



Guidelines at a Glance

Canadian Tissue Residue Guidelines

Methylmercury

This fact sheet describes the Canadian Tissue Residue Guidelines for methylmercury to protect wildlife consumers of aquatic biota. 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.



What levels of mercury are safe for wildlife consumers of aquatic biota in Canadian waters?

The Canadian Tissue Residue Guideline (CTRG) to protect wildlife consumers of freshwater, marine, and estuarine biota is 33 micrograms of methylmercury per kilogram (wet weight) of their prey's tissue. This guideline is based on available toxicity data for various wildlife species, mainly birds and mammals.

If the levels of methylmercury measured in the prey of wildlife consumers of aquatic biota are less than the guideline, one would not expect to see adverse health effects in even the most sensitive species. In wildlife where the CTRGs 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 wildlife species. Further investigation of a particular species, including its food intake, body weight, and other specific factors, is needed to determine whether or not there is a negative impact.

How do levels of mercury in Canadian wildlife consumers of aquatic biota compare to the guidelines?

Most measurements of mercury in wildlife have concentrated on total mercury rather than methylmercury. In some cases, such as freshwater fish, most of the mercury in their tissues is thought to be in the methylmercury form. In other species, methylmercury may be <30-100% of the total mercury measured in tissues. Also, wildlife testing for mercury in Canada has focused on commercially important fish species. Wildlife consumers of aquatic biota generally eat prey that are smaller in size and from lower in the food web than these commercial species. Therefore, wildlife prey may have less mercury in their tissues than suggested by the available data.

Freshwater fish from seven provinces and one territory have been measured with total mercury levels of 130-2,200 micrograms per kilogram wet weight. Most data for other freshwater species comes from Ontario and Quebec, where total mercury levels for invertebrates (prey for some wildlife, such as many waterfowl) range from 14-2,200 micrograms per kilogram wet weight, for amphibians and reptiles range from 68-445 micrograms per kilogram wet weight, for terrestrial mammals range from 10-15,600 micrograms per kilogram wet weight, and for birds range from 43-58,100 micrograms per kilogram wet weight.

Fewer studies of marine species have been done, with the greatest number on marine mammals from the eastern and western Arctic and the Atlantic coast. Levels of total mercury in marine invertebrates range from 120-629 micrograms per kilogram wet weight, in marine fish range from 5-720 micrograms per kilogram wet weight, and in marine mammals range from 160-202,000 micrograms per kilogram wet weight.

How can CTRGs be used to make a difference?

In general, Canadian Tissue Residue Guidelines can be used by Canadian federal, provincial, and territorial governments on a voluntary basis to set local guidelines, for example, for a particular species. CTRGs may also be used to estimate levels in water and/or sediment that would be protective and would not result in accumulation through the food chain. CTRGs 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 methylmercury measured in wildlife tissues has the potential to cause adverse environmental effects.

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