1996 Inventory of Toxic Air Emissions:

A Product of the Great Lakes Regional Air Toxic Emissions Project

Part 1: Point and Area Sources

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Wisconsin Department of Natural Resources, Bureau of Air Management

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Acronyms and Abbreviations

AIRS	Aerometric Information Retrieval System
AMS	Area and Mobile Source
BTU	British Thermal Unit
CAA	Clean Air Act
CAR	California Air Resources Board
CAS	Chemical Abstract Service
CEP	Cumulative Exposure Program
DVMT	Daily Vehicle Miles Traveled
EET	Emission Estimating Techniques
EIIP	Emission Inventory Improvement Program
EIS	Emission Inventory System
ESP	Electrostatic Precipitator
FIRE	Factor Information Retrieval System
FPRT	Fuel Process Rate
GIS	Geographic Information Systems
GLC	Great Lakes Commission
GLEI	Great Lakes Emissions Inventory
GLIN	Great Lakes Information Network
GLNPO	Great Lakes National Program Office, U.S. Environmental Protection Agency
GLPF	Great Lakes Protection Fund
HAP	Hazardous Air Pollution
IDEM	Indiana Department of Environmental Management
IEPA	Illinois Environmental Protection Agency
IJC	International Joint Commission
IMS	Information Management System
INDOT	Indiana Department of Transportation
MACT	Maximum Achievable Control Technology
MCEI	Minnesota Criteria Pollutant Emission Inventory
MDEQ	Michigan Department of Environmental Quality
MPCA	Minnesota Pollution Control Agency
MSDS	Material Safety Data Sheet
n.e.c.	Not Elsewhere Classified
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NO_x	Nitrogen Oxides
NTI	National Toxic Inventory
NYDEC	New York Department of Environmental Conservation
OEPA	Ohio Environmental Protection Agency
PAH	Polycyclic Aromatic Hydrocarbons
PDEP	Pennsylvania Department of Environmental Protection
PM	Particulate Matter
POTW	Publicly Owned Treatment Works
QA/QC	Quality Assurance/Quality Control
RAPIDS	Regional Air Pollutant Inventory Development System
SAMS	SIP Air Pollutant Inventory Management System
SCC	Source Classification Code
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SSD	Source Summary Database
STEPS	State Environmental Programs Systems
TANKS	Storage Tank Emissions Software

TOG	Total Organic Gases
TRI	Toxic Release Inventory
U.S. EPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture
VOC	Volatile Organic Compound
WDNR	Wisconsin Department of Natural Resources

Preface

The Great Lakes Regional Toxic Air Emissions Inventory project conducts a regional emissions inventory of toxic air contaminants which are significant contributors to the contamination of the waters and urban areas of the Great Lakes.

The Inventory Project is an important step in meeting the goals of the 1986 Great Lakes Toxic Substances Control Agreement (signed by the Great Lakes governors and Premier of Ontario), and sections 112(c)(6), 112(k) and 112(m) of the 1990 U.S. Clean Air Act Amendments.

This project is a partnership between the eight Great Lakes states, the province of Ontario and the U.S. Environmental Protection Agency (U.S. EPA). The objective of this ongoing initiative is to present researchers and policy makers with detailed, basin wide data on the source and emission levels of toxic contaminants. The initial report focused on 49 toxic air pollutants from point and area sources using 1993 data; this inventory database consists 1996 data, also includes mobile sources, and has been expanded to include 82 toxic air pollutants.

The air toxic emission estimates contained in this report represent the best single compilation of such estimates, however, this inventory project has also identified the limitations which still exist in making such estimates. Results should therefore be viewed as an initial step for use by policy-makers, modelers and others involved in air quality management. These data can support regulatory decisions if used in conjunction with other sources of quality assured data.

The Great Lakes Commission, together with the eight Great Lakes states and the province of Ontario is now compiling inventories for 1997 and 1998, and eventually, 1999 data. Through this continuing effort, a mechanism has been established to support sound regulatory decisions.

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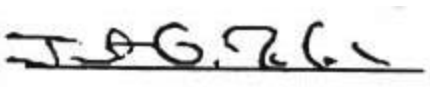

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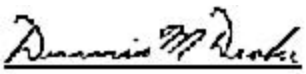

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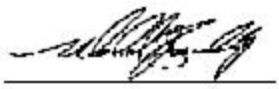

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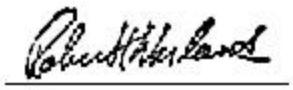

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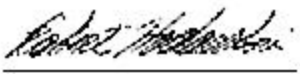

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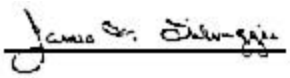

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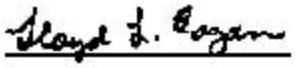

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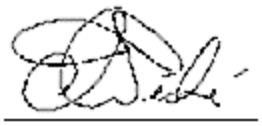

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The Great Lakes Regional Air Toxic Emissions Inventory has been a challenging endeavor for all involved. As an unprecedented effort to compile a regional inventory of toxic air emissions, a multitude of complex issues had to be resolved to ensure that the priorities of all Great Lakes jurisdictions - federal, state, and provincial - were adequately addressed.

This unique effort has benefited from the leadership of Orlando Cabrera-Rivera, chair of the Steering Committee for the Great Lakes Regional Air Toxic Emissions Inventory Project, Julie Wagemakers, project manager, Great Lakes Commission, and Dave Asselmeier and Chun Yi Wu for administering the quality assurance and quality control checks on the inventory data. Emission inventory specialists from the Great Lakes states, U.S. EPA and the province of Ontario worked together closely, making the project a team effort.

This report was written, compiled, and reviewed by all of the above project participants in addition to their staff. Editorial, report compilation and technical assistance was provided by Great Lakes Commission staff member Derek Moy. Project administration and oversight was provided by Dr. Michael J. Donahue, Commission Executive Director, and Julie Wagemakers, Program Manager, Communications and Information Management. Contractual support for software development was provided by Windsor Technologies, Inc.

Executive Summary

Introduction and Inventory Objective

This report, a product of the Great Lakes Regional Air Toxic Emissions Inventory Project, presents a multijurisdictional inventory of point and area sources (mobile to be published early next year) of toxic air emissions that have the potential to impact environmental quality in the Great Lakes basin. This initiative was undertaken through an intergovernmental partnership involving the eight Great Lakes states, the province of Ontario, and the U.S. Environmental Protection Agency (U.S. EPA). The objective of this ongoing initiative is to present researchers and policy makers with detailed, basin wide data on the source and emission levels of 82 toxic contaminants.

The development and release of the inventory is an important step in meeting the goals of the 1986 Great Lakes Toxic Substances Control Agreement (signed by the Great Lakes governors and Premier of Ontario), and sections 112(c)(6), 112(k) and 112(m) of the 1990 U.S. Clean Air Act Amendments (see http://www.cglg.org/pub/toxics/index.html and http://earth1.epa.gov/oar/caa.html for further details).

The inventory project presents a compilation of the best available data for calendar year 1996 emissions from point and area sources. The data will be updated annually and the level of detail will increase year to year. This project also released version 2.0 of the *Regional Air Pollutant Inventory Development System (RAPIDS)* to calculate emissions for 82 pollutants (which include mobile sources). The Great Lakes jurisdictions believe this work will provide a strong foundation upon which to build national and binational strategies to reduce toxic air emissions affecting the Great Lakes.

The inventory effort focused on the identification of point and area source categories that contribute to the total emissions of toxic contaminants listed in Table 1-1. This list of 82 contaminants was compiled using the International Joint Commission's list of Great Lakes critical pollutants, U.S. EPA's list of targeted toxic chemicals and compounds defined in the U.S. Clean Air Act Amendments of 1990, section 112 (c)(6), and those pollutants suggested by the Great Lakes states. This project also identified significant number of small point and area sources not currently regulated under the Clean Air Act (CAA) and collectively release large amounts of one or more toxic air pollutants of concern. These sources include many traditionally unregulated sites with relatively small gas-fired, coal-fired, or oil-fired boilers, traffic markings, woodburning stoves and fireplaces and generally any facility with an incinerator. These are sources within one county or urban area that collectively release large amounts of one or more toxic air pollutants of concern.

The inventory project is strengthening decision making capabilities in the basin by promoting interjurisdictional consistency in data collection and analysis, establishing standard procedures and protocols, developing and testing an automated emission estimation and inventory system, and demonstrating the value of client/server technology via the Internet to transmit and exchange

environmental data among the Great Lakes jurisdictions and inform the larger Great Lakes community.

Inventory Scope and Findings

The 1996 emissions inventory effort began in September 1998 with primary funding provided by the U.S. EPA. In August 1998, the 1993 point and area source inventory was released. Over the four previous years, the Great Lakes states, with support from the U.S. EPA and the Great Lakes Protection Fund developed and tested (through a Southwest Lake Michigan Inventory), the regional infrastructure and tools for emissions inventory compilation including the *Regional Air Pollutant Inventory Development System* (RAPIDS) versions 1.0 and 2.0 and the *Air Toxic Emissions Inventory Protocol for the Great Lakes States.*

In compiling the inventory, challenges were encountered in the area of data breadth, quality, availability and consistency from one jurisdiction to the next. Given variances in staffing resources and data management from one jurisdiction to the next, project staff received data in varied forms that needed to be standardized before being incorporated into the inventory.

The 1996 inventory should not be used for jurisdictional comparisons, but rather to demonstrate the potential of such a complete and comprehensive inventory as a decision support tool. Key findings associated with the inventory effort, as expressed by the federal, state, and provincial members of the project Steering Committee, are as follows:

- A comprehensive, multijurisdictional inventory of toxic air pollutants, sources and emission levels within the Great Lakes basin provides an important decision-making tool for environmental protection efforts.

- Air emissions data varies significantly from one Great Lakes jurisdiction to the next in terms of breadth, quality and availability. Greater consistency in data acquisition, compilation and analysis is needed to ensure meaningful basin wide assessment and interjurisdictional comparison.

- Great Lakes jurisdictions are well advised to develop and maintain the program and staffing infrastructure needed to participate in basin wide emissions inventory efforts over the long term. Continuity in inventory development and updating will provide a much-needed benchmark for trend identification and analysis.

Inventory Methodology

The Regional Toxic Air Emissions Inventory effort focuses on significant sources of air emissions of 82 toxic air pollutants in the jurisdictions bordering the Great Lakes. Working cooperatively through the Great Lakes Commission, inventory work is undertaken by the air quality departments of the state and provincial governments in the region. Staff at each agency followed the *Regional Toxic Air Emissions Inventory Protocol* they developed jointly and finalized in June 1994. The protocol provides instructions to accomplish the regional inventory development effort so the inventory is complete, accurate, and consistent from one jurisdiction to the next. The protocol:

- Assigns responsibilities and procedures to the states, Great Lakes Commission, U.S. EPA Great Lakes National Program Office (GLNPO);
- Outlines procedures to identify and locate emission sources of target compounds;
- Guides selection of specific emission estimation techniques;
- Instructs states on compiling and updating the regional repository at GLNPO;
- Outlines quality assurance/quality control procedures for emission data and estimates; and
- Identifies and explains the full suite of automated tools available for developing the regional inventory.

Because the inventory was a multi-state, regional effort, a high level of coordination and communication was necessary to ensure consistency among the states and province of Ontario in terms of data management, methodology, calculation methods and other issues. During the course of the inventory development effort, a Great Lakes Regional Air Toxic Emissions Inventory Technical Steering Committee communicated via daily e-mail exchanges, weekly or biweekly conference calls, and bimonthly in-person meetings. The committee oversaw contractor development of the inventory software and resolved outstanding issues and inconsistencies among the eight states and Ontario. The Steering Committee is composed of representatives from each of the air management programs from the eight Great Lakes states as well as Ontario and observers from U.S. EPA. A complete list of members with contact information can be found in Appendix BB**.**

The Steering Committee worked closely with the project software development contractor, Windsor Technologies Inc., to develop and test RAPIDS. Following on the success of the 1993 inventory, RAPIDS was enhanced to include a mobile source module to estimate emissions from on-road and non-road mobile sources; the addition of growth factors algorithm to project emissions; controlled emission factor functionality; development of mobile sources emission factors for the Great Lakes region; and improved emissions estimation and reporting capabilities. This effort represents the first attempt to prepare software for estimating toxic pollutant emissions on a multi-state basis. RAPIDS is a client/server system developed in PowerBuilder® with an ORACLE® back-end database. The software takes full advantage of Internet/Great Lakes Information Network (GLIN) connections between the states, the Great Lakes Commission and the U.S. EPA GLNPO office in Chicago.

Finally, a Quality Assurance/Quality Control (QA/QC) Committee reviewed the inventory report, established QA/QC criteria for use by all states and the province of Ontario, and ensured the report provides an accurate and useful summary of toxic air emissions at the regional level.

Report Organization and Content

Following completion of the *Air Toxic Emissions Inventory Protocol* and development and testing of RAPIDS, version 1.0 and 2.0, collection of the best available inventory data commenced using 1996 records. An intensive process of quality control/quality assurance efforts ensured accuracy as 1996 data were compiled and analyzed.

Emissions estimates for the 82 target compounds are presented in the first half of this report. Definitions of source categories, and the level of detail in emissions estimates, are state/province specific and are outlined in the state/provincial reports in Appendices A through I.

Next steps

This project is releasing its inaugural toxic mobile source emissions inventory using 1996 data early next year. This inventory will serve as a template for future mobile source inventories for both this project and on an individual state and provincial basis, both within and beyond the Great Lakes region.

Through the continued efforts of the Steering Committee, the inventory will become more comprehensive over time and become an increasingly valuable tool for decision making within the Great Lakes basin. The Steering Committee will continue to meet on a regular basis to discuss inventory enhancements, both through defining data collection and refining and testing the RAPIDS software to accommodate continued expansion of this project.

The Steering Committee has developed RAPIDS to include a mobile source estimation module which is used by each Great Lakes jurisdiction to estimate emissions from cars, trucks, trains, recreation vehicles, airplanes, marine vessels, farm equipment, construction equipment and other non-road engines. This expansion of RAPIDS provides a complete profile for air toxic emissions and expands the list of toxic compounds of concern to 82. The complete 1996 point, area and mobile source emissions inventory is available on the Great Lakes Information Network (GLIN) at http://great-lakes.net/envt/air/airtox.html.

Collection of 1997 and 1998 data for point and area sources is already underway. For the 1999 inventory, the Steering Committee is also planning to expand its list from 82 pollutants to match the 188 hazardous air pollutants designated by the U.S. EPA.

This bridges the gap between the science of inventorying toxic air emissions and the public policy debate concerning how these emissions affect human health and the environment and how they should be addressed. Follow-up by state, provincial and federal environmental protection agencies is necessary to make further progress toward these goals. The Steering Committee recommends that regulatory decisions not be based on this data alone.

1. Introduction

The Great Lakes Regional Air Toxic Emissions Inventory represents a unique milestone in the continuing effort to quantify and manage the toxic air emissions that impact the waters of the Great Lakes Basin. The air management programs in all eight Great Lakes states, Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the province of Ontario, cooperated in compiling an emissions inventory of toxic air contaminants from point and area sources.

The emission inventory effort was developed in support of the Great Lakes Toxic Substances Control Agreement signed in 1986 by the governors of eight Great Lakes states, and in 1989 by the premier of Ontario. This agreement contains a provision ensuring cooperation toward "quantifying the loadings of toxic substances originating from all sources, with the purpose of developing the most environmentally and economically sound control programs". Sharing emissions information of comparable and compatible quality across jurisdictions will ensure sound regulatory and policy decisions in the region.

Since 1989, the Great Lakes states and Ontario have been working together, through the Great Lakes Commission (GLC), to develop a regional database of toxic air emissions. In 1994, the Southwest Lake Michigan Air Toxics Pilot Inventory project was developed. This pilot inventory, led by the states of Michigan, Illinois, Indiana and Wisconsin, served to test the infrastructure for regional emissions inventory compilation and to develop the Regional Air Pollutant Inventory Development System, RAPIDS. The pilot inventory focused on emissions of 49 compounds from small point and area sources. In late 1995, the eight Great Lakes states and Province of Ontario began compiling the first full inventory of toxic air emissions from point and area sources for the year 1993. That pilot inventory was completed in 1998 while the states and province began work on the base year 1996 inventory. Compilation of the 1997 and 1998 inventories are currently underway. The GLC will continue working with state and provincial agencies, organizations and industrial sectors in developing and implementing the latest emission estimation procedures.

In 1996, work began on the mobile source module for RAPIDS. RAPIDS 2.0 was designed with the ability to estimate emissions from on-road vehicles and non-road engines. This major addition, along with other enhancements, has made RAPIDS one of the most comprehensive multimedia inventory systems available. With the addition of mobile sources to the inventory, the database has been expanded to include 82 toxic air pollutants. The states and province began estimating mobile source emissions using RAPIDS 2.0 in late 1998.

Table 1-1: Great Lakes Commission's list of 82 targeted toxic air pollutants.

Non-Metal Compounds (Excluding PAHs)	
Acetaldehyde	Methyl chloroform (1,1,1-Trichloroethane)
Acrolein	Methylene chloride (Dichloromethane)
Acrylamide	Methylene diphenyl diisocyanate (MDI)
Acrylonitrile	Parathion
Atrazine	Pentachloronitrobenzene (quintobenzene)
Benzene (including benzene from gasoline)	Pentachlorophenol
1,3-Butadiene	Phenol
Carbon tetrachloride	Phosgene
Chlordane	Styrene
Chloroform	2,3,7,8 -tetrachlorodibenzo -furan (TCDF)
Coke oven emissions	2,3,7,8 -tetrachlorodibenzo -p-dioxin (TCDD)
Di-n-butyl phthalate	Tetrachloroethylene (Perchloroethylene)
Di-n-octyl phthalate	Toluene
Dichloroethyl ether (bis(2-chloroethyl) ether)	2,4-Toluene diisocyanate
Diethylhexyl phthalate (Bis(2-ethylhexyl)phthalate) (DEHP)	Total polychlorinated biphenyls (PCBs)
Ethylbenzene	Total polychlorinated dibenzodioxins (PCDDs)
Ethylene dibromide (Dibromoethane)	Total polychlorinated dibenzofurans (PCDFs)
Ethylene dichloride (1,2-Dichloroethane)	Trichloroethylene
Ethylene oxide	2,4,5-Trichlorophenol
Formaldehyde	2,4,6-Trichlorophenol
Glycol ethers	Trifluralin
Heptachlor	Vinyl chloride
Hexachlorobenzene	Xylenes (Meta)
Hexachlorobutadiene	Xylenes (Ortho)
Hexachloroethane	Xylenes (Para)
Hydrazine	Xylenes (Iso)
Methoxychlor	
16 PAHs (POM)	
Acenaphthene	Chrysene
Acenaphthylene	Dibenz(a,h)anthracene
Anthracene)	Fluoranthene
Benz(a)anthracene	Fluorene
Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene
Benzo(b)fluoranthene	Naphthalene
Benzo(ghi)perylene	Phenanthrene
Benzo(k)fluoranthene	Pyrene
Metal Compounds	
Antimony	Copper
Arsenic	Lead
Beryllium	Alkylated lead
Cadmium	Maganese
Chromium	Mercury
Chromium (6)	Nickel
Cobalt	

The 1996 reports are available as a printed document or online via the Great Lakes Information Network (GLIN, http://www.great-lakes.net). Additional information, including background documents, GIS maps depicting air emissions across the basin, the emissions protocol document and list of products for the project are located on the emission inventory project's web site (http://www.glc.org/air/air3.html).

The air emissions inventory project is funded primarily by the U.S. EPA under the auspices of the urban area sources program, Section 112(k), and the Great Waters program, Section 112(m).

The eight states and Ontario will continue to work collaboratively to improve and refine the toxics inventory and strengthen its ability to support sound regulatory decisions at all levels of government.

2. Methodology

The Great Lakes Air Toxic Emissions Inventory Project focuses on locating, evaluating, and estimating emissions from sources regulated under each of the state and provincial air management programs. The inventory process also includes a number of small point and area sources not currently regulated under the Clean Air Act (CAA) and that collectively release large amounts of one or more toxic air pollutants of concern. These sources include small coal-fired boilers, consumer solvents, residential fuel combustion, wood burning stoves, and fireplaces. Summaries of the methodologies for area source emission estimations are shown in Appendices J through Y. These area source methodologies were based on the U.S. EPA's Emissions Inventory Improvement Program (EIIP) and the Great Lakes States methods for estimation emissions from area sources. For a detailed discussion on the inventory methodology, see *The 1993 Great Lakes Regional Air Toxic Emissions Inventory* report and the *Air Toxic Emissions Inventory Protocol for the Great Lakes States* online at http://great-lakes.net/envt/air/airtox.html.

Air Toxic Emissions Inventory Protocol for the Great Lakes States

The *Air Toxic Emissions Inventory Protocol for the Great Lakes States*, finalized in June 1994, provides instructions for the states to follow to ensure the completeness, accuracy, consistency and quality of the regional toxic emissions inventory. Each jurisdiction prepared its portion of the Great Lakes Regional Air Toxic Inventory in the manner outlined in the protocol, and performed a quality assurance check on their emissions data and estimates to ensure the highest possible quality database.

Inventory completeness, one of the most important objectives of the protocol, has been addressed by identifying all source categories that have the potential to emit one of the target toxic air pollutants within the Great Lakes basin. The accuracy of the inventory is addressed by using the most recent information available to identify and locate emission sources and estimate emissions. The QA/QC plan outlines procedures to maximize the quality and accuracy of the inventory's data and estimates.

The protocol does not contain specific, detailed information on estimating emissions for each type of device/process expected to be encountered in the Great Lakes basin. Instead, acceptable generic emission estimating techniques (EETs) are identified for the emission sources that produce toxic pollutants. A generic discussion of each EET and a list of technical references are provided in the protocol for those who require more detailed information.

By focusing on the procedures that the participating jurisdictions must follow to compile their portion of the database, the protocol assigns responsibilities and procedures (joint, state/provincial, Great Lakes Commission, U.S. EPA, Great Lakes National Program Office (GLNPO)); outlines procedures to identify and locate emission sources of target compounds; guides selection of specific emission estimation techniques; instructs jurisdictions on compiling and updating the regional repository at GLNPO; outlines quality assurance/quality control procedures for emission data and estimates; and identifies and explains the full suite of

automated tools available for developing the regional inventory (RAPIDS, FIRE, SPECIATE and others).

Since the participating states envision that the full regional database of air toxic emissions data and estimates will be updated periodically, the protocol also provides the procedures to update the regional inventory and an estimated schedule for such updates. Procedures to resolve differences of opinion among the participating states regarding various aspects of the regional inventory development effort is a significant component of the protocol.

The protocol outlines the major steps and checkpoints that the Great Lakes jurisdictions followed in developing their portion of the inventory. These include the completion of: staff resource development; device/process identification in the study area; data collection requirements; emission calculation and area source reconciliation; QA/QC activities and upload to the regional repository at GLNPO.

Two important issues for the inventory development effort are the appropriate level of detail and the use of facility versus area approach for calculating emissions. For the inventory, the protocol defines the following level of detail as being appropriate for meeting the goals of the project:

- **Emittants included:** Include all target compounds listed in Table 1-1;
- **Spatial resolution:** By county for area and mobile sources, and to the nearest 100 meters for facility sources and associated devices;
- **Temporal resolution:** Annual emissions estimates and annual activity data; and
- **Source/device/process categorization:** By the most detailed source/device/process as identified in U.S. EPA's Source Classification Codes (SCC) and Area and Mobile Source (AMS) coding systems of process codes plus a further breakdown by Standard Industrial Classification (SIC), as appropriate, to better categorize a given source (required to prevent the problem of inconsistent aggregation of sources/devices/processes among the participating states).

The protocol describes the two emission calculation approaches as follows:

- **Facility source approach:** Separately identify each device/process at each facility source and calculate its emissions (often referred to as a facility/point source approach); and
- **Area source approach:** Aggregate all similar or identical device/processes within a defined area and calculate their total emissions directly using the appropriate surrogate activity data (the source in this case is the area in which all of the devices are found, usually an entire county).

The area source approach is generally used for sources that are small and numerous, such as gasoline stations and dry cleaning establishments. They are not included as facility sources because the effort required to gather and estimate emissions for each individual facility is beyond the resources available for inventory development efforts. Some area sources, such as consumer products, have no analog as a facility source.

The protocol refers to certain software tools (e.g. the Regional Air Pollutant Inventory Development System, discussed below) that can be used to prepare a state or province's portion of the regional inventory. However, the protocol procedures, if followed, will result in emissions data and estimates that are compatible and consistent, whether or not these software tools are used.

Developing and Testing Client/Server Emission Estimation and Inventory Software: RAPIDS

Development of the Regional Air Pollutant Inventory Development System (RAPIDS) has been the key to the effort to develop a comprehensive, accurate and consistent air toxic emissions inventory across eight states and one province of Ontario.

During the course of this inventory, the regional Steering Committee worked closely with the project software development contractor, Windsor Technologies Inc., to enhance and test RAPIDS. The RAPIDS enhancements during this phase of the project included: the incorporation of a mobile source module to estimate emissions from on-road and non-road mobile sources, growth factors algorithm to project emissions, controlled emission factor functionality, development of mobile sources emission factors, and improvement of emissions estimation and reporting capabilities. This effort represents the first attempt to prepare software for estimating toxic pollutant emissions on a multi-state basis. RAPIDS is a client/server system developed in PowerBuilder® with an ORACLE® back-end database. The software takes full advantage of new Internet/Great Lakes Information Network (GLIN) connections between the states, the Great Lakes Commission and the U.S. EPA GLNPO office in Chicago. For a more detailed discussion on RAPIDS, please see http://great-lakes.net/envt/air/airtox.html.

Collecting and Compiling Data from Eight States and One Province

Each state and province based emission estimates on the best available inventory data. The states and province promoted consistency among their respective inventories by following the *Air Toxics Emissions Inventory Protocol for the Great Lakes States* and by using emission factors from FIRE Version 6.0 or later.

Rather than comparing emissions from one jurisdiction to the next, the emphasis of this project was to prepare a reliable and technically accurate inventory for the region as a whole and to outline areas where improvements are needed in overall methodology and implementation.

Coordination Methods

As a regional effort, a high level of coordination and communication was necessary to ensure consistency among the eight states and province in terms of data management, methodology, calculation methods and other issues. The Great Lakes Commission provided project management and secretariat services.

During the course of the inventory, Steering Committee members and associates communicated via daily e-mail exchanges, conference calls on a weekly or biweekly basis, and monthly or bimonthly in-person meetings to oversee contractor development of the inventory software, and

to resolve outstanding issues and inconsistencies among the eight states and one province contributing to the regional inventory.

The Steering Committee developed an Internet group mailing service, airtoxics@great-lakes.net, which facilitates transmittal of thousands of messages between members, contractors, and with a larger group of peer reviewers, university and industry researchers, other Great Waters/Urban Area Source states (including Texas and Louisiana), and federal agency representatives. The Great Lakes Commission holds a complete archive of all airtoxics@great-lakes.net messages, including minutes for all conference calls and in-person meetings at http://great-lakes.net/lists/airtoxics/.

Finally, the Steering Committee established Quality Assurance/Quality Control (QA/QC) criteria for use by the states and province to ensure the report provides an accurate and useful summary of toxic air emissions at the regional level. The committee then made a QA/QC review of the regional inventory to identify and correct any remaining differences. Details of the Steering Committee QA/QC efforts and all related e-mail transactions have been archived by the Great Lakes Commission.

3. Results

The following results represent emissions from point and area sources in the Great Lakes region. These results are based on 1996 data. Mobile sources for 1996 will be released early next year.

Definitions of point and area sources are dependent on data collection methods, as reporting requirements for air toxics emissions are different from state to state, one emission source defined as an area source in one state may be covered as a point source in other states.

The regional emission inventory, using 1996 data, includes emissions from 16 area source categories:

- Agricultural Pesticide Application
- Architectural Surface Coatings
- Auto Body Refinishing
- Chromium Electroplating
- Consumer and Commercial Solvent Use
- Dry Cleaning
- Gasoline Marketing
- Graphic Arts
- Industrial Surface Coating
- Landfills
- Marine Vessel Loading, Ballasting, and Transit
- Public Owned Treatment Works
- Residential Fuel Combustion
- Residential Wood Combustion
- Solvent Cleaning
- Traffic Markings

Although these categories are covered by all states, some states and the province of Ontario may not estimate emissions for some area source categories due to the coverage of point sources and resource restrictions. For example, the Marine Vessel Loading, Ballasting, and Transit category is covered in point sources for IL, IN, and WI. No emissions were estimated for this area source category from these states.

Overall

The 1996 emissions were estimated for 82 target compounds, however, data were only available to obtain emissions for 77 air toxins, including 16 polycyclic aromatic hydrocarbons (PAHs), 49 non-metal compounds and 12 metal compounds. Table 2 shows pollutant names and estimated emissions from point and/or area sources. Among the 77 pollutants, 76 pollutants are emitted from point sources, and 62 pollutants are emitted from area sources. Area sources contribute more than two thirds of total emissions for 15 PAHs, 16 non-metal compounds, and 1 metal compound. Point sources are responsible for more than two thirds of total emissions for 1 PAH,

29 non-metal compounds and 10 metal compounds. The contributions of point and area sources to the remaining four non-metal compounds and one metal compound are relatively even.

Among the 77 pollutants, toluene was estimated to have the highest emissions at 265,156,995 pounds, while 2,4,5-Trichlorophenol emissions are the lowest recorded at about 0.02 pounds. Point and area source emissions are from 641 distinct standard industrial classification (SIC) codes and 1143 distinct source classification codes (SCC).

It should be noted that this project has demonstrated that area sources are significant contributors to the total emissions of certain toxic air pollutants; further improvement on emissions estimation techniques and development of emission factors are needed for some source categories.

Specific Pollutants

A closer look was taken at the top five non-metal compounds and the top five metal compounds according to the emission totals. The selected pollutants are toluene, xylenes (includes o, m, and p), tetrachloroethylene, benzene, methyl chloroform, manganese, chromium, copper, lead, and nickel.

The source contribution of emissions for the selected 10 pollutants was analyzed by category for area sources and the first two digits of the SIC codes for point sources. The most significant source categories and their contributions are shown in Tables 3 and 4. More than 90% of emissions of tetrachloroethylene, benzene, and methyl chloroform are attributed to area sources. Dry Cleaning and Solvent Cleaning account for about 75% and 17% of tetrachloroethylene emissions, respectively. Residential Wood Combustion and Gasoline Marketing contribute approximately 71% and 9% of benzene emissions, respectively. Solvent Cleaning is responsible for about 62% of methyl chloroform emissions while Consumer and Commercial Solvent Use accounts for 35% of the total contribution. Although more than 73% of emissions are from area sources for toluene and xylenes, the source distribution is more scatted. The contributions from Solvent Cleaning, Consumer and Commercial Solvent Use, Gasoline Marketing, Architectural Surface Coatings, and Industrial Surface Coating ranged from 6.3% to 20.4% of toluene emissions. Consumer and Commercial Solvent Use, Gasoline Marketing, SIC 37xx (Manufacturing of Transportation Equipment), Industrial Surface Coating, and Auto Body Refinishing contribute from 8.5% to 22.6% of xylenes emissions.

In contrast with the top five non-metal compounds, point sources dominate the emissions of the top five metal compounds, accounting for more than 91% contributions. The most significant source category for all five metal compounds is Primary Metal Industries (SIC code 33xx) which contribute 33% to nickel emissions and up to 82% to copper emissions. Other significant sources include SIC 32xx (Stone, Clay, and Glass Products) with a 27.5% contribution to manganese; SIC 49xx (Electric, Gas, and Sanitary Services) with a 36.3% contribution to chromium, 19.4% contribution to lead and a 27.6% contribution to nickel; and SIC 10xx (Metal Mining) with a 17.3% contribution to lead.

Detailed analyses of source contributions for each pollutant are shown in pie charts and tables following Table 3-3.

Please note that the above analysis is based on point and area source emissions only. Mobile sources have been identified as significant sources for benzene, 1,3-butadiene, formaldehyde, and acrolein. Therefore, the source contributions are expected to change for these pollutants when mobile source emissions become available for analysis.

Table 3-1: Summary of 1996 air toxics emissions from point and area sources

Pollutant Name	Cas No.	Point (lb)	Area (lb)	Total (lb)	Point (%)	Area (%)
PAHs						
Acenaphthene	83329	41,084.78	204,768.52	245,853.29	16.71	83.29
Acenaphthylene	208968	202,998.49	2,431,824.74	2,634,823.24	7.70	92.30
Anthracene	120127	46,755.30	264,590.97	311,346.27	15.02	84.98
Benz(a)anthracene	56553	50,968.99	661,651.54	712,620.53	7.15	92.85
Benzo(a)pyrene	50328	76,738.75	141,360.76	218,099.51	35.19	64.81
Benzo(b)fluoranthene	205992	59,799.58	127,953.99	187,753.57	31.85	68.15
Benzo(ghi))perylene	191242	20,794.49	111,024.70	131,819.19	15.78	84.22
Benzo(k)fluoranthene	207089	10.53	58,418.72	58,429.24	0.02	99.98
Chrysene	218019	2,190,653.64	310,437.15	2,501,090.79	87.59	12.41
Dibenz(a,h)anthracene	53703	8,185.16	65,348.74	73,533.90	11.13	88.87
Fluoranthene	206440	128,848.67	380,021.52	508,870.19	25.32	74.68
Fluorene	86737	135,258.56	457,233.95	592,492.51	22.83	77.17
Indeno(1,2,3-cd)pyrene	193395	22,351.77	165,706.30	188,058.07	11.89	88.11
Naphthalene	91203	1,219,148.27	12,553,337.60	13,772,485.87	8.85	91.15
Phenanthrene	85018	477,278.15	5,967,147.96	6,444,426.11	7.41	92.59
Pyrene	129000	147,545.66	343,174.43	490,720.09	30.07	69.93
Non-Metal Compounds (Excluding PAHs)						
Acetaldehyde	75070	1,571,519.37	348,654.85	1,920,174.23	81.84	18.16
Acrolein	67641	138,296.73	328,869.10	467,165.83	29.60	70.40
Acrylamide	107028	1,280.42		1,280.42	100.00	0.00
Acrylonitrile	107131	2,283,472.45	59,233.12	2,342,705.57	97.47	2.53
Atrazine	1912249		9,540,401.15	9,540,401.15	0.00	100.00
Benzene	71432	6,014,889.67	58,665,453.39	64,680,343.05	9.30	90.70
1,3-Butadiene	106990	439,831.30	6,339,210.89	6,779,042.19	6.49	93.51
Carbon tetrachloride	56235	93,942.94	44,269.11	138,212.06	67.97	32.03
Chlordane	57749	0.94		0.94	100.00	0.00
Chloroform	67663	1,426,701.99	135,142.77	1,561,844.76	91.35	8.65
Coke oven emissions		1,926,830.47		1,926,830.47	100.00	0.00
Dichloroethyl ether (bis(2-chloroethyl) ether)	111444	923.15		923.15	100.00	0.00
Diethylhexyl phthalate (DEHP)	117817	44,639.50		44,639.50	100.00	0.00
Di-n-butyl phthalate	84742	37,211.44	5,325,509.66	5,362,721.10	0.69	99.31
Di-n-octyl phthalate	117840	8,047.87		8,047.87	100.00	0.00
Ethylbenzene	100414	5,110,659.72	14,482,016.31	19,592,676.04	26.08	73.92
Ethylene dibromide (Dibromoethane)	106934	5,599,448.51	34,686.05	5,634,134.56	99.38	0.62
Ethylene dichloride (1,2-Dichloroethane)	107062	165,314.33	21,012.56	186,326.90	88.72	11.28

Table 3-1: Summary of 1996 air toxics emissions from point and area sources (continued)

Pollutant Name	Cas No.	Point (lb)	Area (lb)	Total (lb)	Point (%)	Area (%)
Ethylene oxide	75218	221,827.24	4,611,661.75	4,833,488.99	4.59	95.41
Formaldehyde	50000	36,563,726.38	2,318,026.63	38,881,753.01	94.04	5.96
Glycol ethers		6,975,364.72	3,411,537.60	10,386,902.31	67.16	32.84
Hexachlorobenzene	118741	8.74	1.20	9.94	87.91	12.09
Hexachlorobutadiene	87683	8.00		8.00	100.00	0.00
Hexachloroethane	67721	876.00		876.00	100.00	0.00
Hydrazine	302012	479.84		479.84	100.00	0.00
Methyl chloroform (1,1,1-Trichloroethane)	71556	2,023,001.12	59,448,624.19	61,471,625.32	3.29	96.71
Methylene chloride (Dichloromethane)	74873	17,272, 959.83	15,194,320.25	32,467,280.08	53.20	46.80
Methylene diphenyl diisocyanate (MDI)	101688	44,345.27		44,345.27	100.00	0.00
Pentachlorophenol	87865	20,886.33		20,886.33	100.00	0.00
Phenol	108952	4,669,230.11	20,382.40	4,689,612.51	99.57	0.43
Phosgene	75445	194.76		194.76	100.00	0.00
Styrene	100425	11,148,935.34	7,736,438.47	18,885,373.81	59.03	40.97
2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	1746016	0.32	0.01	0.33	96.57	3.43
2,3,7,8-tetrachlorodibenzo-furan (TCDF)	51207319	31.99	0.65	32.64	98.02	1.98
Tetrachloroethylene (Perchloroethylene)	127184	4,247,924.91	67,150,057.95	71,397,982.85	5.95	94.05
Toluene	108883	53,908,691.46	211,248,303.45	265,156,994.91	20.33	79.67
2,4-Toluene diisocyanate	584849	6,451.52	4,468.28	10,919.81	59.08	40.92
Total polychlorinated biphenyls (PCBs)	1336363	35.31	0.09	35.39	99.76	0.24
Total polychlorinated dibenzodioxins (PCDDs)		31.96	4.15	36.11	88.50	11.50
Total polychlorinated dibenzofurans (PCDFs)		22.46	22.91	45.37	49.51	50.49
Trichloroethylene	79016	16,414,463.40	34,856,735.12	51,271,198.52	32.01	67.99
2,4,5-Trichlorophenol	95954	0.02		0.02	100.00	0.00
2,4,6-Trichlorophenol	188062	12,784.14		12,784.14	100.00	0.00
Trifluralin	1582098	6,322.00	656,024.08	662,346.08	0.95	99.05
Vinyl chloride	75014	737,092.83	147,149.19	884,242.02	83.36	16.64
Xylenes (includes o, m, and p)	1330207	38,207,919.87	102,788,432.94	140,996,352.81	27.10	72.90
m-Xylenes	108383	71,488.43	739,420.28	810,908.71	8.82	91.18
o-Xylenes	95476	227,738.28	19,754,291.74	19,982,030.01	1.14	98.86
p-Xylenes	106423	3,086.21	483,519.35	486,605.56	0.63	99.37
Metal Compounds						
Antimony	7440360	59,601.20		59,601.20	100.00	0.00
Arsenic	7440382	164,679.94	1,011.69	165,691.63	99.39	0.61
Beryllium	7440417	15,745.90	432.71	16,178.61	97.33	2.67

Table 3-1: Summary of 1996 air toxics emissions from point and area sources (continued)

Pollutant Name	Cas No.	Point (lb)	Area (lb)	Total (lb)	Point (%)	Area (%)
Cadmium	7440439	222,966.16	282,829.91	505,796.07	44.08	55.92
Chromium	7440473	901,994.07	53,946.91	955,940.96	94.36	5.64
Chromium (6)	18540299	21,449.67	6,355.48	27,805.15	77.14	22.86
Cobalt	7440484	34,365.57	146,249.71	180,615.28	19.03	80.97
Copper	7440508	816,456.85	4,613.39	821,070.24	99.44	0.56
Lead	7439921	806,038.29	6,269.92	812,308.21	99.23	0.77
Manganese	7439965	3,230,807.56	20,869.23	3,251,676.81	99.36	0.64
Mercury	7439976	208,321.25	6,805.56	215,126.80	96.85	3.15
Nickel	7440020	557,257.45	53,735.05	610,992.50	91.20	8.80

Table 3-2: The most significant source categories for the top five non-metal compounds

Pollutant Name	Cas No.	Emissions (lb)	*Most Significant Source Category*	% of Contribution
Toluene	108883	265,156,994.91	Industrial Surface Coating	20.40
Xylenes (includes o, m, and p)	1330207	140,996,352.81	Auto Body Refinishing	22.63
Tetrachloroethylene	127184	71,397,982.85	Dry Cleaning	74.26
Benzene	71432	64,680,343.05	Residential Fuel Combustion	70.87
Methyl chloroform	71556	61,471,598.26	Solvent Cleaning	61.70

Table 3-3: The most significant source categories for the top five metal compounds

Pollutant Name	Cas No.	Emissions (lb)	*Most Significant Source Category*	% of Contribution
Manganese	7439965	3,251,676.81	Primary Metal Industries (SIC code 33xx)	58.93
Chromium	7440473	955,940.96	Primary Metal Industries (SIC code 33xx)	40.11
Copper	7440508	821,070.24	Primary Metal Industries (SIC code 33xx)	82.04
Lead	7439921	812,308.21	Primary Metal Industries (SIC code 33xx)	38.56
Nickel	7440020	610,992.50	Primary Metal Industries (SIC code 33xx)	32.61

Table 3-4: Summary of 1996 air toxics emissions by SCC. (Those represented contribute more than 5% to the regional total)

SCC	Material Code	IL	IN	MI	MN	NY	OH	PA	WI	ON	Emissions	Regional Percentage
2104008051	ACENAPHTHENE				x		x		x	x	165690.5273163060	67.39406
30300302	ACENAPHTHENE									x	25444.2339324800	10.34936
2104008000	ACENAPHTHENE	x									17694.0353900000	7.19699
2104008030	ACENAPHTHENE		x	x					x	x	14451.3203061701	5.87803
Other	ACENAPHTHENE	x	x	x	x	x	x		x	x	22573.1730550439	9.18156
2104008051	ACENAPHTHYLENE				x		x		x	x	2182780.014411660	82.84351
2104008030	ACENAPHTHYLENE		x	x					x	x	163754.500136991	6.21501
Other	ACENAPHTHYLENE	x	x	x	x	x	x		x	x	288288.725451349	10.94148
0	ACETALDEHYDE		x		x	x	x		x		778513.17000000	40.54388
2630020000	ACETALDEHYDE	x							x		340310.27804580	17.72289
39999992	ACETALDEHYDE									x	226363.91880000	11.78872
30700221	ACETALDEHYDE								x		125582.42000000	6.54016
Other	ACETALDEHYDE	x	x	x	x	x	x	x	x	x	449404.44315420	23.40435
2630020000	ACROLEIN	x							x		318987.36351940	68.28140
39000989	ACROLEIN				x						55225.22453200	11.82133
30700707	ACROLEIN				x						23622.32059500	5.05652
Other	ACROLEIN	x	x	x	x	x	x	x	x		69330.92135360	14.84075
39999992	ACRYLAMIDE									x	564.37760000	44.07743
30199999	ACRYLAMIDE	x									390.00000000	30.45868
0	ACRYLAMIDE						x		x		326.00000000	25.46033
Other	ACRYLAMIDE	x							x		0.04240000	0.00356
50100506	ACRYLONITRILE		x	x	x	x		x			2059968.854254270	87.93119
0	ACRYLONITRILE		x			x	x		x		171252.000000000	7.31001
Other	ACRYLONITRILE	x	x	x	x	x		x	x	x	110484.715745730	4.75880
2104008051	ANTHRACENE				x		x		x	x	222981.434247237	71.61847
2104008030	ANTHRACENE		x	x					x	x	19265.367075731	6.18776
30300302	ANTHRACENE									x	18559.711698000	5.96112
2104008000	ANTHRACENE	x									15924.631860000	5.11477
Other	ANTHRACENE	x	x	x	x	x	x		x	x	34615.125119032	11.11788
0	ANTIMONY		x		x	x	x		x		37237.8634943830	62.47838
50100515	ANTIMONY			x	x	x				x	7387.0460818745	12.39412
Other	ANTIMONY	x	x	x	x	x	x		x	x	14976.2904237425	25.12750
30300813	ARSENIC									x	59634.8488740000	35.99135
10100202	ARSENIC	x	x	x	x	x		x	x	x	43837.7813115835	26.45737
30302399	ARSENIC				x						8837.9473150120	5.33396
Other	ARSENIC	x	x	x	x	x	x	x	x	x	53381.0524994045	32.21732
2461800000	ATRAZINE	x	x	x	x	x	x		x		9540401.14521032	100.00000
2104008051	BENZ(A)ANTHRACENE				x		x		x	x	600949.6045245860	84.32954
2104008030	BENZ(A)ANTHRACENE		x	x					x	x	57803.8112316030	8.11144
Other	BENZ(A)ANTHRACENE	x	x	x	x	x			x	x	53867.1142438109	7.55902
2104008051	BENZO(A)PYRENE				x		x		x	x	102218.4269309310	46.86779
30600201	BENZO(A)PYRENE	x	x	x	x					x	39193.1383860660	17.97030
2630020000	BENZO(A)PYRENE								x		14734.9600000000	6.75607
30300308	BENZO(A)PYRENE	x	x	x						x	13806.5421882200	6.33039
30300302	BENZO(A)PYRENE	x	x							x	12236.4873073800	5.61051
Other	BENZO(A)PYRENE	x	x	x	x	x			x	x	35909.9531216728	16.46494
2104008051	BENZENE				x		x		x	x	38881352.09159000	60.11309
2104008030	BENZENE		x	x					x	x	3525861.97103931	5.45121
2104008000	BENZENE	x									3432642.86527000	5.30709
Other	BENZENE	x	x	x	x	x	x	x	x	x	18840486.12210070	29.12861
2104008051	BENZO(B)FLUORANTHENE				x		x		x	x	108399.8504096250	57.73517
30300302	BENZO(B)FLUORANTHENE									x	37075.8829869200	19.74710
30300308	BENZO(B)FLUORANTHENE									x	17517.9257634000	9.33028
2104008030	BENZO(B)FLUORANTHENE		x	x					x	x	9631.4835381081	5.12985
Other	BENZO(B)FLUORANTHENE	x	x	x	x	x			x	x	15128.4320379262	8.05760
2104008051	BENZO(GHI)PERYLENE				x		x		x	x	57536.7369309317	43.64822
2104008000	BENZO(GHI)PERYLENE	x									35388.0707800000	26.84592
2104008050	BENZO(GHI)PERYLENE								x	x	13288.6341820460	10.08096
30300302	BENZO(GHI)PERYLENE									x	13085.6059027400	9.92694
Other	BENZO(GHI)PERYLENE	x	x	x	x	x			x	x	12520.1330710536	9.49796

Table 3-4: Summary of 1996 air toxics emissions by SCC. (continued)

SCC	Material Code	IL	IN	MI	MN	NY	OH	PA	WI	ON	Emissions	Regional Percentage
2104008051	BENZO(K)FLUORANTHENE				x		x		x	x	51109.0534524588	87.47170
2104008030	BENZO(K)FLUORANTHENE		x	x					x	x	4811.0767676429	8.23402
Other	BENZO(K)FLUORANTHENE	x	x		x	x			x	x	2509.1154092104	4.29428
10100202	BERYLLIUM	x	x	x	x	x		x	x	x	6074.7461916712	37.54800
30500706	BERYLLIUM		x	x		x		x			3573.2830301510	22.08646
0	BERYLLIUM		x		x	x	x				1659.4097269998	10.25681
Other	BERYLLIUM	x	x	x	x	x		x	x	x	4871.1752741303	30.10873
50100791	DIETHYLHEXYL PHT								x		457.860000	49.59757
50182599	DIETHYLHEXYL PHT								x		388.120000	42.04300
50100702	DIETHYLHEXYL PHT								x		77.170000	8.35942
2501060052	1,3-BUTADIENE			x	x						5404741.650749510	80.05614
2501060050	1,3-BUTADIENE								x		661233.000000000	9.79432
Other	1,3-BUTADIENE	x	x	x	x	x	x	x	x	x	685214.659521701	10.14954
2104006000	CADMIUM		x						x	x	276056.9433746140	54.57870
50100102	CADMIUM	x	x	x	x	x		x			176759.6293534030	34.94682
Other	CADMIUM	x	x	x	x	x	x	x	x	x	52979.5094706867	10.47448
0	CARBON TETRACHLORIDE		x		x	x	x				86655.7540000028	62.69768
2401008000	CARBON TETRACHLORIDE	x	x			x	x		x		21245.9948000000	15.37203
2630020000	CARBON TETRACHLORIDE	x			x					x	20779.6112335049	15.03459
Other	CARBON TETRACHLORIDE	x	x	x	x	x			x	x	9530.6882107815	6.89570
50100515	CHLORDANE									x	0.9387627720	100.00000
50300701	CHLOROFORM							x	x		730154.9260000000	46.74952
30700199	CHLOROFORM				x			x	x		137238.7731000000	8.78697
30700102	CHLOROFORM					x			x		97362.8000000000	6.23383
0	CHLOROFORM		x		x	x	x		x		81372.3916900000	5.21002
39999992	CHLOROFORM									x	81025.6638000000	5.18782
2630020000	CHLOROFORM	x			x					x	78842.2574747398	5.04802
Other	CHLOROFORM	x	x	x	x	x		x	x	x	355847.8842990790	22.78382
50100506	CHROMIUM		x	x	x	x		x			271942.864328013	28.45459
30300904	CHROMIUM	x	x		x			x			252164.172390018	26.38506
0	CHROMIUM		x		x	x	x		x		196767.858800000	20.58870
Other	CHROMIUM	x	x	x	x	x	x	x	x	x	234833.263971115	24.57165
30901018	CHROMIUM VI	x			x						12363.3728520000	44.46432
2309100010	CHROMIUM VI				x	x					6320.4514217152	22.73122
10100202	CHROMIUM VI	x	x								1737.9951219892	6.25062
30901028	CHROMIUM VI	x			x						1684.1765832000	6.05707
Other	CHROMIUM VI	x	x	x	x	x			x	x	5699.1585775890	20.49677
10300209	CHRYSENE	x	x	x	x	x		x			2165765.8300445900	86.59285
2104008051	CHRYSENE				x		x		x	x	261728.0708324770	10.46456
Other	CHRYSENE	x	x	x	x	x		x	x	x	73596.8462148523	2.94259
2104006000	COBALT		x		x				x	x	141974.3016618010	78.62888
0	COBALT		x		x		x		x		11638.2098200000	6.44553
Other	COBALT	x	x	x	x	x			x	x	26950.0236939363	14.92559
30300308	COKE OVEN GS	x	x	x							1364678.986270000	70.82507
30300302	COKE OVEN GS	x	x								536863.680059999	27.86253
Other	COKE OVEN GS	x	x	x							25287.807284000	1.31240
30400215	COPPER	x									455125.246340000	55.43842
0	COPPER		x		x	x	x		x		189176.260000000	23.04340
30400224	COPPER	x							x		50041.100000000	6.09546
Other	COPPER	x	x	x	x	x		x	x	x	126613.809307323	15.42272
2104008051	DIBENZAHAN				x		x		x		50687.1605937501	68.93033
2104008000	DIBENZAHAN	x									7077.6141600000	9.62497
30300302	DIBENZAHAN									x	4825.8998234800	6.56282
2104008030	DIBENZAHAN		x	x					x	x	4811.0767676429	6.54267
Other	DIBENZAHAN	x	x	x	x	x			x	x	6132.1461317612	8.33921
2401030000	ETHYLENE DIBROMIDE								x		9842.8848000000	28.17641
2401990000	ETHYLENE DIBROMIDE				x						6856.5053302735	19.62755
2401055000	ETHYLENE DIBROMIDE								x		2953.4412000000	8.45457
2401015000	ETHYLENE DIBROMIDE								x		2654.6262000000	7.59918
2401040000	ETHYLENE DIBROMIDE								x		1906.6860000000	5.45811
Other	ETHYLENE DIBROMIDE	x	x	x	x	x	X		x	x	10718.9259050639	30.68418

Table 3-4: Summary of 1996 air toxics emissions by SCC. (continued)

SCC	Material Code	IL	IN	MI	MN	NY	OH	PA	WI	ON	Emissions	Regional Percentage
2425000000	DI-N-BUTYL PHTHALATE		x	x		x	x	x	x	x	5310077.8374121300	99.01835
Other	DI-N-BUTYL PHTHALATE	x	x	x	x	x	x	x	x	x	52643.1505786115	0.98165
50200505	1,2-DICHLORETHANE	x	x	x	x			x		x	3604368.070399270	62.29972
30101891	1,2-DICHLORETHANE							x			1961187.760000000	33.89816
Other	1,2-DICHLORETHANE	x	x	x	x	x		x	x	x	219972.738836632	3.80212
0	DIEYLHEXYL PHTHALATE		x		x	x			x		16234.205328000	36.36735
39999992	DIEYLHEXYL PHTHALATE									x	9060.906000000	20.29795
40200710	DIEYLHEXYL PHTHALATE					x					3863.000000000	8.65377
40201901	DIEYLHEXYL PHTHALATE					x					3421.730000000	7.66525
40202132	DIEYLHEXYL PHTHALATE		x								2540.000000000	5.69003
Other	DIEYLHEXYL PHTHALATE	x	x	x	x	x			x		9519.664849045	21.32565
0	DIOCTYL PHTHALATE		x								6280.0000000000	78.03304
40299995	DIOCTYL PHTHALATE					x					1582.0000000000	19.65737
Other	DIOCTYL PHTHALATE		x	x		x					185.8728669477	2.30959
2401001000	ETHYLBENZENE	x	x	x	x	x	x	x	x	x	6938684.35272171	35.41468
2501060100	ETHYLBENZENE	x						x	x		4163718.40945468	21.25140
0	ETHYLBENZENE		x		x	x	x		x		1751450.33599998	8.93931
40500501	ETHYLBENZENE	x									1071591.60000000	5.46935
2505020120	ETHYLBENZENE					x					1047510.00000000	5.34644
39999992	ETHYLBENZENE									x	1043185.85560000	5.32437
Other	ETHYLBENZENE	x	x	x	x	x	x	x	x	x	3576535.19894212	18.25445
2401030000	ETHYLENE OXIDE								x		1092560.050000000	22.60396
2460000000	ETHYLENE OXIDE	x	x	x	x	x			x		836736.505700000	17.31123
2401990000	ETHYLENE OXIDE				x						761072.091660352	15.74581
2401055000	ETHYLENE OXIDE								x		327831.770000000	6.78251
2401015000	ETHYLENE OXIDE								x		294663.220000000	6.09628
Other	ETHYLENE OXIDE	x	x	x	x	x	x		x	x	1520625.985762730	31.46021
2104008051	FLUORANTHENE				x		x		x	x	331381.6645245860	65.12106
30300308	FLUORANTHENE									x	42173.9448691400	8.28776
30300101	FLUORANTHENE	x	x								42158.0783999999	8.28464
2104008030	FLUORANTHENE		x	x					x	x	28901.2306101799	5.67949
Other	FLUORANTHENE	x	x	x	x	x		x	x	x	64255.2964668360	12.62705
2104008051	FLUORENE				x		x		x	x	388672.4517090470	65.59956
30300302	FLUORENE									x	87237.3734198000	14.72379
30300308	FLUORENE									x	38529.2849374000	6.50292
2104008030	FLUORENE		x	x					x	x	33723.6973842381	5.69184
Other	FLUORENE	x	x	x	x	x			x	x	44329.6326247446	7.48189
20200202	FORMALDEHYDE				x	x					10254406.59579960	26.37331
50200505	FORMALDEHYDE	x	x	x	x			x			8556343.46384877	22.00606
30600201	FORMALDEHYDE	x	x								5968460.28145340	15.35029
20200252	FORMALDEHYDE	x									2444139.73301000	6.28608
0	FORMALDEHYDE		x		x	x	x		x		2020157.26284000	5.19564
Other	FORMALDEHYDE	x	x	x	x	x		x	x	x	9638251.43007493	24.78862
0	GLYCOL ETHRS		x		x				x		4258901.27000000	41.00261
2460000000	GLYCOL ETHRS	x	x	x	x	x			x		2241197.20870000	21.57715
2425000000	GLYCOL ETHRS		x							x	984493.09038214	9.47822
Other	GLYCOL ETHRS		x		x	x	x		x	x	2902310.15794676	27.94202
0	HEXCHLORETH		x				x				849.0000000000	96.91781
Other	HEXCHLORETH		x								27.0000000000	3.08219
30500623	HEXCLBENZENE									x	6.8253128514	68.69144
2461800000	HEXCLBENZENE	x			x				x		1.2011408990	12.08854
10200902	HEXCLBENZENE				x						1.0451618100	10.51874
30500614	HEXCLBENZENE									x	0.8187200974	8.23978
Other	HEXCLBENZENE							x		x	0.0458555223	0.46150
30904001	HYDRAZINE					x					398.0000000000	82.94355
30112199	HYDRAZINE					x					33.0000000000	6.87723
Other	HYDRAZINE					x	x		x	x	48.8444190754	10.17922

Table 3-4: Summary of 1996 air toxics emissions by SCC. (continued)

SCC	Material Code	IL	IN	MI	MN	NY	OH	PA	WI	ON	Emissions	Regional Percentage
2104008051	INDENO(1,2,3-CD)PYR				x		x		x		118651.8029687500	63.09317
2104008000	INDENO(1,2,3-CD)PYR	x									35388.0707800000	18.81763
30300302	INDENO(1,2,3-CD)PYR									x	14539.5623101200	7.73142
2104008030	INDENO(1,2,3-CD)PYR		x	x					x	x	9631.4835381081	5.12155
Other	INDENO(1,2,3-CD)PYR	x	x	x	x	x			x	x	9847.1532266106	5.23623
0	LEAD		x		x	x	x		x		175512.809900016	21.60668
30300813	LEAD		x							x	144291.997276000	17.76321
30400301	LEAD	x	x	x	x				x		52868.959130900	6.50849
Other	LEAD	x	x	x	x	x		x	x	x	439634.267034532	54.12162
0	MANGANESE		x		x	x	x		x		1203210.134700000	37.00307
30500606	MANGANESE	x	x	x				x			526851.201089680	16.20258
30300908	MANGANESE	x	x	x		x		x		x	390027.487599000	11.99476
30400701	MANGANESE	x	x	x				x	x		210878.971361667	6.48529
30500613	MANGANESE	x	x	x				x			183351.865614590	5.63873
30500706	MANGANESE		x	x				x			177263.132726260	5.45148
Other	MANGANESE	x	x	x	x	x	x	x	x	x	560067.104918015	17.22409
50100102	MERCURY	x	x	x	x	x		x		x	99502.9222629122	46.09929
30499999	MERCURY							x			59746.3216000000	27.68022
Other	MERCURY	x	x	x	x	x	x	x	x	x	56595.5670648267	26.22049
0	METHYLENE DIPHENYL DIISOCYANATE		x		x						33557.2830000000	75.67275
39999992	METHYLENE DIPHENYL DIISOCYANATE									x	3741.2062000000	8.43654
30999999	METHYLENE DIPHENYL DIISOCYANATE		x								3462.0000000000	7.80692
Other	METHYLENE DIPHENYL DIISOCYANATE	x	x		x	x			x	x	3584.7782996064	8.08379
0	METHYLENE CHLORIDE		x		x	x			x		6438143.27049999	19.82998
2401001000	METHYLENE CHLORIDE	x	x	x	x	x	x		x	x	5187767.64486405	15.97872
2415000000	METHYLENE CHLORIDE	x		x				x			4863365.90214050	14.97954
39999992	METHYLENE CHLORIDE									x	3421444.40220000	10.53831
2460000000	METHYLENE CHLORIDE	x	x	x	x	x			x		2016996.73380000	6.21250
Other	METHYLENE CHLORIDE	x	x	x	x	x			x	x	10539007.52383710	32.46095
2104008051	NAPHTHALENE				x		x		x	x	5068425.188780160	36.80109
2460000000	NAPHTHALENE	x	x	x	x	x			x		2554555.310140000	18.54825
2401005000	NAPHTHALENE	x	x	x	x	x	x	x	x		2253594.153266500	16.36302
2501060100	NAPHTHALENE	x						x	x		840507.138979097	6.10280
0	NAPHTHALENE		x		x		x		x		821169.640000000	5.96239
Other	NAPHTHALENE	x	x	x	x	x	x	x	x	x	2234234.671812620	16.22245
30300904	NICKEL	x	x		x			x			137012.1435122420	22.43919
0	NICKEL		x		x	x	x		x		104326.0438999970	17.08602
10100401	NICKEL	x	x	x	x	x		x		x	47368.2260339698	7.75774
2104006000	NICKEL		x		x				x	x	36613.1936699458	5.99633
10200401	NICKEL	x	x	x	x	x			x		33585.3470492600	5.50045
Other	NICKEL	x	x	x	x	x	x	x	x	x	251688.1094049940	41.22027
50100101	PCBs					x				x	10.3197925740	29.15677
50100516	PCBs					x					9.4449600000	26.68508
50100515	PCBs			x	x	x				x	8.3784043114	23.67171
50100506	PCBs			x	x	x					2.2110792038	6.24702
30399999	PCBs		x								2.0000000000	5.65065
50200506	PCBs								x		1.9300000000	5.45288
Other	PCBs		x	x	x	x			x	x	1.1099218597	3.13589
10200903	PCDD	x	x	x	x	x				x	24.5945663282	68.11419
2104008051	PCDD				x						4.1465956276	11.48392
10300903	PCDD		x		x	x					3.9004606179	10.80225
Other	PCDD	x	x	x	x	x				x	3.4662232067	9.59964
2104008051	PCDF				x						22.8926633602	50.46047
10200903	PCDF	x	x	x	x	x				x	14.8265586235	32.68100
50100103	PCDF			x	x						3.4881421624	7.68863
Other	PCDF	x	x	x	x	x				x	4.1601562531	9.16990

Table 3-4: Summary of 1996 air toxics emissions by SCC. (continued)

SCC	Material Code	IL	IN	MI	MN	NY	OH	PA	WI	ON	Emissions	Regional Percentage
50182599	PENTACHLOROPHENOL								x		10715.750000	51.30509
50100791	PENTACHLOROPHENOL								x		9960.100000	47.68717
Other	PENTACHLOROPHENOL								x		210.480000	1.00774
2420020055	TETRACHLOROETHYLENE	x		x		x	x		x		24945196.87000000	33.86095
2420010055	TETRACHLOROETHYLENE	x	x	x		x					22840165.33000000	31.00355
2415000000	TETRACHLOROETHYLENE	x		x				x			8017222.37445008	10.88269
2420000000	TETRACHLOROETHYLENE									x	6295030.22259650	8.54496
Other	TETRACHLOROETHYLENE	x	x	x	x	x	x	x	x	x	11571896.29864450	15.70785
2104008051	PHENANTHRENE				x		x		x	x	4500248.614818060	69.83164
2104008030	PHENANTHRENE		x	x					x	x	1177742.299580150	18.27536
Other	PHENANTHRENE	x	x	x	x	x	x	x	x	x	766435.651479881	11.89300
0	PHENOL		x		x	x	x		x		2604606.141569000	55.53990
30120201	PHENOL	x									465320.593920000	9.92237
30599999	PHENOL	x									340214.000000000	7.25463
39999992	PHENOL									x	292096.272400000	6.22858
Other	PHENOL	x	x	x	x	x		x	x		987375.377631995	21.05452
0	PHOSGENE		x				x				193.0000000000	99.09632
Other	PHOSGENE	x				x					1.7600072334	0.90368
2104008051	PYRENE				x		x		x	x	298816.4517090470	60.89346
30300302	PYRENE									x	94507.1565590000	19.25887
30300308	PYRENE									x	42173.9448691400	8.59430
Other	PYRENE	x	x	x	x	x			x	x	55222.5487271733	11.25337
2401990000	STYRENE							x			7112743.40981244	37.66271
0	STYRENE		x		x	x	x		x		6495805.08289999	34.39596
30101817	STYRENE	x	x	x		x		x	x		995835.89705236	5.27305
Other	STYRENE	x	x	x	x	x	x	x	x	x	4280989.41255693	22.66828
10200903	TCDD,2378	x	x	x	x	x					0.2885936076	87.96967
Other	TCDD,2378	x	x	x	x	x			x	x	0.0394667427	12.03033
10200902	TCDF,2378			x	x						31.7214059420	97.19671
Other	TCDF,2378	x	x	x	x	x			x	x	0.9148900211	2.80329
2415000000	METHYL CHLOROFORM	x		x				x			24919898.61460430	40.53888
2460000000	METHYL CHLOROFORM	x	x	x	x	x			x		21453891.50490000	34.90049
2415050000	METHYL CHLOROFORM								x		3616937.84000000	5.88392
2415360000	METHYL CHLOROFORM		x								3473156.00000000	5.65002
Other	METHYL CHLOROFORM	x							x		8007714.57975367	13.02669
2401001000	TOLUENE	x	x	x	x	x	x	x	x	x	42099012.8838213	15.87701
2401990000	TOLUENE			x	x			x			38098027.4573700	14.36810
2460000000	TOLUENE	x	x	x	x	x			x		23774241.1350700	8.96610
2501060100	TOLUENE	x						x	x		14997652.4813106	5.65614
2401005000	TOLUENE	x	x	x	x	x	x	x	x		13351772.6388396	5.03542
Other	TOLUENE	x	x	x	x	x	x	x	x	x	132836330.9716660	50.09723
2425000000	2,4-TOLUENE DIISOCYANATE					x					4468.280900000	40.91905
0	2,4-TOLUENE DIISOCYANATE		x				x		x		2721.400000000	24.92169
40299995	2,4-TOLUENE DIISOCYANATE					x					2648.000000000	24.24952
40706404	2,4-TOLUENE DIISOCYANATE	x									611.520000000	5.60010
Other	2,4-TOLUENE DIISOCYANATE	x			x	x			x		470.604292498	4.30964
2415000000	TRICHLORETHYLENE	x		x				x			21544891.15877080	42.02143
40100205	TRICHLORETHYLENE	x	x	x	x	x		x	x		8167594.62166599	15.93018
2415050000	TRICHLORETHYLENE								x		3422217.08000000	6.67474
2415360000	TRICHLORETHYLENE		x								3286177.00000000	6.40940
Other	TRICHLORETHYLENE	x	x	x	x	x	x	x	x	x	14850317.89623750	28.96425
50100101	2,4,5-TRICHLORPHENOL									x	0.0217334759	100.00000
50100791	2,4,6-TRICHLORPHENOL								x		7655.3600000000	59.88169
50182599	2,4,6-TRICHLORPHENOL								x		4901.8200000000	38.34297
Other	2,4,6-TRICHLORPHENOL								x	x	226.9619863403	1.77534

Table 3-4: Summary of 1996 air toxics emissions by SCC. (continued)

SCC	Material Code	IL	IN	MI	MN	NY	OH	PA	WI	ON	Emissions	Regional Percentage
2461800000	TRIFLURALIN	x		x	x						656024.0821191450	99.04551
Other	TRIFLURALIN	x	x				x				6322.0273805638	0.95449
30101864	VINYL CHLORIDE			x							567293.4121090000	64.15590
64630001	VINYL CHLORIDE	x									138000.0000000000	15.60659
2630020000	VINYL CHLORIDE	x			x					x	131078.8564672990	14.82387
Other	VINYL CHLORIDE	x	x	x	x	x	x		x	x	47869.6755859449	5.41364
2501060101	XYLENE,M				x					x	281368.223644146	34.69789
2415000000	XYLENE,M			x	x						151594.080099535	18.69435
2501060100	XYLENE,M								x		70041.000000000	8.63735
0	XYLENE,M		x			x	x				46527.040000000	5.73764
Other	XYLENE,M		x	x	x	x		x	x	x	549530.343743681	67.76723
2104008051	XYLENE,O				x		x		x	x	5162048.98052351	25.83346
2401990000	XYLENE,O			x	x			x			4378803.21208584	21.91371
2401001000	XYLENE,O							x		x	4035705.32256469	20.19667
2501060100	XYLENE,O							x	x		3645945.58447933	18.24612
Other	XYLENE,O		x	x	x	x		x	x	x	2759526.24535778	13.81004
2415000000	XYLENE,P			x	x						151594.0800995350	31.15338
2501060101	XYLENE,P				x					x	108929.1322233990	22.38551
2415050000	XYLENE,P								x		37321.1600000000	7.66969
2415360000	XYLENE,P		x								35842.0000000000	7.36572
2501060100	XYLENE,P								x		27116.0000000000	5.57248
Other	XYLENE,P		x	x	x	x			x	x	125803.2123335190	25.85322
2401005000	XYLENES ISO	x	x	x	x	x	x	x	x		31905350.79628750	22.62849
0	XYLENES ISO		x		x	x	x		x		14913922.44950010	10.57752
2401990000	XYLENES ISO			x	x			x			13340462.22360290	9.46157
2460000000	XYLENES ISO	x	x	x	x	x			x		11956326.76360000	8.47988
39999992	XYLENES ISO									x	11273843.79720000	7.99584
2501060100	XYLENES ISO	x							x		8588474.50757999	6.09127
2401001000	XYLENES ISO	x	x	x	x	x	x	x	x	x	7248807.20746767	5.14113
Other	XYLENES ISO	x	x	x	x	x	x	x	x	x	41769189.90391940	29.62430

4. Conclusion

Air regulatory agencies in the eight Great Lakes states and province of Ontario agree that a collaborative effort is vital to successfully implementing a compatible database of airborne toxic pollutant emissions for the Great Lakes region. They have been working cooperatively toward this goal since 1987. As quality controlled and quality assured emissions inventories are developed and refined, the states, province of Ontario and the U.S. Environmental Protection Agency can work separately and in concert to define and regulate sources; evaluate control technology; establish guidelines for siting new facilities; and reduce airborne deposition of persistent toxic chemicals to the Great Lakes.

Realizing that mobile sources are a critically important category of air toxic emission sources relevant to human activities in industrialized societies, a mobile source emissions estimation module is now integrated into RAPIDS. This expansion of RAPIDS provides a more complete profile for toxic air emissions and will expand the list of toxic compounds of concern from 49 to 82.

Annual Great Lakes Toxic Air Emissions Inventories are available online through the Great Lakes Information Network. Also available through GLIN is AirMapper, where users can view a geographic representation of the inventory of pollutant concentrations and eventually point sources. Using GLIN's dissemination functions as a tool, decision makers and the general public will be able to make better informed decisions that help reduce toxic pollution, protect and restore habitats and support intergovernmental partnerships. Timely access to a comprehensive inventory will provide the foundation for sound public policy decisions.

This emissions inventory will assist in the successful implementation of key provisions of the Great Lakes Toxic Substances Control Agreement, signed by the Great Lakes governors and Premier of Ontario in 1986. In addition, this work is consistent with the state activities for the implementation of the Urban Area Source Program required under sections 112(c) and 112(k) of the Clean Air Act Amendments of 1990, and the assessment of atmospheric deposition to the Great Lakes under the efforts of U.S. EPA's Great Waters Program.

Further Refinements and Cooperative Efforts

The air regulatory agencies in the eight Great Lakes states and the province of Ontario have developed a system that can create a reliable and technically accurate inventory of estimated air toxic emissions. These inventories are to be used by the air agencies in coordination with ambient air quality data collected by the Great Lakes Monitoring Network to assess the contribution to airborne toxic impacts on the Great Waters and support the development of remedial action and other management plans.

While the states and Ontario are committed to compiling periodic inventories to assess and analyze the contribution of toxic air emissions on the Great Waters, these inventories can also serve a number of other very important purposes as well.

The Inventory, for example, can assist the U.S. EPA in assessing the impact of hazardous air pollutants (HAPs). U.S. EPA has prepared a National Toxic Inventory (NTI), in order to perform a risk-based assessment associated with the exposure to HAPs. This assessment, also known as the Cumulative Exposure Project (CEP), can be enhanced by the use of state specific inventories. The Great Lakes air toxic inventory can provide better spatial and temporal resolution of emissions through the use of more representative activity data from the survey of point sources, the use of county level data for area and non-road sources, and the use of local traffic data. The list of contaminants for the Great Lakes air toxic inventory would need to be expanded to the full list of HAPs as delineated in Section 112(b) of the Clean Air Act to support the CEP. In addition, the Great Lakes air toxic inventory could be used as a national model for preparing state-specific air toxic inventories.

The Great Lakes air toxic inventory can also be used to assist the states and Ontario in completing their other air emissions inventory needs. States with ozone nonattainment areas are required to complete annual point source ozone and comprehensive periodic (every 3 years) inventories for those areas. Some states have expanded this annual effort to support the emission fee effort of Title V of the Clean Air Act and some states have expanded the periodic inventory to the entire state. Much of the information collected for the ozone effort is directly transferable to the Great Lakes air toxic inventory, as well as other inventory efforts.

The data collected from the Great Lakes air toxic inventory can also be used to assist in other ongoing assessments. These include regional ozone, particulate matter and haze; urban air toxic programs; mercury deposition; and, acid deposition studies. The U.S. EPA is currently developing a national database that will contain a state's comprehensive emission inventory (air toxic and criteria pollutant emissions). If a state does not provide its own inventory, the U. S. EPA will estimate emissions for that state. It is preferable for a state to complete this effort on its own to provide a more accurate picture of its air emissions profile. Ontario would benefit from these efforts and is encouraged to do the same as the Great Lakes states.

The U. S. EPA does not have the authority to require states to submit a comprehensive emissions inventory. In addition, there is no similar requirement for Ontario. The Great Lakes States and Ontario have tried to overcome this obstacle through the use of inventory protocols. These have had limited success because of the differences in resources available to states and in the authority to ask for information needed to complete the inventory. A comprehensive federal emissions reporting rule that consolidates all emissions inventory requirements could provide consistency for the states and Ontario.

In summary, the Great Lakes states and the province of Ontario have successfully implemented a system, The Great Lakes Regional Air Toxic Emissions Inventory, to compile and analyze air toxic emissions for the Great Lakes region. Beyond the periodic air toxic inventory work that the States and Ontario will be compiling, this system can be utilized for many other important air quality assessments. These include:

1. The NTI and the CEP;
2. Regional inventories for ozone, particulate matter and haze;
3. The urban air toxic program;
4. Mercury deposition studies; and,
5. Acid deposition studies.

The Great Lakes Regional Air Toxic Emissions Inventory is an example of regional cooperation of eight states and the province of Ontario. It can be used as a model for states compiling inventories for input into the National Toxics Inventory (NTI) or National Emissions Trends Inventory. It also serves as a model for the regional inventory efforts underway as part of a regional assessment of various toxic pollutants.