



Guidelines at a Glance

Canadian Water Quality Guidelines

Inorganic Mercury and Methylmercury

This fact sheet describes the Canadian Water Quality Guidelines for inorganic mercury and methylmercury to protect freshwater and marine life. It is part of the series *Guidelines at a Glance*, which summarizes information on toxic substances and other parameters for which there are Canadian Environmental Quality Guidelines.

The National Guidelines and Standards Office of Environment Canada coordinates the development of Canadian Environmental Quality Guidelines in cooperation with the Canadian Council of Ministers of the Environment (CCME).

Where does mercury come from?

Mercury is a metallic element that occurs naturally in the earth's crust. Most of it occurs as cinnabar, a mineral composed of mercury sulphide. Small amounts of free metal may also be present in some rocks. Mercury is released slowly from minerals and rocks as they erode under normal weather conditions. Other natural sources of mercury include forest fires and other wood-burning events, volcanoes, and hot springs. Anthropogenic sources of mercury in Canada include: metal smelting; coal-burning power plants; municipal waste incineration; sewage and hospital waste incineration; coal and other fossil fuel combustion; cement manufacturing; and mercury waste in landfills or storage. Mercury is used in a variety of products, including thermometers, barometers, and electrical products such as dry-cell batteries, fluorescent lamps, and electrical switches. Cavities in teeth are filled with dental amalgam, an alloy of silver and mercury.

Most major mercury sulphide deposits in Canada are in British Columbia, with one deposit in Ontario. In the past, mercury mines operated in Canada, but none exist now.

What happens to mercury released into the environment?

Mercury has a complicated global cycle that involves movement among the various environmental compartments (living and non-living), long-range transport, and chemical transformations. Mercury in the atmosphere can be carried thousands of kilometres and enter ecosystems by falling in dust or in rain and snow. Inorganic mercury that enters fresh and salt (marine) water can be altered chemically into two organic forms: methylmercury and dimethylmercury. Of these two forms, methylmercury is a greater environmental concern because it accumulates in food webs to levels that are toxic to fish and wildlife. Because of these processes, even a minuscule amount of mercury in the water can have adverse effects on aquatic organisms and their predators.

Aquatic plants take inorganic mercury and methylmercury directly from the surrounding water while aquatic animals, such as fish and shellfish, get mercury both from water and from eating food contaminated with mercury. Essentially all the mercury in the bodies of large predatory fish and wildlife comes from the food they eat.

What effects can mercury have on fish and other forms of aquatic life?

In comparison to organisms not exposed to mercury, aquatic plants and animals living in mercury-polluted water are likely to be smaller in both length and weight, and to have physical deformities, reproduction disorders, and a shorter life span. Mercury is a neurotoxin that damages or destroys nerve tissue. When mercury enters the body, it moves into the bloodstream and is carried to the liver, kidneys, and brain, causing a variety of neurological symptoms. Mammals that accumulate toxic levels of mercury show signs of brain damage by abnormal behaviour, eating disorders, loss of balance, lack of coordination, and paralysis of the legs. Selenium, which is an essential trace nutrient, can partially nullify the negative effects of mercury.



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What levels of mercury are safe for plants and animals that live in Canadian waters?

The Canadian Water Quality Guideline (CWQG) to protect freshwater life is 26 nanograms of inorganic mercury per litre of water (in other words, 26 parts per trillion). For methylmercury, the interim CWQG is 4 nanograms per litre of water. These freshwater guidelines are based on many scientific studies that examined the impacts of mercury on plants, invertebrates, and fish that live in our lakes and rivers. The methylmercury interim guideline is recommended for direct exposure to methylmercury in water. It may not protect freshwater animals that are exposed to methylmercury through their food.

The interim CWQG to protect marine life is 16 nanograms of inorganic mercury per litre of water. This marine guideline is based on scientific studies that examined the impacts of mercury on plants and animals that live in our estuaries and along our coasts. We did not have enough information to calculate a marine guideline for methylmercury.

If the levels of inorganic mercury and methylmercury measured in a lake, river, estuary, or ocean are less than the corresponding guideline, one would not expect to see adverse health effects in even the most sensitive species. In places where the CWQGs for mercury are exceeded, adverse effects will not necessarily occur. Whether effects will occur depends on the amount by which the guideline levels are exceeded and on the kinds of plants and animals that live there. When the CWQG was developed, exposure to methylmercury through food or accumulation in the food web was not addressed. Therefore, aquatic life such as predatory fish may not be adequately protected. Further investigation at a particular site is needed to determine whether or not there is a negative impact.

In order to protect wildlife species that depend on aquatic organisms for food, Canadian Tissue Residue Guidelines (CTRGs) have also been developed for methylmercury. The CTRGs are based on the highest concentration of methylmercury in the body tissues of aquatic food organisms that is not expected to result in adverse effects to wildlife. A separate *Guidelines at a Glance* fact sheet describes these CTRGs in more detail.

How do levels of mercury in Canadian waters compare to the guidelines?

In most Canadian fresh and marine waters, levels of total mercury (inorganic mercury plus methylmercury and other organic forms) are less than 20 nanograms per litre of water (parts per trillion). Water testing in Ontario and Quebec showed methylmercury levels were generally less than 1 nanogram per litre of water, with some exceptions. In these tests, methylmercury ranged from <1% to 73% of total mercury, but was usually <20%. Elsewhere in Canada, mercury levels in rainwater have been measured but not in lake, river, or sea water.

How can CWQGs be used to make a difference?

In general, Canadian Water Quality Guidelines can be used by Canadian federal, provincial, and territorial governments on a voluntary basis to set local guidelines, discharge limits for industry, and clean-up targets. CWQGs are most commonly used in environmental assessments as benchmarks or yardsticks to which measured levels are compared. Anyone can use the guidelines to determine if the level of mercury measured in a sample of water has the potential to cause adverse environmental effects.

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