

## Existing Great Lakes Chemical Monitoring Programs

The Great Lakes region is fortunate to have a number of programs that monitor for PBTs and other toxic substances. A number of major programs, mostly those that are ongoing, are listed below. This list is by no means 100% comprehensive; many one-time projects are not included.

Include RAPIDS (emissions inventory) and TRI?

### AIR

The **Integrated Atmospheric Deposition Network (IADN)**, a joint U.S.EPA-Environment Canada program, monitors concentrations of PCBs, pesticides, PAHs, and trace metals in the air and precipitation of the Great Lakes basin. Limited monitoring has been conducted for dioxins and furans, mercury, and PBDEs.

The **National Air Pollution Surveillance (NAPS)** network collects data on ambient air levels of toxics at rural, suburban, city-centre, and industrial sites in Canada. This effort is carried out by Environment Canada in cooperation with provincial environmental and municipal agencies. The program includes measurement of volatile organic compounds (VOC), including toxics and ground-level ozone precursors, polar volatile organics (PVOC) such as aldehydes and ethers, components of fine particulate matter (PM), including metals and inorganic and organic ions, and persistent, toxic semi-volatile organic compounds (SVOC) such as benzo(a)pyrene and polychlorinated dibenzo-p-dioxins (CDDs) and furans (CDFs).

The **Mercury Deposition Network (MDN)** began in 1995 and measures total mercury (and in some cases, methylmercury) in precipitation. Over 85 sites currently are in operation, including sites in most of the Great Lakes states (excluding Michigan and Ohio) and in Ontario.

The **Michigan Mercury Deposition Network**, run by Michigan DEQ and University of Michigan (Dr. Jerry Keeler), has been in operation in some form since late 1994. The network monitors speciated mercury in air and precipitation at rural and urban sites in Michigan.

In 1996, Environment Canada initiated the **Canadian Atmospheric Mercury Measurement Network (CAMNet)**, which consists of 11 sites that span the country. Tekran mercury analyzers are used to monitor total gaseous mercury (TGM) concentrations, and RGM is monitored at some sites. Precipitation mercury measurements are taken at some of the sites through the MDN.

Atmospheric concentrations of dioxins, furans, and coplanar PCBs are monitored by the **National Dioxin Air Monitoring Network (NDAMN)**, with a focus on meat and poultry-producing areas. NDAMN stations in the Great Lakes region include Fondulac, MN; Lake Dubai, WI; and Jasper, NY. Funding for this network is currently ending (as of March 2005).

### WATER AND SEDIMENTS

Since 1980, the Ontario Ministry of the Environment (OME) **Enhanced Tributary Monitoring Program (ETMP)** has been collecting water samples (and biota?) near the mouths of 16 strategically chosen watersheds throughout the Great Lakes Basin representing approximately 50% of the total flow into the Great Lakes from Canadian watersheds. Currently, approximately 20 samples per year are collected at each station with an emphasis on the spring freshet, which typically accounts for a significant proportion of annual contaminant loadings. Samples are analysed for trace organics (PCB congeners, organochlorines, chlorobenzenes, and PAHs), physical parameters, nutrients, and metals, as well as other in-use pesticides at selected locations.

Through the **Great Lakes Index Station Network Monitoring** program, OME samples at 66 stations in summer to determine concentrations of priority toxic contaminants in sediment and suspended particulate material. Summer species composition and abundance of benthic invertebrates are monitored as a biological indicator of overall ecosystem health and as a general stress response indicator.

Through Environment Canada Ecosystem Health Division's (EHD) **Great Lakes Surveillance Program**, water quality is monitored in the Great Lakes via cruises alternated between the lakes except Lake Michigan so that each is monitored biennially. Water quality information (for both organic and inorganic compounds) is collected along with supporting information.

EHD conducts **water quality monitoring on the Interconnecting Channels** of the Great Lakes (i.e. St. Lawrence, Niagara, St. Clair and Detroit Rivers) to assess upstream/downstream loadings of pollution. Water and suspended sediment samples are collected to determine concentrations and loadings of trace organics (pesticides, chlorobenzenes, PCBs, PAHs, and chemicals of emerging concern).

EHD also operates the **Tributary Track-down Program**, which screens sediments in Lake Erie and Lake Ontario tributaries for contaminants to determine the extent of contamination as well as to help indicate if ongoing sources may be present in watersheds.

For the above EHD programs, see <http://www.on.ec.gc.ca/monitoring/water-quality/intro-e.html>

U.S. EPA-GLNPO initiated the **Great Lakes Aquatic Contaminant Surveillance (GLACS)** program in 2003 to monitor levels of PCBs, organochlorine pesticides, PAHs, mercury, dioxins and furans, and pollutants of emerging concern (PBDEs and PFOS/PFOA) in Great Lakes water. Similar monitoring for organochlorines had been undertaken by GLNPO in the mid-1990s. Monitoring will most likely rotate among the Lakes, with a focus on one Lake each year (following the U.S-Canada Cooperative Monitoring program).

The **Great Lakes Sediment Assessment Program**, begun in 1997, assesses contaminant concentrations in sediment in the Great Lakes.

[www.nwri.ca](http://www.nwri.ca)

In order to determine the nature and extent of sediment contamination, GLNPO uses the R/V Mudpuppy to conduct sampling to perform **sediment assessments at in Great Lakes AOCs** in the U.S.

The Lake Erie-Lake St. Clair Basin is one of more than 50 study units that are part of the U.S. Geological Survey's **National Water-Quality Assessment (NAWQA) Program**. Sediment and water samples from this unit have been analyzed for organic contaminants as well as in-use pesticides.

<http://oh.water.usgs.gov/nawqa/index.html>

## **FISH**

The Canadian **Department of Fisheries and Oceans (DFO) Great Lakes Fish Contaminants Surveillance Program** was developed jointly with the U.S. EPA and the U.S. Fish and Wildlife Service (FWS) and was initiated in 1977. Lake trout (or walleye for western Lake Erie) are collected in cooperation with the Ontario Ministry of Natural Resources and DFO collects prey fish species (alewife, sculpin, smelt) and invertebrate diet items (Mysis, Diporeia, plankton) at a subset of the monitoring sites annually. Fish are collected at 10 sites annually, but the sites rotate among 4 sites on each Lake. Whole fish are analyzed for PCBs, OC pesticides, and mercury. A subset of the samples is analyzed for non-routine contaminants (toxaphene, dioxins and furans, chemicals of emerging concern) by the EC Ultra-trace Laboratory at Burlington. DFO also measures a limited number of metals (arsenic, copper, cadmium, lead, nickel, and zinc) in selected forage fish. DFO maintains a tissue bank for retrospective analysis.

The U.S. EPA Great Lakes National Program Office (GLNPO), in cooperation with the eight Great Lakes States and USGS Biological Research Division, monitors PBTs in fish in the open waters and tributaries of the Great Lakes through the **Great Lakes Fish Monitoring Program (GLFMP)**. The program has been operating in some form since the 1960s. The first element of the program monitors contaminants in whole lake trout (walleye in Lake Erie) to assess temporal trends in the open waters of the Lakes, as well as to assess the risks of such contaminants on the health of the fishery and on the wildlife that consume them. The second element monitors contaminants in skin-on fillets of popular sport fish, coho and chinook salmon (rainbow trout in Lake Erie), to assess human exposure.

The **Great Lakes States and Tribes** also operate their own **fish contaminant monitoring** programs, which are used to determine fish consumption advisories. Fish advisory guidance varies from state to state.

## **OTHER WILDLIFE**

Long-term monitoring of contaminant levels in mussels, zebra mussels, juvenile fish, and selected sport fish is undertaken via the **Ontario Biomonitoring Program** to track levels of PBTs across the Great Lakes. Sport fish results track trends over the basin as a whole, as well as forming the basis of the Guide to Eating Ontario Sport Fish. Mussel and juvenile fish data provide a means of identifying problem zones and potential contaminant sources. The **Ontario Sport Fish Contaminant Monitoring Program** is part of this effort.

The Canadian Wildlife Service (CWS) of Environment Canada has been monitoring levels of persistent toxics (including organochlorines and mercury) in **herring gull eggs** at 15 Great Lakes

sites since 1974. The Michigan Department of Environmental Quality (MDEQ) began a similar annual gull egg monitoring project in 1999, augmenting the CWS work. In addition to Herring gull egg monitoring, the CWS occasionally measures contaminants in eggs from double-crested cormorants, ring-billed gulls, black-crowned night herons, great black-backed gulls and several species of terns. CWS has also performed periodic contaminant monitoring in **amphibians and ospreys**.

For more than 20 years, the Canadian Wildlife Service (CWS) has periodically collected **Snapping Turtle eggs** and examined the species' reproductive success in relation to contaminant levels on a research basis.

Populations of **bald eagles** nesting on the shores of Lakes Erie and Ontario have been monitored annually by Ontario Ministry of Natural Resources, Canadian Wildlife Service, and Bird Studies Canada since 1983. Between 1988-1999, blood and feather samples were taken from eaglets to monitor levels of PCBs, organochlorine pesticides, and heavy metal contaminants.

Environment Canada initiated the **Fish and Wildlife Health Effects and Exposure Study** in 2001. The goal of this systematic assessment in Canadian AOCs is to determine if there are fish and wildlife health effects, similar to those reported for the human population, that are associated with contaminants in the aquatic environment. Phase I (2001-2005) of the study investigates conditions in the Canadian AOCs of the lower Great Lakes. Upon completion, the need for assessments at AOCs in the upper Great Lakes will be determined.

## **HUMAN BIOMONITORING**

A recent study conducted by the Wisconsin Department of Public Health (WiDPH) analyzed the level of bioaccumulative toxic chemicals in women of childbearing age (18 – 45) in the Great Lakes Basin. Samples were collected from women who used 3 different Women Infant and Child (WIC) clinics located along Lakes Michigan and Lake Superior.

A similar study was conducted by a partnership of the Assembly of First Nations, Health Canada and First Nations in the Great Lakes basin between 1990 and 2000 to examine the effects of contaminants on the health of the Great Lakes Aboriginal population. The Contaminants in Human Tissues Program (CHT) identified three main goals:

- To determine the levels of environmental contaminants in the tissues of First Nations people in the Great Lakes Basin;
- To correlate these levels with freshwater fish and wild game consumption; and
- To provide information and advice to First Nations people on the levels of environmental contaminants found in their tissues.

In 2000, Health Canada compared the incidence of morbidity and mortality in human populations in the 17 Areas of Concern (AOCs) in Ontario to rates for the province as a whole. The Health Canada studies were based primarily on hospital and census databases. For each AOC, specific data were compiled on a variety of diseases and disorders, such as cancer incidence, reproductive disorders, and congenital deformities. A second, independent analysis of

the Health Canada data focused on two highly industrialized AOCs, Windsor and Hamilton [see Environmental Health Perspectives 109 (6): 827-843 (2001)].

Initiated in 1992, the Agency for Toxic Substances and Disease Registry (ATSDR) Great Lakes Human Health Effects Research Program (GLHHERP) is designed to characterize exposure to contaminants via consumption of Great Lakes fish and investigate the potential for short- and long-term adverse health effects via grants to researchers.

While there have been many small-scale human biomonitoring studies, no Great Lakes regional human biomonitoring program, which could be conducted similarly to the CDC National Health and Nutrition Examination Survey (NHANES) project, has been undertaken.