http://www.hydroquebec.com/sustainable-development/documentation-center/mercury-reservoirs.html

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Mercury in hydroelectric reservoirs | Hydro-Québec and the mercury issue

6-8 minutes

Sources of mercury

Mercury is found everywhere in the environment. It is in the air, soil and vegetation, as well as in lakes and rivers. It can be released into the air naturally, by volcanoes and forest fires, or as a result of human activities such as coal burning and waste incineration. In the Nord-du-Québec region, it is carried through the atmosphere over long distances, and falls into lakes and forests with dust particles and rain. Mercury that is present mainly in inorganic form is relatively harmless, because it is not readily assimilated by living beings.

The Robert-Bourassa development and its reservoir.

Conversion of mercury

Once it enters lakes and rivers, inorganic mercury is converted by bacteria into a form that is easily taken up by live organisms. This form of mercury (methylmercury) can become toxic in high concentrations. The concentrations of methylmercury increase as it passes through the food chain, from plankton (small plants and animals living suspended in the water) to aquatic insects and on to fish.

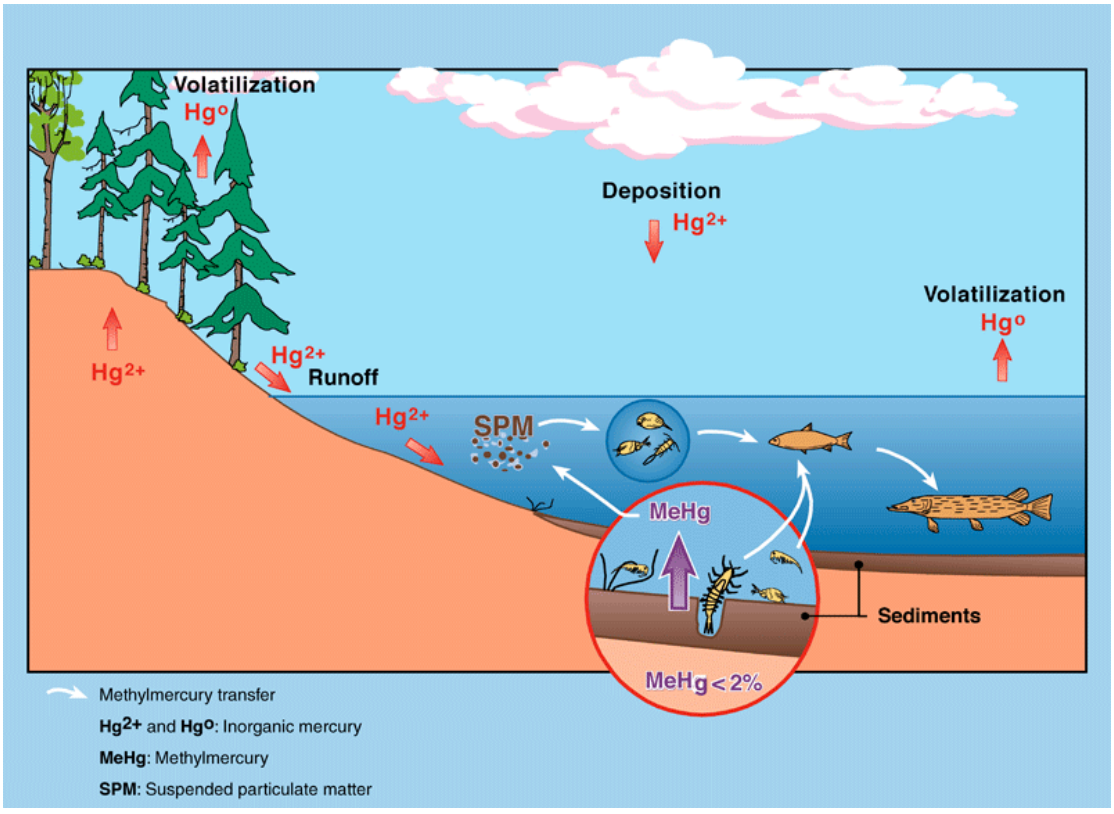


Figure 1.2: Fate of mercury in natural lakes

Fish (such as northern pike, walleye and lake trout) that eat other fish contain more mercury than fish (such as lake whitefish and brook trout) that feed on insects. Mercury levels in fish that do not eat fish are generally well within the Canadian marketing standard of 0.5 mg/kg for fisheries products. However, even in natural lakes, levels found in fish that eat other fish often exceed this standard. Mercury accumulates throughout the fish's life, meaning that the older and larger the fish, the higher the mercury level. All the fish in all the lakes and rivers in Québec contain mercury.

Mercury levels vary greatly from one lake to another, depending on each lake's specific characteristics. In the La Grande complex region, for example, average mercury concentrations in 800-mm-long northern pike vary from 0.37 to 1.22 mg/kg. In this case, according to Québec public health authorities, the recommended consumption for adults in general ranges from two to eight northern pike meals per month, depending on the water body from which the fish came. Calculations are based on an eight-ounce portion of fish per meal.

Mercury and reservoirs

In recently impounded hydroelectric reservoirs, the green parts of the terrestrial vegetation (i.e., the ground cover, leaves and moss) provide food for the bacteria that convert the inorganic mercury to methylmercury, which is easily accumulated by living organisms (plankton, insects, fish, animals and humans). Fish in and downstream from reservoirs

consequently contain more mercury shortly after impoundment. However, the phenomenon is temporary, since the green parts of the vegetation are quickly decomposed by the bacteria. Submerged tree trunks and branches do not release mercury, as their decomposition is minimal.

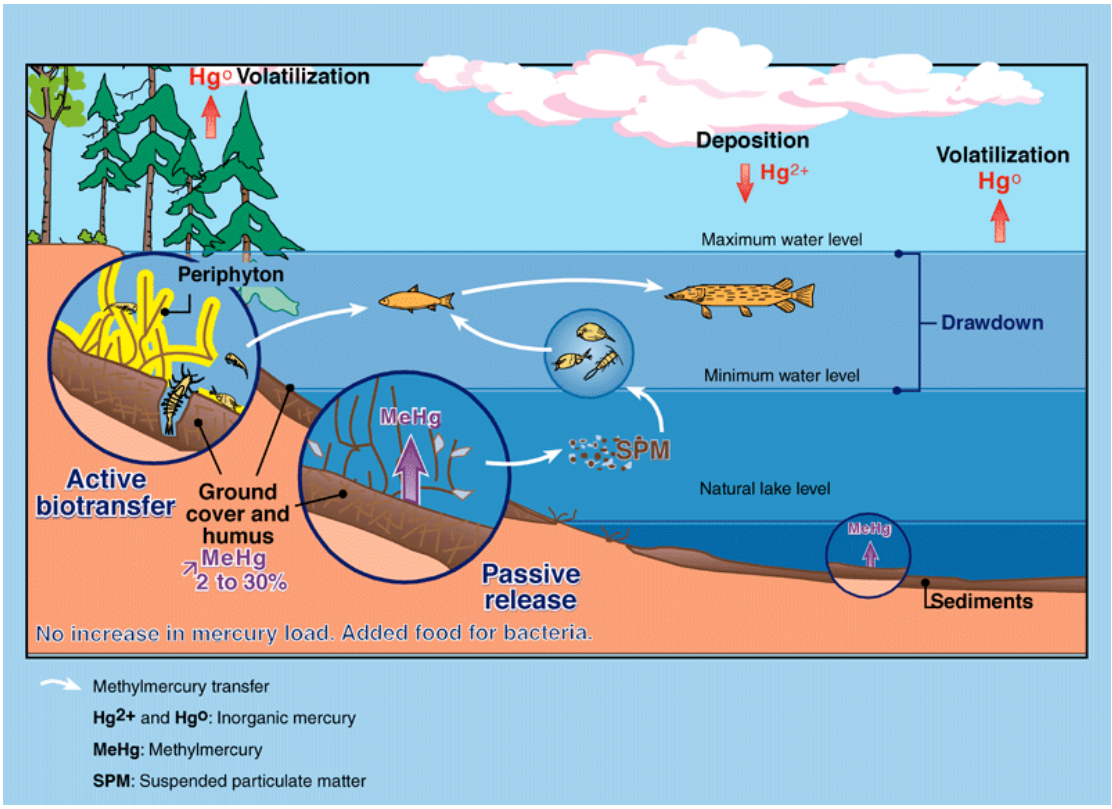
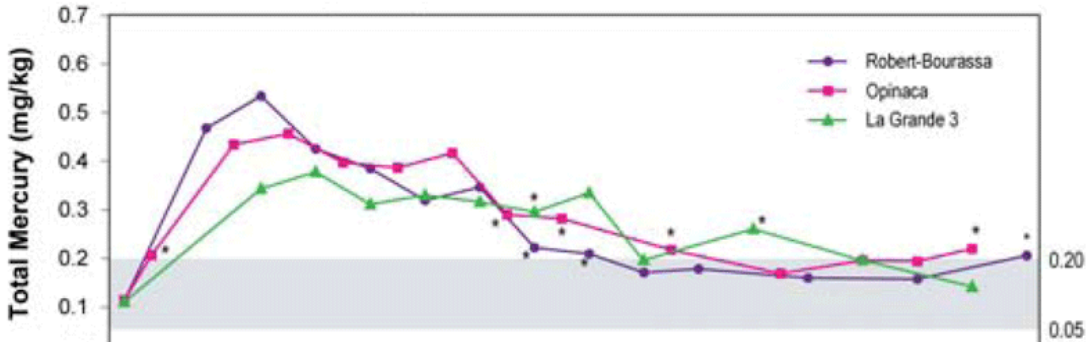


Figure 1.3: Fate of mercury shortly after reservoir impoundment

In the different reservoirs in the La Grande complex, average fish mercury levels increased by factors ranging from 2 to 8, depending on the species and reservoir.



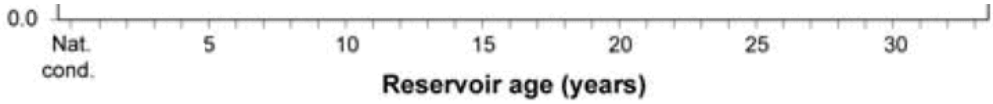


Figure 1.4: Changes in mercury levels in 400-mm lake whitefish in reservoirs in the western sector of the La Grande complex

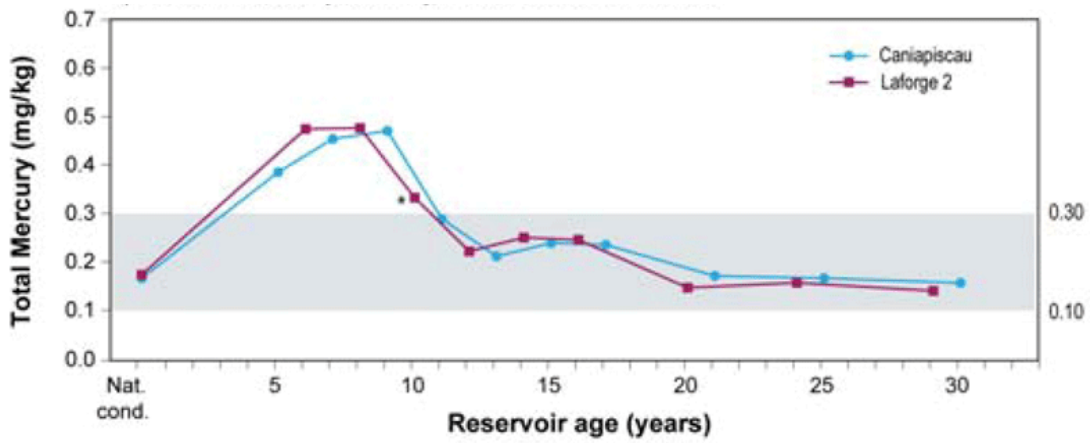


Figure 1.5: Changes in mercury levels in 400-mm lake whitefish in reservoirs in the eastern sector of the La Grande complex

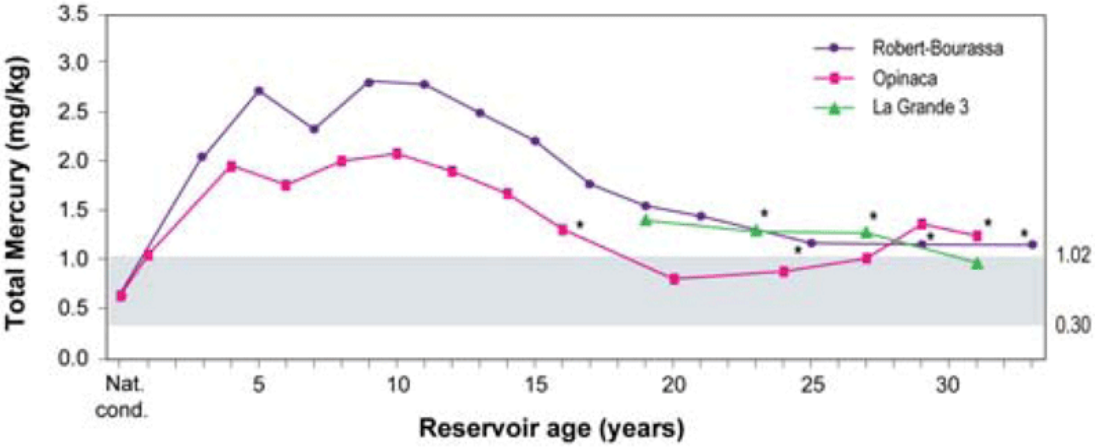


Figure 1.6: Changes in mercury levels in 400-mm walleye in reservoirs in the western sector of the La Grande complex

A temporary phenomenon

Monitoring of reservoir fish has shown that mercury levels in

insect-eating species such as lake whitefish return to levels equivalent to those in natural lakes after 10 to 20 years. In fish that feed on other fish, such as walleye, the return to normal levels takes longer and is usually complete after 20 to 35 years. The increase in mercury levels is temporary, because the main mechanisms involved in the production of methylmercury and its transfer to fish are intense shortly after reservoir impoundment but are relatively short-lived. The increased methylmercury production generally ends 8 to 10 years after impoundment, due to the rapid depletion of the readily decomposable elements of the flooded soil and vegetation, which provide food for the bacteria that convert the inorganic mercury to methylmercury. After this time, methylmercury transfer to fish by periphyton, zooplankton and insect larvae is reduced to the level occurring in natural lakes.

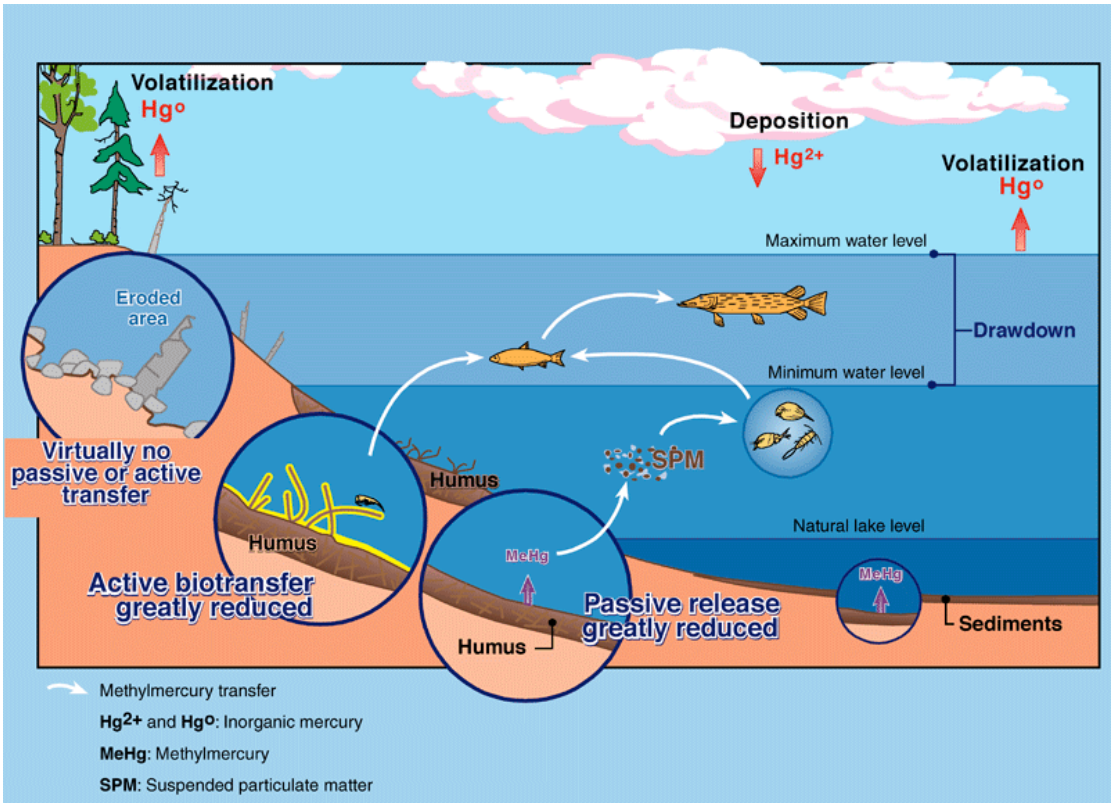


Figure 1.7: Fate of mercury several years after reservoir

impoundment

Therefore, fish born 8 to 10 years after reservoir impoundment live in an environment where the production and transfer of mercury along the food chain are similar to those of neighboring natural lakes. Also, 20 years after impoundment, non-piscivorous fish of an average length that are about 10 years old have mercury levels equivalent to those of fish in natural lakes.