

Health Effects of Mercury in Humans and the Environment

Hat makers during the 19th century developed symptoms of shaking and slurred speech from their exposure to elemental (metallic) mercury, which was used to felt wool and give it a metallic sheen. This is the origin of the expression, “mad as a hatter.” These workers were exposed through inhalation of mercury fumes, but the most common route of exposure to mercury today is through the consumption of methylmercury in fish tissue.

When elemental mercury is released into the environment, either from the atmosphere or from industrial or other human sources, bacteria in rivers and lakes may convert the metal into the organic form, called methylmercury. This form of the metal is assimilated by larger organisms when they consume the bacteria, and mercury begins its journey up the food chain.

Methylmercury is concentrated as it moves up the food chain because each fish eats a number of smaller fish contaminated with the compound, but can only eliminate the compound very slowly. In older, predatory fish, it can concentrate to levels high enough to create the potential for mercury poisoning symptoms in the fish, as well as in birds, humans, or other mammals that eat the fish.

Methylmercury, unlike its elemental counterpart, can penetrate into mammalian cells because it mimics a common amino acid. In exposed species, it can be found in blood, tissue, hair, breastmilk, and feathers. It can even cross the blood-brain barrier, where it is capable of causing damage to nerves in the brain.

Methylmercury interferes with nerve cell division, making prenatal and childhood exposure more damaging than adult exposure. Prenatal exposure can cause brain damage, changes in brain architecture, blindness, and multiple intellectual deficits. Children exposed to methylmercury have also shown multiple cognitive deficits and neuropathological abnormalities. Adults show brain changes and lesions in the same areas, although not as severe. Methylmercury affects the visual, auditory, and motor centers of the brain. At higher doses, it can also adversely affect the kidneys and cardiovascular system.

Symptoms of acute mercury poisoning include numbness or tingling in the fingers, toes, and mouth; headache; memory or hearing loss; visual or speech disorders, and lack of coordination. In the most severe cases, it can lead to coma and death.

However, humans are not the only species affected by mercury contamination in fish. Wildlife that eat fish are also affected, such as otters, raccoons, opossums, foxes, eagles, loons, hawks, and herons. Otters, foxes, and even a Florida panther have been found that apparently died from mercury poisoning.

Most of what we now know about mercury poisoning came from accidental exposures. In the 1950's, industry discharged methylmercury directly into Minamata Bay in Japan.

Cats, fish, and birds developed strange symptoms and died. The local fishermen and their families were exposed, killing 54 residents and leaving many with severe disabilities and cognitive disorders. This incident first focused international attention on the health effects of high levels of methylmercury in fish.

A second incident occurred in 1972 in Iraq, when seed grain treated with a mercury-containing antifungal agent was accidentally made into bread and consumed. Although most people who ate the bread had no symptoms at the time of exposure, more than 400 people died from mercury poisoning during the weeks that followed. The health effects of this incident were studied in detail, giving us much of the knowledge we have today.

The levels of methylmercury in fish and grain in these incidents were many times higher than what is found in fish today. Studies of mercury in fish tissue in North Carolina have found fish in some areas of eastern North Carolina with mercury levels in their edible tissue above the state action level. When this level or higher is found in fish tissue, fish advisories are posted.

According to Dr. Luanne Williams of the N.C. Department of Health and Human Services, testing of a small population in Brunswick and Columbus counties conducted a few years ago showed what experts expected to find. Those individuals who ate posted fish on a regular basis had higher levels of mercury in their hair and blood. "This is why we advise people to limit their consumption of fish in these areas," Williams said.

Ten advisories are now in effect for mercury in fresh water areas in North Carolina, mainly for bass and bowfin (blackfish). The advisories recommend that children and women of childbearing age, especially pregnant women, avoid the consumption of these fish. Other adults should limit fish in their diet to a safe level, usually two meals per month.

King mackerel, an ocean fish, has been posted for the entire Atlantic seaboard of the southeastern United States. The advisories for this fish are based on fish size, since mercury concentrates to higher levels in larger fish. The advisories recommend that no one eat king mackerel larger than 39 inches, and that children under 12 and women of childbearing age limit their consumption of 33-39 inch king mackerel to no more than 8 ounces per month. Fish shorter than 33 inches are considered safe to eat.

For complete information on which waterways in North Carolina have posted health advisories, go to <http://www.schs.state.nc.us/epi/fish/>.

The U.S. Food and Drug Administration (FDA) recently announced fish advisories on several ocean species: shark, swordfish, king mackerel, and tilefish. Due to the acknowledged health benefits of eating fish, the FDA recommended that pregnant women and women of childbearing age limit their consumption of these fish to no more than 12 ounces per week. This is the first such advisory on deep ocean fish, which previously were thought to live and feed far enough from mercury sources to be safe.

The state is currently intensifying its work on mercury in fish. “We have been awarded a grant by the Environmental Protection Agency to perform comprehensive testing of the fish and waters of other areas of Eastern North Carolina,” said Michelle Woolfolk of the Division of Water Quality. “We want to provide the Division of Health and Human Services and the citizens of North Carolina with as much information as possible.”

Possible Break-Out Text Box:

Common Sources of Mercury Include:

- Hazardous and medical waste incineration
- Dental offices (mercury amalgam fillings)
- Sewage (from human waste, contaminated by dental fillings, as well as industrial wastewater)
- Hospitals, doctor’s offices, veterinary clinics (thermometers and other mercury-containing devices and lab chemicals)
- Laboratories (educational, medical, research and testing, quality control)
- Heating, ventilation, and air conditioning (HVAC) systems and HVAC businesses (mercury thermostats, relays)
- Housing construction and demolition (mercury relays and switches; “silent” light switches; HVAC systems; appliances)
- Automobiles (batteries; mercury tilt switches, such as used to turn on trunk and hood lights; mercury vapor headlamps and HID headlights; anti-lock braking systems; virtual instrument panels)
- Caustics (in chemicals such as sodium hydroxide due to manufacturing process)

Potential Household Sources of Mercury:

- Latex paint manufactured before 1990; some oil-based paints, check the label
- Batteries (small button batteries, such as in hearing aids, watches, and novelty items)
- Cosmetics (thimerosal, a preservative in contact solutions, some skin bleaching crèmes)
- L.A. Gear sneakers made before 1997 with flashing lights in soles
- Gauges: manometers, barometers, vacuum gauges
- Fluorescent light bulbs (except “low mercury” ones), neon lamps, mercury vapor lamps, metal halide lamps, high pressure sodium lamps (these last three are most often used in industrial and outdoor lighting)
- Appliances (mercury tilt switches, such as used to stop washer spinning when lid is open; pilot light sensors)
- Clothes irons and other appliances that turn off when tipped over
- Detergents and cleaning products
- Medical products
- Old pesticides