COOPERATING TO IMPLEMENT THE GREAT LAKES WATER QUALITY AGREEMENT
MISE EN OEUVRE DE L'ACCORD SUR LA QUALITÉ DE L'EAU DES GRANDS LACS

Third Implementation Plan (IP3) for the Integrated Atmospheric Deposition Network 2005-2010

Prepared by the Canada-U.S. IADN Steering Committee
Presented to the Binational Executive Committee (BEC)
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Commitment of the Parties

The following Implementation Plan commits the Parties to the Great Lakes Water Quality Agreement to maintain the Integrated Atmospheric Deposition Network (IADN) as called for under Annex 15 of the Great Lakes Water Quality Agreement.

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Executive Summary

The Third Implementation Plan (IP3) for operation of the Integrated Atmospheric Deposition Network (IADN), covering the years 2005-2010, is presented. IADN fulfills the monitoring and surveillance requirements of Annex 15 of the Great Lakes Water Quality Agreement (GLWQA) by measuring concentrations and calculating atmospheric loadings of persistent bioaccumulative toxic substances (PBTs) to the Great Lakes. While IADN has succeeded in fulfilling its primary goals and most of the recommendations set forth under IP2, enhancement of the network must continue for IADN results to continue to be of high quality and relevant to stakeholders, policymakers, and researchers. Implementation of this plan will depend on available resources, and the network will change in response to the changing needs of stakeholders and data users.

Target activities for the IP3 period include (in no specific order):

1. Additional urban sampling and urban input assessment
2. Use of research vessels for over-water concurrent air and water sampling (to improve characterization of air-water exchange) and to examine urban plumes
3. Cooperation with Canada and U.S. PBT water monitoring programs to improve the availability and comparability of PBT water concentration data needed for loadings calculations
4. Exploration and consideration of new technologies such as passive samplers
5. Continued analysis of historical IADN "core" contaminants, with consideration of delisting once detectability and/or concentrations drop to a certain level
6. Measurement of high priority substances not currently on IADN's core list (mercury and dioxins) and substances of emerging concern (i.e., polybrominated diphenyl ethers, or PBDEs) given adequate resources and technology
7. Appropriate follow-up to past quality assurance studies and continued use of a dedicated Quality Assurance Officer
8. Continued centralized data management and use of the NatChem database to service data requests
9. Improved loadings calculations, including use of relevant non-IADN data
10. Shortened data and loadings turnaround time
11. Collaboration with modelers to better assess urban inputs, improve loadings calculations, and track PBTs and their sources and source regions
12. Continued international collaboration with other PBT monitoring experts and networks
13. Binational publications and improved outreach

Introduction

Annex 15 of the Great Lakes Water Quality Agreement (GLWQA) states that the Parties shall conduct research, surveillance, and monitoring and implement pollution control measures for reducing the atmospheric deposition of persistent bioaccumulative toxic substances (PBTs) to the Great Lakes. The Integrated Atmospheric Deposition Network (IADN) was designed, and is funded, to fulfill the **surveillance and monitoring** requirements of the Annex by measuring concentrations of PBTs in air and precipitation and determining atmospheric loadings to the Great Lakes biennially. It provides a platform (in terms of data from the network, expertise of network partners, and physical sampling sites) for research concerning atmospheric deposition as well as input into decision-making regarding the development of pollution prevention and reduction measures. The Parties (Canada and the United States), rather than IADN alone, bear the primary responsibility to perform the tasks given in Annex 15 as a whole, including atmospheric deposition-related research, studying health effects of PBTs, and devising pollution control measures. IADN does not have the resources or the expertise to address all of these tasks.

However, as resources allow, IADN does cooperate in research in areas mentioned in the Annex. IADN Steering Committee members can, and commonly do, advise those who work in pollution prevention and control on what progress has been made and where, in general, source regions of PBTs are located. This type of outreach to decision-makers and stakeholders will be continued. Given additional funding and manpower, more topics falling generally under Annex 15 could be tackled. Currently year-to-year funds are generally only sufficient to maintain the core IADN program. It should be noted that atmospheric deposition research is also funded through the Great Lakes Air Deposition (GLAD) grant program, a cooperative effort between US EPA Region 5, the Great Lakes Commission, and the Great Lakes States.

IADN, run jointly by U.S. EPA and Environment Canada, has been in operation since 1990. This document, the Third Implementation Plan for the IADN (IP3), outlines future plans for the network for the years 2005-2010. The first implementation plan governing the operation of network (IP1) was signed in 1990. After a peer review by international experts in 1997, the second implementation plan (IP2) was signed in 1998. IP3 builds on the findings of the 2002 peer review and the guidance of the IADN Steering Committee. Technical summaries prepared for the peer reviews provide detail about IADN's past progress and activities.

IADN Mandates and Goals

In addition to Annex 15, IADN is called for in the Canada-Ontario Agreement (COA) and in Section 112(m) of the U.S. Clean Air Act Amendments of 1990. The U.S.-Canada Great Lakes Binational Toxics Strategy (GLBTS), signed in 1997, also calls for monitoring of PBTs in the Great Lakes basin. IADN data are used by the GLBTS and the Lakewide Management Plans (LaMPs) to track progress towards reduction of targeted PBTs in the basin. Results are also used to report on the State of the Lakes Ecosystem Conference (SOLEC) Indicator #117 ("Atmospheric Deposition of Toxic Chemicals"), to report to Congress to fulfill U.S. Government Performance and Results Act (GPRA) requirements, and for other uses by researchers and stakeholders within the basin, nationally, and internationally. The U.S. Great Lakes Strategy 2002 also calls for the continued operation of IADN as well as some of the improvements identified in this Implementation Plan.

The goals of IADN are to:

1. Determine, with a specified degree of confidence, the atmospheric loadings and trends (both spatial and temporal) of persistent bioaccumulative toxic chemicals to the Great Lakes and its basin on at least a biennial basis;

2. Acquire quality-assured air and precipitation concentration measurements, with attention to continuity and consistency of those measurements, so that trend data are not biased by changes in network operations or personnel; and
3. Help determine the sources of the continuing input of those chemicals.

Chemicals that are a priority for monitoring by IADN are those that, via listing in documents like the GLWQA or the GLBTS, are of known concern to the Great Lakes, as well as chemicals that are suspected to be a Great Lakes ecosystem problem and are currently the subject of research and/or assessment. Measured chemicals have been determined to have an atmospheric pathway and ecological and/or human health effects.

Much progress has been achieved in fulfilling the goals and recommendations set forth in IP2. Some developments are mentioned below, and overall progress under IP2 is detailed in the 2002 IADN Technical Summary. Recommendations and goals for the IP3 period are listed below under the appropriate subject area. Implementation will depend on available resources, and the network will change in response to the changing needs of stakeholders and data users.

Sampling Design

Locations of IADN stations are given in Figure 1. One master station is located on each of the Great Lakes, and ten satellite stations provide more spatial detail for the network. Over the IP2 period, the Ontario Ministry of the Environment discontinued its involvement in the program in 1999, with the subsequent loss of 4 satellite stations. Data from a satellite station on Lake Superior (Brule River) were found to be similar to the Master Station data from Eagle Harbor, so the site was moved to Cleveland, Ohio in 2002. This decision was taken following the guidance of IP2 to locate satellite stations so that urban impacts on lakewide loadings could be assessed. The master stations, with long data records, will continue to hold the highest priority for continued operation.

The research buoy (ECO-1) operated by Environment Canada in the western end of Lake Ontario has been under development as an IADN satellite site since 1999. This over-water platform, although only available for 4-6 months of each year, has provided atmospheric measurements in the urban plume of Toronto/Hamilton and may allow simultaneous air-water monitoring. Concentrations of PBTs in water are required for better air-water exchange calculations. Improvements have been made in this area with the establishment of a clean lab and changes to the contaminant sampling protocols for Environment Canada's Great Lakes Surveillance Program and the re-establishment of the water organics program by U.S. EPA in Lake Michigan starting in 2003.

Assessing atmospheric inputs from urban areas and concurrent air-water measurements will continue to be priorities of IADN during IP3. A study conducted in 2002 by IADN cooperators revealed differences in atmospheric PCB levels within Chicago. Such spatial gradients will be explored further via the use of temporary stations or passive samplers. Additional urban stations or short-term urban sampling will be pursued within resource limitations. The possibility of collection of air samples during the sampling cruises for the U.S. and Canadian water monitoring

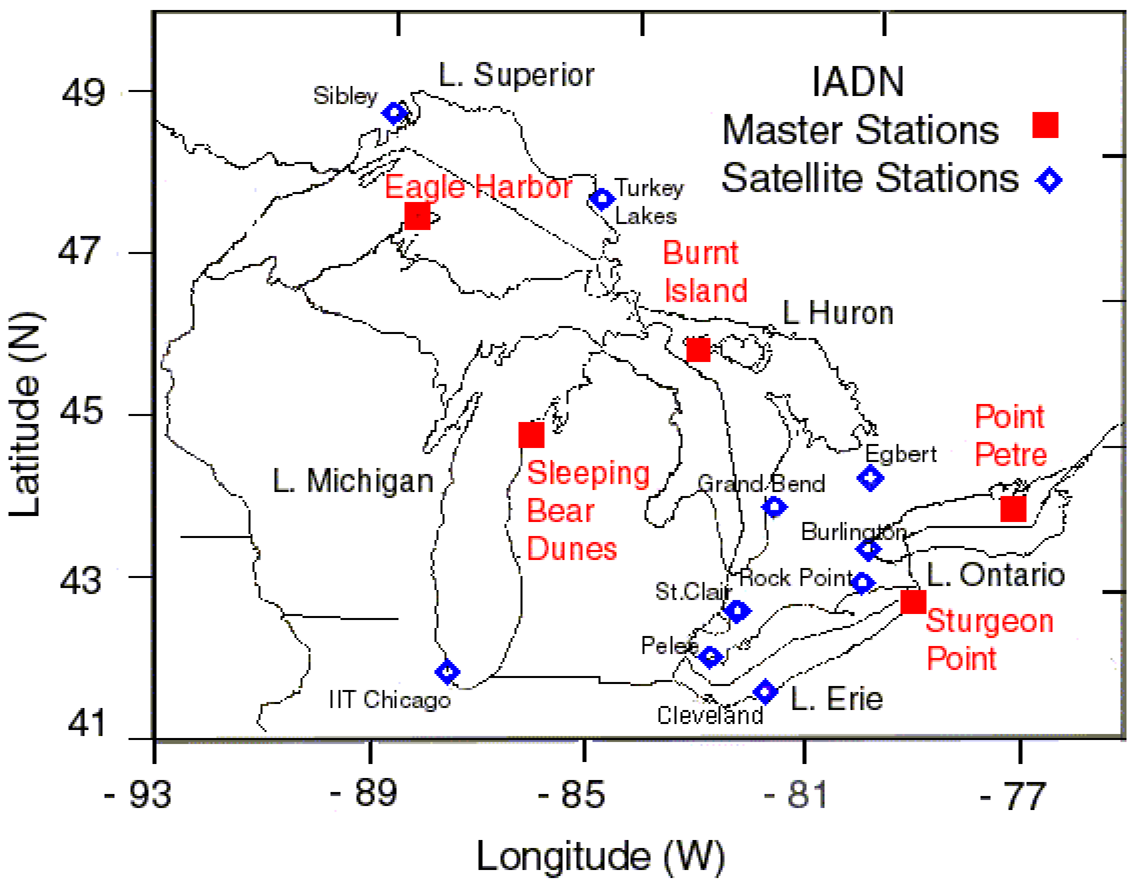

Figure 1. IADN Station Map.

programs will be investigated. Modeling expertise will be sought to better estimate urban inputs of PBTs to the Lakes.

The use of alternative technologies, such as passive samplers and denuders, will be explored during IP3. Passive samplers are relatively inexpensive and allow for a longer sampling time (1-3 months). They have been located at IADN sites, and the results from such samplers have been favorably compared to those from conventional sampler technology. Passive samplers may be used in the future to complement IADN data, particularly in urban areas.

Chemicals

Under IP1 and IP2, multiple lists of chemicals (called "tiers") were used to separate chemicals with well-established methods from those for which analytical method development was needed. After considerable discussion by the IADN Steering Committee, the concept of classifying chemicals in tiers of importance was discarded because the list of chemicals is now limited by resources rather than by available methods. A list of priority chemicals to be analyzed by all agencies at all stations has been compiled, along with a list of chemicals analyzed by at least one IADN laboratory. Given necessary supplemental information (such as physicochemical properties and water concentration data), IADN will strive to calculate and report on loadings for the first list. Both lists are given in Table 1.

As suggested in IP2, an IADN PCB congener suite has been developed. The suite consists of congeners that make up most of the PCB mass in the atmosphere as well as those that are toxicologically important. All participating agencies will measure these congeners at a minimum, and the total PCBs figures reported by the network are for the PCB Suite.

A “trigger point” for delisting chemicals from the IADN list has been determined. The detectability of chemicals was examined by media (gas-phase, particulates, precipitation), season, and Lake. It was determined that currently all of the chemicals being measured are detected in at least 25% of the samples in at least one season, Lake, and media. If detectability for a chemical drops below this criterion, consideration will be given to dropping that chemical, but other factors will also be considered, such as whether the chemical still presents risk (particularly as demonstrated by fish consumption advisories and fish contaminant levels).

Gaseous mercury and mercury in precipitation is being measured at Canadian stations through the Canadian Atmospheric Mercury Network (CAMNet) and the Mercury Deposition Network (MDN), respectively. The U.S. will continue to pursue funding to monitor mercury at its stations. The State of Michigan currently operates a mercury monitoring station collocated with at IADN at Eagle Harbor.

Indiana University, the current EPA IADN laboratory grantee, has received funding from the U.S. EPA Great Lakes Atmospheric Deposition Program (GLAD) to measure dioxins at the U.S. master stations and Chicago for two years starting in Fall 2004. In Canada, collaboration with the National Air Pollutant Surveillance Network (NAPS) has provided dioxin and furan air data at the two Canadian master stations, and since the spring of 2004, dioxin has been measured in precipitation at those stations as well.

It is important that IADN remains current in its choice of chemicals while recognizing that the PBT concentration and loading trends established over the history of the network constitute a globally unique dataset that must be protected. Banned PBTs and combustion by-products (PAHs) will continue to be measured by IADN. In addition, trace metals will continue to be measured at Canadian stations. However, over the IP3 period it is expected that the list of chemicals will grow with the addition of chemicals of emerging concern, such as polybrominated diphenyl ethers (PBDEs). Monitoring of mercury, dioxins and furans, and emerging chemicals, in addition to the current IADN “core” chemicals (PCBs, organochlorine pesticides, and PAHs), can only occur through a combination of additional dedicated resources and collaboration with other groups.

Table 1. IADN Chemical List (updated June 2004).

Chemicals measured at all Master and satellite stations in air and precipitation

Suite PCBs	γ-HCH (lindane)
	Methoxychlor
Organochlorine pesticides:	*trans*-Nonachlor
Aldrin	
trans-Chlordane (γ)	*Polycyclic aromatic compounds:*
cis-Chlordane (α)	Anthracene
p,p'-DDT	Benz[*a*]anthracene
p,p'-DDD	Benzo[*b*]fluoranthene+ Benzo[k]fluoranthene
p,p'-DDE	Benzo[*ghi*]perylene
o,p'-DDT	Benzo[*a*]pyrene
Dieldrin	Benzo[*e*]pyrene
α-Endosulfan	Chrysene + Triphenylene
β-endosulfan	Dibenz[*a,h*]anthracene
Endrin	Fluoranthene
Heptachlor epoxide	Fluorene
Hexachlorobenzene (HCB)	Indeno[*1,2,3,cd*]pyrene
α-HCH	Phenanthrene
β-HCH	Pyrene

Additional chemicals for which data are available
Monitoring done by at least one agency

o,p'-DDD (MSC, IU/EPA)	Coronene (MSC, IU/EPA)
o,p'-DDE (MSC)	Dibenz[*a,c*]anthracene (MSC)
Endosulfan sulphate (MSC, IU/EPA)	Indene (EHD)
Heptachlor (MSC, EHD)	1-Methylnaphthalene (EHD)
Mirex (MSC, EHD)	2-Methylnaphthalene (EHD)
Octachlorostyrene (IU/EPA)	Retene (MSC, IU/EPA)
Oxychlordane (MSC, IU/EPA)	1,2,3,4-Tetrahydronaphthalene (EHD)
Di- thru pentachlorobenzenes (EHD)	
Photomirex (MSC)	***Trace elements:***
Acenaphthene (MSC, EHD)	Arsenic (MSC)
Acenaphthylene (MSC, EHD)	Cadmium (MSC, EHD)
Anthanthrene (MSC)	Lead (MSC, EHD)
Benzo[*ghi*]fluoranthene (MSC)	Selenium (MSC)
2-Chloronaphthalene (EHD)	Mercury (MSC, EHD)
PBDEs: IU and EHD start 2004	Dioxins: IU and EHD start 2004 Canadian Master Stations through NAPS network

Quality Assurance and Quality Control

During IP2, laboratory and field audits, round robins, and other intercomparison studies were performed, including collocated multi-agency sampling initiated in 1998. Reference standards common to all laboratories were also adopted. The results of the studies indicated that there are some differences in results among agencies. A follow-up QA study was performed in 2003-04, and several measures are now being taken to address the situation.

The use of a multiple laboratory configuration will be maintained during IP3. The IADN Steering Committee feels that this approach prevents potential biases from going undetected. In addition, the long-term trend at each station has been strengthened by generally having laboratory consistency since the inception of IADN. On the U.S side the laboratory is a grantee, and competitions will be conducted periodically to be fair and ensure that a laboratory (or laboratories) of the highest caliber is being utilized.

A multi-agency network of the magnitude of IADN needs an independent dedicated QA officer. Such an individual was present during IP2 and this has led to improved data comparability. This will be continued during IP3 given sufficient funding.

Data Analysis, Reporting, and Outreach

The use of a centralized database and network-wide data manager will continue. These two features have allowed uniform quality control of all data contributed to the IADN database. These data are then submitted to the National Air Chemistry Database (NAtChem/Toxics) at MSC. During IP2, data requests had to go through the IADN data manager via the IADN website. In IP3 this process will be upgraded to fully utilize the capabilities of the NAtChem database that in the near future will allow direct web-based access. Data will be sequestered for a period of 2 years after submission to NAtChem to allow the preparation of publications by the Steering Committee and then will become public. This data policy is aligned with that of other networks such as the Northern Contaminants Program (NCP), CAPMon (Canadian Air and Precipitation Monitoring Network), and CAMNet. Summary data and IADN publications will remain accessible via the IADN website.

Several recommendations from the peer-review of 2002 regarding improvements to the IADN loadings calculation have been implemented in the latest loadings estimates for 1999-2000. These improvements include monthly loadings calculations to avoid aggregation of meteorological and concentration data, over-lake wind speeds and precipitation estimates, the automation of the loadings calculations using a SAS program, and an update of physicochemical properties. During the IP3 period, several more improvements will be implemented. They include a better calculation of dry deposition, inclusion of satellite site data in the loadings calculations, and a collaborative approach with modelers to better represent the air-water exchange process. Improved quality and availability of water concentration data will also improve the estimates of volatilization from the Lakes.

Additional use of data from non-IADN sources (other researchers, other federal programs, state/provincial and tribal efforts) could also be used in the loadings calculations to fill gaps in spatial and chemical coverage. Such sources include the Mercury Deposition Network, state gas-phase mercury monitoring efforts, trace metal monitoring programs, and the National Air Pollution Surveillance (NAPS) network.

Efforts will be ongoing to reduce data turnaround time (from the sample collection to the data delivery). Optimized data turnaround time and the new automated loadings program will allow the biennial loadings reports to be produced in a more timely manner. The IADN Steering Committee's goal is to complete the 2001-02 and 2003-04 loadings reports by 2006, the 2005-06 report by 2008, and the 2007-08 report by 2010.

IADN will continue its international collaboration in IP3. For example, an air and precipitation monitoring intercomparison study between Germany and Canada, organized through EMEP, is currently underway at Point Petre. IADN traditionally brings in international experts to make recommendations during formal peer reviews held at the end of each Implementation Period. In the future, the IADN Steering Committee will also convene ad-hoc advisory panels, which will include international experts, to review important work products or processes (such as the loadings model) on an as-needed basis. Participation of IADN personnel in development of the Center for Environmental Cooperation's Environmental Monitoring and Assessment plan will also help integrate IADN with North American PBT monitoring efforts.

Outreach to stakeholders (such as participants in the Binational Toxics Strategy, the Lakewide Management Plan groups, and researchers doing work related to atmospheric deposition and PBTs) via the use of IADN data and results and IADN Steering Committee expertise will continue. Oral presentations at conferences and meetings, scientific publications, the State of the Lakes Ecosystem (SOLEC) and U.S. Government Performances and Results Act (GPRA) indicators, and media coverage are important avenues by which IADN data reaches researchers, Great Lakes stakeholders, decision-makers, and the public. Binational publication of results and preparation of press releases for significant IADN reports will continue to occur during IP3. Partnerships with modelers and other partners who can use IADN and other data to track the movement of PBTs and locate sources will also be pursued.