# HARMFUL POLLUTANTS

## Toxic Substances, Legacy Contaminants and Substances of Emerging Concern

*What happens when harmful pollutants end up in the Great Lakes?*

GREAT LAKES FACT SHEET

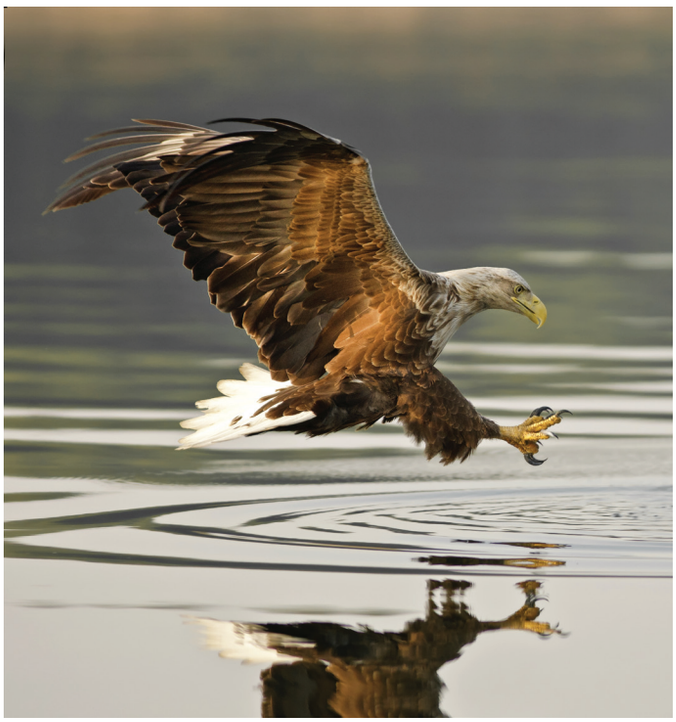
10

# Background

The Great Lakes played a critical part in North America's industrial development. Substances such as mercury, PCBs (polychlorinated biphenyls) and DDT (dichlorodiphenyltrichloroethane) were widely used and often ended up in the lakes because the resulting environmental and health impacts were not well understood. Canada and the United States have made considerable progress in reducing the levels of some of these historical contaminants found in the lakes.

The management of PCBs is one example of the progress that has been made. PCBs do not biodegrade or decompose significantly in the environment and while they were never manufactured in Canada, they were widely used in industrial applications throughout the 1970s. In 1977, they were banned from import, manufacture and sale, and in 1985, their use was made illegal. By 2007, Ontario had destroyed over 90 per cent of PCBs in storage and reduced those in use by 68 to 70 per cent against a targeted reduction of 90 per cent.

The targets for PCB reductions were set under the Great Lakes Binational Toxics Strategy (GLBTS), signed by Environment Canada and the U.S. Environmental Protection Agency in 1997. The GLBTS set seventeen goals to reduce the use and presence of twelve high-priority substances and implement pollution prevention measures for other pollutants. Of the seventeen goals established in 1997, thirteen have been achieved, and significant progress has been made on the remaining four.



## WHAT ARE HARMFUL POLLUTANTS?

Everything in the world, from the air we breathe to the clothes we wear, is composed of chemicals in various combinations. Some of these chemicals, however, have been linked to possible harmful effects on human health and the environment. These harmful pollutants are released from a variety of sources, and some of them can travel easily throughout the environment, depositing on land and water far from where they originate. While some are released through natural events such as forest fires, most are released through human activities. Transportation, heating, coal-fired electricity generation, mining, industrial processes, incineration of waste, and the use and disposal of consumer products are all potential sources of harmful pollutants.

It was in studies of the Great Lakes that many scientists first observed the effects of harmful pollutants on the environment. Toxic substances were discovered in wildlife during routine monitoring. In the 1960s and '70s, some bird populations were critically depleted, others had difficulty hatching their eggs, and still others could not reproduce at all. Fish showed signs of contamination as well, including tumours and reproductive difficulties. Targeted actions to control many of the sources of these pollutants have resulted in a significant improvement in water quality in the lakes, and by the late 1970s, decreases in the levels of toxic substances allowed many species to regain their vitality. For example, the bald eagle population has recovered significantly from its decline in the 1960s – in 2009, its status in southern Ontario was upgraded from "endangered" to "special concern."

However, some relatively new substances, as well as older substances whose effects are only now being detected, are presenting new challenges. Although the effects of exposure to current levels of these substances of emerging concern remain unclear, they are considered potential risks to the environment and human health.

## HOW DO HARMFUL POLLUTANTS AFFECT THE GREAT LAKES?

### Harmful pollutants ...

- **may persist in the lakes:** Some harmful pollutants do not easily break down into less harmful substances in the Great Lakes environment. These persistent substances pose a particular challenge for remediation and, in some cases, are legacy contaminants — substances that remain in the environment long after their use has been discontinued.

- **can bioaccumulate and biomagnify:** Some toxic substances can build up in the bodies of individual organisms (bioaccumulation), and some of these substances become increasingly concentrated as they move up through the food chain when a predator species consumes contaminated prey (biomagnification). The high levels of mercury found in some large, predatory Great Lakes fish are an example of how these processes of bioaccumulation and biomagnification work. Testing has also revealed high levels of mercury in the blood and tissue of people who eat a lot of these fish.

- **affect human health:** As the concerns about mercury in Great Lakes fish demonstrate, harmful pollutants have been linked to a number of human health effects. Drinking water is another potential source of human exposure to harmful pollutants. Water treatment plants around the Great Lakes produce some of the safest drinking water in the world, but they were not designed to remove some substances of emerging concern. The effects of harmful pollutants on human health range from temporary and relatively mild to chronic and serious. They vary from substance to substance and even from one person to another, depending on factors such as genetic susceptibility and stage of development at the time of exposure. For example, children eat, breathe and drink more per unit of body weight than adults and are thus subject to greater exposure to contaminants in their environment.

- **impact wildlife populations:** Wildlife often act as early indicators of potential large-scale environmental impacts and effects on human health. Harmful pollutants can affect the ability of a species to develop, reproduce and survive. Scientists have noted a possible correlation between some substances of emerging concern and disruptions of the endocrine system, which regulates hormone levels in living organisms. For example, it has been suggested that a male-biased ratio in herring gull egg hatches and the feminization of 10 per cent of adult males are results of endocrine system disruptions caused by some of these substances of emerging concern.

- **have an economic impact:** It has been estimated that a cleanup of sites identified as Areas of Concern (AOCs) under the Great Lakes Water Quality Agreement (GLWQA) would result in a cumulative increase of $12 to $19 million in coastal property value. Similarly, protecting fish habitats and the food chain is key to supporting profitable and sustainable sport and commercial fisheries.

## CHALLENGES AHEAD

While some harmful pollutants in the Great Lakes have been controlled with considerable success, the following are some examples of the challenges that lie ahead:

**Non-point sources:** When releases of the same type of substance originate from multiple sources rather than from a single, identifiable point of origin, such as an industrial facility or sewage treatment plant, the sources are referred to as non-point sources. Runoff from roads, parking lots, vehicles and agricultural fields is an example of non-point source pollution that finds its way into the Great Lakes. Runoff can collect oils, road salt, pesticides, fertilizers and other potentially hazardous materials as it moves across the land and into the water. Because of their large surface areas, the Great Lakes are also particularly vulnerable to the deposition of airborne pollutants, another non-point source of contamination.

**Sewage effluent and water treatment:** The capacity of sewage treatment facilities and storm drains is often not adequate to deal with heavy precipitation, resulting in releases of untreated stormwater and sewage into the Great Lakes. Sewage effluent contains a variety of potentially toxic substances and has been, by volume, one of the top sources of pollution in the lakes. In addition to these ongoing problems, municipal treatment plants were not designed to break down many of the substances that have now been detected in wastewater, such as pharmaceuticals and household hazardous wastes.

**Consumer products and pharmaceuticals:** Harmful pollutants originating from consumer products, prescription medication, cleaning supplies, gardening products, solvents, paints, batteries and fuels have been found in increasing concentrations in the lakes. Polybrominated diphenyl ethers (PBDEs) and pharmaceuticals and personal care products (PPCPs) are two examples of these pollutants that have been identified as substances of emerging concern.

PBDEs are commonly used as flame retardants and heat stabilizers in a variety of products, including televisions, computers and other electronics, clothing, furniture and carpeting. PBDEs make their way into the environment when products containing them are subjected to everyday wear and tear or are disposed of in landfills or through incineration. Studies conducted on laboratory animals have linked PBDE exposure to cancer, reproductive disorders, behavioural problems and damage to the thyroid.

PPCPs include prescription and over-the-counter pharmaceuticals, such as antibiotics, birth control pills, and veterinary medicines, as well as insect repellents, fragrances, cosmetics, sunscreens, deodorants and antibacterial compounds. PPCPs can end up in the water supply through direct discharges from pharmaceutical plants, residues in wastewater and urine, and disposal into the sewer system. Many sewage treatment plants are not equipped with the technology necessary to remove these substances. Some PPCPs are suspected of causing disruptions to the endocrine system, and aquatic organisms have exhibited reproductive abnormalities, such as deformed sexual organs or an altered ratio of males to females, after even low exposure to some PPCPs.

## WHAT IS BEING DONE?

In addition to the Great Lakes Binational Toxics Strategy, there are a number of initiatives in place to address harmful pollutants in the Great Lakes. The following are some examples of these strategies:

### International Collaboration

» **Great Lakes Water Quality Agreement (GLWQA):** Signed by Canada and the U.S. in 1972 and amended most recently in 2012, the GLWQA addresses persistent toxic substances, airborne toxic substances and hazardous pollutants in the Great Lakes. The agreement seeks zero discharge and virtual elimination of the toxic substances deemed most detrimental. Virtual elimination means reducing the quantity or concentration of a substance in a release to below the lowest level that can be accurately measured using sensitive but routine sampling and analytical methods.

### Federal Initiatives

» **Canadian Environmental Protection Act, 1999 (CEPA 1999):** CEPA 1999 governs many aspects of the assessment and legislation of toxic substances throughout their life cycles. One of the guiding principles of CEPA 1999 is the virtual elimination of the most toxic, persistent and bioaccumulative substances.

### Provincial Initiatives

» **Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA):** This agreement, ratified in 1971 and currently being updated to reflect recent amendments to the GLWQA, makes provision for the federal and provincial governments to work together on issues related to the Great Lakes. The COA addresses harmful pollutants in its Harmful Pollutants Annex.

» **Ontario Toxics Reduction Act:** This act requires business owners to track and quantify any toxic substances that they create, use and release, to develop toxic substances reduction plans and to report regularly on progress against these plans.

» **Ontario Environmental Protection Act:** This act governs how hazardous materials are handled, controlled and disposed of within the province.

» **Municipal Industrial Strategy for Abatement (MISA):** MISA focuses on the abatement of persistent toxic substances entering Ontario's waterways from major industrial toxic polluters.

» **Cosmetic Pesticides Ban:** Implemented in 2009, Ontario's pesticide ban eliminated, with some exemptions, the use of pesticides to control weeds and insects for purely cosmetic purposes in lawns, gardens, schoolyards and parks.

## WHAT CAN YOU DO?

- **Divert wastes that may contain hazardous materials from regular garbage disposal:** Contact your municipality for information related to the collection and disposal of hazardous materials or to find out if something qualifies as hazardous waste. Some pharmacies also offer a safe disposal service for expired medication and other pharmaceutical products.
- **Read the label before you buy a product and always make informed purchasing decisions:** Protect yourself, your family and the Great Lakes by choosing household cleaners, soaps, cosmetics and other products that do not contain hazardous materials.
- **Follow fish advisories, particularly as they apply to children and women of child-bearing age:** If you are eating fish from the Great Lakes, check the consumption guidelines in the *Guide to Eating Ontario Sport Fish*.
- **Get involved:** Look for opportunities to get involved in public consultations on important issues such as harmful pollutants and on agreements and legislation related to the Great Lakes. Urge government, businesses and other organizations to take action on Great Lakes issues.


## SELECTED RESOURCES

For more information on harmful pollutants and the Great Lakes, consult the following resources:


Environment Canada. Canadian Environmental Protection Act, 1999. **http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=26A03BFA-1**

Government of Canada. Chemical Substances. **http://www.chemicalsubstances.gc.ca**

Great Lakes Binational Toxics Strategy. **http://binational.net/bns/index-e.html**

Health Canada. Consumer Product Safety. **http://www.hc-sc.gc.ca/cps-spc/index-eng.php**

International Joint Commission. Great Lakes Water Quality Agreement. **http://www.ijc.org/rel/agree/quality.html**

Ontario Ministry of the Environment. Drinking Water Ontario. **http://www.ene.gov.on.ca/environment/dwo/en/index.htm**

Ontario Ministry of the Environment. Guide to Eating Ontario Sport Fish. **http://www.ene.gov.on.ca/environment/envision/guide/**

Ontario Ministry of the Environment. Toxic Substances. **http://www.ene.gov.on.ca/environment/en/category/toxic_substances/index.htm**

Pollution Probe. Primer on Toxic Substances. **http://www.pollutionprobe.org/whatwedo/chemicals/toxicsprimer**

Pollution Probe. The Source Water Protection Primer. **http://www.pollutionprobe.org/report/swpprimer.pdf**

Stewardship Ontario. Orange Drop Recycling Program. **http://www.makethedrop.ca/**



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**PHOTOS**

**Front cover:** © Alex Senson. Bird banding programs are an important means of monitoring the effects of harmful pollutants on wildlife.

**Non-point sources:** Road salt. © Charley Lhasa.

**Consumer products and pharmaceuticals:** © tiramisu_addict.