# ATSDR Studies on Chemical Releases in the Great Lakes Region

**Agency for Toxic Substances and Disease Registry**

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Thank you to the staff of the National Center for Environmental Health/Agency for Toxic Substances and Disease Registry (NCEH/ATSDR) for their efforts in compiling *ATSDR Studies on Chemical Releases in the Great Lakes Region*.

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## Director's Preface

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The Great Lakes form one of the world's principal freshwater seas and one of North America's most spectacular and beautiful natural features. For the millions of people who live near the Great Lakes and the millions more who visit them, the lakes, the watersheds that feed them, and the surrounding land are a source of inspiration and sustenance.

But careless practices over many years have resulted in contamination of the Great Lakes ecosystem. Countless chemical products and byproducts of modern life—solvents, metals, pesticides, persistent organic pollutants, and more—have found their way into the air, water, land, and biota, and even into people's bodies. Substantial cleanup has already been accomplished, and more is underway. We are, however, only beginning to understand the consequences of this contamination.

For almost a century, since the 1909 enactment of the Boundary Waters Treaty, the International Joint Commission (IJC) has helped the U.S. and Canadian governments manage the lake and river systems along the border. An important expression of that commitment was the Great Lakes Water Quality Agreement (GLWQA), first signed in 1972. The GLWQA commits the United States and Canada to restoring and maintaining the chemical, physical, and biological integrity of the Great Lakes region ecosystem, and explicitly recognizes the importance of protecting human health as part of this task.

Since its formation more than 20 years ago, the Agency for Toxic Substances and Disease Registry (ATSDR) has been committed to protecting public health from chemical contamination. In 2001, the IJC asked ATSDR for "assistance in evaluating the public health implications of environmental contamination in Great Lakes Areas of Concern (AOCs) by providing information on ATSDR's public health assessments of hazardous waste sites within these AOCs." Areas of Concern are ecologically degraded places in the region. This report is the response to that request, which specifically stated

> In its 11th Biennial report, the IJC intends to comment on the hazards posed by the continuing presence of hazardous materials in the AOC's. To this end, the Commission would request that ATSDR provide to the Commission information on public health assessments that it has conducted on hazardous waste sites located within any of the 33 [*sic*] United States AOC's. It would be most helpful if ATSDR could identify evaluated sites with each AOC, the Hazard Category assigned to each site, any relevant demographic information available to ATSDR concerning populations at risk, completed exposure pathways identified, and the priority substances following these pathways.

This request was more complex than it appeared. AOCs did not correlate well geographically with waste sites that ATSDR had evaluated; some waste sites occupied small parts of an AOC while others were only partly contained within the AOC. Sources of contamination might be

outside an AOC but could still contribute to environmental pollution within that AOC. Many sources of contamination were not within ATSDR-evaluated sites.

In addition, many sites that ATSDR evaluated had since been remediated and did not provide current information regarding environmental contamination in the AOCs. Therefore, in assembling this report, ATSDR scientists considered whether additional data sources might be useful in answering the request. We surveyed many sources of data on environmental exposures and human health (see Appendix 3 for the environmental and health data that were considered).

Ultimately, four kinds of environmental data were included. At the core of the final report were the ATSDR site assessment/public health assessment data that addressed the specific IJC request quoted above. We have updated those assessments with additional information from the U.S. Environmental Protection Agency (U.S. EPA) and other sources to reflect remediation efforts since the time of the initial assessment. In addition, to provide a more complete picture of ongoing chemical inputs into the Great Lakes AOCs and to add value to the final report, ATSDR provided examples of data from three other major U.S. EPA data sources, including the Toxic Release Inventory (TRI), the National Pollutant Discharge Elimination System (NPDES) and the Impairments of Beneficial Use database. While each of these drew on a large, sophisticated database, important limitations remain: even these environmental databases taken together provide only a partial picture of the burden of chemical exposures people in the region face.

We also considered whether available health data would let us link environmental contamination in the region to human health concerns. For reasons further explicated in Chapter 1, we concluded that current data do not allow us to draw firm conclusions about the threat to human health from critical pollutants across the Great Lakes region. Further multi-agency research must address this essential public health concern. Although we were limited by available time and resources in the number of databases we could summarize in this document, we believe that the compilation of environmental data included here provides useful information to scientists, policy makers, and the public.

Limitations aside, a principal value of this report is that it compiles for the first time in one place information on 146 ATSDR site assessments conducted between 1982 and 2007 in the Great Lakes region and also provides updated information on their status. In addition, we provide some information on other chemical inputs into the Great Lakes region from publicly available datasets. A major conclusion of this report is that we need better and more integrated scientific data to allow us to assess threats that these chemicals may pose to human health. Even as we work to prevent pollution and to clean up the residua of past emissions—much-needed efforts that are well underway—we need to advance our understanding of the health consequences of chemical exposures. Better data are an essential first step.

*The preparation of this report*

An early draft of this report became public in 2007, before ATSDR had finished reviewing and finalizing it. That draft had unacceptable scientific limitations, described at http://www.atsdr.cdc.gov/grtlakes/pdfs/Scientific_Concerns.pdf. To assure the scientific quality of the final report, ATSDR obtained substantial internal and external scientific review of the penultimate draft of the report (including a review by the U.S. Institute of Medicine available at http://www.nap.edu/catalog.php?record_id=12476) and also invited public comment. After considering all of the comments, ATSDR carefully revised the report. Responses to the Institute of Medicine and to the public comments will be available on the ATSDR Web site.

In the course of that review and revision, several important points became clear.

First, good science matters. Earlier drafts did not clearly assemble and analyze the available data; as a consequence, the data as presented could have led to incorrect conclusions. ATSDR corrected the deficiencies and submitted the document to what we considered to be an appropriate review and clearance process for a document of this high level of importance and interest. The result is this December 2008 final document.

Second, good communication matters. Methods, data, and conclusions must be made clear to all report readers.

Third, people care passionately about the environment, about health, and about the links between the two. All of us—at our agency, across the Great Lakes region, across the nation—believe in wholesome, healthy, environments, and believe that accurate, timely information will help us get there. That shared concern is a precious resource.

This report aims to be accurate, informative, and useful to health professionals, decision-makers, and the public. It confirms that the Great Lakes region is contaminated with toxic chemicals, that we lack sufficient information about human exposure to these chemicals, that we are therefore limited in our ability to draw solid conclusions about their health impact across the region, and that we need better information. I am proud that our agency—together with many partners in government, academia, civil society, and the private sector—is taking steps to fill data gaps and improve our understanding, from our Great Lakes Human Health Effects Research Program (http://www.atsdr.cdc.gov/grtlakes/program-overview.html) to our Biomonitoring program (http://www.cdc.gov/biomonitoring/).

This report is an important step on the journey toward understanding the public health implications of environmental contamination in the Great Lakes region. We need to work hard to build that understanding. More importantly, we need to apply that understanding, by taking effective action to protect people now and in the future, and to sustain a healthy ecosystem.

## Executive Summary

*Background*

This report responds to and extends a 2001 request from the International Joint Commission (IJC), the binational organization that works to implement the Great Lakes Water Quality Agreement (GLWQA) between the United States and Canada. The GLWQA calls for the two nations to define "the threat to human health from critical pollutants" found in the Great Lakes region. This final report supersedes all previous drafts and contains responses to public comments and to those comments in a review of the penultimate draft of this report from the Institute of Medicine (IOM) of the National Academies.

Among other things, the GLWQA calls on the two nations to define "the threat to human health from critical pollutants" found in the Great Lakes region. In its December 2001 request, the IJC asked ATSDR to review those health assessments it had conducted on hazardous waste sites within "Areas of Concern" on the United States side of the Great Lakes region. The IJC stated further that

> It would be most helpful if ATSDR could identify evaluated sites within each AOC, the Hazard Category assigned to each site, any relevant demographic information available to ATSDR concerning the populations at risk, completed exposure pathways identified, and the priority substances following these pathways.

*This report*

The GLWQA defines "Areas of Concern" (AOC) as ecologically degraded geographic regions that require remediation. This report summarizes ATSDR, U.S. Environmental Protection Agency (U.S. EPA), and state agency activities in 26 AOCs along Great Lakes streams, rivers, and lakes in the United States. In addition, because waste sites and other sources of environmental data frequently do not correlate well geographically with AOCs, we have also provided information on 54 counties in close geographic proximity to the included AOCs.

*The pollutants*

The GLWQA defines "critical pollutants" as substances that persist in the environment, bioaccumulate in fish and wildlife, and are toxic to humans and animals. The GLWQA lists 11 critical pollutants. This report emphasizes the critical pollutants within the constraints imposed by available data and also provides information on other pollutants. Where information on other pollutants is available from included sources and thought to be of interest to some readers of this report, we have included it as well.

*Environmental data*

At the core of the final report are the ATSDR site assessment/public health assessment data from hazardous waste sites in the AOCs or in counties that are in close proximity to AOCs. We have updated those assessments with additional information from the U.S. EPA and other sources to reflect remediation efforts since the time of the initial assessment.

In addition, to provide a more complete picture of ongoing chemical inputs into the Great Lakes AOCs and add value to the final report, ATSDR provided examples of data from three other major U.S. EPA data sources, including U.S. EPA 2001 chemical release data from its Toxic Release Inventory (TRI), U.S. EPA 2004 data on pollutant discharges into water, from its

National Pollutant Discharge Elimination System (NPDES), and data on "beneficial use impairments," such as wildlife and drinking water advisories, from each of the Great Lakes states.

The data in the report are presented in three ways: in text, in tables, and in Geographic Information System-based (GIS) maps created by ATSDR for each of the 26 U.S. AOCs and the 54 AOC counties that lie within or in close proximity to the AOCs. We have provided information that was current as this document was prepared. These datasets are, however, updated on an ongoing basis, and the most current information is found on the U.S. EPA and ATSDR Web sites.

*Health Data*

To assess potential health effects related to AOCs, health data should be

- biologically associated with relevant exposures, and
- well-matched to the environmental data in space and time.

Except as noted in the context of ATSDR health assessment documents, no currently available health data meet these needs; thus, the body of the report does not include other health data. The bibliography and Appendices 3 and 4 summarize additional environmental health data and research relevant to the region (though not specific to AOCs) and ATSDR remains committed to improving the availability and relevance of data linking health and environment.

*Conclusions*

This report yields six principal conclusions.

1. As a result of both past and ongoing releases, environmental pollution in the Great Lakes region is widespread. Of 146 hazardous waste sites located in AOC counties and evaluated by ATSDR, many have been remediated; but others are still undergoing long-term remediation. In addition, recent data from EPA databases demonstrate ongoing chemical releases in the region.
2. Throughout the region, fish tissue monitoring detects contaminant levels at or above levels thought to pose a risk to human health as determined by state and federal regulatory agencies. These monitoring efforts have led to the issuance of advisories to limit fish or wildlife consumption in all but one of the 26 AOCs—Presque Isle Bay in Pennsylvania. Fish advisories that result from chemical releases into an AOC are in some cases specific to locations within that AOC, and in other instances are regional.
3. The data reported here do not reflect the totality of chemical pollution in the region. Many sources of contamination exist that are not ATSDR-evaluated sites. TRI data did not reflect the totality of toxic releases: reporting exemptions included small firms, firms from certain industry sectors, and other categories of emitters. The NPDES data did not include information on nonpoint-source water pollutants. Thus, available data even taken together do not include exposures from pesticide applications, from mobile sources, or from indoor sources. Hence the data provide only a partial picture of contaminants in the environment.
4. The available information on environmental pollution provides little insight on the *exposure* of people to pollutants. TRI data on chemicals used and emitted, and NPDES

data on chemicals discharged into water, do not indicate whether these chemicals reach people and enter their bodies. ATSDR assessments of hazardous waste sites do, however, include analysis of exposure pathways, and, when available, include data on how much exposure actually occurs.

5. Current data do not allow us to draw firm conclusions about relationships between critical pollutants in the Great Lakes region and potential health effects.
    - Data that are routinely collected (such as information on cancer and birth defects) are not well matched to exposure data in time or by location and therefore cannot help to assess whether the identified environmental exposures have adverse health consequences.
    - In addition, data are not routinely collected on some important health effects that might be associated with toxic exposures such as neurobehavioral, endocrine, reproductive, and immune effects.
6. Although much research on environmental contamination and related health issues has been done in the Great Lakes region, more is needed. From 1992 to 2008, the ATSDR Great Lakes Human Health Research Program has provided approximately $32 million in extramural research funding to the Great Lakes region. For ATSDR, this represents a tangible commitment to public health in the region. Data from these studies have provided useful information to important public health issues and are vital to improving and safeguarding human health in the Great Lakes region. For more information on the Great Lakes Human Health Effects Research Program, see Appendix 4.

*Recommendations*

Additional work is needed to permit scientists, decision makers, and members of the public to define and take action to reduce the threat to human health from pollutants in the Great Lakes region. Needs include

1. Original data on environmental contaminants, including characterization of air, water, soil, foods, consumer goods, and pathways of exposure.
2. Modeling of exposure pathways using appropriate information about historical environmental exposure especially to provide information about potential causes of health conditions with long latencies.
3. Increased biomonitoring to characterize amounts of chemicals in the bodies of people living in the Great Lakes region.
4. Development of health data linkages to permit joint analyses of the various environmental data sets and linkage between health and environmental data.
5. Collection of data on a broader range of outcomes that may be associated with chemical exposure such as neurobehavioral, endocrine, reproductive, and immune functions.
6. Performance of analytical epidemiology studies to investigate specific hypotheses arising from the foregoing data sets, including advanced techniques for measuring exposure and outcomes, careful consideration of individual variability in susceptibility including genetic analyses, careful control of confounders, and sophisticated data analysis.

7. Appropriate public health action based on the foregoing information, such as developing standardized criteria for restrictions on human consumption of Great Lakes region fish.

Given the magnitude of needed actions, additional work will require a coordinated, collaborative effort by the relevant state and federal agencies and partners.

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