

Clearing the Air

Reducing Air Toxic Deposition to the Great Lakes



The detection of toxic substances in Siskiwit Lake, a remote lake on Isle Royale in Lake Superior, in the early 1980s made it apparent just how far toxic substances can travel in the atmosphere and contaminate environments far from their release point. The Great Lakes are particularly susceptible to accumulating toxic substances from the atmosphere, due to their climate, depth, surface area and other factors. This susceptibility, combined with their proximity to sources of toxic pollution, has led to widespread advisories on sportfish consumption in the eight Great Lakes states, which accounted for about 60 percent of the more than 3,000 fish advisories that were in place in the United States in 2004.

In signing the Great Lakes Toxic Substances Control Agreement in 1986, the governors of the eight Great Lakes states committed to better quantify and control atmospheric loadings of toxic substances to the lakes. A similar commitment was made when the United States and Canada amended the Great Lakes Water Quality agreement in 1987 to include Annex 15, committing the parties to research, monitor and prevent atmospheric deposition of toxics to the Great Lakes. These commitments were mirrored in U.S. federal legislation in 1990 as part of the Clean Air Act amendments. Efforts to achieve these goals and commitments have produced many successes and identified new challenges as well.

Many of the chemicals that were originally identified as threatening the Great Lakes and other ecosystems have been banned from production and/or use in the United States and Canada. While concentrations of some substances have decreased substantially, in other cases chemical

contamination remains above levels believed to cause human and wildlife health impairments. In addition, new categories of problem chemicals have been identified, many of which make their way into the lakes by being transported through the air. For many chemicals of greatest concern, such as mercury, air deposition is believed to be the main source of current entry to the lakes.

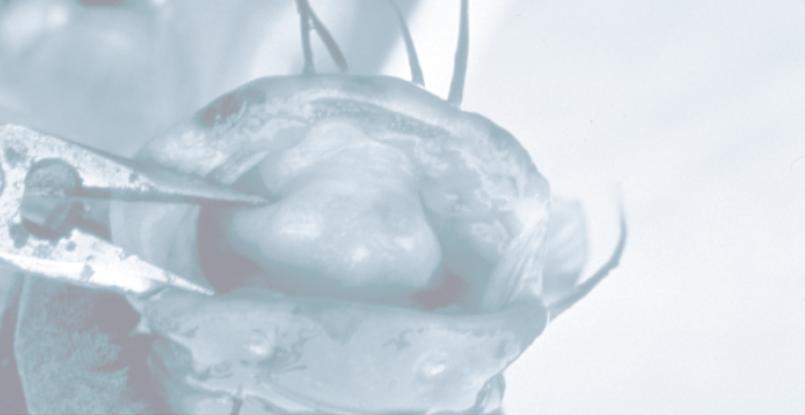
The Great Lakes are particularly susceptible to accumulating toxic substances from the atmosphere

The Great Lakes Commission has played a critical role over the past two decades in promoting the ability of the region's state and provincial governments to estimate air emissions of toxic substances and has developed a regional inventory of such emissions. In 2003, the Commission began a partnership with the U.S.

Environmental Protection Agency (U.S. EPA) to promote additional scientific research activities and informed policymaking that effectively addresses atmospheric deposition. The Great Lakes Atmospheric Deposition (GLAD) program has awarded nearly \$3 million in U.S. EPA funds over the past three years to a total of 19 research projects that are addressing the most urgent scientific topics and informational needs in this arena.

Controlling atmospheric deposition has proven to be a significant challenge on which scientists and policymakers have continued to work together to achieve results. Most environmental laws and regulations have been written to control discharges to water to address water quality issues and discharges to air to address air quality issues. Atmospheric deposition is an issue that requires policymakers to cross these traditional boundaries and adapt regulatory tools in a way that will control impacts

Continued on back page



Some Current GLAD Projects

The GLAD program is currently sponsoring 19 projects, with nearly \$3 million in total funding. A complete listing of sponsored projects is available at www.glc.org/glad/projects. Some examples of current research activities are described below.

Fish Consumption and Human Health Outcomes

For many persistent toxic substances in the Great Lakes, fish consumption is the most significant human exposure route. Many of these chemicals become concentrated within the food chain (bioaccumulate) and can reach very high concentrations, especially in larger fish at the top of the food chain. Despite these concerns, fish also contain many important nutrients and can be a very beneficial to health. Researchers at the Wisconsin Department of Health and Family Services are conducting an epidemiological study to determine positive and negative health outcomes among a large cohort of Great Lakes fish consumers and a control group. Outcomes of the study will greatly help policymakers and the public better understand the health risks and benefits from eating Great Lakes fish.

Speeding Recovery of an Area of Concern

Presque Isle Bay in Erie, Pa., was the first Great Lakes Area of Concern to be designated an “Area of Recovery,” in which natural recovery of the bay has been chosen to improve the ecosystem health. Preventing continuing inputs of toxic substances, particularly PAH, to the bay is critical to ensuring and speeding up the natural recovery process. A research team at Gannon University has collected a year’s worth of air and precipitation samples at three sites in and around Erie and has analyzed them to determine PAH concentrations. These data are being studied to reveal where these toxic compounds are coming from and will be used to create strategies to reduce loadings of PAH to the bay.

Improving Knowledge of Mercury Sources and Exposure

There remains a significant need to better understand the amount of mercury that deposits to the region’s waters, where it comes from, and the processes that determine the distance it travels and its pattern of deposition. Several GLAD projects are tackling these issues. Work is being done to monitor for mercury in air and rain samples and determine source types and locations. Models are being used to examine mercury emissions, transport and deposition, and to determine the relationships between known sources and aquatic ecosystems. Researchers are also investigating the dynamics of mercury deposition to urban surfaces, the interactions of sulfur deposition and mercury accumulation, and the variations in mercury characteristics that influence its entry into the food chain. In all, these projects will make significant progress in helping state and national policymakers better understand the origin of mercury deposition and formulate better policies to prevent it.

Measuring Sources of Brominated Flame Retardants

Over the past decade, a series of chemicals known as brominated flame retardants have been detected in the environment, in wildlife and in human tissue throughout the world and it has been shown that these chemicals have been increasing in concentrations at a very rapid rate. Although production has stopped for many compounds, their continued presence in products will result in releases well into the future. These gradual and dispersed releases have proven to be a challenge to quantify and there are not currently any good estimates of how much of these chemicals are entering the environment. A research team at the University of Michigan is measuring brominated flame retardants within and outside of a variety of buildings to develop accurate estimates of how much of these compounds are entering the environment.



Continuing Needs

Despite considerable progress in achieving reductions in toxic substance levels and significant advances in research, many challenges remain. The following are examples of areas in need of expanded research.

Developing Total Maximum Daily Loads

Total Maximum Daily Loads (TMDLs) are a primary tool for state agencies to improve impaired water quality. The approach is to determine the total amount of pollution loading that a waterbody can sustain, identify current sources, and limit those sources in a way that results in the necessary input reductions. Many water bodies across the Great Lakes region suffer impairments due primarily to atmospheric inputs, including pervasive impairments due to mercury contamination. However, developing TMDLs that account for atmospheric inputs has proven challenging due to the complications in identifying sources and determining their relative contributions. Additional research and technology development is needed to assist in implementing these regulatory tools for atmospheric pollutants

Many water bodies
across the Great Lakes
region suffer impairments
due primarily to
atmospheric inputs

Addressing Chemicals of Emerging Concern

Additional chemical substances continue to be identified in the Great Lakes environment. For many newly identified substances, there is little information on risks of health impairments, making it difficult or impossible to determine if the measured amounts are a cause for concern. With tens of thousands of chemicals in commerce and many thousands more being produced by reactions of these chemicals in the environment, it is certain that more chemicals will be identified, particularly as detection

methods continue to improve. There is a need to efficiently identify potential risks, prioritize among possibly harmful chemicals, and determine their sources and emission levels. Toxicological research, modeling and information management systems are needed to address such issues.

Developing Linkages to Health Outcomes

Characterization of atmospheric emissions and concentrations has advanced substantially over the past 15 years, as has the characterization of human exposures through fish consumption and other routes. However, developing concrete links between atmospheric concentrations and water-related exposures remains an important need. In particular, information is needed regarding the fate of chemicals after they deposit to or enter water bodies and how direct the linkage is between recent deposition and human exposures. Answering such questions will help determine how quickly reductions in emissions can be expected to result in reduced threats to human health.

Filling Monitoring Gaps and Developing New Technologies

Although much monitoring of toxic substances in air and precipitation is done by Federal, state and academic projects, there remain many important gaps in the region's toxic monitoring systems. Some pollutants of concern are monitored rarely and in some cases current monitoring activities are only temporary. Monitoring within urban areas and over the Great Lakes themselves are areas of particular need. Continued innovation and improvement in monitoring technologies is needed to allow detection of more chemical species and at lower levels.

Great Lakes Air Deposition Program

Continued from page one

of air pollution on water quality. To develop and support the implementation of effective control strategies, a substantial amount of information is needed to show where deposited toxic substances are originating and what amount of reduction is needed to achieve water quality objectives. While much can be done at the regional and national level to reduce emissions, in many cases worldwide sources are now a significant factor influencing the overall deposition of many substances.

Under the GLAD program, the Great Lakes Commission is working with the region's state governments, the U.S. EPA, academic partners and many others to address significant scientific challenges in characterizing and controlling the deposition of toxic substances to the Great Lakes. GLAD-sponsored projects typically pursue research in one of five key areas: human and wildlife health impacts; monitoring technologies and programs; source identification and characterization; toxic emissions inventories; and modeling of chemical fate and exposure. Each of these presents unique challenges and is critical in achieving the program's overall goal of facilitating informed and effective management actions.

The GLAD program accepts proposals on a yearly basis for projects that will form part of a comprehensive strategy to address the above focus areas. The program anticipates awarding nearly \$700,000 to projects in 2007. However, this level of funding will support only a small fraction of the worthy research projects that are proposed and needed to address critical issues. As a result, considerable additional resources are required in this area. The Great Lakes Commission looks forward to working with its many partners in continuing to address this issue.

GLAD Program

The Great Lakes Air Deposition (GLAD) program is coordinated by the Great Lakes Commission to address the deposition of toxic pollutants to the waters of the Great Lakes region and to promote efforts to reduce such deposition and the resulting adverse impacts on human and wildlife health. Through scientific research projects and other activities, the GLAD program works with leading scientists to better understand the sources of toxic pollutants, their transport in the environment, their deposition to the Great Lakes basin and the resulting impacts on human health and the Great Lakes ecosystem. Funding for the GLAD Program is provided by the U.S. Environmental Protection Agency's Air and Radiation Division. For more information, contact Jon Dettling at dettling@glc.org.

Visit us online:

GLAD Program: www.glc.org/glad

Air Emissions Inventory: www.glc.org/air

Centralized Air emission Repository On-Line (CAROL): <http://mds.glc.org/carol>

For updates on the GLAD program, join our email list: www.glc.org/glad/gladinfo.html

Photos courtesy U.S. Environmental Protection Agency and the Michigan Tourism Bureau



Great Lakes Commission
Eisenhower Corporate Park
2805 S. Industrial Hwy., Suite 100
Ann Arbor, MI 48104-6791