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Deposition of Air Pollutants to the Great Waters

Third Report to Congress

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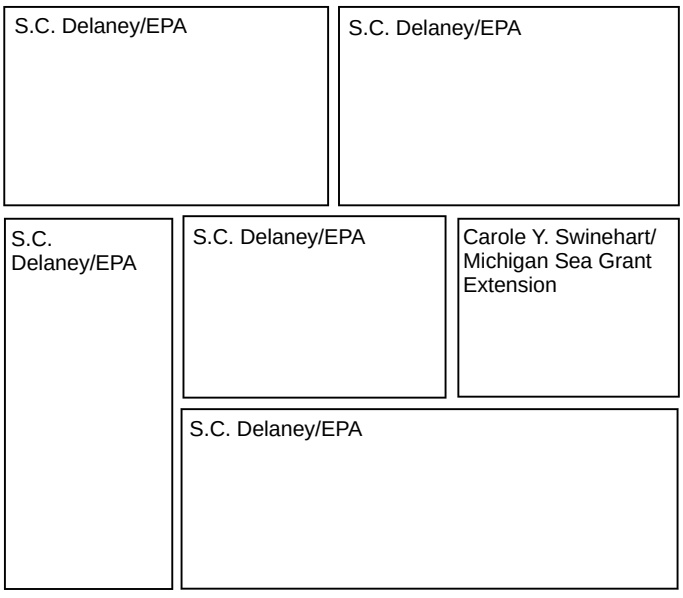

EXECUTIVE SUMMARY

With section 112(m) of the 1990 Clean Air Act (CAA), Congress directed the U.S. Environmental Protection Agency (EPA), in cooperation with the National Oceanic and Atmospheric Administration (NOAA), to identify and assess the extent of atmospheric deposition of air pollutants to the Great Lakes, the Chesapeake Bay, Lake Champlain, and coastal waters, collectively known as the Great Waters. Further, section 112(m) directed EPA to report its findings to Congress in periodic reports. This is EPA's third Report to Congress on the deposition of air pollutants to the Great Waters. The first report was published in May 1994, and the second report was published in June 1997.

The goals of the *Third Great Waters Report to Congress* are to discuss the current state of knowledge regarding atmospheric deposition of pollutants to the Great Waters based on new research and program activities undertaken since the *Second Report to Congress* and to describe any necessary revisions to requirements, standards, and limitations under the CAA or other Federal laws. This report is not intended to be a comprehensive summary of all relevant scientific research and activities. Instead, it summarizes and highlights major trends and key findings, and builds on conclusions presented in the *First* and *Second Reports to Congress*.

How does deposition of air pollutants affect public health and the health of the Great Waters ecosystems?

Great Waters Pollutants of Concern

Cadmium and cadmium compounds
Chlordane
DDT/DDE
Dieldrin
Hexachlorobenzene
"-Hexachlorocyclohexane
Lindane ((-hexachlorocyclohexane)
Lead and lead compounds
Mercury and mercury compounds
Polychlorinated biphenyls
Polycyclic organic matter
Tetrachlorodibenzo-p-dioxin (dioxins)
Tetrachlorodibenzofuran (furans)
Toxaphene
Nitrogen compounds

A rapidly growing number of atmospheric deposition monitoring and modeling studies confirm that, along with runoff and discharges of pollution into waterways, atmospheric deposition is a significant pathway of pollutant inputs to the Great Waters. These studies show that the contribution of atmospheric deposition to overall pollutant loadings varies greatly by pollutant and location. For example, studies show that atmospheric deposition contributes from less than 5 to 100 percent of dioxins and furans entering the Great Lakes, depending on the location of the monitoring site, and from 2 to 38 percent of the nitrogen load to certain coastal waters. Given this variability in contributions, the improvement of the quality of the Great Waters environments requires an understanding of all of the sources of the pollutants into a waterbody, including runoff from urban areas and farms, discharge from point sources, and seepage from contaminated sediments, as well as atmospheric deposition.

Like the *First* and *Second Reports to Congress*, this report focuses on 15 pollutants of concern, including certain pesticides, metal compounds, chlorinated organic compounds, and nitrogen compounds (see sidebar). Some of these pollutants are single compounds while others represent categories of several or even hundreds of individual compounds. They are emitted into the air by a wide range of sources, including industries and other human activities, natural sources, and re-emissions of these pollutants from soil and water. What is known about their emission rates, concentrations in the environment, transformation processes, deposition rates and pathways, and health and environmental effects varies widely. Nevertheless, recent research has added to our knowledge of the adverse human health and ecological effects of these pollutants. At certain levels, these pollutants are associated with adverse

effects on many target organs in humans and animals, including the liver, kidney, nervous system, endocrine system, reproductive organs, and immunological system. Research since the *Second Report to Congress* provides additional evidence that some of the pollutants are likely "endocrine disruptors," meaning they may interfere with the action of hormones in wildlife and humans.

A number of regional and national assessments and monitoring programs described in this report suggest that, while environmental conditions are improving in general, the current concentrations of pollutants of concern continue to impair the ecological health of many Great Waters. For example, the NOAA Estuarine Eutrophication Surveys indicate that approximately 89 percent of the Great Waters that are coastal estuaries show some degree of adverse effects associated with amounts of nitrogen in excess of natural levels. (Nitrogen is a natural component of these waterbodies, but excess amounts can also be introduced through natural and human activities such as runoff from urban and agricultural areas and atmospheric deposition.) Because of long-range atmospheric transport and certain chemical properties (e.g., persistence, mobility, bioaccumulation, and bioconcentration), the pollutants of concern may contribute to ecological impairment far from known emission sources and long after releases.

At current levels of contamination, pollutants of concern in the Great Waters pose potentially the greatest health risks to individuals who consume fish from contaminated waters for subsistence or cultural reasons, women of child-bearing age, the developing fetuses of pregnant women, and young children who consume fish from contaminated waters. For mercury in particular, exposures do not appear to pose a health risk to people consuming average amounts of fish, but sensitive sub-populations (e.g., young children, and pregnant women and their developing fetuses) with higher than typical fish consumption may be at risk. Also at risk are subsistence fish-eating populations who consume large amounts of fish. The extent of risk for these groups depends on the amount of fish consumed and the mercury concentrations present in the fish.

What are the recent and anticipated trends in emission and deposition of Great Waters pollutants of concern and their concentrations in the Great Waters environment?

Where monitoring trends information exists, either nationally or locally, atmospheric deposition of pollutants of concern to the Great Waters has declined or remained relatively constant in recent years, as described in Chapter II. Specifically, deposition of lead, cadmium, polycyclic organic matter (POM) – which includes a group of compounds known as polycyclic aromatic hydrocarbons (PAHs) – polychlorinated biphenyls (PCBs), and some banned or restricted use pesticides is declining in the Great Lakes. Other Great Waters have also shown decreasing trends of some of the pollutants of concern, such as lead in Long Island Sound. Deposition of nitrogen in the U.S. has remained fairly constant. These trends may reflect the results of emission reduction programs established under the CAA, pesticide bans, as well as other local, tribal, State, Federal, and international pollution control efforts, many of which are described in this report. There is considerable uncertainty in the trends estimates, however, because limited monitoring capability, technological barriers, and variable collection and analysis methods make it difficult to adequately characterize historical or current conditions. In addition, these estimates do not address all Great Waters waterbodies for all pollutants of concern.

Emissions of mercury to the atmosphere come from human-made sources, natural emissions, and re-emission from biologic and geologic processes. Emissions of mercury have been on a downward trend since 1990, due chiefly to the phase-out of mercury in many products. Nevertheless, monitoring suggests that atmospheric deposition is a significant contributor of mercury to the Great Waters. At EPA's current reference dose for mercury, levels in some lakes and streams remain sufficiently high to pose adverse

human health and ecological risks and to result in fish consumption advisories for mercury in many Great Waters.

Lead air emissions, ambient air concentrations, and deposition levels in the Great Lakes region have also decreased in recent years. Cadmium emissions in the Great Lakes region, on the other hand, increased in the 1980s and have not shown a trend since then, while cadmium deposition in the Great Lakes region is believed to have decreased in recent years. In the Chesapeake Bay, trends in atmospheric deposition of lead and cadmium are difficult to discern with current information, but total inputs of both lead and cadmium in some eastern parts of the bay have increased in recent years due to the increase in population and industrial activities. In some areas of the Chesapeake Bay, levels of these metals may be high enough in sediments to cause adverse ecological effects.

Air emissions of dioxins, furans, and POM (including PAHs) in the U.S. are from both natural and human-made combustion and incineration processes. Emissions have declined for dioxins and furans, while trends for POM are not known. A large degree of variation has been observed in deposition levels of dioxins and furans over time within and between the Great Lakes. Deposition levels of these compounds are related to the pattern of industrialization and population density. In many instances, long term monitoring indicates that concentrations of dioxins and furans in biota in the Great Waters have declined over time. Analytical results indicated that levels in aquatic species are declining steadily and in several Great Waters, no dioxin was found in fish samples taken between 1987 and 1994.

Although CAA programs have had a major impact on nitrogen oxide (NO_x) emissions, the emission reductions have been balanced approximately equally with emission increases attributable to economic growth, resulting in a relatively flat trend since 1980. Deposition monitoring data suggest that the deposition rates of inorganic nitrogen (e.g., NO_x, ammonia) to many of the Great Waters watersheds have also been relatively constant for the past two decades, though some increases have been noted downwind of areas where population or livestock operations are growing. The EPA expects that additional NO_x controls to be implemented under the CAA will slightly outpace emission increases associated with economic growth, resulting in a net decreasing trend in NO_x emissions through 2005. Emissions are expected to remain steady at that level until 2010. Research is ongoing into the lesser known, but apparently important, forms of nitrogen deposition (e.g., dry deposition, organic nitrogen). Current and anticipated nitrogen deposition rates are significantly greater than natural rates, and combined with nitrogen inputs from runoff from farms and cities, have the potential to overwhelm the capacities of surface waters to assimilate the additional nitrogen.

Manufacture of PCBs in the U.S. no longer occurs; however, releases into the environment continue to occur because of PCBs in electrical transformers and capacitors that are still in use, releases from soils and sediments contaminated with PCBs, and releases during some combustion processes. The number and magnitude of PCB sources in the U.S. has decreased 20-fold in the past 20 years. Furthermore, deposition of PCBs in the Great Lakes has decreased and a net loss of PCBs has been observed in the Chesapeake Bay. Overall, PCB concentrations in the environment appear to have declined but are still present and continue to result in the need for fish consumption advisories in many Great Waters.

Based on recent academic research on atmospheric pollutant concentrations in the Great Lakes region, DDT and DDE, followed by dieldrin and chlordane, are estimated to fall below current detection limits in the atmosphere between 2010 and 2020. Hexachlorocyclohexane and hexachlorobenzene are projected to be eliminated in the atmosphere by 2030 and 2060, respectively. These estimates assume current rates of long-range transport of these pollutants into the region and do not mean that concentrations would be eliminated in deposited media (water and sediments) by these dates. However,

these estimates indicate that reduction strategies in the Great Lakes, along with the original bans and restrictions on the use of these substances, are having the intended effect.

What actions are EPA and others taking to address atmospheric deposition?

Chapter III of this report describes more than 60 programs under way from the local to international levels that directly or indirectly contribute to reducing atmospheric deposition of pollution to the Great Waters or to understanding its effects. Although EPA leads or supports many of these programs, which often use multimedia and cross-program approaches to control pollution, other Federal agencies, State and tribal organizations, industry groups, and Canada have also initiated and implemented many important activities. Examples of EPA's cross-program and multimedia approaches include the pulp and paper industry "cluster rule" that for the first time integrates, coordinates, and streamlines applicable requirements of the Clean Water Act and the CAA. The EPA's air and water programs are also working together to address the contribution of air deposition into water quality protection under total maximum daily load (TMDL) determinations. This also includes coordinated activities such as the Persistent Bioaccumulative Toxics Initiative, Clean Water Action Plan, and Contaminated Sediment Management Strategy. Several State organizations have successfully worked with industry and municipalities to develop pollution prevention programs and programs to collect banned and restricted use pesticides. Tribes are working to reduce exposure of indigenous populations to pollutants of concern through a variety of efforts, and industry has initiated efforts to reduce the use of pollutants of concern in products and processes. Canada has implemented a variety of programs, some of which are joint efforts with the U.S., like the Binational Toxics Strategy which seeks to eliminate pollutants of concern from the Great Lakes environment.

These coordinated Agencywide efforts demonstrate EPA's commitment to implement the strategic directions discussed in the *First* and *Second Reports to Congress* and in the section 112(m)(6) adequacy determination, and to pursue all authorities available for addressing atmospheric deposition and Great Waters pollutants of concern. In addition, developing and implementing these and other programs and initiatives described in this report have not required revisions to requirements, standards, and limitations in accordance with the CAA and other Federal laws which provide protection of human health and the environment from atmospheric deposition to the Great Waters.

What are EPA's findings and conclusions from this Third Report to Congress?

The new scientific and programmatic information presented in this report supports and builds on the three broad conclusions presented in the *First* and *Second Reports to Congress*.

- Atmospheric deposition from human activities can be a significant contributor of toxic chemicals and nitrogen compounds to the Great Waters. The relative importance of atmospheric loading for a particular chemical in a given waterbody depends on many factors, including characteristics of the waterbody, properties of the chemical, and the kind and amount of atmospheric or water discharges.

- A plausible link exists between emissions into the air of Great Waters toxic pollutants of concern, the atmospheric deposition of these pollutants (and their transformation products), and the concentrations of these pollutants found in water, sediments and biota, especially fish and shellfish. For mercury, fate and transport modeling and exposure assessments predict that the

anthropogenic contribution to the total amount of methylmercury in fish is, in part, the result of anthropogenic mercury releases from industrial and combustion sources increasing mercury body burdens (i.e., concentrations) in fish. Furthermore, the consumption of fish is the dominant pathway of exposure to methylmercury for fish-consuming humans and wildlife. However, what is known about each stage of this process varies with each pollutant (for instance, the chemical species of the emissions and its transformation in the atmosphere).

C Airborne emissions from local as well as distant sources, both within and outside the U.S., contribute pollutant loadings to waters through atmospheric deposition. Determining the relative roles of particular sources -- local, regional, national, and possibly global, as well as anthropogenic, natural, and re-emission of pollutants -- contributing to specific waterbodies is complex, requiring careful monitoring, atmospheric modeling, and other analytical techniques.

Actions taken by EPA and others to control sources of Great Waters pollutants of concern appear to have positively affected trends in pollutant concentrations measured in air, water, sediment, and biota. Overall deposition rates of pollutants of concern have declined slightly or remained constant. Several pollutants of concern continue to enter the Great Waters primarily through atmospheric deposition. In addition, long-range transport of pollutants of concern from other U.S. regions or other countries is estimated to contribute significantly to atmospheric loadings to the Great Waters. For example, the global reservoir of mercury (which includes mercury from both U.S. and foreign sources) is estimated to contribute about 40 percent of the total mercury deposition to U.S. lands and waters.

Concentrations of some pollutants of concern in the water, sediment, and biota of the Great Waters declined in recent years, whereas others were constant or variable. Concentrations of most pollutants of concern still pose potential adverse ecological and human health effects. For example, approximately 5 percent of the Nation's coastal and inland watersheds include "areas of probable concern," meaning a watershed that is associated with a certain number of monitoring sites with sediment contamination at levels likely to cause adverse effects. Water quality data also indicate that water quality standards in place for drinking water supplies in the Great Waters are not being exceeded for the pollutants of concern, but that surface water quality guidance and criteria are being exceeded for some of the Great Waters. In addition, nationally, fish consumption advisories were in place for 39 of 56 Great Waters waterbodies as of 1997.

Based on current trends, EPA expects atmospheric deposition to remain a significant source of several pollutants of concern to the Great Waters for the foreseeable future. In addition, because of the ability of these pollutants to persist and bioaccumulate, they are expected to remain in the water, sediments and biota for much longer.

Implementation of existing EPA regulations is expected to further reduce emissions of mercury, NO_x, POMs, dioxins and furans, cadmium, and hexachlorobenzene. The EPA continues to implement programs under CAA authorities and expects that pollutant emissions will be further controlled by several rules scheduled to take effect in coming years. As a result, atmospheric deposition and loadings of these pollutants may be significantly reduced. In addition, actions taken to voluntarily reduce chemical use, implement pollution prevention initiatives, advance technology (e.g., alternative fuel vehicles), and implement pollution control laws issued by States and other nations will further reduce pollutant loadings to the Great Waters.

What future directions will EPA follow to implement section 112(m)?

The EPA developed six key recommendations that will assist in meeting the objectives and requirements of the CAA related to the Great Waters program.

- The EPA will continue to support the maintenance and expansion of efforts to monitor Great Waters pollutants of concern in order to evaluate the relative contributions of local, regional, and long-range transport to deposition in the U.S., as well as natural versus human-made sources.

- The EPA will continue to develop and implement regulations and pollution prevention programs regionally and nationally, including multimedia programs, in order to reduce the impact of sources of Great Waters pollutants of concern within the U.S.

- For Great Waters pollutants emitted by sources outside the U.S., EPA will work within international frameworks to reduce sources of these pollutants.

- The EPA will support model development and research that establish and clarify the linkages from emissions to atmospheric deposition to waterbody loadings to adverse public health and the environmental effects of Great Waters pollutants of concern in order to enable effective risk management decisions.

- The EPA will encourage and support the establishment of common baselines and measures of progress in order to better assess trends and health of Great Waters and other waterbodies affected by atmospheric deposition.

- The EPA will work to increase public awareness of risks of exposure to Great Waters pollutants.

These key recommendations build on the strategic themes identified in the *First* and *Second Reports to Congress*: (1) continued implementation of the CAA to directly control emissions of Great Waters pollutants of concern; (2) use of an integrated multimedia approach throughout the Agency, including coordination of clean air programs with programs available under other Federal laws (e.g., Clean Water Act); and, (3) continued support of research activities that address the goals of the Great Waters program.

In support of the first strategic theme, EPA will develop or assess the need for new rules and programs under the CAA, including maximum achievable control technology (MACT) standards, section 112(c)(6) standards, as well as standards that could stem from the residual risk program, the utility air toxics determination, and the integrated urban air toxics strategy. As appropriate, EPA will consider the impacts of atmospheric deposition in developing standards under these authorities. In addition, EPA will ensure the timely implementation of NO_x control programs already in place and will encourage innovative, nonregulatory approaches to reducing NO_x emissions and other sources of atmospheric nitrogen.

This report describes a number of multimedia and cross-program initiatives (e.g., Clean Water Action Plan, Persistent Bioaccumulative Toxics Initiative) that are in line with EPA's second strategic theme for the Great Waters program. Some of these initiatives, such as the pulp and paper cluster rule, will produce tangible environmental benefits within the near future. Other initiatives, such as development of multimedia models in support of TMDL determinations and completion of the

Contaminated Sediment Non-point Source Inventory, will provide tools and data resources that will help EPA target future pollution control activities.

There has been substantial progress in research activities relevant to the Great Waters program since the *Second Report to Congress*. However, important information gaps remain, and there are critical limitations to current atmospheric monitoring and modeling capabilities. Consistent with the third strategic theme, therefore, EPA will initiate and continue to support scientific research to fill these critical gaps, including the following activities:

- Support research to examine and quantify the ecological effects of atmospheric deposition and to better quantify the water quality benefits of air pollution controls;

- Expand the geographic coverage and consistency of waterbody monitoring to enable more accurate characterizations of the extent of contamination and ecosystem effects due to atmospheric deposition;

- Encourage and support interagency coordination to better quantify the indirect loadings of atmospheric deposition to the Great Waters through the development of tools that can quantify watershed transport of pollutants of concern;

- Continue to support the development of modeling tools which address the transport and fate of pollutants in ecosystems and characterize risk, including research to clarify mechanisms of mercury methylation so as to better predict and manage ecosystems at risk;

C Develop reliable approaches for quantifying and monitoring nitrogen dry deposition and wet organic nitrogen deposition;

- Support joint work with States and industry to fill gaps in emissions information for MACT source categories and further refine emissions measurement methods, inventories, and modeling for Great Waters pollutants of concern;

C Support research on viable prevention and controls for sources of pollutants of concern;

- Encourage and support greater coordination and expansion of monitoring networks to assess deposition of pollutants to coastal waters, to assess the contribution of long-range transport to deposition in the U.S., and to evaluate the impact of agricultural and urban sources;

- Develop standard methods to monitor pollutants of concern to enable the comparison of data and trends analyses;

- Support international efforts to quantify the transboundary contributions of pollutants of concern and to share technology, information, and expertise with other countries on reducing releases to the environment and on cost-effective alternatives to their use;

- Working closely with other EPA and inter-governmental efforts to address, in particular, persistent bioaccumulative toxic pollutants, and to identify and evaluate additional pollutants which may be of concern to the Great Waters;

- Continue research to identify additional endocrine disrupting chemicals and their associated effects; and,

- Continue coordination and support of efforts to improve the consistency of fish consumption advisories and the awareness and understanding of advisories among populations most at risk to exposure to the Great Waters pollutants of concern.

The EPA is committed to continuing to address air deposition of pollutants into the Nation's waters as a priority matter. To that end, and to assure continued coordination of the many related tasks involved and outlined in this report, EPA will develop a detailed biennial work plan for implementation actions beginning this year and updated every two years. As EPA develops and implements plans, programs and initiatives with NOAA and its other Federal, State, tribal, industry and community partners, we expect to make significant, measurable progress toward our goal of assuring the protection of human health and the environment from adverse effects attributable to atmospheric deposition of pollution to the Great Waters.

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ABBREVIATIONS AND ACRONYMS

ADN	Atmospheric deposition nitrogen
AEOLOS	Atmospheric Exchange Over Lakes and Ocean Surfaces
AIEO	American Indian Environmental Office
AILESP	American Indian Lands Environmental Support Project
AIRMoN	Atmospheric Integrated Research Monitoring Program
AOC	Areas of concern
APC	Areas of probable concern
AQC	Air Quality Committee
ARL	Air Resources Laboratory
ATSDR	Agency for Toxic Substances and Disease Registry
BACT	Best available control technology
BASMAA	Bay Area Stormwater Management Agencies Association
BNS	Binational Toxics Strategy
BRACE	Bay Regional Atmospheric Chemistry Experiment
CAA	Clean Air Act
CASTNet	Clean Air Status and Trends Network
CBADS	Chesapeake Bay Atmospheric Deposition Study
CBEP	Community-Based Environmental Program
CBP	Chesapeake Bay Program
CBPO	Chesapeake Bay Program Office
CEC	Commission on Environmental Cooperation
CENR	Committee on Environment and Natural Resources
CHPAC	Children's Health Protection Advisory Committee
CMAQ	Community multi-scale air quality
CTDEP	Connecticut Department of Environmental Protection
CVAFS	Cold vapor atomic fluorescence spectrometry
CWA	Clean Water Act
CZM	Coastal zone management
DC	District of Columbia
DDD	1,1'-(2,2-dichloroethylidene)bis(4-chlorobenzene)
DDE	1,1'-(dichloroethenylidene)bis(4-chlorobenzene)
DDT	1,1'-(2,2,2-trichloroethylidene)bis(4-chlorobenzene)
DIN/SRP	Dissolved inorganic nitrogen to soluble reactive phosphorus
DNREC	Department of Natural Resources and Environmental Conservation
EAGLE	Effects on Aboriginals from the Great Lakes Environment
EDSTAC	Endocrine Disruptor Screening and Testing Advisory Committee
EEGLE	Episodic Events/Great Lakes Experiment
EGU	Electric generation units
EMAP	Environmental Monitoring and Assessment Program
EPCHC	Environmental Protection Committee of Hillsborough County
EOM	Extractable organic matter
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
FAMS	Florida Atmospheric Mercury Study
FCP	Fish Contamination Program
FDEP	Florida Department of Environmental Protection
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FIP	Federal implementation plan
FR	Federal Register

g	Gram
GIS	Geographic Information System
GLNPO	Great Lakes National Program Office
GLWQA	Great Lakes Water Quality Agreement
GMPO	Gulf of Mexico Program Office
GPRA	Government Performance and Results Act
HAP	Hazardous air pollutant
HCB	Hexachlorobenzene
HCH	Hexachlorocyclohexane
HMIWI	Hazardous/medical/infectious waste incinerators
HNO_3	Nitric acid
HYSPLIT	Hybrid single particle Lagrangian integrated trajectory
IADN	Integrated Atmospheric Deposition Network
IAQAB	International Air Quality Advisory Board
IBI	Index of Biotic Integrity
IDEM	Indiana Department of Environmental Management
IJC	International Joint Commission
INC	International Negotiating Committee
kg	Kilogram
LaMP	Great Lakes Lakewide Management Plans
LAER	Lowest achievable emission rate
LCBP	Lake Champlain Basin Program
LISS	Long Island Sound Study
LMMBS	Lake Michigan Mass Balance Study
LRTAP	Europe Long-Range Transboundary Air Pollution
MACT	Maximum achievable control technology
MCL	Maximum contaminant level
MCM	Mercury cycling model
MDEQ	Michigan Department of Environmental Quality
MDN	Mercury Deposition Network
MOU	Memorandum of Understanding
MPCA	Minnesota Pollution Control Agency
MTRL	Maximum tissue residue level
MWC	Municipal waste combustors
N	Nitrogen
NAAEC	North American Agreement on Environmental Cooperation
NAAQS	National ambient air quality standard
NADP	National Atmospheric Deposition Program
NADP-MDN	National Atmospheric Deposition Program - Mercury Deposition Network
NADP-NTN	National Atmospheric Deposition Program - National Trends Network
NAFTA	North American Free Trade Agreement
NCSU	North Carolina State University
NDAMN	National Dioxin Air Monitoring Network
NEP	National Estuary Program
NERRS	National Estuarine Research Reserve System
NESCAUM	Northeast States and Eastern Canadian Provinces Mercury Study
NH_3	Ammonia
NH_4^+	Ammonium
NH_x	Reduced nitrogen compounds (e.g., ammonia, ammonium)
NLFWA	National Listing of Fish and Wildlife Advisories

NLEV	National low emission vehicle
NO	Nitric oxide
NO_2	Nitric dioxide
NO_3	Aerosol nitrate
NOAA	National Oceanic and Atmospheric Administration
NOEL	No observed effects level
NO_x	Oxides of nitrogen
NS&T	National Status and Trends
NSI	National Sediment Inventory
NSPS	New source performance standards
NSQS	National Sediment Quality Survey
NTI	National Toxics Inventory
NORBIC	North Business-Industrial Council
OAP	Office of Atmospheric Programs
OAQPS	Office of Air Quality Planning and Standards
OAR	Office of Radiation
OC	Organochlorine chemical
OCHP	Office of Children's Health Protection
OMS	Office of Mobile Sources
OPPTS	Office of Pollution Prevention and Toxics
ORD	Office of Research and Development
OTAG	Ozone Transport Assessment Group
OTAQ	Office of Transportation and Air Quality
OTC	Ozone Transport Commission
OTR	Ozone Transport Region
OW	Office of Water
PAH	Polycyclic aromatic hydrocarbon
PBT	Persistent bioaccumulative toxic
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzo-p-dioxin
PCDF	Polychlorinated dibenzofuran
PEL	Probable effects level
PM	Particulate matter
POM	Polycyclic organic matter
POP	Persistent organic pollutant
RACT	Reasonably available control technology
RADM	Regional Atmospheric Deposition Model
RAP	Regional action plan
RELMAP	Regional Lagrangian Model of Air Pollution
R-EMAP	Regional Environmental Monitoring and Assessment Program
REMSAD	Regulatory Modeling System for Aerosols and Deposition
SAB	Science Advisory Board
SAV	Submerged aquatic vegetation
SFEI	San Francisco Estuary Institute
SFEP	San Francisco Estuary Project
SIP	State implementation plan
SMOC	Sound management of chemicals
SoFAMMS	South Florida Atmospheric Mercury Monitoring Study
SVOC	Semi-volatile organic compound
SWFWMD	Southwest Florida Water Management District

SWMP	System-Wide Monitoring Program
TBNEP	Tampa Bay National Estuary Program
TEQ	Toxic equivalent quantity
TLRI	Toxics Loading and Release Inventory
TMDL	Total maximum daily load
tpy	Tons per year
TRANSCO	Transfer coefficient
TRI	Toxic Release Inventory
TRIM	Total Risk Integrated Methodology
TSCA	Toxic Substances Control Act
UNC-CH	University of North Carolina at Chapel Hill
UN-ECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Program
US	United States
USGS	U.S. Geological Survey
VOC	Volatile organic compound
WLSSD	Western Lake Superior Sanitary District
WMNP	Waste Minimization National Plan
WMPT	Waste Minimization Prioritization Tool
WQB	Water Quality Board
WRDA	Water Resources Development Act
yr	Year