/16/04 – 11/18/04 Presentation at Workshop on Environmental Health Effects of Persistent Toxic Substances – Hong Kong: "The GLBTS as a Governance Model to reduce PTS" - 11/30/04 GLBTS Stakeholder Forum is held in Chicago, IL - 12/01/04 Draft *GLBTS 2004 Progress Report* issued - 12/01/04 GLBTS Integration Workgroup meets in Chicago, IL
2005
- 2/10/05 GLBTS update presented to Lake Superior LaMP Chemical committee in Marquette, MI, given by Alan Waffle and E.Marie Wines - 3/09/05 GLBTS update presented at GLRPPR in Chicago, IL, given by Alan Waffle - 3/11/05 GLBTS attendance (Alan Waffle) at EC's Workshop on Pharmaceuticals and Personal Care products in Burlington, Ontario - 3/23/05 GLBTS Integration Workgroup meets in Windsor, Ontario: Draft *Management Assessments for HCB, B(a)P, PCB, mercury, alkyl-lead, and pesticides* presented - 3/29/05 GLBTS attendance at IJC Chemical Exposure Workshop in Chicago, IL - 4/11/05 GLBTS display presented at US National Environmental Partnership Summit - 5/05 Final *GLBTS 2004 Progress Report* posted at http://binational.net/bns/2004/index.html - 5/17/05 GLBTS Stakeholder Forum is held in Toronto, Ontario - 5/18/05 GLBTS Integration Workgroup meets in Toronto, Ontario - 5/24/05 GLBTS presentation given by Ted Smith at IAGLR in Ann Arbor, MI - 6/01/05 GLBTS presentation at Canadian Pollution Prevention Roundtable in Victoria, British Columbia, given by Tricia Mitchell and Alan Waffle - 9/15/05 GLBTS Integration Workgroup meets in Chicago, IL - 9/27/05 GLBTS update presented to Lake Superior LaMP Workgroup in Thunder Bay, Ontario, given by Alan Waffle - 9/29/05 GLBTS attendance (Ted Smith and Alan Waffle) at SOLEC Chemical Integrity Workshop in Windsor, Ontario - 11/02/05 GLBTS attendance (Alan Waffle) at IJC GLWQA Public Meeting in Windsor, Ontario - 12/06/05 GLBTS Stakeholder Forum is held in Chicago, IL - 12/07/05 Draft *GLBTS 2005 Progress Report* issued - 12/07/05 GLBTS Integration Workgroup meets in Chicago, IL

2006 and Ongoing
- 2/08/06 Presentation to Binational Executive Committee in Chicago on GLBTS successes and path forward by Gary Gulezian and Danny Epstein - 2/16/06 GLBTS Integration Workgroup meets in Windsor, Ontario - 3/07/06 to 3/08/06 GLBTS attendance (Ted Smith and Alan Waffle) at Environment Canada/Ontario Ministry of the Environment "Emerging Chemicals Workshop" in Toronto, Ontario - 3/29/06 to 3/30/06 GLBTS attendance (Alan Waffle and Tricia Mitchell) at Environment Canada's "Workshop on Pharmaceuticals" in Burlington, Ontario - 4/26/06 to 4/27/06 GLBTS attendance (Alan Waffle) at CEC SMOC meeting in Windsor, Ontario - 4/28/06 GLBTS attendance (Ted Smith and Alan Waffle) at EC & US EPA GLWQA Review in Chicago - 4/28/06 to 12/06 GLBTS participation as the US (Ted Smith) and Canadian (Alan Waffle) co-chairs of the Toxics Workgroup reviewing the GLWQA - 5/17/06 GLBTS Stakeholder Forum is held in Toronto, Ontario - 5/18/06 GLBTS Integration Workgroup meets in Toronto, Ontario - 5/31/06 GLBTS presentation to Lake Superior LaMP Workgroup in Duluth, Minnesota, given by Alan Waffle - 6/14/06 GLBTS presentation at Canadian Pollution Prevention Roundtable in Halifax, given by Alan Waffle - 6/22/06 GLBTS attendance (Alan Waffle) at Great Lakes Cities Initiative meeting in Perry Sound, Ontario - 7/31/06 Final *GLBTS 2005 Progress Report* posted at http://binational.net/bns/2005/2005-GLBTS-English-web.pdf - 08/02/06 GLBTS and GLWQA presentations at DePaul University, Chicago, given by Danny Epstein and Susan Nameth - 8/03/06 to 8/07/06 GLBTS promotion booth at Tall Ships event on the Chicago Waterfront, hosted by staff from EC (Canadian lead Tricia Mitchell) and US EPA (US EPA Lead E.Marie Wines) - 9/19/06 GLBTS Integration Workgroup meets in Chicago, IL - 9/19/06 GLBTS presentations at Harbin Institute of Technology in Harbin, China, given by Alan Waffle - 9/25/06 to 9/26/06 *International Workshop on Contaminated Site of Lindane and POPs in China*, Xian, China, given by Alan Waffle, S. Venkatesh, and Yi-Fan Li - 10/11/06 to 10/12/06 GLBTS attendance (Alan Waffle) at State of Lake Huron Workshop in Honey Harbour, Ontario - 11/01/06 GLBTS display booth at SOLEC - 11/05/06 to 11/09/06 GLBTS attendance (Tricia Mitchell) at Society of Environmental Toxicology and Chemistry 27th Annual Meeting in Montreal - 11/20/06 GLBTS Presentation at University of Toronto, given by Alan Waffle, S. Venkatesh, and Tricia Mitchell - 12/06/06 GLBTS Stakeholder Forum is held in Chicago, IL - 12/07/06 Draft *GLBTS 2006 Progress Report* issued - 12/07/06 GLBTS Integration Workgroup meets in Chicago, IL - 12/12/06 to 12/14/06 GLBTS attendance (Ted Smith and Alan Waffle) at first U.S. Conference Characterizing Chemicals in Commerce in Austin, Texas

Substance Activities: Mercury (Hg)

GLBTS Workgroup Activities and Reports

1998

- 3/23/98 Workgroup (WG) is formed at the first implementation meeting
- 5/5/98 WG conference call is held
- 8/24/98 *Background Information on Mercury Sources and Regulations* is posted on the GLBTS Website
- 9/10/98 Options Paper *Developing a Virtual Elimination Strategy for Mercury* is posted on the GLBTS Website
- 11/16/98 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
- 11/17/98 GLBTS workshop on Potential Mercury Reductions at Electric Utilities is held in Chicago

1999

- 1/99 GLBTS web postings include: *Wisconsin Mercury Source Book* on community Hg reduction plans, findings of the Mercury Reduction at Electric Utilities workshop, and *Mercury Success Stories*
- 2/99 Information and FAQs on mercury fever thermometers posted on the GLBTS Website
- 3/99 GLBTS web postings include: The WDNR guide, *Mercury in your Community and Environment,* and a manual for hospitals, *Reducing Mercury Use in Health Care*
- 4/99 Workshop on community initiatives for reducing Hg
- 4/27/99 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario
- 11/18/99 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
- 11/99 Draft GLBTS Step 1&2 *Sources and Regulations* report for mercury is posted on the GLBTS Website

2000

- 5/16/00 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario
- 6/00 GLBTS web page on Mercury Thermometers and FAQs is updated
- 8/00 Memo on progress in reducing mercury use posted on the GLBTS Website
- 9/1/00 A final draft GLBTS *Reduction Options* (Step 3) report for mercury is prepared and posted on the GLBTS Website on 9/29/00
- 10/17/00 Expansion of mercury web page links
- 11/18/00 WG meeting at the GLBTS Stakeholder Forum in Toronto

2001

- 5/17/01 WG meeting at the GLBTS Stakeholder Forum in Toronto
- 11/14/01 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL

2002

- 5/29/02 – 5/30/02 WG meeting at the GLBTS Stakeholder Forum in Windsor, Ontario
- 12/2/02 WG meeting in Chicago, IL on reducing impact of dental mercury
- 12/3/02 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL

2003

- 5/14/03 – 5/15/03 WG meeting at the GLBTS Stakeholder Forum in Windsor, Ontario
- 12/16/03 – 12/17/03 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL

2004
- 6/17/04 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario - 8/04/04 Workgroup report revised: *Options for Dental Mercury Reduction Programs: Information for State and Local Governments* - 11/30/04 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
2005
- 5/17/05 WG meeting in Toronto, Ontario - 12/06/05 WG meeting in Chicago, IL
2006 and Ongoing
- 02/06 WG finalizes Management Assessment for Mercury - 5/17/06 WG meeting in Toronto, Ontario - 12/06/06 WG meeting in Chicago, IL

Other Mercury Related Activities

1997 and Earlier
- Chlorine Institute voluntary mercury commitment to reduce mercury use by 50% by 2005 - 12/97 *Mercury Report to Congress* is released by US EPA
1998
- 5/8/98 Chlorine Institute releases progress report on voluntary mercury commitment - 6/25/98 US EPA and AHA sign an MOU on reducing medical wastes - 9/15/98 Three northwest Indiana steel mills commit to developing mercury inventories and reduction plans - 10/98 IDEM household mercury collection efforts - Dow Chemical Company commits to mercury reductions - PBT Strategy grant to the Northeast Waste Management Officials' Association to encourage state mercury reduction efforts
1999
- 8/99 As part of 1998 agreement, mercury inventories at Indiana steel mills are completed - 10/99 Mercury waste collection component of the Cook County (Illinois) Clean Sweep pilot begins - Six Ontario hospitals sign MOU to voluntarily reduce Hg - Pollution Probe investigates Hg reduction options for electrical products sector in Ontario - Automotive Pollution Prevention Project efforts to phase out Hg - US EPA grant to Ecology Center of Ann Arbor: promoting mercury P2 in the health care industry - Western Lake Superior Sanitary District (WLSSD) begins multimedia zero discharge pilot / focus on Hg - Michigan Mercury Pollution Prevention Task Force - 11/16/98 Draft *PBT National Action Plan* for Mercury is released by US EPA - Total mercury used in lamps declines from an estimated 17 tons in 1994 to an estimated 13 tons in 1999, even though significantly more mercury-containing lamps are sold in 1999 than in 1994.

2000
- Chlorine Institute reports 42% reduction, production-adjusted, in mercury use - US EPA, state agencies, and academic researchers conduct meetings with chlor-alkali industry representatives to coordinate mercury reduction projects - Olin Corp. cooperates with US EPA, state, and academic researchers on mercury monitoring project at chlor-alkali plant - Indiana steel mills complete mercury reduction plans; extend invitation to suppliers to commit to developing mercury inventories and reduction plans - Auto Alliance commits to eliminate mercury switches in auto convenience lighting; New York DEC and Michigan DEQ implement mercury removal programs at auto scrap yards - Hospitals for a Healthy Environment produces a Mercury Virtual Elimination Plan for hospitals under the AHA-US EPA MOU. State and local governments provide technical assistance to hospitals, and the National Wildlife Federation (NWF) continues its outreach and education efforts, signing up nearly 600 medical facilities to NWF's "Mercury Free Medicine Pledge." - Wisconsin DNR and Department of Agriculture conduct a dairy mercury manometer replacement program; approximately 375 mercury manometers are recycled. - University of Wisconsin extension creates a Website and list server to share information about mercury in schools. - The Thermostat Recycling Corporation collects over 500 lbs of mercury from over 57,000 thermostats collected and processed from January 1, 1998 to June 30, 2000. The program is expanded to the Northeast and will gradually be expanded to include the entire U.S. - The Great Lakes Dental Mercury Reduction Project funded by the Great Lakes Protection Fund produces a brochure template*: Amalgam Recycling and Other Best Management Practices*. Great Lakes Dental Associations reprint and distribute this document to their memberships. The University of Illinois-Chicago dental school and the Naval Dental Research Institute conduct research on controlling mercury in dental wastewater and help to educate dentists about best management practices. - Coalitions including Health Care Without Harm and the National Wildlife Federation successfully encourage several national retailers to stop the sale of mercury-containing thermometers to the public. Duluth, Minnesota, Ann Arbor Michigan, unincorporated areas of Dane County, Wisconsin, and several Dane Country municipalities, ban the sale of mercury thermometers.
2001
- 651 hospitals join the National Wildlife Federation's Mercury-Free Hospitals campaign - Ispat-Inland Indiana Harbor Works, Bethlehem Steel-Burns Harbor Division, US Steel-Gary Works, the Delta Institute, and Lake Michigan Forum created the *Guide to Mercury Reduction in Industrial and Commercial Settings* - Mercury Switch-out Pilot Program launched by Pollution Probe, Ontario Power Generation, Ontario Ministry of the Environment, and Environment Canada to collect mercury switches from old vehicles - 2/21/01 A workshop entitled "Extended Producer Responsibility and the Automotive Industry" is sponsored by the Canadian Autoworkers Union's Windsor Regional Environment Council and Great Lakes United
2002
- 2/27/02 Great Lakes United kicks off series of information-sharing sessions about auto mercury-switch removal programs for State agency staff - 4/5/02 Chlorine Institute releases its *Fifth Annual Report to EPA*, showing a 75% reduction in mercury use by the U.S. chlor-alkali industry between 1995 and 2001, more than meeting this sector's commitment to reduce mercury use 50% by 2005 - 10/1/02 Thermostat Recycling Corporation announces that it collected 28,000 thermostats and 231 pounds of mercury in the first half of 2002, a 15% increase from mercury collections in the first half of 2001. The program began to serve the 48 continental U.S. States in the fall of 2001. - 10/18/02 The Hospitals for a Healthy Environment (H2E) program has 335 partners representing 1,019 facilities: 347 hospitals, 618 clinics, 22 nursing homes and 32 other types of facilities. These partners are health care facilities that have pledged to eliminate mercury and reduce waste, consistent with the overall goals of H2E.
2006
- 6/06/06 US EPA reaffirms Clean Air Mercury Rule (CAMR)

Substance Activities: Polychlorinated Biphenyls (PCBs)

GLBTS Workgroup Activities and Reports

1998 and Earlier

- As of January 1993, approximately 25,000 tonnes of high-level PCBs are either in use or in storage in Ontario; 1529 active PCB storage sites in Ontario
- 3/23/98 WG is formed at the first implementation meeting
- 6/15/98 WG requests that the IG develop a strategy on sediments
- 11/10/98 Options Paper *Virtual Elimination of PCBs* is posted on GLBTS Website
- 11/16/98 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL

1999

- 4/27/99 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario
- 11/18/99 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
- 11/99 Draft *GLBTS Step 1&2 Sources and Regulations* report for PCBs is posted on the GLBTS Website
- WG solicits and gains commitment of 3 U.S. auto manufacturers to reduce PCBs
- WG solicits commitment of steel producers to reduce PCBs

2000

- 5/16/00 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario
- Final draft GLBTS Step 3 *Reduction Options* report for PCBs is prepared (7/14/00) and posted (9/29/00) on the GLBTS Website
- WG continues to use PCB reduction commitment letters, through EC and US US EPA, to seek commitments to reduce PCBs. Specific companies are targeted, primarily major owners of PCB transformers and capacitors, and associations, such as CGLI
- WG solicits and gains commitment to reduce PCBs from 2 Canadian auto manufacturers, 4 Canadian steel producers, and over 30 municipal electrical utilities in Ontario
- WG leaders and Council of Great Lakes Industries (CGLI) finalize outreach letters used to seek PCB reduction commitments from trade associations. CGLI identifies specific trade associations to begin outreach. EC mails letters to trade initial associations. US EPA mailings to follow.
- WG begins to compile case study reports on reasons why companies remove their PCBs
- WG begins to collect photographs of PCB-containing electrical equipment to assist potential owners with identification of equipment which may contain PCBs
- WG drafts a fact sheet on PCB-containing submersible well pumps to be used for outreach to potential users of wells and servicers of well pumps.
- As of April 2000, approximately 7,500 tonnes of high-level PCBs are either in use or in storage in Ontario; 1,191 active PCB storage sites in Ontario

2001

- WG continues to mail letters to companies and trade associations seeking commitments to phase out PCBs
- WG prepares case studies submitted by Bethlehem Steel Corporation's Burns Harbor Division and ComEd Energy Delivery, a unit of Chicago-based Exelon Corporation, for posting on the GLBTS Website
- 1/01 PCB federal databases are updated for Canada.
- 5/01 PCB WG progress meeting held in Toronto, Ontario, Canada. WG discusses two reasons that companies are unable to commit immediately to PCB reductions: 1) reduction/replacement is dependent on companies' internal planning and budgeting cycle; 2) reduction/ replacement is tied to market conditions. US EPA and EC will continue mailing out the voluntary reduction and commitment letters to the priority sectors and associations seeking additional commitments to reduce PCBs.
- 5/17/01 WG meeting at the GLBTS Stakeholder Forum in Toronto
- 7/01 US EPA compiles and analyzes data for 1995-1999 submitted by U.S. PCB disposers
- 8/29/01 WG posts photographs of electrical equipment which may contain PCBs (transformers, and capacitors) to GLBTS Website to help increase awareness of the types of equipment that

Substance Activities: Polychlorinated Biphenyls (PCBs)
may contain PCBs - 9/01 In coordination with LaMP activities, EC mails a package of information to all small quantity PCB owners (over 300 owners) in the Lake Superior and Lake Erie Basins to help raise awareness of PCB initiatives underway in support of the GLBTS. The information package contained a copy of PCB Owners Outreach Bulletin, fact sheets, and maps of PCB Storage sites in the Lake Erie and Lake Superior Basins. - 11/01 PCB WG meeting is held in Chicago, IL. WG discusses the need for more outreach, especially toward small and medium sized companies. Representatives of General Motors outline the company's plan to phase-out all PCB materials from its North American facilities. - As of April 2001, 80% of high-level PCBs (Askarel > 1%, 10,000 ppm) had been destroyed in Ontario, Canada; however only 25% of low-level PCBs were destroyed, mostly from stored contaminated soil from a contaminated site cleanup in Ontario. - As of April 2001, approximately 6,000 tonnes of high-level PCBs are either in use or in storage; 992 active PCB storage sites in Ontario. - 8/30/01 Fact sheet posted to GLBTS Website: PCBs in Submersible Well Pumps - 11/14/01 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
2002
- WG continues to modify BNS-PCB Website based on recommendations received in an email survey conducted by EC and US EPA in November 2001 - 5/02 WG meeting is held at the GLBTS Stakeholder Forum in Windsor, Ontario - 5/02 Hydro One representative states that the company is free of all high-level PCBs but still has several small stations and other sources of low-level PCBs. Hydro One has introduced a PCB management program that extends to the year 2020. - 5/02 MOE representative presents a strategy to implement an annual charge for having equipment with PCBs. Amendments for *Regulation 362* are proposed, including the addition of a schedule of destruction targets. - 10/02 Approx. 400 PCB commitment letters are sent to school boards and other sensitive sites in Ontario. - 10/02 Canada develops a new (draft) plan of outreach and recognition to try to increase the rate of PCB phase-out in Canada. The main elements of the draft plan are to identify and recognize contributions made by individual companies or their industry associations that go beyond regulatory requirements and to publicize success stories. - As of April 2002, 84% of high-level PCBs (Askarel > 1%, 10,000 ppm) had been destroyed in Ontario, compared to 1993. - As of April 2002, approximately 4,147.4 tonnes of high-level PCBs are either in use or in storage in Ontario; 916 active PCB storage sites in Ontario.
2003
- 5/14/03 WG meeting at the GLBTS Stakeholder Forum in Windsor, Ontario - 9/11/03 PCB Reduction Recognition Awards presented to Enersource Hydro, Hydro One, Slater Steel, and Stelpipe Ltd. - 12/16/03 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
2004
- 6/17/04 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario - 6/17/04 PCB Reduction Recognition Awards presented to City of Thunder Bay and Canadian Niagara Power - 11/30/04 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
2005
- 5/17/05 WG meeting in Toronto, Ontario - 12/06/05 WG meeting in Chicago, IL

2006 and Ongoing
- 5/17/06 WG meeting in Toronto, Ontario - 12/06/06 WG meeting in Chicago, IL

Other PCB Related Activities
1999 and Earlier
- US EPA finalizes PCB regulations which include a requirement for U.S. owners to register their PCB transformers - EC and Ontario government hold two workshops on PCB management in the Toronto area - 10/99 PCB waste collection component of the Cook County (Illinois) PCB/Hg Clean Sweep pilot begins - U.S. PCB transformer registration database is updated - Requests for voluntary PCB reduction commitments are mailed to automotive, iron & steel, and municipal electrical power utilities in Ontario
2000
- Region 5 PCB Phasedown Program and pilot phasedown enforcement policy are finalized - A PBT workgroup continues to work on a National Action Plan for PCBs - 2/00 EC mails survey to approximately 500 registered owners of in-use PCB equipment in Ontario, requesting updated information - Cook County PCB/Hg Clean Sweep pilot concludes - 11/00 Canada mails letter to over 2000 registered PCB waste storage owners/managers in Ontario for a recent update of their stored PCB inventory which will be used to modify federal databases for better tracking and monitoring - Update and modification of Federal PCB databases started in 2000 and will continue until completion in 2003 - Three Canadian Federal PCB Regulations are being amended: (1) Chlorobiphenyl Regulation; (2) Storage of PCB Material Regulations; (3) PCB Export Regulations - Extensive Public Consultation is conducted during summer and fall of 2000 and will continue
2001
- 5/2/01 Final Reclassification of PCB and PCB-contaminated Electrical Equipment rule becomes effective - US EPA finalizes a rule on Return of PCB Waste from U.S. Territories Outside the Customs Territory of the U.S. The rule clarifies that PCB waste in U.S. territories and possessions outside the customs territory of the U.S. may be moved to the customs territory of the U.S. for proper disposal at approved facilities. - EC updates National PCB In-Service Inventory from survey of registered owners and prepares fact sheet - EC's regulatory amendment process proposes the strengthening of federal regulations regarding PCB management
2002
- 42 electrical utilities submit voluntary reduction commitment letters to Environment Canada - Algoma voluntarily commits to eliminate 71,103 kgs (44,400 litres) of PCBs by Dec. 2005 - Approximately 27 school boards and sensitive sites respond to PCB commitment letters; 18 of those companies reported that all PCBs were eliminated from their inventories; 3 reported that all high-level PCBs were eliminated from their inventories

2003
- Amended Canadian PCB regulations are expected to be published in the *Canada Gazette I* and *II* in 2003. These regulations will target phase-out of high-level PCB use by 2007, low-level PCB use by 2014, and prohibit storage after 2009.
2005
- 06/05 An event report on the May 2005 PCB Award Ceremony is published under the title: "Ontario companies recognized for PCB phase-out" page 8, Canadian HazMat Magazine, June/July 2005, accessible at www.hazmatmag.com.
2006 and Ongoing
- 11/04/06 Proposed Canadian PCB regulations are published in the *Canada Gazette I.*

Substance Activities: Dioxins/Furans
GLBTS Workgroup Activities and Reports
1998
- 3/23/98 WG is formed at the first implementation meeting - 11/16/98 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
1999
- 4/27/99 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario - 6/1/99 WG Conference call: sources discussions - 7/7/99 WG Conference call: sources discussions - 9/7/99 WG Conference call: developing a decision tree source prioritization process - 10/5/99 WG Conference call: finishing development of a decision tree process - 11/18/99 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL - 12/7/99 WG Conference call: application of the decision tree process
2000
- 1/11/00 WG Conference call: continuing the decision tree process - 2/1/00 WG Conference call; decision made to initiate a Burn Barrel Subgroup - 3/7/00 WG Conference call: continuing the decision tree process - 4/4/00 WG Conference call: continuing the decision tree process - 4/4/00 Burn Barrel Subgroup has inaugural teleconference - 4/25/00 Burn Barrel Subgroup teleconference: strategy matrix discussed - 5/2/00 WG Conference call: continuing the decision tree process

Substance Activities: Dioxins/Furans
- 5/16/00 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario: decision tree process is completed - 5/26/00 GLBTS draft Step 1&2 *Sources and Regulations* report is prepared - 7/11/00 WG Conference call: developing reduction projects for high priority sectors - 8/1/00 Burn Barrel Subgroup teleconference: discussion Terms of Reference; link to Lake Superior LaMP - 8/18/00 An addendum to the GLBTS Draft *Sources and Regulations* report is prepared to addressed the newly released U.S. Dioxin Reassessment and the draft report is posted (9/29/00) on the GLBTS Website - 9/12/00 WG Conference call: developing reduction projects - 9/12/00 Burn Barrel Subgroup teleconference: discussion of Chisago County "Buyback" program; discussion of survey questions regarding state/local regulatory frameworks, and garbage quantity/quality questions. - Final GLBTS Step 3 *Reduction Options* report is prepared (9/27/00) and the report is posted (9/29/00) on the GLBTS Website - 11/14/00 Burn Barrel Subgroup teleconference: outline of a strategy document prepared. - 11/00 Discussion papers on Landfill Fire and Incinerator Ash Management prepared for workgroup review.
2001
- The WG continues to collect information regarding emissions from steel manufacturing, landfill fires, and incinerator ash management - 1/16/01 Burn Barrel Subgroup teleconference: Burn Barrel Strategy - 2/6/01 WG Conference call - 2/13/01 Burn Barrel Subgroup teleconference: Review presentation for Integration Workgroup - 3/13/01 Burn Barrel Subgroup teleconference: Status of efforts to prepare regulatory profile - 4/10/01 Burn Barrel Subgroup teleconference: Proposal for US EPA funding of subgroup activities - 5/8/01 Burn Barrel Subgroup teleconference: Review Strategy/ Implementation Plan document - 5/17/01 WG meeting at the GLBTS Stakeholder Forum in Toronto: WG approves Burn Barrel Strategy/ Implementation Plan document; Canadian and US presentations on wood preservation - 6/12/01 Burn Barrel Subgroup teleconference: Implementation activities for Summer/Fall - 6/22/01 Burn Barrel Subgroup receives $55k of US EPA PBT funding - 10/9/01 Burn Barrel Subgroup teleconference: Regional Lake Superior campaign - 11/6/01 Burn Barrel Subgroup teleconference: Sharing information - 11/14/01 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL - 12/18/01 Burn Barrel Subgroup teleconference: Sharing information

2002
- 2/12/02 Burn Barrel Subgroup teleconference: web page initiation, bylaws/ordinance discussion. - 3/19/02 Burn Barrel Subgroup teleconference: web page & list serve development, outreach updates - 4/5/02 Lake Superior Region workshop on household garbage burning issue – Thunder Bay, ON - 4/16/02 Burn Barrel Subgroup teleconference: web page & list serve development - 4/24/02 WG Conference call: discussing ash management - 5/14/02 Burn Barrel Subgroup teleconference: finalize web page, prepare for Windsor GLBTS meeting - 5/30/02 WG meeting at the GLBTS Stakeholder Forum in Windsor: demonstration of newly launched subgroup Website "Trash and Open Burning in the Great Lakes". The WG meeting was held jointly with the HCB/B(a)P WG due to common issues that are of interest to both workgroups. - 6/18/02 Burn Barrel Subgroup teleconference: Planned activities for summer, addressing "burners" for sale; purchase Website domain name www.openburning.org - 7/24/02 WG Conference call: discussing the treated wood issue - 9/10/02 Burn Barrel Subgroup teleconference: Updates on activities in various jurisdictions - 11/13/02 WG Conference call: discussing a pilot project on the treated wood issue
2003
- 3/18/03 Burn Barrel Subgroup teleconference: Exploring partnerships with health organizations - 5/14/03 WG meeting at the GLBTS Stakeholder Forum in Windsor, Ontario - 6/3/03 Burn Barrel Subgroup teleconference: EPA Office of Solid Waste outreach materials - 7/31/03 WG teleconference: Draft two-year workplan - 9/9/03 Burn Barrel Subgroup teleconference: WDNR's "Air Defenders" kit - 11/4/03 Burn Barrel Subgroup teleconference: Addressing suppliers of small backyard incinerators - 11/4/03 WG teleconference: Draft two-year workplan; finalizing the Burn Barrel Strategy - 12/16/03 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
2004
- 3/02/04 WG teleconference: Progress on issue papers - 3/09/04 Burn Barrel Subgroup teleconference - 5/11/04 Burn Barrel Subgroup teleconference - 6/04 Draft issues papers prepared on *Emissions from Agricultural Burning, Structure Fires, Tire Fires, and Wildfires* and *Prescribed Burning* - 6/17/04 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario - 9/14/04 Burn Barrel Subgroup teleconference - 9/09/04 Burn Barrel Subgroup teleconference - 10/14/04 WG teleconference: Draft *Management Assessment for Dioxins* - 11/30/04 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
2005
- 5/17/05 WG meeting in Toronto, Ontario - 12/06/05 WG meeting in Chicago, IL

2006 and Ongoing
- 5/17/06 WG meeting in Toronto, Ontario - 12/06/06 WG meeting in Chicago, IL

Other Dioxin/Furan Related Activities
1999 and Earlier
- WLSSD begins multimedia zero discharge pilot / focus on dioxins - Two Ontario utilities eliminate use of PCP in treated poles
2000
- 1/00 WLSSD report on open barrel burning practices is released - 2/00 Wood stove changeover pilot programs in Traverse City, MI, and Green Bay, WI - 6/12/00 draft chapters of the *U.S. Dioxin Reassessment* for external scientific review are released - 9/28/00 Three draft chapters of the *U.S. Dioxin Reassessment* for SAB review are released
2001
- February 2001, Release of *National Inventory of Releases of Dioxins and Furans, Updated Edition*, by EC - May 2001, Release of report "Characterization of Organic Compounds from Selected Residential Wood Stoves and Fuels" by EC
2002
- PCP re-registration review proceeding as joint Canada/U.S. endeavor
2003
- 7/18/03 CEC draft Phase One North American Regional Action Plan on Dioxins and Furans, and Hexachlorobenzene available for public comment - *Ash Characterization Study* in Ontario - Secondary metal smelter release inventory study in Ontario - EPA develops Backyard Trash Burning Website and brochures available at www.epa.gov/nsw/backyard - Public release of first US National Dioxin Air Monitoring Network (NDAMN) ambient air monitoring data - Canada-wide Standards for iron sintering and steel manufacturing endorsed in March 2003 - Release of Wisconsin "Air Defenders" Kit for Burn Barrel education - Dioxin sampler added at an Integrated Atmospheric Deposition Network (IADN site), Burnt Island
2004 and Ongoing
- US EPA compiles case studies of open burning reduction efforts

Substance-Specific Activities: Pesticides

GLBTS Workgroup Activities and Reports

1998

- 3/23/98 WG is formed at the first implementation meeting
- 11/16/98 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
- 12/31/98 Draft GLBTS Challenge report for the Level I pesticides is posted on the GLBTS Website

1999

- 4/27/99 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario
- 11/18/99 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL

2000

- 5/16/00 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario
- GLBTS U.S. Pesticides Challenge Report: *The Level 1 Pesticides in the Binational Strategy* is finalized (3/1/00) and posted (9/29/00)
- 5/00 EC announces that with the cooperation of PMRA they have reevaluated their position on Level I pesticides, and that based on all available information have met the Level I challenge.

2001

- WG reviews pollution prevention opportunities for Level II pesticides (endrin, heptachlor, lindane and HCH, tributyl tin, and pentachlorophenol) and begins preparing report

Other Pesticide Related Activities

1999 and Earlier

- 10/96 EC prepares report: *Canada-Ontario Agreement Objective 2.1: Priority Pesticides Confirmation of No Production, Use, or Import in the Commercial Sector in Ontario*
- US EPA funding to four existing Clean Sweep programs for pilot data collection efforts for Level I pesticides

2000

- Draft National Action Plan for Level 1 Pesticides under the U.S. National PBT Initiative completed and released for review and public comment
- PBT Pesticides Workgroup reviewing toxaphene remediation in Brunswick, GA
- Level I PBT pesticides (except mirex) are regularly collected by ongoing Clean Sweep programs
- Phase out of the Level II Pesticides lindane and tributyl tin compounds are the subject of bi-national negotiations through pesticide regulatory agencies in the U.S. and Canada

2001

- Waste pesticide collections (Clean Sweeps) continue
- 10/5/01 Members of the world's primary maritime organization, the International Maritime Organization, adopt the International *Convention on the Control of Harmful Anti-fouling* Systems on Ships. The agreement calls for a global prohibition on the application of organotin compounds by January 1, 2003, and a complete prohibition by January 1, 2008.

2002

- PCP re-registration review proceeding as joint Canada/U.S. endeavor

Substance-Specific Activities: Pesticides

2004 and Ongoing

- At the end of 2004, lindane use was discontinued in Canada.
- In 2006 U.S. manufacturers agreed to relinquish the remaining registrations for lindane (use will cease in the U.S. in 2009).

Substance-Specific Activities: Hexachlorobenzene (HCB) / Benzo(a)pyrene (B(a)P)

GLBTS Workgroup Activities and Reports

1998

- 3/23/98 WG is formed at the first implementation meeting
- 9/98 & 10/98 Discussions are held with the pesticide manufacturing, chlorinated solvent manufacturing, and petroleum refinery industries regarding their emission levels, and to determine any success stories, pollution prevention opportunities, and other planned or possible emission reduction actions
- 11/16/98 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL

1999

- 4/27/99 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario
- 11/18/99 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
- 11/99 Draft GLBTS Step 1&2 *Sources and Regulations* Reports for B(a)P and HCB are posted on the GLBTS Website

2000

- 5/16/00 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario
- Discussions held with the U.S. Scrap Tire Management Council and scrap tire managers in the Midwest
- 6/15/00 Final drafts GLBTS Step 3 *Reduction Options* reports for B(a)P and HCB are prepared
- 7/12/00 Final drafts GLBTS Step 3 *Reduction Options* reports for B(a)P and HCB are posted on the GLBTS Website
- 9/21/00 WG conference call is held
- 10/00 draft Canadian Steps 1& 2 reports for HCB and B(a)P (PAHs) circulated to stakeholders and workgroup members for comments

2001

- 5/17/01 WG meeting at the GLBTS Stakeholder Forum in Toronto
- 11/14/01 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
- Canada implements Strategic Options Processes with steel mills and wood preservers
- Algoma Steel signs an *Environmental Management Agreement* with EC and Ontario MOE to address environmental priorities
- A Woodstove Changeout Program is held in Georgian Bay, Ontario, in conjunction with the Hearth Products Association of Canada

2002
- 5/30/02 WG meeting at the GLBTS Stakeholder Forum in Windsor, Ontario - Woodstove change-out outreach material in development, a Website may be developed to promote change-outs and share information with stakeholders - Petroleum refinery B(a)P emissions analysis completed - Preparation of incentives for scrap tire pile recycling begins - Status and potential for reduction of newly inventoried primary aluminum B(a)P emissions determined - Work with Council of Great Lakes Industries (CGLI) and pesticide industry continues to determine pesticide HCB contaminant levels - Success stories of reductions in HCB TRI releases from the chemical industry are identified - Outreach activities (e.g., Website development, preparation of consumer information sheets) are conducted to increase public awareness of environmental impacts, safe handling, and applications of used treated wood - WG seeks to improve linkages and integration of release information and environmental data on persistent toxics - WG works to fill release data gaps, resolve questions about company NPRI release estimates for Level I substances, and develop reduction projects with stakeholders - 12/3/02 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
2003
- 5/14/03 WG meeting at GLBTS Stakeholder Forum in Windsor, Ontario - Work with CGLI and pesticide industry, to determine pesticide HCB contaminant levels, continues - Rubber Manufacturers Assn. provides detailed information on scrap tire management in the Great Lakes Basin - Resource needs identified to successfully implement a Scrap Tire Outreach Plan - B(a)P emissions from coke ovens in basin continue to decline as a result of shutdowns and regulations - Work on more accurate B(a)P inventory (especially for air emissions) - Several conference calls held on Woodstove Smoke Reduction contract to encourage best practices and develop outreach materials - Natural Resources Canada *Burn it Smart*! campaign conducts over 300 residential wood-burning workshops across Canada; campaign presentation to be updated to include wood stove change-out and more workshops planned for Ontario - Initial discussions held with Canadian Vehicle Manufacturers' Association on verification of B(a)P release estimates for the on-road motor vehicle sector - 12/16/03 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
2004
- 6/17/04 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario - US EPA wood stove/fireplace initiatives: media outreach package, Website, fact sheets and labeling program promoting EPA-certified stoves and clean/safe wood burning practices. - Fifty-one *Burn it Smart!* public education workshops delivered in 40 Ontario rural and First Nations communities in 2004 - Work with CGLI and pesticide industry to determine pesticide HCB contaminant levels, continues - Re-assessment of Ontario HCB and B(a)P releases from use of pentachlorophenol-treated and creosote-treated wood products. - 11/30/04 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL

2005
- 5/17/05 WG meeting in Toronto, Ontario - Prepared *Management Assessment Reports for HCB and B(a)P* using the General Framework to Assess Management of GLBTS Level 1 Substances - 31 *Burn it Smart*! workshops held in various First Nation communities, Ontario communities and 2 U.S. border cities - Conducted tests on artificial logs to determine emissions - Worked with CGLI, pesticide industry, and the Pest Management Regulatory Agency of Health Canada to determine HCB releases from pesticide application - Surveyed 2001 Georgian Bay Wood Stove Changeout and Education seminar attendees to follow-up on changes to their wood burning practices - Continued to promote scrap tire pile inventory development and mapping, and cleanup initiatives - 12/06/05 WG meeting in Chicago, IL
2006 and Ongoing
- 5/17/06 WG meeting in Toronto, Ontario - 17 *Burn it Smart!* workshops held in various First Nation and tribal communities, Ontario communities, and two U.S. border cities. Approximately 220 people attended these workshops. - Initiated a North American HCB modeling project to evaluate long-range transport impacts - Worked with CropLife Canada and Pest Management Review Agency to improve estimates of Canadian HCB releases from pesticide application. - New York Academy of Sciences held a conference call in October with stakeholders from both U.S. and Canada to discuss estimates of PAH releases from creosote-treated wood. - 12/06/06 WG meeting in Chicago, IL

Other HCB/B(a)P Related Activities
1999 and Earlier
- Dow Chemical Company commits to HCB reductions - Two Ontario utilities eliminate use of PCP in treated poles - U.S. chlorothalonil manufacturer reduces HCB content through process improvements - 10/99 Draft Report, *Global HCB Emissions* (Robert Bailey, 1999), is distributed to the WG - 1/99 wood stove changeover pilot program for Eastern Ontario
2000
- 1/00 WLSSD report on open barrel burning practices is released - 2/00 Wood stove changeover pilot programs in Traverse City, MI, and Green Bay, WI - PBT workgroups continue to work on draft *National Action Plans* for HCB and B(a)P - 5/5/00 Robert Bailey prepares report, *HCB Concentration Trends in the Great Lakes*, for the WG
2001
- 2/01-4/01The Hearth Products Association expands the Great Lakes Great Stove Changeout Program to 12 States - 6/01 US EPA issues an administrative order requiring Magnesium Corporation of America (Rowley, UT) to ensure proper handling, containment, and disposal of anode dust found to contain high levels of HCB (>12,000 ppm), as well as dioxins, PCBs, and chromium

2002
- Source release information to improve inventories collected through voluntary stack testing - An emission testing program for wood burning in fireplaces, wood stoves, and pellet stoves developed and implemented with partners to fill information gaps - PCP re-registration review proceeding as joint Canada/U.S. endeavor
2003
- 7/18/03 CEC draft Phase One North American Regional Action Plan on Dioxins and Furans, and Hexachlorobenzene available for public comment - An EPA rule to control emissions (including HCB) from hydrochloric acid production is promulgated - The "Voluntary Woodstove/Fireplace Smoke Reduction Activities and Outreach Materials" contract awarded by EPA - An EPA rule for the control of coke oven battery stack emissions (including B(a)P) is promulgated - HCB added to CEPA listing of prohibited toxic substances; proposed regulation published to prohibit products with concentrations greater than 20 ppb
2004
- Twelve Wood Energy Technology Transfer Inc. training workshops held in Ontario - USEPA *Scrap Tire Pile Mitigation Support Project* underway promoting mapping and cleanup of tire piles - Scrap tire pile cleanup forum held in Chicago on February 23 – 24, 2004 - Proposed Ontario Tire Stewardship scrap tire diversion program awaiting approval from the Ontario Ministry of the Environment - Independent third party audits verify Ontario's four metallurgical coke producers meeting reduction goals set out in best practice manual for controlling PAH (includes B(a)P) releases)
2005
- Amendments to U.S. *Air Toxics Standards for Coke Oven Batteries* came out in April 2005. - US EPA finalized rules on wastewater discharges from iron and steel facilities. - Developing U.S. best practices Scrap Tire Cleanup Guidebook. - Partnered with The Home Depot to promote *Burn it Smart*! at six stores in Eastern Ontario. - Partnered with the Puget Sound Clean Air Agency to conduct more emissions testing on wax firelogs and regular cordwood. - Commenced Ontario B(a)P mapping project to highlight priority areas.
2006 and Ongoing
- US EPA initiated Green Stoves Labeling Program - US EPA initiated studies to evaluate Outdoor Wood Boilers - EC commenced information gathering exercise with Hearth, Patio and Barbecue Association of Canada on outdoor wood boiler usage in Ontario and Eastern Canada - EC completed B(a)P mapping project for the Great Lakes Basin by adding Ontario information - EC worked with Ontario Ministry of the Environment and initiated other projects to improve the emission inventories of HCB and B(a)P. - New York Academy of Sciences published an Ecological Assessment and Pollution Prevention Report detailing PAH releases from all sources in New York and New Jersey Harbor - *Burn-it-Smart*! public education information provided at Cottage Life Shows in Toronto in April and November, at the International Plow Match in Peterborough in September, and the Home Hardware national sales meeting in St. Jacobs (north of Waterloo) in September - EC produced final report on artificial log study with Puget Sound Clean Air Agency - EC partnered with Hearth, Patio and Barbecue Association on emission testing of five conventional wood stoves and drafted report - Ontario Ministry of the Environment announced that the Used Tire Program was deferred beyond the immediate future - US EPA initiated a Mid-West Clean Diesel Initiative in Region 5 to reduce diesel emissions

Substance-Specific Activities: Alkyl-lead

GLBTS Workgroup Activities and Reports

1998

- 3/23/98 WG is formed at the first implementation meeting
- 11/16/98 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
- 12/31/98 Draft GLBTS Challenge report for alkyl-lead is posted on the GLBTS Website

1999

- 1/99 EC prepares *Alkyl Lead Inventory Study - Sources, Uses and Releases in Ontario, Canada: A Preliminary Review*, and posts report on the GLBTS Website. The report concludes that the Canadian challenge of reducing alkyl-lead use by 90% between 1988 and 2000 has been exceeded.
- 9/8/99 GLBTS and PBT workgroups meet with National Motor Sports Council to discuss voluntary phase-out of leaded gasoline
- 10/29/99 draft GLBTS *Sources, Regulations and Options* (Steps 1, 2 & 3) Report for Alkyl-Lead is posted on the GLBTS Website

2000

- GLBTS *Sources, Regulations, and Reduction Options* (Step 1, 2 & 3) report for alkyl-lead is finalized (6/00) and posted (9/29/00) on the GLBTS Website
- GLBTS U.S. Challenge on Alkyl-lead: *Report on the Use of Alkyl-lead in Automotive Gasoline* is finalized (6/00) and posted (9/29/00) on the GLBTS Website

2001

- The U.S. meets the challenge of confirming no use of alkyl-lead in automotive gasoline. The US EPA PBT Program takes the lead for the U.S. in coordinating stakeholder efforts to reduce remaining alkyl-lead releases

Other Alkyl-lead Related Activities

1999 and Earlier

- Work begins on a draft *National PBT Action Plan* for Alkyl-lead

2000

- 8/25/00 A Draft *PBT National Action Plans* for alkyl-lead is posted on the PBT Website for public review and comment
- Auto racing industry expresses interest in working with US EPA to find lead-free gas substitutes

2001

- US EPA begins working with NASCAR to permanently remove alkyl-lead from racing fuels used, specifically, in the Busch, Winston Cup, and Craftsman Truck Series

Substance-Specific Activities: Octachlorostyrene (OCS)

GLBTS Workgroup Activities and Reports

1998

- 3/23/98 WG is formed at the first implementation meeting
- 6/16/98 Background Paper and Draft Action Plan for OCS posted on GLBTS Website
- 11/16/98 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
- 12/31/98 Draft GLBTS Challenge report for OCS is posted on the GLBTS Website

1999

- 4/27/99 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario
- 11/18/99 WG meeting at the GLBTS Stakeholder Forum in Chicago, IL
- Data on OCS trends in fish is assessed by the WG

2000

- 5/16/00 WG meeting at the GLBTS Stakeholder Forum in Toronto, Ontario
- 6/30/2000 EC draft report on Octachlorostyrene Sources, Regulations and Programs for the Province of Ontario 1988, 1998, and 2000 forwarded to interested stakeholders
- 9/22/00 Draft GLBTS Stage 3 report for OCS is distributed at the 9/22 Integration Workgroup meeting and e-mailed to the OCS Workgroup
- 12/00 US EPA and EC convene a meeting of North American magnesium producers to promote sharing of lessons regarding methods for preventing and managing OCS and other chlorinated hydrocarbon wastes

2004

- 8/04 Draft *Management Assessment for OCS* (Step 4) Report prepared

Other OCS Related Activities

1999 and Earlier

- 3/10/99 CGLI report, *OCS and Suggested Industrial Sources: A Report to the GLBTS Workgroup*, is submitted to the workgroup

2000

- 8/25/00 A Draft PBT National Action Plan for OCS is posted on the PBT Website for public review and comment

2002

-4/02 Toxics Release Inventory data for 2000 is made available to the public

Sediments

Canadian and U.S. Activities

1998 and Earlier

- 6/15/98 PCB WG requests that the IG develop a strategy on sediments
- 6/19/98 Integration WG discusses sediments challenge
- US EPA provides guidance to workgroups on how to deal with sediments within chemical-specific workgroups

1999

- 1/26/99 Overview and presentation of IJC SedPAC Activities given at Integration WG meeting
- 2/99 Integration WG members develop a draft charge for a sediments subgroup
- 4/28/99 Draft Sediments subgroup charge presented at Integration WG meeting

2000

- 2/15/00 US EPA and EC present a draft sediment reporting format at the Integration WG meeting. The proposed format will map progress and report annually on sediment remediation in the Great Lakes Basin using 1997 as the baseline year
- 5/16/00 At the Stakeholder Forum, US EPA and EC present the draft sediment reporting format and commit to hold a sediment technology workshop

2001

- 4/24/01 US EPA and EC host a two-day workshop on "Removing and Treating Great Lakes Contaminated Sediment," presenting sediment remediation technologies and case studies

2002 and Ongoing

- Ongoing assessments and remediations in both the U.S. and Canada within the Great Lakes watershed (see Section 6.0)

Related Sediment Activities

1998 and Earlier

- 11/97 The IJC's Sediment Priority Action Committee (SedPAC) issues draft white paper *Overcoming Obstacles to Sediment Remediation in the Great Lakes Basin*
- 12/1-2/98 IJC SedPAC holds "Workshop to Evaluate Data Interpretation Tools Used to Make Sediment Management Decisions" in Windsor, Ontario

2002

- 1/02 The second National Sediment Quality Survey report to Congress, *The Incidence and Severity of Sediment Contamination in Surface Waters of the United States, National Sediment Quality Survey: Second Edition*, is released for review by US EPA

2004

- Work under The Great Lakes Legacy Act begins

Long-Range Transport (LRT) Activities
1999
- 11/19/99 EC presents the status of their LRT effort at the Integration WG meeting
2000
- 3/27/00 EC prepares report: *Long-Range Transport of Persistent Toxic Substances to the Great Lakes: Review and Assessment of Recent Literature* (Ortech Environmental)
2001
- Several studies are undertaken in the U.S. and Canada to characterize global transport processes.
2003 and Ongoing
- 9/16/03 - 9/17/03 EC and USEPA sponsor LRT Workshop in Ann Arbor, MI, with support of the CEC, the IJC, and the Delta Institute - 9/03 LRT workshop background paper, the workshop program, presentations, and draft summary document are posted on the Internet at http://delta-institute.org/pollprev/lrtworkshop/_workshop.html - Research into long-range transport of persistent toxic substances to the Great Lakes continues

General Activities Related to Reductions in GLBTS Substances
US EPA Regulatory Determinations
1998 and Earlier
- 12/95 Maximum Available Control Technology (MACT) rules for large Municipal Waste Combustors (MWC) are promulgated - 9/97 MACT rules for Medical Waste Incinerators (MWI) are promulgated - 4/15/98 Pulp, Paper, and Paperboard Cluster Rule is promulgated - 6/29/98 Amendments to the PCB Disposal Regulations are finalized - 11/12/98 Federal Plan for MACT Implementation for large MWCs is finalized
1999
- 5/28/99 An Advance Notice of Proposed Rulemaking is released for the RCRA LDR for Mercury-Bearing Hazardous Wastes - 7/6/99 Federal Plan for MACT Implementation for MWI is proposed - 8/30/99 MACT for small MWCs are proposed (expected to be final in 2000) - 9/30/99 Final Standards for Hazardous Air Pollutants for HWC are promulgated - 10/29/99 TRI Amendments: new PBT reporting thresholds
2000
- 12/00 Compliance deadline for large MWC MACT - 9/02 Compliance deadline for MWI MACT

General Activities Related to Reductions in GLBTS Substances
- 1/1/00 New TRI reporting thresholds for PBTs become effective
2001
- US EPA finalizes the Reclassification of PCB and PCB-contaminated Electrical Equipment rule and a rule on Return of PCB Waste from U.S. Territories Outside the Customs Territory of the U.S.
2002
- PCP re-registration review proceeding as joint Canada/U.S. endeavor - 4/02 the first year of data reported under TRI PBT rule become available - 2/14/02 President Bush announces Clear Skies Initiative to cut mercury emissions from power plants by 70%
2005
- 5/18/05 US EPA publishes Clean Air Mercury Rule
2006
- 6/06/06 US EPA reaffirms Clean Air Mercury Rule

US EPA Activities
1999 and Earlier
- 6/97 *Deposition of Air Pollutants to the Great Waters: Second Report to Congress* is released - 12/97 *Mercury Report to Congress* is released - 4/98 *Final Emission Inventory Data for Section 112(c)(6) Pollutants* is released - 11/16/98 US EPA's Multimedia PBT Strategy is announced - 11/16/98 Under the PBT Strategy, a draft *National Action Plan for Mercury* is released - PBT Strategy grant awarded to WLSSD to work on reducing open trash burning - U.S. PCB transformer registration database is updated - Sample collection begins for the National Study of Chemical Residues in Fish - U.S. GLBTS workgroup leaders participate in development of Draft National Action Plans of part of PBT Strategy
2000
- 6/00 *Deposition of Air Pollutants to the Great Waters: Third Report to Congress* is released - 6/12/00 draft chapters of the *U.S. Dioxin Reassessment* for external scientific review are released - 9/00 US EPA's 1996 National Toxics Inventory is released - 9/28/00 Three draft chapters of the *U.S. Dioxin Reassessment* for SAB review are released - PBT workgroups continue to work on National Action Plans for HCB, B(a)P, the Level I pesticides, and PCBs - US EPA's Office of Air and Radiation and Office of Water collaborate on an Air-Water Interface Workplan to address atmospheric deposition of toxics and nitrogen to U.S. water bodies.
2001
- 5/23/01 U.S. signs the United Nation's global treaty on Persistent Organic Pollutants (POPs)

2002
- 1/02 *The Incidence and Severity of Sediment Contamination in Surface Waters of the United States, National Sediment Quality Survey: Second Edition* is released for review - 7/23/02 Final PBT National Action Plan for Alkyl-lead published - Preliminary data from first year of National Study of Chemical Residues in Lake Fish Tissue released
2004
- 5/18/04 Great Lakes Interagency Task Force created by U.S. Executive Order

EC Regulatory Determinations
1999 and Earlier
- *Canadian Environmental Protection Act* is renewed
2000
- Canada-Wide Standards (CWS) (release limits) are developed for mercury, particulate matter, ozone, and benzene, and are being developed for dioxins/furans. - Canadian Strategic Options Processes (SOPs) are under development for the Iron and Steel Manufacturing sector and finalized for the Wood Preservation sector - 6/19/00 EC solicits public comments on proposed amendments to the PCB regulations under CEPA
2001
- 2/19/01 Canada announces $120.2 million in new regulatory and other measures to accelerate action on clean air - 7/7/01 A notice with respect to Polychlorinated Biphenyls in Automotive Shredder Residue is published in the Gazette, Part I, for automobile shredding facilities that generated PCB-contaminated residue during 1998, 1999, or 2000. - EC proposes amendments to the Chlorobiphenyl Regulations and Storage of PCB Material Regulations promulgated in 1977 and 1992, respectively - Canada's PCB Waste Export Regulations (SOR/97-108) are being amended
2005
- 6/05 CCME accepts in principle a draft CWS for the coal-fired electric power generation sector. Final endorsement of the CWS is expected prior to the end of 2005.
2006
- 11/04/06 Proposed Canadian PCB regulations are published in the *Canada Gazette I.*

EC Activities
1999 and Earlier
- Ontario “Drive Clean” program - 1/99 The Canadian *Dioxins and Furans and Hexachlorobenzene Inventory of Releases* is finalized. - EC upgrades and digitizes its National PCB database
2000
- Draft HCB, B(a)P (PAH), and OCS release inventories for Ontario are updated and circulated for review

	- EMA with Algoma Steel being finalized. - EC, in coordination with the Hearth Products Association, conducts testing of conventional and US EPA-certified wood stoves to investigate releases of dioxins/furans, PAHs, HCB, and particulate matter
Other Activities	
1998 and Earlier	
	- CEC issues Continental Pollutant Pathways Initiative - 7/98 UNEP POPs negotiations initiated
1999	
	- Under the GLWQA, The Lake Ontario LaMP Stage 1 report is released - By the end of 1999, emission control retrofits either completed or underway at all large MWC in the U.S. - The initial *Great Lakes Regional Air Toxics Emissions Inventory*, using 1993 data, is released - The Lake Ontario LaMP Update 1999 is released
2000	
	- Under the GLWQA, Canada and the U.S. work on restoring beneficial uses to 43 AOCs in the Great Lakes Basin through the RAP program - The Lake Erie, Lake Michigan, and Lakes Superior LaMPs 2000 are released - The Lake Ontario Lamp Update 2000 is released - The Lake Huron Initiative Action Plan is released - Numerous pilot projects and pollution prevention/reduction agreements relevant to toxics of concern are underway with the steel, automobile, and other manufacturing industries and utilities in Ontario and the U.S. Great Lakes States - 11/8/00 – 11/9/00 Atmospheric deposition workshop held, *Using Models to Develop Air Toxics Reduction Strategies* - 12/00 Final POPs negotiations - The 1996 Great Lakes Inventory of Toxic Air Emissions is prepared by the Great Lakes Commission
2001	
	- 2/01 21st session of the UNEP Governing Council is held: UNEP will undertake a global study on the health and environmental impacts of mercury - 8/22/01 The IJC issues a Review of Progress under the Canada-United States Great Lakes Binational Toxics Strategy - Monitoring of air deposition of toxic pollutants in the Great Lakes Basin under IADN
2002	
	- Monitoring of air deposition of toxic pollutants in the Great Lakes Basin continues under IADN
2003	
	- 9/19/03 – 9/20/03 IJC 2003 Great Lakes Conference and Biennial Meeting in Ann Arbor, MI - Monitoring of air deposition of toxic pollutants in the Great Lakes Basin continues under IADN
2004	
	- 4/23/04 Great Lakes Commission releases 2001 Great Lakes Regional Air Toxic Emissions Inventory, available online at www.glc.org/air - 10/6/04 – 10/8/04 State of Lakes Ecosystem Conference (SOLEC) held in Toronto, Ontario

2006 and Ongoing	
	- 11/01/06 – 11/03/06 State of Lakes Ecosystem Conference (SOLEC) held in Milwaukee, WI - Monitoring of air deposition of toxic pollutants in the Great Lakes Basin continues under IADN

APPENDIX C

PART I: GREAT LAKES BINATIONAL TOXICS STRATEGY ASSESSMENT OF LEVEL 1 SUBSTANCES SUMMARY

December 2005

Executive Summary

The Great Lakes Binational Toxics Strategy (GLBTS) was signed by the United States and Canada (the Parties) in 1997 to advance the goals of Article II(a) of the Great Lakes Water Quality Agreement (GLWQA). The Strategy focus has been on persistent toxic substances (PTS) in the Great Lakes ecosystem, in particular those chemicals which bioaccumulate up the food chain, and Article II(a) includes the goal that "the discharge of any or all persistent toxic substances be virtually eliminated". The GLBTS sets forth seventeen (17) interim reduction goals for twelve "Level 1" PTS over a ten year time-frame which ends in 2006.

In anticipation of this important milestone, in 2004, the Parties, working with many stakeholders from industry, non-governmental organizations, Provinces, States, Tribes, cities and academia, commenced an overall program review of each of the Level 1[51] substances, to review progress made to date in reducing these substances and to explore future directions for the continued management of these substances. This report provides a concise summary of each substance review. This report also addresses two non-substance-specific goals in the GLBTS: 1) to assess atmospheric inputs of Level 1 substances from world-wide sources, and 2) to complete or be well advanced in remediation of priority sites with contaminated bottom sediments in the Great Lakes Basin by 2006.

The substance reviews include two major parts:[52] 1) an overall environmental assessment of Level 1 substances in the Great Lakes environment, including a review of current levels in Great Lakes media and biota, an evaluation of these levels against available health based/risk based criteria, historical trends and projected trends looking forward; and 2) a source reduction assessment that looks at use and emission reductions accomplished to date under the GLBTS against the original targets, as well as an analysis of the remaining source sectors, and further opportunities for the GLBTS and others to continue to effect reductions toward our ultimate goals of virtual elimination. Finally, these reviews provide recommendations to the Parties for the future management of each Level 1 substance.

General Outcomes

With regard to source reductions, much progress has been made to date. Of seventeen (17) reduction goals, ten have been met, three more will be met by 2006, and the remaining four will be well advanced toward their respective targets. Notwithstanding these accomplishments, much remains to be done to achieve the ultimate goal of virtual elimination in the Great Lakes.

Overall, the environmental analyses show many of the Level 1 substances remain in the Great Lakes environment at levels which exceed health based criteria, particularly mercury, PCBs, and the cancelled pesticides. These substances continue to impair the Great Lakes, and limit fish

[51] Mercury, PCBs, dioxins and furans, hexachlorobenzene (HCB), benzo(a)pyrene (B(a)P), octachlorostyrene (OCS), alkyl lead, mirex, aldrin/dieldrin, toxaphene, DDT, chlordane
[52] A description of the Management Framework is found in Part II of this document.

consumption, particularly among sensitive populations such as pregnant women and children, and among subsistence fishers.

Our analyses suggest that source reduction opportunities remain for the “active substances” (i.e., substances for which we have ongoing workgroup activities), which include mercury, PCBs, dioxins and furans, HCB and B(a)P. With respect to the “inactive” (i.e., no ongoing workgroup activity) Level 1 substances, cancelled pesticides, alkyl lead, and OCS, the Parties have decided to suspend GLBTS workgroup activities indefinitely, pending periodic review, and to leverage other programs, as appropriate. However, these substances will continue to be tracked and monitored in the Great Lakes. Finally, the GLBTS will continue to monitor and report on progress of sediment remediation activities in Areas of Concern in the Great Lakes Basin, and will continue to study issues associated with long-range transport of toxic substances from world-wide sources, in order to better inform our priorities and identify necessary action steps to move forward.

Specific Recommendations

Below is a brief summary of management recommendations and future opportunities by substance/challenge. A more detailed discussion of these is presented within the body of this report.

Substance	Recommendation	Future Opportunities
Mercury	Continue Active Level 1 Status	Source reduction opportunities remain for the GLBTS Mercury Workgroup in the auto scrap, appliance, industrial equipment, and dental sectors. In addition, the GLBTS will continue to encourage and track efforts to reduce mercury releases in sectors with regulatory systems in place or under implementation (e.g., mercury cell chlor-alkali plants and coal-fired power plants).
PCBs	Continue Active Level 1 Status	Source reduction opportunities remain for the GLBTS PCB Workgroup to continue to encourage decommissioning of in-service PCB equipment. Other significant future Workgroup opportunities include updating the current inventories, which will help in identifying additional intervention steps; mandatory dates for PCB phase out in Canada through voluntary activities (via the anticipated Canadian PCB phase out proposal scheduled for publication next year) and proposed regulatory amendments to existing Canadian PCB regulations; and incentives and recognition for PCB phase out and outreach programs.
Dioxins/ Furans	Continue Active Level 1 Status	Source reduction opportunities remain for the GLBTS Dioxin Workgroup to address the use of burn barrels. Other significant future Workgroup opportunities include characterization of sources such as uncontrolled burning, and exploring pathway interventions to mitigate exposure to dioxins and furans.
HCB	Continue Active Level 1 Status	Future Workgroup opportunities include continuing to update and improve the emissions inventories, identifying long-range transport

		contributions of HCB to the Great Lakes, and cooperating with the Dioxin Workgroup on similar source sectors to take advantage of the HCB reduction co-benefits that may also be achieved. The Workgroup should determine the co-benefits of reducing specified chlorobenzene compounds as a result of actions that reduce HCB.
B(a)P	Continue Active Level 1 Status	Source reduction opportunities remain for the GLBTS HCB/B(a)P Workgroup in residential wood combustion and scrap tire pile mitigation. Other significant future Workgroup opportunities may be identified through continued updating and improvement of emissions inventories. The Workgroup should determine the co-benefits of reducing Level 2 PAHs[53] resulting from activities that reduce B(a)P emissions.
Alkyl Lead	Suspend GLBTS Workgroup Activities	The Parties will refer to the National Programs to continue to work with National Association of Stock Car Auto Racing (NASCAR) to reduce the use of leaded fuel in race cars, and with the Federal Aviation Administration and aviation industry to find alternatives to leaded gasoline in aviation fuel.
Pesticides (aldrin/ dieldrin, chlordane, DDT, mirex, toxaphene)	Suspend GLBTS Workgroup Activities	The Parties will refer to National, Provincial, State, Tribal and local Clean Sweep programs to continue to address the stockpile of cancelled pesticides in the Great Lakes Basin, and to various remediation programs that address pesticide contamination. The Parties will participate in international fora that address pesticide phase-outs and disposal, world-wide.
OCS	Suspend GLBTS Workgroup Activities	The Parties will continue to monitor OCS in the Great Lakes environment, and study OCS via long-range transport.
Sediments	Continue Remediation Activities	The Parties will continue to report annually on progress made in the Areas of Concern to remediate sediments contaminated with Level 1 Substances
LRT	Continue Study of Long-Range Transport of Level 1 and 2 Substances	The Parties will continue to study the long-range transport of Level 1 and 2 substances to the Great Lakes, evaluate the relative contributions from world-wide sources, and work within international fora such as UNEP to reduce releases.

Conclusions

The GLBTS presents a unique model of how international cooperation and collaborative problem solving of issues that are beyond the reach of existing regulations can lead to real results in environmental protection. There may be an important ongoing role for the GLBTS, not only with respect to the current Level 1 substances, but also for newer chemicals of emerging concern. New innovative reduction strategies could be applied to the sources of current Level 1

[53] Anthracene, Benzo(a)anthracene, Benzo(g,h,i)perylene, Perylene, Phenanthrene

PTS that can be eliminated from products and production processes as well as to additional chemicals that may fall under the scope of the GLBTS. The Parties intend to focus on next steps for the GLBTS in the coming months. Protecting the chemical integrity of the Great Lakes, advancing the goals of the Great Lakes Water Quality Agreement, and virtually eliminating PTS from the Great Lakes Basin are of paramount importance. The GLBTS is one important tool to move us toward these goals.

1.0 Mercury

Challenge Goal Status

Both Canada and the U.S. have made significant progress in achieving reductions of mercury releases. Canada has reduced releases of mercury from anthropogenic sources in Ontario by approximately 84 percent (1988 baseline), against the goal of a 90 percent reduction. It is unlikely that Canada will meet its reduction goal by 2006. Mercury releases in Ontario have been cut by over 11,700 kilograms (kg) since 1988, based on Environment Canada's 2002 mercury inventory. The U.S. release challenge applies to the aggregate of air releases nationwide and to releases to the water within the Great Lakes Basin. According to the most recent National Emissions Inventory (NEI) estimates, U.S. mercury emissions decreased approximately 45 percent between 1990 and 1999, against a challenge goal of 50 percent. If an estimate of gold mining emissions is included in the 1990 inventory, the estimated reduction increases to 47 percent. By 2006, additional regulations and voluntary activities are expected to reduce U.S. mercury emissions by at least 50 percent (from the 1990 baseline), meeting the challenge goal.

On May 18, 2005, U.S. EPA published the world's first regulations limiting mercury emissions from coal fired power plants. Under the Clean Air Mercury Rule (CAMR), States are required to implement regulations that will reduce power plant mercury emissions 21 percent nationally by 2010, and 69 percent eventually. States can choose to participate in a national mercury emissions allowance trading program, or to achieve required reductions through emissions standards. Under the allowance trading program, power plants will be able to "bank" unused emissions allowances for later use, creating an incentive for reductions beyond the required 21 percent between 2010 and 2017. Use of these banked allowances after 2018, when the emissions "cap" is lowered to 15 tons (69 percent below the current level), will allow emissions to exceed the cap for some years beyond 2018. Trading of emissions allowances could cause emissions reduction amounts in some States to differ from the national average.

In June 2005, the Canadian Council of Ministers of the Environment (CCME) accepted in principle a draft Canada-wide standard (CWS) that would significantly reduce mercury emissions from the coal-fired electric power generation (EPG) sector. Final endorsement of the CWS by ministers is expected prior to the end of 2005.

This Canada-wide Standard consists of two sets of targets:

- Provincial caps on mercury emissions from existing coal-fired electric power generation plants, with the 2010 provincial caps representing a 65 percent national capture of mercury from coal burned, or 70 percent including recognition for early action.
- Capture rates or emission limits for new plants, based on best available control technology, effective immediately. Capture rates and emission rates are based on coal type. A 75 percent capture rate has been established for sub-bituminous coal and lignite, and an 85 percent capture rate has been established for bituminous coal and blends.

In Ontario, the 2010 CWS cap (kg/yr) is 0, and in June 2005 the Ontario provincial government also released a plan to phase out all coal-fired plants in Ontario. The first of five plants was closed in April 2005. Three of the remaining four plants will close in 2007, with the remaining station, Nanticoke GS to close in early 2009. Once all plants have been closed, a 100 percent reduction of emissions from this sector will be achieved in Ontario.

Mercury use (or consumption) in the U.S. has declined significantly since 1995. However, the exact amount is difficult to quantify because the U.S. Geological Survey (USGS) stopped reporting estimated U.S. mercury consumption after 1997. On the basis of data reported by the chlor-alkali industry and the lamp industry, it is estimated that mercury use declined by more than 50 percent between 1995 and 2003. This assumes that mercury use by other sectors remained constant between 1997 and 2003. This may underestimate the actual decline, considering likely reductions in the use of mercury in measurement and control devices, switches and relays, and dental amalgam that have not been quantified.

Environmental Analysis

Geographic Distribution, Temporal Perspectives, Criteria and Risk

The consideration of mercury in the environment is complicated by the need to sort through contributions from natural sources, those associated with legacy sources, and currently occurring anthropogenic sources. GLBTS mercury efforts have been focused on currently-occurring anthropogenic sources. The following points illustrate pieces of the mercury puzzle:

- Mercury levels continue to exceed risk-based criteria within the Great Lakes, most notably for methylmercury in fish and for sediment quality.
- Long-term trends (over 30 years) show a substantial decline (e.g., in herring gull eggs and sediments).
- Shorter term trends are less certain. In the past 10-20 years, mercury levels in fish, bald eagles, herring gull eggs, and atmospheric deposition have not declined.
- Mercury emissions decreased more than 40 percent in the U.S.
- Mercury releases in Ontario were reduced by 84 percent between 1988 and 2002.
- Mercury deposition data show no discernable decrease between 1995 and 2003.
- Mercury concentrations in biota are influenced not only by rates of mercury input into the environment, but also by factors that affect bioavailability and methylation of mercury.

One possible explanation for the lack of correspondence between the emissions trends and recent deposition trends is that reductions in deposition caused by North American emissions reductions have been offset by increases in deposition caused by global emissions. Trends of mercury concentrations in fish may not follow trends in mercury deposition, because mercury fish concentrations may be affected by mercury contributions from sediments, particularly in areas of past high direct water discharges.

Mercury is a major cause of fish consumption advisories in the Great Lakes Basin, with the highest mercury exposures caused by eating fish from certain inland lakes within the Basin. Therefore, continued efforts to reduce mercury inputs to the Great Lakes are warranted. Consumption of fish from the Great Lakes region adds to human body burdens of methylmercury, which often exceed health criteria. However, fish consumption also provides many health benefits, and in many cases Great Lakes fish are lower in mercury than other sources of fish. In the U.S., NHANES findings indicate that blood mercury levels in young children and childbearing-aged women usually are below U.S. EPA's reference dose; however, blood mercury analyses for 16 to 49-year-old women showed that approximately 6 percent of women in the survey had blood mercury concentrations greater than 5.8 ug/L, a blood mercury level equivalent to the current U.S. EPA reference dose, or the level, following application of an uncertainty factor, at which exposure is considered unlikely to cause appreciable risk. In Canada, exceedances of health guidelines for mercury are comparatively rare, because Canada's guidelines are less restrictive than U.S. guidelines.

Sources of Mercury

Mercury inputs to the Great Lakes environment have been reduced significantly. However, a wide variety of sources continue to impact the Great Lakes, especially atmospheric deposition. Mercury deposition results primarily from releases to the air from past and current anthropogenic sources, both in North America and globally. Mercury from natural sources, emissions from current human activities, and re-emission of historic anthropogenic mercury, each contribute to mercury levels in the Great Lakes. In Ontario, the largest air emissions sources of mercury include electric power generation, iron and steel production, municipal waste (primarily land application of biosolids), cement and lime manufacturing, and incineration. In the U.S., the largest air emissions source of mercury is now coal-fired electric power generation. The recent regulatory action in the U.S. and a proposed draft Canada-wide standard may result in substantial reductions from this sector. (The recently promulgated Clean Air Mercury Rule on coal-fired power plants in the U.S. is under legal challenge.) Other sources of mercury in the U.S. include industrial boilers, production of gold and other metals, steel production using steel scrap, hazardous waste incineration, and chlorine production at mercury cell plants. In addition, mercury levels in some areas are elevated as the legacy of past contamination of water and sediments by direct water discharges of mercury.

Management Assessment

The GLBTS has identified a number of opportunities to reduce mercury releases to the Great Lakes Basin. Since mercury releases can be transported to the Great Lakes via the atmosphere from long distances, the GLBTS has also attempted to influence reductions across North America. The GLBTS can help promote reductions by continuing to share information about cost-effective reduction opportunities, tracking progress toward meeting reduction goals, including reductions achieved through various other programs and regulations, and publicizing voluntary achievements in mercury reduction. Particular attention will be paid to information-sharing in areas where mercury releases are significant but there are no existing federal regulations, or regulations are under development (e.g., contamination of metal scrap by mercury-containing devices, and their resulting emissions). The GLBTS will continue to encourage and track efforts to reduce mercury releases in sectors with regulatory systems in place or under implementation (e.g., mercury cell chlor-alkali plants and coal-fired power plants).

In addition, the GLBTS may have opportunities to promote mercury reduction beyond the U.S. and Canada, for instance by participating in the United Nations Environment Program's efforts to help developing countries identify sources of mercury and strategies for control. As North American releases decrease and global releases increase, an increasingly large share of mercury inputs to the Great Lakes Basin will come from overseas sources. The GLBTS has yet to determine if new reduction targets and challenge goals are appropriate.

Management Outcome

The final management outcome for mercury is continued Active Level 1 status with periodic reassessment by the GLBTS. The Mercury Workgroup will: 1) disseminate information about removal of mercury devices in auto scrap, appliances, and industrial equipment; 2) assist state, provincial, and local governments identify cost-effective reduction approaches for mercury releases from dental offices; and 3) participate in national and international mercury reduction programs.

2.0 Polychlorinated Biphenyls (PCBs)

Challenge Goal Status

The GLBTS established quantitative challenge goals to reduce high-level PCBs in equipment in both the U.S. and Canada. In Canada, the challenge goal of a 90 percent reduction of high-level PCBs (>1 percent PCBs or 10,000 ppm, 1993 baseline) in storage has been achieved based on the information available as of December 2004. Canada is still working to meet its in-service challenge goal of a 90 percent reduction of high-level PCBs (>1 percent PCB or 10,000 ppm) by 2006. While the U.S. currently lacks sufficient data to determine the precise status of its progress toward a challenge goal of a 90 percent national reduction of high-level PCBs (>500 ppm) by 2006, substantial progress has been made on this front, as illustrated by the efforts of key stakeholder groups, including electric utilities, in voluntarily removing from service high-level PCB-containing equipment.

Environmental Analysis

Geographic Distribution, Temporal Perspectives, Criteria and Risk

PCBs are monitored in fish, herring gull eggs, bivalves, water and sediments, air, food, and human body burdens. Risk based criteria have been developed for PCB levels in fish, sediments, water, and food. Preliminary analysis of the available data suggests that environmental levels of PCBs exceed water, sediment, and fish tissue criteria in some cases. For example, the GLWQA criterion for PCBs in fish is regularly exceeded, particularly in lake trout. In addition, the issuance of fish consumption advisories for PCBs in the Great Lakes Basin (613 in 2004) indicates that PCBs continue to be present at levels of concern. PCBs are one of the most common cause of fish consumption advisories in the Great Lakes (i.e., in the Lakes proper, not including inland water bodies). Trends in PCB levels in water, sediment, air, fish, and wildlife have generally declined since the 1970s. More recent data (including some data showing PCB spikes) are less clear and need further analysis to delineate trends. For example, some decreasing trends are lake-specific or species/community-specific, making it difficult to draw basin-wide conclusions. PCB levels measured in air in rural areas near each of the Great Lakes have generally declined, but there are some localized hotspots (e.g., the Chicago plume) and some unexplained increases have been observed.

Sources of PCBs

Other potential sources of PCBs include:

- Releases (accidental releases, fires, volatilization) from equipment and other remaining in-service items containing manufactured PCBs;
- Accidental releases from storage/disposal facilities during the handling of PCB wastes;
- Emissions from combustion or incineration of materials containing PCBs;
- Inadvertent formation during certain chemical production processes;
- Reservoirs of past PCB contamination and environmental cycling (e.g., contaminated sediments, soil, and Superfund sites);
- Long-range transport from outside the Great Lakes Basin;

- Other (e.g., dispersive sources from landfills or storage sites).

A better overall understanding of the potential for these sources to contribute to PCB levels in the Great Lakes Basin is needed.

Management Assessment

Key remaining opportunities for the GLBTS to effect further reductions in PCBs include continuing to solicit industry to decommission and dispose of PCBs in electrical equipment, tracking inventoried PCBs in priority industry sectors (high/low-level PCBs in storage and also in service), updating PCB inventory databases on a regular basis, encouraging the ongoing remediation of PCB-contaminated sediment sites, and monitoring environmental trends in the Great Lakes Basin. In addition to voluntary efforts, there are regulatory programs in place in the U.S. to address certain sources of PCBs (e.g., contaminated sites, coplanar PCBs via dioxin control). In 2006, Canada will propose revisions to its existing PCB regulatory framework to set timelines for ending the use of PCBs in equipment and to accelerate PCB destruction. The GLBTS should develop additional information on the relative contributions of all PCB sources to the Great Lakes environment to help prioritize future PCB reduction efforts. The Workgroup should cooperate with the Dioxin Workgroup on common source concerns, such as those where the formation of both dioxins and co-planar PCBs occur. Collateral benefits should be realized for HCB and OCS as well.

Management Outcome

The final management outcome for PCBs is to continue Active Level 1 status with periodic reassessment by the GLBTS. The PCB Workgroup will continue to:

- Target in-service PCB-containing electrical equipment, as the potential remains for the equipment to be a source of future releases;
- Explore non-traditional opportunities to foster PCB reductions through mentoring and outreach programs, financial incentives (e.g., insurance premiums), and ISO registration (in the U.S.);
- Continue the PCB Recognition Award Program; and
- Collect and assess a more complete set of data on PCB sources and environmental levels, in order to prioritize the remaining opportunities for PCB source reductions, and to elucidate PCB trends and impacts on the environment.

3.0 Dioxins and Furans

Challenge Goal Status

Canada has achieved an 87 percent reduction in dioxin releases (1988 baseline) in the Great Lakes Basin against the challenge goal of 90 percent. Canada will continue to work toward this commitment within the Great Lakes Basin. Total annual dioxin releases from inventory sources in Ontario are currently estimated at 35 g (toxic equivalent) TEQ.

The U.S. is confident that it has met the challenge goal of a 75 percent reduction in national dioxin releases. Because the U.S. challenge goal baseline is defined in terms of the U.S. EPA Dioxin Reassessment which is currently undergoing review by the National Academy of Sciences, formal conformation of the challenge goal achievement will have to wait until the release of the final reassessment. The U.S. EPA draft reassessment estimates emissions for the years 1987 and 1995. In May of 2005, U.S. EPA released a draft inventory for the year 2000. This new draft inventory, which is awaiting peer review, estimates total dioxin emissions for 2000 to be approximately 1500 grams TEQ. This is a greater than 90 percent reduction over the draft 1987 baseline estimate.

Environmental Analysis

Geographic Distribution, Temporal Perspectives, Criteria and Risk

In general, there are sufficient data on the presence of dioxins in multiple media to assess impacts in the Basin. These include data in whole fish, fish tissue, herring gull eggs, sediment, water, air, human serum, and food. Current environmental and health criteria information, though limited, is sufficient to conclude that dioxins have a continued adverse impact on the Basin. For the criteria that exist, current data collected in the Great Lakes indicate exceedances of sediment and water quality guidelines. Dioxin contamination triggers fish consumption advisories for at least one species in each of the Great Lakes. While more research is needed to determine a safe level for dioxins in food, the U.S. government has identified significant risks posed by current levels of dioxins found in foods and has recommended steps to reduce exposure (The Interagency Working Group on Dioxins, 2004).

A long-term downward trend in dioxin/furan levels is seen in U.S. and Great Lakes sediment cores, Great Lakes herring gull eggs, and average U.S. and Canadian human body burdens. Long-term temporal trend information is not available for dioxin/furan levels in open water, fish tissue, ambient air, and the commercial food supply. Despite long-term downward trends in dioxin levels in the environment and humans, current trends are less certain in some media (such as ambient air and beef and dairy products). Current environmental levels of dioxins are extremely low, relative to most pollutants, but because of their extreme toxicity and ability to bioaccumulate, their risk potential is significant.

Sources of Dioxin

Dioxin releases to the Great Lakes environment have come from a wide variety of sources. With stringent controls in place on many of the previously dominant industrial and municipal sources, the largest remaining quantified source in both the U.S. and Ontario is the open burning of household waste. Other major sources include land application of sewage sludge, combustion and incineration, and metals smelting, refining, and processing. In addition to the inventoried sources of dioxin, a number of uncharacterized sources exist. The Dioxin Workgroup has begun to develop estimates for some of these uncharacterized sources, which include wildfires and prescribed burning, structural fires, and agricultural burning.

Management Assessment

While significant reductions of dioxin releases have been achieved in both the U.S. and Canada, additional opportunities for further GLBTS action remain. However, the Workgroup's level of effort focusing on release reductions is expected to decline. The Burn Barrel Subgroup should continue its efforts to actively engage partners on the issue of household garbage burning and to educate public and local officials. U.S. EPA and the Utility Solid Waste Activities Group (USWAG) are preparing a memorandum of understanding (MOU) regarding secondary uses of treated wood. The Workgroup should monitor MOU implementation. The Workgroup should also continue working on pathway intervention and improving the emissions inventory for poorly characterized sources. The Workgroup should evaluate the need for a full Workgroup versus a core group that oversees a few subgroups (e.g., focusing on pathway intervention, source characterization, uncontrolled combustion). The Workgroup should also consider the need to engage new members, such as local government officials, and representatives from the fields of health and agriculture. The Workgroup should coordinate with other Workgroups on common issues such as residential wood burning and coplanar PCBs. The Workgroup should continue to track dioxin levels in the environment and examine the impact of dioxin sources outside the Basin through long-range transport. Setting new quantitative challenge goals would be difficult for the remaining, largely non-point sources of dioxin. Rather than pursue a quantitative challenge goal, the Dioxin Workgroup may consider framing new qualitative challenge goals and examining possible numerical targets for specific sources.

Management Outcome

The recommended management outcome for dioxins and furans is to continue Active Level 1 status. The Dioxin Workgroup will:

- Continue efforts related to household garbage burning;
- Monitor implementation of USWAG/U.S. EPA treated wood MOU;
- Explore exposure pathway intervention opportunities;
- Continue to gather information on poorly characterized sources, including reservoir sources and coplanar PCBs;
- Work toward an integrated air monitoring network within the Great Lakes Basin; and
- Examine the impact of dioxin sources outside the Basin through long-range transport.

4.0 Benzo(a)Pyrene (B(a)P)

Challenge Goal Status

Both Canada and the U.S. have made progress in achieving reductions of B(a)P. Canada has reduced releases in Ontario by approximately 45 percent, relative to a 1988 baseline, and continues to pursue the goal of a 90 percent reduction. However, it is unlikely that Canada will meet its reduction goal by 2006. Total B(a)P releases in Ontario are currently estimated at 29,000 lbs (13,200 kg) per year. The U.S. has reduced B(a)P emissions in the Great Lakes Basin by approximately 77 percent from 1996 to 2001, against a goal of unspecified reductions. Current estimated B(a)P emissions in the U.S. Great Lakes States are 43,700 lbs (19,900 kg) per year.

Environmental Analysis

Geographic Distribution, Temporal Perspectives, Criteria and Risk

In general, basin-wide data indicate that there has been little change in B(a)P concentrations in the Great Lakes environment over the past decade. However, a recent declining trend has been reported in Lake Erie bottom sediment, the only lake with available lakewide sediment data. B(a)P levels in Great Lakes soil and sediment exceed criteria while B(a)P levels in fish tissue, air, and water are below available criteria. Higher concentrations of B(a)P are found on Lakes Erie and Ontario than on the other Great Lakes, at sites near major population centers.

Sources of B(a)P

Eighty percent of Ontario's anthropogenic B(a)P releases are primarily from non-point sources, including: residential wood combustion, use of creosote-treated wood products, motor vehicle emissions, and open burning (prescribed burning and household waste burning). The remaining twenty (20) percent are from iron & steel cokemaking operations. Iron and steel coke ovens remain the largest B(a)P point source in Ontario, though emissions were reduced by 73 percent between 1988 and 2003.

The U.S. Great Lakes inventory is comprised of B(a)P emissions from residential wood combustion, cokemaking, and other sources. Since the 2001 inventory was prepared, it is expected that subsequent coke oven emissions will be lower as a result of additional MACT requirements. Potential sources of B(a)P emissions not listed in the U.S. Great Lakes inventory include: forest and wildfires, residential burning of household waste, scrap tire fires, prescribed burning, and mobile sources. However, forest and wildfires and prescribed burning occur mainly in the Western U.S. and may not contribute significantly to B(a)P levels in the Great Lakes Basin.

The impact of B(a)P is not specific to any one lake basin, though concentrations are higher in the more urban lower lakes and other urban areas such as Chicago. Air monitoring data do not reflect reductions in B(a)P emissions inventories. The absence of a corresponding decrease in the environment indicates that there may be source contributions to the environment that are currently unaccounted for or are underestimated in current inventories.

Management Assessment

The GLBTS has identified a number of opportunities to continue to effect reductions in B(a)P releases to the Great Lakes Basin. These include reducing or preventing B(a)P emissions from residential wood combustion, scrap tire fires, and residential burning of household waste. Other important opportunities include gathering information on emissions from poorly characterized sources, and improving the current emission inventories for Ontario and the U.S. Great Lakes Basin, especially to identify sources that are not included in the inventories. To propose new reduction targets, much effort would be required to develop current and baseline inventories that provide accurate estimates of all potential sources of B(a)P, making it impractical to establish new challenge goals at this time.

Management Outcome

The final management outcome for B(a)P is continued active Level 1 status. The GLBTS B(a)P Workgroup will:

- Continue to pursue reduction activities, especially for the following source sectors:
    1) Residential Wood Combustion: "Burn-it-Smart," wood stove change-out programs, firelog testing, and wood boilers;
    2) Scrap Tires: Ontario Tire Stewardship program, U.S. Best Practices Guidebook, additional training and pile mapping.
- Improve B(a)P inventories by identifying missing sources and source categories that have achieved virtual elimination.
- Determine the co-benefits of reducing Level 2 PAHs resulting from activities that reduce B(a)P emissions.

5.0 Hexachlorobenzene (HCB)

<u>Challenge Goal Status</u>

Both Canada and the U.S. have achieved significant reductions of HCB from sources resulting from human activity. Estimated releases of HCB in the U.S. have been reduced from approximately 8,519 lbs (3,872 kg) in 1990 to 2,911 lbs (1,323 kg) in 1999. In Ontario, releases of HCB have been estimated at 37 lbs (17 kg) in 2003, reduced by approximately 68 percent, relative to a 1988 baseline. This satisfies the U.S. commitment of unspecified reductions. Canada continues to pursue the goal of a 90 percent reduction in HCB releases; however, it is unlikely that this goal will be met by 2006.

<u>Environmental Analysis</u>

Geographic Distribution, Temporal Perspectives, Criteria and Risk

There are sufficient data on the presence of HCB in multiple media to assess its impact in the Basin. The data for HCB show declining concentrations in various media (herring gull eggs, water, sediment, air). There are no HCB triggered fish advisories in the Great Lakes, and HCB levels are below detection limits in fish tissue and human serum in broad national surveys. However, individual research studies have found measurable levels of HCB in tissue samples of residents in the Great Lakes region, including blood and breast milk. A few exceedances of sediment and water quality criteria have been observed in recent years. Continued HCB releases and intercontinental transport may explain the longer-than-expected half-lives for HCB observed in air over the Great Lakes.

Sources of HCB

In addition to HCB releases from sources in the U.S. and Canada, long-range transport and deposition of HCB from elsewhere around the world contribute to loadings in the Great Lakes. HCB is thought to be widely distributed in the global atmosphere with global emissions estimated at 50,600 lbs (23,000 kg). However, the contribution of global HCB concentrations to the Great Lakes is uncertain. It has been estimated that microcontaminant HCB levels in pesticide products in the U.S. have been reduced by at least 95 percent since 1990. Similar reductions have also occurred in Canada. [***the last two sentences need confirmation***] Principal sources of HCB in the U.S. and Ontario are pesticide application (volatilization of HCB as a microcontaminant), residential household waste burning (burn barrels), the manufacture of chemicals and plastics materials, and the use of ferric/ferrous chloride containing trace levels of HCB.

<u>Management Assessment</u>

A number of opportunities for the HCB Workgroup remain. The HCB Workgroup continues to encourage emission reductions from pesticide application and chemical manufacturing. The HCB Workgroup also supports other actions which impact HCB releases, including: 1) Household Garbage Burning Strategy in the Great Lakes Basin (GLBTS Burn Barrel Subgroup);

2) full lifecycle management of pentachlorophenol-treated wood products; and 3) collection of data on HCB levels in the environment. The HCB Workgroup is working to refine HCB emissions estimates for pesticide application, chemical manufacturing, combustion sources, and publicly owned treatment works. The GLBTS believes that establishing new challenge goals for HCB, in either the U.S. or Canada, would provide no added benefit towards achieving further HCB reductions.

Management Outcome

The final management outcome for HCB is continued active Level 1 status. The HCB Workgroup will:

- Improve emission inventories;
- Continue to work with pesticide and chemical manufacturers to reduce HCB emissions, where possible;
- Identify the impact of long-range transport of HCB to the Great Lakes; and
- Determine the co-benefits of reducing specified chlorobenzene compounds as a result of actions that reduce HCB. Collect, report, and use specified chlorobenzene compound information to show benefits related to the reduction of HCB.

6.0 Alkyl-Lead

Challenge Goal Status

Canada has exceeded its challenge goal to reduce alkyl-lead use, generation, and release by 90 percent between 1988 and 2000. Leaded gasoline sales in Ontario declined by almost 99 percent from 1988 to 1997. The U.S. has met the challenge goal to confirm no-use of alkyl-lead in automotive gasoline by 1998 and continues to support and encourage stakeholder efforts to reduce alkyl-lead releases from other sources. Both Canada and the U.S. have prepared challenge reports documenting their status with respect to the challenge goals.

Environmental Analysis and Sources of Lead

Alkyl-lead itself is not a persistent environmental compound, but rapidly degrades to other forms of lead in the environment. Thus, information on the use of alkyl-lead has been employed in place of environmental monitoring data. Most available information on alkyl-lead use in gasoline is limited to older data or is not readily accessible. However, in general, there are sufficient data for GLBTS purposes relative to the remaining sources of alkyl-lead to assess its impact on the Basin. The dominant historic uses of alkyl-lead have been discontinued (e.g., tetraethyllead in gasoline) in North America and in many other countries, and the remaining uses are limited to aviation fuel for piston-engine aircraft, fuel for racing cars, and fuel for off-road and marine vehicles. The remaining significant sources of alkyl-lead are very small compared to historic on-road automotive sources. As a result of Canadian and U.S. regulations, the production of leaded gasoline and its use in on-road vehicles have declined dramatically, as have estimated lead emissions resulting from on-road vehicles. However, in the past decade, with the elimination of routine reporting of leaded automobile gas production, it is more difficult to assess whether the trend in use has continued downward.

Management Assessment

There is little opportunity for the GLBTS to effect further reductions in the remaining uses or releases of alkyl-lead. Both the aviation and automobile racing sectors, the two primary remaining sources of alkyl-lead, would be more effectively addressed at the national level.

Management Outcome

The final management outcome is to suspend GLBTS workgroup activities, and to refer reduction efforts to national programs that address the remaining uses of alkyl-lead. These include efforts by U.S. EPA to:

- Work with racing associations such as the National Association for Stock Car Auto Racing (NASCAR) for voluntary agreements to reduce the use of leaded fuel in race cars;
- Work with the Federal Aviation Administration (FAA) and aviation industry to seek acceptable alternatives to leaded gasoline in aviation fuel; and
- Continued efforts to enhance and promote the phase-out of leaded gasoline use in motor vehicles world-wide.

A periodic reassessment (e.g., at intervals sufficient to elucidate trends) will be undertaken using the General Framework to Assess Management of GLBTS Level 1 Substances, until the Parties determine that virtual elimination has been reached.

7.0 Pesticides

Challenge Goal Status

The GLBTS established challenge goals for both Canada and the U.S., which call for confirmation that there is no longer use or release of the Level 1[54] pesticides from sources that enter the Great Lakes Basin, and for international coordination in the event that long-range sources are confirmed. Both countries have prepared reports confirming that all pesticide uses for all Level 1 pesticides have been canceled, and production facilities have closed in the U.S. and Canada. Although evidence of purposeful release has not been identified, potential release from contaminated sites and remaining unused stocks is still possible. However, ongoing site remediation and waste pesticide collection programs (e.g., Pine River remediation and Clean Sweeps programs) are in place and have continued to make progress in reducing these potential release sources since the preparation of the challenge reports.

For these reasons, we believe that the U.S. and Canada have met the principal intent of their challenges, even though the statement "...no longer use or release..." cannot be confirmed as long as unused stocks and contaminated sites exist. To address the second part of the Level 1 pesticide challenge goals outlined in the Strategy, the U.S. and Canada continue to support international frameworks concerned with reducing or phasing out use and release of these substances world-wide.

Environmental Assessment

Geographic Distribution, Temporal Perspectives, Criteria and Risk

Monitoring data are available on the Level 1 pesticides in fish, herring gull eggs, bivalves, water and sediments, air, food, and human body burdens. Criteria have been developed for fish, sediments, water, and food. These criteria are intended to protect certain populations (e.g., human health, wildlife) or uses (e.g., swimming, drinking water) against unsafe levels of the Level 1 pesticides. Preliminary analyses of available data show exceedances in many areas. Some examples include:

- Fish: Measured concentrations of all of the Level 1 pesticides in Great Lakes fish tissue exceed at least one of the available criteria for the protection of human health; toxaphene levels in larger Lake Superior fish are also high and the cause of fish consumption advisories.
  Eighty-five fish consumption advisories have been issued in the Great Lakes States and Ontario due to chlordane, DDT, mirex, and toxaphene.
- Water: Concentrations of dieldrin, DDT, and toxaphene in most of the Lake waters exceed the GLI water quality guidance criteria for the protection of human health.
- Sediments: Dieldrin and DDT exceeded sediment guidelines associated with probable or severe effects in aquatic life; aldrin and mirex exceeded criteria values representing lowest effect levels.

[54] Aldrin/dieldrin, toxaphene, chlordane, mirex, DDT

Overall, the Level 1 pesticides remain ubiquitous in the Great Lakes environment, and at concentrations that may be of concern for both humans and wildlife.

With regard to trends, available data show that Level 1 pesticides have generally declined over the past twenty years in Great Lakes Basin media. However, due to their persistence and long environmental retention times, declines of the Level 1 pesticides in the Great Lakes environment are slow.

Sources of Pesticides

The Level 1 pesticides have been canceled, production facilities have been closed, and intentional releases have been effectively controlled in the U.S. and Canada. The principal remaining sources of the Level 1 pesticides in the Great Lakes Basin are reservoir sources, including sediments, soils, and localized contaminated industrial sites (Superfund sites). Over 100 National Priority List sites within the eight Great Lakes States show contamination by one or more of the Level 1 pesticides. In addition, ongoing Clean Sweeps collections suggest that significant stored quantities of the Level 1 pesticides exist in the Great Lakes Basin, and thus could represent potential future sources if not stored or disposed of properly. Although available evidence does not suggest new or ongoing sources of Level 1 pesticides in the Great Lakes, the contribution of long-range sources (international and regional) may require further investigation. Continued production and use of the Level 1 pesticides has been reported in India, China, Argentina, and possibly Mexico and Central America.

Management Assessment

Current programs exist to address remaining sources of the Level 1 pesticides in the Basin. These include regulations and activities to reduce remaining stockpiles (e.g., Clean Sweeps conducted at the state and local levels), target reservoir sources (e.g., government remediation activities), and support international programs (e.g., the Stockholm Convention).

Management Outcome

The final management outcome is to suspend GLBTS workgroup activities, and to refer source reduction efforts to state and local Clean Sweep programs and existing government environmental remediation activities. Further reductions in pesticide contamination in the Great Lakes environment will occur over time. The GLBTS will also continue to advocate its interests in international fora (including those targeting pesticide phase out and disposal). A periodic reassessment (e.g., at intervals sufficient to elucidate trends) will be undertaken using the General Framework to Assess Management of GLBTS Level 1 Substances, until the Parties determine that virtual elimination has been reached.

8.0 Octachlorostyrene (OCS)

<u>Challenge Goal Status</u>

The GLBTS established similar goals for the U.S. and Canada, to confirm that there is no longer use or release from sources that enter the Great Lakes Basin. If ongoing, long-range sources of OCS from outside the U.S. and Canada are confirmed, the GLBTS will work within international frameworks to reduce or phase out releases of this substance.

<u>Environmental Assessment</u>

Geographic Distribution, Temporal Perspectives, Criteria and Risk

There is monitoring data for OCS in herring gull eggs (1987-2003), sediment cores, lake trout (Lake Ontario), atmospheric deposition, and human breast milk (Ontario). These data are sufficient to allow for informed management decisions under the GLBTS process. Generally, human health and environmental criteria for OCS have not been established; however, for those that exist, there are generally no exceedances.

Sediment, gull egg, and trout data collectively indicate that OCS has been reduced by more than 90 percent in Lake Ontario, where levels were once the highest. Herring gull egg data indicate a widespread decline in OCS (66 to 90 percent) across all lakes since 1987, but more recent 1997-2003 data show that OCS levels appear to have stabilized at 9 of 15 herring gull colonies, with continued declines at the 6 remaining colonies.

Historically, OCS levels were relatively high in Lakes Erie and Ontario, due to sources along the Niagara River and further upstream. Dated sediment cores indicate that OCS levels in Lake Ontario peaked during the 1960s. More recent surveys of surface sediments at Canadian tributaries to Lake Erie and Lake Ontario (Environment Canada, 2001-2003) detected OCS in none of the 112 tributaries to Lake Ontario, and only 5 of 101 tributaries to Lake Erie.

With regard to atmospheric deposition, OCS has been found in nearly all samples collected at the five Integrated Atmospheric Deposition Network Great Lakes monitoring stations from 1999 to 2002; however, all sites observed a decline in OCS during this time period. OCS deposition is higher at the two sites near Lake Erie and Chicago than the three sites near Lakes Superior and Michigan, which suggests that higher levels are found in urban air-sheds.

A Health Canada study published in 1993 found that, of the 10 provinces studied, OCS residues were detected only in human breast milk samples from Ontario. Health Canada has assessed exposures to the population of Ontario and reported that safety margins for exposure to OCS are 25- to 100-fold under precautionary risk estimates.

Sources of OCS

Electrolytic production of magnesium was among the first recognized sources of OCS. At present, there is one electrolytic magnesium factory in the State of Utah and one operating in the Province of Quebec.

The U.S. and Canada have pooled available information regarding potential sources of OCS and determined that it is currently generated as an unintended byproduct from a variety of industrial processes (although generation may not necessarily imply current release). Five U.S. firms have recently reported generation and management of OCS wastes to U.S. EPA's Toxics Release Inventory, including three inorganic pigment producers, one chemical and vinyl producer, and one magnesium metal producer; however, other industrial processes may also generate OCS.

There are reasonable grounds for considering that OCS may be produced through processes known to yield chlorinated hydrocarbons. HCB and OCS have close structural similarity, and studies that have analyzed air for both compounds have found both. One reported past source was the chlor-alkali industry; however production technology changes during the 1970s would have ended generation of OCS.

Additional potential candidates for generating OCS, perhaps at low levels, include aluminum foundries and secondary smelters; incinerators; plasma-etching processes in semi-conductor manufacturing; secondary copper smelting; and production of graphite, sodium, nickel, vanadium, niobium, and tantalum. Although there are continuing sources of OCS, improved environmental management of wastes over the past several decades has contributed to declines in levels of this toxic substance across the Great Lakes.

Management Assessment

Potential opportunities to reduce OCS are the same as opportunities to reduce other trace chlorinated hydrocarbon byproducts, such as dioxins and HCB, addressed by the GLBTS. Therefore, sectors that undertake actions to reduce releases of dioxins and HCB will likely also reduce OCS releases as a collateral benefit. Environmental evidence supports the view that there has been substantial progress in reducing releases of OCS in both Canada and the U.S. As OCS is declining in the environment and there appear to be no grounds for concern about this substance, there is no strong case for pursuing further reductions. Overall, there is no rationale for commissioning a new OCS-specific regulation or study.

Management Outcome

The final management outcome is to suspend GLBTS workgroup activities for OCS. There are no known risk-based grounds for new GLBTS activities or challenge goals regarding OCS. The GLBTS will continue to review OCS in environmental biota and media through monitoring programs and long-range transport studies. If additional sources of OCS are identified, they will be addressed through the appropriate forum or program.

9.0 Long-Range Transport

Challenge Goal

The GLBTS established a common goal for both the U.S. and Canada, to "Assess atmospheric inputs of Strategy substances to the Great Lakes. The aim of this effort is to evaluate and report jointly on the contribution and significance of long-range transport of Strategy substances from world-wide sources. If ongoing long-range sources are confirmed, work within international frameworks to reduce releases of such substances."

Since its inception, the GLBTS has addressed this challenge goal by promoting research and discussion and providing a forum for reporting progress on the assessment of the impact of long-range transport (LRT). The most recent of these activities was a two-day workshop on the LRT of Strategy substances, held in Ann Arbor, Michigan, on September 16-17, 2003. Drawing on a commissioned background paper and over 70 experts from around the world, the workshop reviewed the latest research on the global fate and cycling of persistent toxic substances (PTS), identified critical knowledge gaps, and provided recommendations on future activities necessary to adequately address long-range transport. Workshop participants drafted an "Ann Arbor Statement" which contains recommendations aimed at improving our understanding of the LRT of air toxics, particularly with respect to how it impacts the Great Lakes Basin. The Delta Institute presented the final Ann Arbor Statement at a conference of the International Association for Great Lakes Research (IAGLR) in May 2004. The Ann Arbor Statement is available at http://delta-institute.org/pollprev/lrtworkshop/_statement.html.

The Ann Arbor Statement presents the following conclusions:

- U.S. and Canadian governments, in cooperation with international agencies, need to enhance initiatives to better understand LRT.
- If the Great Lakes Basin continues to be a source and a sink of air toxics, the goals of the Great Lakes Water Quality Agreement will never be realized, thereby compromising the health of the ecosystem and its inhabitants.
- Significant financial capital will be required to coordinate and implement the necessary actions. While progress has been made in understanding LRT, work on this challenge goal still remains.

Environmental Analysis

There are not sufficient data on the contribution of LRT to fully assess its impact on the Great Lakes Basin. However, current research indicates that LRT, both intra- and inter-continental, may be a significant source of Strategy substances to the Great Lakes Basin.

Recent studies have investigated the LRT of many PTS substances. Mercury modeling has shown that the Great Lakes Basin is not only affected by mercury emissions from North American sources but also that emissions from Asia and Europe make a significant contribution to the mercury burden over the Great Lakes. The presence of lindane in the air in the Great Lakes region and in the North American Arctic can similarly be traced to contributions from both North American and world-wide sources. The major North American source for toxaphene, a legacy chemical, may be the soils of the southeastern U.S. Although, given the prevailing westerly winds, these sources should not affect the Great Lakes, there are certain meteorological situations, lasting only a few days, where there is a direct pathway from these southeastern sources to the Great Lakes. Under these conditions toxaphene air concentrations in the Great Lakes Basin are about two to three orders of magnitude greater than those when the winds are westerly and could be a major factor in the net impact on the Great Lakes Basin.

Researchers at Lawrence Berkeley National Laboratory investigated the North American and global scale transfer efficiency of Level 1 substances to the Great Lakes using the Berkeley-Trent (BETR) contaminant fate modeling framework. The modeling results were used to group substances according to the geographic scale of emissions likely to be transported and deposited to the Great Lakes, with the following results: 1) Local or regional scale: aldrin, dieldrin, and B(a)P; 2) Continental-scale: chlordane, dioxin, DDT, toxaphene, OCS, and mirex; 3) Northern hemispheric scale: PCBs; and 4) Global scale: HCB and a-HCH.

Management Assessment

The Ann Arbor Statement identifies a number of actions that are considered to be the most critical scientific and research needs to understand and eventually reduce the LRT of chemicals to the Great Lakes. These actions pertain to emissions inventories, monitoring, modeling, and integration and synthesis. The GLBTS can add value to current efforts by addressing some of these needs through support for: 1) the development of better estimates of the use and emissions of PTS substances both within the Basin and on an appropriate broader scale, 2) air monitoring efforts both in the Basin and in potential source regions upwind of the Basin, 3) improved modeling for informed decision-making, e.g., inter-comparison of models to enhance confidence in the use of such models, 4) investigation of the LRT potential of emerging chemicals, and 5) cooperation with international agencies to reduce emissions at the source.

Two international initiatives, in particular, have a direct impact on reducing the transport of Strategy substances to the Great Lakes. The first is a United Nations Environment Program (UNEP) partnership looking at the fate and transport of substances, primarily mercury. The second is a pesticide initiative in which Canada, the U.S., and China are investigating lindane usage in China and the China-Pacific transport pathway. It is important that the GLBTS participate with these initiatives to further the interests of the Great Lakes region. In addition, implementation of the Stockholm Convention by individual countries will lead to reduced uses and releases of a number of persistent organic pollutants, which should also lead to reduced loadings from other countries to the Great Lakes.

Management Outcome

The current challenge goal for LRT remains relevant, and no changes are recommended at this time. The GLBTS will continue to:

- Support the study of LRT of Strategy substances, including actions to improve emissions inventories, monitoring, and modeling (as recommended in the Ann Arbor Statement);
- Evaluate and report jointly on the contribution and significance of LRT of Strategy substances from world-wide sources; and
- Work within international frameworks to reduce releases.

10.0 Sediments

Challenge Goal Status

The GLBTS established one goal for both the U.S. and Canada, to "Complete or be well advanced in remediation of priority sites with contaminated bottom sediments in the Great Lakes Basin by 2006." Progress toward this goal continues, as reported annually in GLBTS progress reports. Contaminated sediments remain at a number of sites in the Great Lakes. While it is estimated that tens of millions of cubic yards of contaminated sediment remain in priority sites, progress is made each year in the critical evaluation of sediments, identification of remedial needs, and remediation. On average, the U.S. has remediated over 450,000 cubic yards of contaminated sediment each year since 1997. U.S. EPA has a goal of remediating 300,000 cubic yards of contaminated sediment a year. It is anticipated that efforts in 2005 and projected efforts in 2006 will result in remediation of over half a million cubic yards of contaminated sediment by the end of 2006. In Ontario, since GLBTS reporting was initiated, sediment remediation projects have been undertaken at Thunder Bay and the St. Clair River. Decisions on natural recovery and natural recovery with administrative controls have been taken at the Severn Sound and Cornwall/St. Lawrence River Areas of Concern (AOCs), respectively. Work is continuing over the next two years on the development of sediment management strategies in 6 of 10 AOCs with sediment related issues in Ontario. Progress in U.S. AOCs is difficult to assess. Many U.S. AOCs are extremely large and have been broken down into manageable projects within an AOC. These manageable projects can take many years to remediate due to a variety of factors. For example, U.S. EPA, States, and other stakeholders are still assessing the magnitude and scope of contaminated sediment at some of these sites. In some cases, AOC boundaries have yet to be finalized. However, progress is being made every year. Typically, over three projects are initiated and three projects are completed each year. In 2004, work under the Great Lakes Legacy Act began, providing added emphasis to sediment remediation efforts in the Great Lakes. See the annual GLBTS progress reports for details about sediment remediation projects in the Great Lakes.

Environmental Analysis

There are sufficient data on the presence of contaminated sediments in the Great Lakes Basin to describe the degree and spatial extent of contamination based on exceedances of sediment quality criteria. Remedial interventions also involve assessments of toxicity, benthic community impacts, contaminant bioavailability/ biomagnification, and exposure pathways and risks. Although discharges of monitored toxic substances have declined dramatically over the past 30 years, the legacy of contamination persists in the sediments of many rivers and harbors where concentrations of contaminants remain high, and continue to pose potential risks to the health of aquatic organisms, wildlife, and humans.

Management Assessment

Responsibility for the management and remediation of contaminated sites resides variously with federal, state, and provincial governments, industries, and other interested stakeholders. The GLBTS has provided a forum to report on activity and support outreach (for instance, in 2001, the GLBTS held a workshop to promote the transfer of sediment remediation technologies). The GLBTS reports annually the volume of sediments remediated from priority sites in the Great Lakes Basin (since 1997) and the quantity of Level 1 substances contained in those sediments. Refer to the most current version of the GLBTS Progress Report (at www.binational.net) for the most up-to-date sediment remediation estimates. Aside from the reporting and outreach efforts, the GLBTS provides no further opportunities to add value to current remediation activities.

Management Outcome

The Sediment goal remains relevant to the GLBTS, which supports continuing sediment evaluation and remediation activities at priority sites in the Great Lakes Basin. The GLBTS will continue to report annually the progress made in sediment remediation activities in the Basin, and identify opportunities to support additional information-sharing efforts (similar to the 2001 workshop) as needed.

PART II: GENERAL FRAMEWORK TO ASSESS MANAGEMENT OF GLBTS LEVEL 1 SUBSTANCES: BACKGROUND, OBJECTIVES, AND DOCUMENTATION

BACKGROUND

Over the past thirty years, the governments of Canada and the United States have joined together with industries, citizen groups, and other stakeholders in a concerted effort to identify and eliminate threats to the health of the Great Lakes ecosystem resulting from the use and release of persistent toxic substances. A major step in this process was the enactment of the *Revised Great Lakes Water Quality Agreement (GLWQA) of 1978* which embraced, for the first time, a philosophy of "virtual elimination" of persistent toxic substances from the Great Lakes. In 1987, the GLWQA was amended, establishing Lakewide Management Plans (LaMPs) as a mechanism for identifying and eliminating any and all "critical pollutants" that pose risks to humans and aquatic life. In 1994, the International Joint Commission's *Seventh Biennial Report* under the GLWQA called for a coordinated binational strategy to "stop the input of persistent toxic substances into the Great Lakes environment." This led to the signing of the *Great Lakes Binational Toxics Strategy* (GLBTS, or Strategy) in 1997. The Strategy specifies Level 1 substances, each targeted for virtual elimination and each with its own specific challenge goals, along with Level 2 substances targeted for pollution prevention. The substances were selected on the basis of their previous nomination to lists relevant to the pollution of the Great Lakes Basin, and the final list was the result of agreement on the nomination from the two countries. The specific reduction challenges for each substance include individual challenge goals for each country, within a time frame that expires in 2006.

Significant progress has been made toward achieving the Strategy's challenge goals. As 2006 approaches, an analysis of progress and determination of next steps is needed to respond to the mandate set forth in the Strategy. The purpose in developing the *General Framework to Assess Management of GLBTS Level 1 Substances* is to provide a tool to assist the Parties (Environment Canada and the United States Environmental Protection Agency) and stakeholders in conducting a transparent process to assess the Level 1 substances.

OBJECTIVE

The framework presents a logical flow diagram for evaluating progress and the need for further action by the GLBTS on the Level 1 substances in order to meet the following objective:

Evaluate the management of GLBTS Level 1 substances with the following potential outcomes:

1. Active Level 1 Status & Periodic Reassessment by GLBTS
2. Consider Submission to BEC[55] for New Challenge Goals
3. Engage LaMP Process
4. Suspend GLBTS Workgroup Activities. Where warranted, refer to another program and/or participate in other fora. Periodic Reassessment by GLBTS, until Parties determine substance has been virtually eliminated.

Additional outcomes that may result from the framework are:

- Recommend benchmark or criteria development as a high priority; and

[55] The Binational Executive Committee (BEC) is charged with coordinating implementation of the binational aspects of the 1987 Great Lakes Water Quality Agreement, including the GLBTS. The BEC is co-chaired by EC and US EPA and includes representatives from the Great Lakes states and the Province of Ontario, as well as other federal agencies in Canada and the U.S.

- Recommend additional environmental monitoring as a high priority.

The framework is intended to serve as a guide in determining the appropriate management outcome(s) for the Level 1 substances: mercury, polychlorinated biphenyls (PCBs), dioxins and furans, hexachlorobenzene (HCB), benzo(a)pyrene (B(a)P), octachlorostyrene (OCS), alkyl-lead, and five cancelled pesticides: chlordane, aldrin/dieldrin, DDT, mirex, and toxaphene. The framework is not intended to specify details of how a Level 1 substance should be addressed once a management outcome is determined.

STRUCTURE OF THE FRAMEWORK

The framework is set up in a hierarchical fashion to allow efficiencies in the decision process. The hierarchy of the framework is to first consider progress toward the challenge goals committed to in the Strategy, then to conduct an environmental analysis and finally, a GLBTS management assessment which leads to various potential management outcomes for a substance.

The environmental analysis (depicted in green) and the GLBTS management assessment (depicted in blue) comprise the two main parts of the framework. The environmental analysis considers available Canadian and U.S. monitoring data and established human health or ecological criteria as the primary basis for an objective evaluation of a substance's impact on the Basin. For substances lacking sufficient risk-based criteria or environmental monitoring data, the framework recommends the development of benchmarks or criteria and additional monitoring as a high priority. While the environmental analysis places emphasis on good monitoring data, evidence of use, release, exposure, or precautionary concerns may also be considered.

If the environmental analysis concludes that there is no basis for concern, GLBTS workgroup activities may be suspended, with periodic reassessment of the substance until the Parties determine that the substance has been virtually eliminated. If, on the other hand, the environmental analysis concludes that there is a reason for concern, the GLBTS management assessment evaluates the ability for the GLBTS to effect further improvements in and out of the Basin. The GLBTS management assessment also considers whether the impact of a substance is basinwide or restricted to a single lake. In cases where the GLBTS can effect further reductions, consideration will be given as to whether new Strategy challenge goals can be established. Virtual elimination is an underlying tenet of the Strategy and should be kept in mind throughout the assessment process.

The GLBTS management assessment can result in a number of potential management outcomes; the outcomes provided in the framework allow a substance to remain in active Level 1 status or GLBTS workgroup activities to be suspended. The outcomes also recognize that it may be appropriate to more actively involve a LaMP process, to refer a substance to another program, to represent GLBTS interests in other fora (e.g., international programs), or to consider proposing new challenge goals. All outcomes include a periodic reassessment by the GLBTS (approximately every two years).

While it is recognized that the Parties have an ongoing responsibility to promote GLBTS interests in other arenas, a potential outcome of the framework is to recommend referral to another program and/or GLBTS representation in other fora. In the GLBTS framework, this option is presented when there is no evidence of Basin effects, or when the GLBTS cannot effect further significant reductions on its own, but can advocate substance reductions in other programs and in international fora.

It should be noted that, in using the framework to conduct assessments for the Level 1 substances, it may not be possible to definitively answer "YES" or "NO" to all questions. It is not necessary to have a definitive answer to proceed in the framework. For example, in assessing whether there is environmental or health data to assess the impact of the substance in the Basin, it may be determined that, while additional data would be helpful, there is some data on releases and environmental presence in certain media with which to assess the status of the substance. In this case, judgment is needed to decide whether these data are sufficient to proceed along the "YES" arrow or whether the available data are not adequate and the analysis should proceed along the "NO" arrow, placing the substance on a high priority list for monitoring. As a general guide, the framework allows flexibility and judgment in interpreting environmental data and in determining the most appropriate management outcome(s).

Each decision node, or shape, in the framework is illustrated below along with a brief explanation that describes, in further detail, the question to be assessed.

GLBTS Level 1 Substances

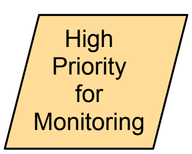
Have the challenge goals for the substance been met?

All 12 Level 1 substances will be assessed.

The first question to consider in assessing the GLBTS status and future management of a Level 1 substance is whether the challenge goals agreed to in the Strategy have been met. The answer to this question informs the subsequent assessment in many ways, not only indicating progress, but also revealing issues associated with the ability to pursue further reductions. Progress toward the U.S. and Canadian goals will be considered jointly. Challenge goals will be evaluated with the best data presently available. Note that some challenge goals target "releases" of a substance while others target its "use". As a result, different types of data may be required to evaluate challenge goal status (e.g., "use" data vs. environmental "release" data). The framework continues with both the environmental analysis and GLBTS management assessment, notwithstanding the status of the challenge goals.

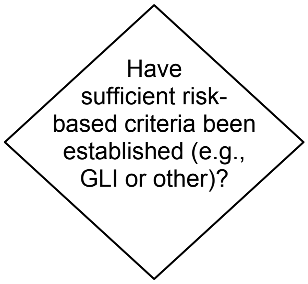
ENVIRONMENTAL ANALYSIS

Characteristics of acceptable monitoring data to assess the temporal, spatial, and population representativeness of a substance in the Great Lakes Basin ecosystem include (but are not limited to) basin-specific measures in water, air, sediment, soil, indoor environments (e.g., dust), fish, biota, or human biological samples. If necessary, use or release data may be used as surrogates (e.g., in the case of alkyl-lead).

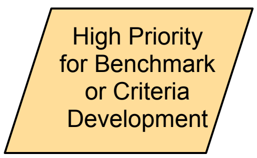


"What gets measured gets managed." Substances entering this box will be recommended as a high priority for monitoring to the Parties. The intent is that these GLBTS substances will be considered by a wide range of government or private agencies when they make decisions regarding which analytes to monitor in the environment. As sufficient monitoring data is developed, substances will be re-evaluated.

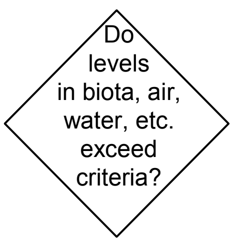
Relevant criteria include, but are not limited to:



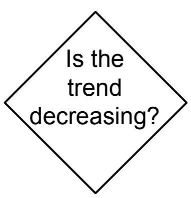
- Water quality criteria
- Fish tissue concentrations
- Ambient or indoor air standards
- Sediment or soil standards
- Limits based on reference doses
- Health-based standards for human biota measurements



If there are no criteria against which to evaluate current levels, the GLBTS will consider whether there is a need for the Parties to recommend the development of human health or ecological criteria. This box effectively creates a GLBTS list of substances that are in need of human health or ecological criteria with which to identify exceedances in the environment.

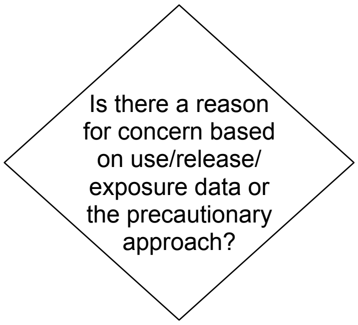


As the framework is intended to be flexible in its implementation, the choice of criteria to use in answering this question may vary. For example, the most strict criteria in one or more media may be used to evaluate environmental levels.



If there are no criteria, or if current levels do not exceed criteria, this box considers whether there is a decreasing trend. A decreasing trend could be defined as a statistically significant negative slope. If the trend is decreasing, the substance is evaluated for evidence of concern based on use, release, exposure, or the precautionary approach. If a decreasing trend cannot be established, then the substance moves directly to the GLBTS management assessment to determine the ability of the GLBTS to effect further reductions.

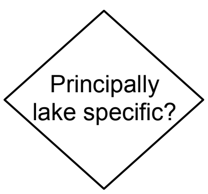
* Note that, in the event that there are established criteria and the GLBTS substance is below those criteria but not decreasing in trend, further analyses may be required to estimate when criteria might be exceeded.



In cases where sufficient monitoring data is not available, or where environmental trends are decreasing and criteria have either not been established or are not being exceeded, the relevant question is whether there is evidence of Basin effects based on documented use, release, or exposure data, or from a precautionary point of view. An example of a precautionary point of view would be documented evidence of significant impact in another geographic location with the same sources and use patterns as in the Basin, or because the effects of a pollutant would be significant by the time it was able to be measured through monitoring.

GLBTS MANAGEMENT ASSESSMENT

Answering this question involves an accelerated version of the first three steps of the GLBTS 4-step process,[56] looking at sources and current programs and regulations to see where the reduction opportunities lie. Part of the assessment will involve consideration of whether the reduction opportunities will be significant enough to merit the effort.



Based on a joint GLBTS-LaMP determination that the impact of a substance is restricted to a single lake, the appropriate LaMP will be engaged for coordination of leadership for reduction actions to be undertaken by the responsible organizations.

The GLBTS will assess the practicality of setting forth new challenge goals.

[56] The GLBTS four-step process to work toward virtual elimination is: 1) Information gathering; 2) Analyze current regulations, initiatives, and programs which manage or control substances; 3) Identify cost-effective options to achieve further reductions; and 4) Implement actions to work toward the goal of virtual elimination.

GLBTS MANAGEMENT OUTCOMES

Active Level 1 Status & Periodic Reassessment by GLBTS

The substance will continue as a Level 1 with reduction actions addressed by the appropriate process and with periodic reassessment, approximately every two years, using the *General Framework to Assess Management of GLBTS Level 1 Substances*.

Consider Submission to BEC for New Challenge Goals

The GLBTS will consider recommending new challenge goals to BEC. The justification for new challenge goals will incorporate the findings of the framework analysis and will include assessment of the desired environmental improvement and feasibility. If the GLBTS decides to propose new challenge goals, the recommendation to BEC will include a reduction percentage, reduction timeline, and baseline for the proposed new challenge goals.

Engage LaMP Process

For substances whose impact is lake-specific, the appropriate LaMP will be engaged to coordinate substance reduction activities with continued support from the GLBTS, recognizing the limited direct implementation capacity of the LaMPs. It is understood that much of the actual implementation would be carried out by the agencies with responsibility to address these substances. A joint review of progress would be undertaken periodically.

Suspend GLBTS Workgroup Activities. Where warranted, refer to another program, and/or participate in other fora. Periodic Reassessment by GLBTS, until Parties determine substance has been virtually eliminated.

In the event that the GLBTS is not able to effect further reductions, or there is no evidence of Basin effects, GLBTS workgroup activities will be suspended. Where warranted, a recommendation will be made to a) refer reduction efforts for the substance to another program, and/or b) represent GLBTS interests in other fora (e.g., Commission for Environmental Cooperation, United Nations Environment Programme). There will be no ongoing workgroup involvement with these substances, though each one will undergo periodic reassessment, approximately every two years, using the *General Framework to Assess Management of GLBTS Level 1 Substances*, until the Parties determine that virtual elimination has been reached.

General Framework to Assess Management of GLBTS Level 1 Substances