COOPERATING TO IMPLEMENT THE GREAT LAKES WATER QUALITY AGREEMENT
MIS EN OEURVE DE L'ACCORD SUR LA QUALITE'DE L'EAU DES GRANDS LACS

Second Implementation Plan for the Integrated Atmospheric Deposition Network 1998-2004

{DRAFT Jan. 1998}

June 1998

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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 as called for under Annex 15 of the Great Lakes Water Quality Agreement.

Dated:

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Purpose and Scope

The Integrated Atmospheric Deposition Network (IADN) has been in operation since 1990 under the guidance of an implementation plan signed in that year (Egar and Adamkus, 1990). The first implementation plan (IP1) committed the United States and Canada to work cooperatively towards the initiation of the IADN and guided the five cooperating IADN agencies (the U.S. Environmental Protection Agency; Environment Canada's Atmospheric Environment Service, National Water Research Institute, Ecosystem Health Division of Ontario Region; and the Ontario Ministry of Environment) in meeting their joint obligation. In 1997, the progress of the IADN program was reviewed in a technical summary (IADN Steering Committee, 1997; hereafter called TS). The TS has been widely distributed for comment and has been the subject of a Peer Review by eminent scientists of international stature.

This document is the Second Implementation Plan of IADN (IP2). It is designed to restate the goals of IADN, briefly outline the future plans for IADN for the period 1998-2004, and provide a timeline from which the IADN yearly workplans will be developed. This is not a stand-alone document. The details of IADN necessary to understand IADN's aims and goals are more fully discussed in the TS and it is expected that the two documents will be used in tandem by those seeking to understand the IADN program in detail.

IADN Mandate and Goal

IADN is specifically called for, by name, in Annex 15 of the Great Lakes Water Quality Agreement (GLWQA). In Canada, these activities are reflected in the Canada-Ontario Agreement (COA). The mandate for IADN also resides in Section 112(m) of the U.S. Clean Air Act Amendments of 1990 (CAA). More recently, the U.S./Canada Binational Great Lakes Toxics Strategy (BGLTS), signed in 1997, calls for monitoring of the atmospheric deposition of toxic chemicals to the Great Lakes basin. Many of the "challenges" in the BGLTS are directly related to IADN capabilities and goals.

The **goals** of IADN **are** to:

1. **Determine**, with a specified degree of confidence, the atmospheric **loadings** and **trends** (both spatial and temporal) of **priority 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.

"***Loading***" of these chemicals is defined as the net flux of the chemical to the water or watershed in units of mass per square meter per unit time or, when multiplied by the surface area of the receiving surface, mass per year. This definition included losses from the surface as a result of gas exchange. "***Trends***" are defined as the yearly rate of change or spatial

differences in the loading of a specific chemical, determined from a significantly long time series of data so that the statistical certainty in the estimate of the rate can be stated with a specified degree of confidence. A "***specified degree of confidence***" means that the loadings and trends are qualified by a measure of the precision of the estimate (usually in terms of one standard deviation of the loading estimate or a statement of the statistical power of the trend determination, i.e. positive or negative slope at the 95% confidence level). "***Priority toxic chemicals***" are those chemicals which, through listing by the IJC or the Parties, are of known concern to the Lakes, including chemicals which are suspected to be an ecosystem problem for the Lakes and are currently under research investigation or assessment. It is clear by this goal that IADN is an evolving program which will include the investigation of new chemical inputs to the Lakes.

IADN Design

This Implementation Plan is designed to allow for some revision to IADN operations during the next six year period. IADN will change as requirements for its data changes. Changes to IADN activities will be documented (as they occur) by frequent updating of the IADN Quality Assurance Program Plan (QAPP). The QAPP is designed to be a "living document" and will provide detailed and accurate descriptions of program activities, personnel and their responsibilities, and status on the quality of the data provided by the network. The IADN QAPP will be updated during 1998.

Station Placement and Number

IADN has been designed around the concept of one Master Station on each of the five Great Lakes, supplemented by a number of Satellite Stations which provide more spatial detail in deposition. The Master Stations offer the complete range of measurements made in the Network, measuring wet and dry deposition of Semivolatile Organic Compounds (SVOCs), trace metals, and particulate mass less than 10 um (PM10). Satellite Stations may contain only a portion of the measurements made at the Master Stations. From the measurement of air concentrations of the SVOCs at these sites and in combination with measurements of the water concentration of the same chemicals made by other programs, IADN also estimates gas exchange of the SVOCs with the lake surfaces. The current IADN station placement is shown in Figure II-1 of the TS.

IADN will continue with the current design, however, rationalization of the placement and number of the Satellite Stations will occur during the first two years of IP2. This rationalization involves an assessment of the need for certain satellite stations using the spatial trend information derived to date. It has been pointed out in the IADN Peer Review that urban influences and direct measures of air-water exchange may be a higher scientific priority than high spatial detail across the lakes. A workshop will be held early in the IP2 period to examine more strategic placement of the Satellite Stations to improve IADN's capability to assess the effects of urban areas on lakewide loadings.

IADN will develop one or more paired urban/rural or urban/remote stations to assess the impact of large urban areas on the Lakes. This will involve moving one or more Satellite stations into cities such as Toronto, Detroit, or Buffalo and making measurements in parallel with

existing IADN stations. Canada proposes that Toronto/Egbert/Point Petre be the urban/rural/remote intercomparison sites for Lakes Ontario and Huron. The US proposes assessing the feasibility of establishing similar paired sites at the existing Chicago urban site and a remote site or at Sturgeon Point/Buffalo. Other possible pairings exist at Detroit and Walpole Island (a National Air Pollution Surveillance site) or Detroit/Grand Bend.

Air-water exchange needs to be addressed in a more systematic fashion. The current procedure of comparing near-shore measurement of organics in air with mid-lake water concentrations (often with a time offset) has been challenged as inadequate. During the first two years of IP2, IADN will assess the feasibility of maintaining a routine monitoring site over the waters of one Great Lake. This may be accomplished either by the use of a buoy, crib or island site. The site will be maintained and monitored on a year-round basis. U. S. EPA will assess the feasibility of utilizing the Research Vessel Lake Guardian and other options for routine paired air/water sampling over one or more of the Great Lakes. Environment Canada will endeavour to utilize lakewide cruises as well as a mid-lake buoy for the acquisition of over-water air concentration measurements simultaneously with whole water samples.

Current Master Stations at Eagle Harbor (Superior), Sleeping Bear Dunes (Michigan), Burnt Island (Huron), Sturgeon Point (Erie) and Point Petre (Ontario) are important, not only because of their strategic placement, but because of the developing time series of data from these sites. These sites should be retained throughout IP2 in order to maintain continuity of record for the assessment of trends. Satellite facilities are equally important for their data input; however, the priority of maintenence of the sites should be based on scientific need and the historical seniority of the stations (i.e. stations with a long record should be retained as a priority).

Chemicals Measured

IP1 called for the measurement of PCBs, α and γ-HCH, Pb and PAHs (with B(a)P) as a target. A second tier of chemicals was to be added as methods were confirmed and a third tier of chemicals were to have methods developed. IP2 will take the same approach. Tier 1 chemicals are those for which routine methods exist and it can be expected that IADN will continue to produce quality assured data for the full period. The Tier 1 chemical list is under review and certain chemicals and isomers are being examined to determine the necessity of their continued measurement. For example, many PCB congeners which are currently measured do not strictly fall under the Tier 1 category because although they can be detected in standard samples, their concentration in the environment is so low in precipitation or the gas or particle phases in air that they are routinely *not detected*. A workshop will be held early in the IP2 period to confirm criteria for inclusion of PCB congeners into the IP2 list.

One activity will use completeness criteria in the IADN QAPP to eliminate certain chemicals which are not seen in at least one season of the year. This reduction in chemical number will result in some economies of measurement and reporting. New chemicals will also be investigated during IP2. The procedures for the addition and deletion of chemicals from the monitoring list will be developed early in the IP2 period.

Table 1 states the chemicals and classes of chemicals currently under Tier 1, 2, and 3 status. Table 2 shows a proposed revised list of chemicals. This list will be finalized by June

1998. This list will be submitted to interested parties (States and non-governmental agencies) for comment during the Spring of 1998. The chemicals workshop will develop criteria for inclusion of chemicals into the IADN QAPP.

Table 1: IP1 Chemical List

IP1 Tier 1 **"Achievable" chemicals**
PCBs (total and congeners)
α - HCH
γ - HCH
Benzo(*a*)pyrene
Pb
IP1 Tier 2 **"Method Development Needed"**
∑DDT
Chlordane
Nonachlor
Heptachlor epoxide
Methoxychlor
Dieldrin
Hexachlorobenzene
Endrin
As
Se
Cd
Hg
IP1 Tier 3 **"Extensive Methodology Development Needed"**
Chlorobenzenes
PAHs
Toxaphene
co-planar PCBs
Dioxins/Furans
Agrochemicals
Industrial chemicals

Table 2. Chemical lists, as suggested for review during early IP2 period.

Proposed IP2 Tier 1 **"Achievable" chemicals**	
PCBs (limited suite and ΣPCB)	***Polycyclic aromatic compounds:***
Organochlorine pesticides:	Phenanthrene
	Acenaphthylene
α - HCH	Acenaphthene
γ - HCH	Fluorene
Dieldrin	Anthracene
trans-Chlordane (γ)	Fluoranthene
cis-Chlordane (α)	Pyrene
trans-Nonachlor	Benzo(*ghi*)fluoranthene
α-endosulphan (I)	Benz(*a*)anthracene
β-endosulphan (II)	Chrysene
p,p'-DDT	Benzo(*e*)pyrene
p,p'-DDD	Benzo(*a*)pyrene
p,p'-DDE	Benzo(*b*)fluoranthene
Hexachlorobenzene	Benzo(*k*)fluoranthene
Trace elements:	dibenzo(*ac*)anthracene
Pb	benzo(*ghi*)perylene
Se	Indeno(*123,cd*)pyrene
Cd	Anthanthrene
As	Retene
Proposed IP2 Tier 2 **"Method Development Necessary (non-routine analyses)"**	
β-HCH	
Heptachlor	
Heptachlor Epoxide	
Methoxychlor	
o,p-DDD	
o,p-DDT	
co-planar PCBs (77, 126)	
Toxaphene (at two Master Stations only)	
Atrazine and selected triazine herbicides	
Dioxins/Furans (at some urban sites)	
Hg^0(gas phase), Hg^{++} (particulate, precip.)	
Proposed IP2 Tier 3 **"Extensive Methodology Development Needed"**	
Endocrine disrupting compounds not currently on Tier 1 and 2 lists	
Chlorobenzenes	
Industrial chemicals (chlorinated naphthalenes, chlorinated paraffins)	
New pesticides and herbicides (e.g. moderately persistent OP pesticides)	

Research Needs under IADN

Annex 15 calls for Research to accompany the IADN Surveillance/Monitoring Activities. Most of these Research needs (assessment of long-range transport, modelling, etc.) have been unfunded during the IP1 period. The U.S. has carried out some of these activities (AEOLOS, for example) in parallel to, but not in coordination, with IADN. The IADN Peer Review Panel recommended better coordination of these efforts with IADN and this makes sense.

Redirection of IADN to resolve research questions is not only impossible with existing resources but may likely involve the wrong personnel, since IADN measurement staff are not modellers and vice-versa. It is recommended that a separate Annex 15 Research Plan be created which will address the neglected activities under Annex 15 and better coordinate activities between the Parties on Research.

IADN does have a measurement research component which leads to better estimates of loadings, measurements, and trends. Research, which will lead to a better assessment of mass transfer coefficients, Henry's law constants, deposition velocities, gas/particle partitioning, will be undertaken under the IP2, subject to available resources. There is some additional funding flexibility in Canada during the IP2 period and increased activity on Research questions is expect.

IADN Quality Assurance/Quality Control

QA/QC has been the hallmark of the IADN program during the IP1 period. As a result, the IADN Peer Review panel has recognized the importance and validity of data obtained from IADN. This QA/QC program will continue and be augmented. The IADN Quality Assurance Program Plan (QAPP) will be revised for the IP2 period to reflect the changes in the program which have developed over the first six years. The Standard Operating Procedures manuals for each agency will also be updated. The strong round-robin laboratory intercomparison series will be continued at least on a biennial basis. Further work on field intercomparisons will be conducted with the renewal of multi-agency sampling at one IADN site (Point Petre), designed to link the measurements made by the various agencies contributing to IADN.

Significant progress has been made in the unification of quality assurance and data analysis techniques. All agencies in the Network are participating in the use of the Research Data Management and Quality Assurance System (RDMQ). This participation will continue. RDMQ provides front-line quality assessment of the data entering the data analysis stream and, as such, a unified treatment of the data is required. Environment Canada commits to maintain the RDMQ infrastructure and data input by the Data Officer. This system provides a crucial link in the submission of the data to the ultimate database repositories.

IADN will have a designated QA/QC Officer (or officers, one on each side of the border). This Officer will oversee the maintenance of the documentation, implementation of the intercomparison studies, QA/QC screening of the data, and provide annual QA/QC reports on the activities of the QA/QC program. The QA/QC officers will work with the IADN Principal Investigators to make the QC program a continuing activity, involving the exchange of

standards, samples and extracts, side-by-side replicate samples, improvement of detection limits, maintenance of the QAPP, etc.

Data Analysis and Reporting

The IP1 period has had a good record of biennial reporting of the data from the IADN through journal articles and reports. The data analysis which has gone into these reports has been developmental and evolutionary. The data analytical tools used to derive the loads and trends of IADN data will be formalized using the data reporting system and specifically outlined in the IADN QAPP. Environment Canada has committed to providing the database structure for the IADN data through the National Air Chemistry Database (NATCHEM/Particles). The status of the IADN data in the NATCHEM/Particles system is directly accessible via the World Wide Web and provides regular updates on the data status.

NATCHEM/Particles has sufficient infrastructure to service routine requests for data from the network. The provision of data to outside users will be structured to comply with the requests for data. Since much of the IADN data will have undergone significant QA/QC and manipulative analyses to reach NATCHEM status, provision of data will be patterned to user needs (e.g., invalidated data will be removed from output data files, qualified data may or may not be removed depending on the sophistication of the user). Decisions of release of raw or individual sample data will be made by the IADN Steering Committee (including the PI whose data is in question) in cooperation with the NATCHEM Manager.

Higher level products which have undergone internal and external reviews (seasonal and annual loading data, trend data, publications, etc.) will be provided to the public via World Wide Web access. These products will be updated at least twice per year and the site will be maintained by the Environment Canada data analysis team (the IADN Data Officer, the NATCHEM Manager and their staff, with review by the IADN Steering Committee). A mirror site at the USEPA will be provided. These sites will both contain US and Canadian logos. A goal of the data analysis effort is to have data released to the public within 18 months of the date of sample collection.

IADN has been chided by the Peer Review panel as being "one of the best kept secrets around". The Parties require the IADN Steering Committee to report on IADN activities on a biennial basis. In addition, IADN will use a number of fora (conferences, public meetings, WWW, journal feature articles, etc.) to distribute information and data. A mechanism for encouraging such dissemination of results are biennial IADN reviews to be held in alternate years in Chicago/Washington and Toronto/Ottawa. These reviews will involve policy makers and analysts, as well as other Federal, Provincial and State agencies, LaMP and RAP participants, and non-governmental organisations. These reviews will be held in October. A written report of progress will accompany these reviews.

Implementation Timetable

As in IP1, this Implementation Plan contains a timetable of IADN developments and progress. This timetable is shown in Table 3.

References:

Egar, D. L. and V. V. Adamkus (1990). *Integrated Atmospheric Deposition Network Implementation Plan.* Environment Canada, 4905 Dufferin Street, Downsview, Ontario, Canada M3H 5T4, 12 p. (URL: ftp://airquality.tor.ec.gc.ca/pub/iadn/www/IP1.doc)

IADN Steering Committee (1997) *Technical Summary of Progress Under the Integrated Atmospheric Deposition Program 1990-1996.* R. M. Hoff, ed., Environment Canada, 4905 Dufferin Street, Downsview, Ontario, Canada M3H 5T4, 101p.
(URL: http://airquality.tor.ec.gc.ca/IADN/IP2.htm)

Table 3: Long Term Implementation Timeline

PHASE I – JUNE 1, 1998 - MAY 31, 2000	PHASE II - JUNE 1, 2000 - MAY 31, 2002	PHASE III - JUNE 1, 2002 - MAY 31, 2004
• Conduct Data Workshop (June 1998) to: ⇒ review air and precipitation data collected from co-location at Point Petre during 1990-1994 ⇒ update loadings and publish results ⇒ assess feasibility of maintaining a routine monitoring site over water; if feasible, establish site • Conduct Chemicals Workshop (October 1998) to: ⇒ establish criteria for maintaining/adding chemicals to list, and revise chemical list ⇒ harmonize sampling and analytical techniques ⇒ rationalize number and placement of Satellite Stations ⇒ develop criteria for urban sites, determine feasibility of establishing paired urban/rural/remote sites, and establish urban sites • Conduct paired air/water sampling on the Great Lakes • Conduct round-robin interlaboratory studies and site audits • Establish WWW access to information products • Conduct IADN information session and review in Toronto/Ottawa (October 1999). • IADN Progress Report (October 1999)	• Conduct Loadings Workshop (June 2000) to update loadings and publish results; • Conduct paired air/water sampling on the Great Lakes • Conduct round-robin interlaboratory studies and site audits • Update WWW products • Conduct IADN information session and review in Chicago/Washington (October 2001) • IADN Progress Report (October 2001) • Conduct Workshop (October 2000) to: ⇒ revise chemical list ⇒ rationalize number and placement of Satellite Stations ⇒ harmonize sampling and analytical techniques	• Conduct Loadings Workshop (June 2002) to update loadings and publish results; and to review chemical list • Conduct paired air/water sampling on the Great Lakes • Conduct round-robin interlaboratory studies and site audits • Update WWW products • Conduct IADN information session and review in Toronto/Ottawa (October 2003) • IADN Progress Report (October 2003) • Conduct IADN Peer Review and IP3 consultations (January 2004) • Finalize IP3 proposal (March 2004)