

# Mercury Rises as a Health Concern

A still commonplace chemical found in many products and used to good purpose in home, office, and health care facilities, mercury has now earned the worst of reputations.

L.B. Sandy Rock

**H**ydrygyrum. Quicksilver. Quacksilver. Mercury. Whatever the moniker, the shiny metallic liquid has captured the interest of many an alchemist and schoolchild. Who hasn't had a puddle of it in his hand or played with the beads that coalesce so magically on any hard surface? Public health policy makers, however, have put it at the top of their list of persistent, bioaccumulative toxic substances (PBTs), and numerous citizen and environmental groups have labeled it a health hazard and possible culprit in various neurological diseases.

## History of mercury

Mercury has been used for centuries for commercial, personal, spiritual, and medicinal purposes despite the fact that it is one of the most potent neurotoxins known.

Mercury occurs in nature in a variety of ores. The most common is cinnabar—the cinnamon to scarlet red mercuric sulfide (HgS)—which is mined for gold extraction as well as for many other uses in commerce and industry. Approximately 40 percent of mercury in the environment comes from natural sources such as mineral deposits and volcanic eruptions. The remaining 60 percent is released into the atmosphere by human activities. The largest contribution comes from the combustion of coal in electric power plants and waste incinerators (including medical), but many other industrial activities and commercial products include mercury that can and does enter the environment.

Elemental mercury is the form in which it is best known. It is the only metallic element that exists as a liquid at standard (“room”) temperature, therefore the chemical designation Hg (Hydra—liquid/water; Argyrum—silver). (Cadmium is as soft as butter at such a temperature; other metals surrounding mercury on the elemental chart—gold, silver, indium, and thallium—are relatively soft as well.) Mercury can exist in nature in various ionic states and forms salts with many elements. Complex compounds of mercury are used in many industrial processes. It readily binds to other metals and thus has been used to extract them from their ores.

As a conductive metal, liquid mercury is an ideal contact for gravity and heat-activated switches. Such switches exist in thermostats,

automobile trunk and hood lights, home appliances, and many pieces of industrial equipment. In fluorescent and high-intensity discharge (HID) lamps, voltage-energized mercury gas is the source of ultraviolet light. Its expansile quality from both heat and barometric pressure makes it nearly indispensable in thermometers and manometers, both industrial and medical. Dental amalgam is essentially half-silver and half-mercury, used for its ease of preparation and application, relative low cost, and durability. And medicinal mercury use historically includes topical antiseptic (mercurio-chrome, merthiolate), diuretic, preservative, cathartic, anti-syphilitic, and freckle cream.

In health care facilities, mercury is ubiquitous; one can usually find it within just a few feet of any location. It is in batteries, thermometers, manometers (particularly wall-mounted sphygmomanometers), thermostats, fluorescent bulbs, medications, laboratory chemicals, and dental amalgam. Through legislation, regulation, and voluntary programs (*see box on page 15 for examples*), mercury use in medical facilities is decreasing.

With black light illumination, one can see mercury vapor rising from a puddle of elemental mercury. Inhalation can be toxic to the lungs, leading to pneumonia, if exposure is high or prolonged. Elemental mercury is minimally absorbed through the skin. It readily crosses both the blood-brain and placental barriers. Inorganic mercury compounds can enter the body through skin as well as by ingestion. Damage to the brain, kidneys, and liver can follow. Organic mercury compounds—including the highly toxic methylmercury—can enter the body through any of these routes. Their fat solubility results in more rapid absorption into the body through all routes and increases their ability to cross blood-brain and placental barriers, thus posing increased risk.

## Exposure sources

The health effects of mercury have been known for several thousand years. Criminals sentenced to work in mercury mines in the fifteenth century B.C. were noted to have a life expectancy of only three years. The tremulous, drooling, paranoid, hyperactive hatter in *Alice in*

The tremulous, drooling, paranoid, hyperactive hatter in *Alice in Wonderland* was made so by constant exposure to a salt of mercury used in the flattening of felt on hats; thus, “mad as a hatter.”

*Wonderland* was made so by constant exposure to a salt of mercury used in the flattening of felt on hats; thus, “mad as a hatter.” *In utero* exposure can lead to devastating neurological damage as seen in the victims of the Minamata (Japan) disaster in the 1950s. Thousands of unborn children were exposed to methylmercury—the most toxic form—that mothers had unwittingly ingested as they ate fish from the bay contaminated by the Chisso Corporation. Other mass exposures have occurred: in the early 1970s, starving Iraqis ate seed grain treated with a mercury-containing fungicide, leading to many casualties and deaths. The most common exposures today, however, are those that are the most difficult to study and evaluate: chronic, low-dose ingestion through the food web. And one of the healthiest foods—fish—is the source.

When elemental mercury in the atmosphere precipitates onto soil or surface water, it ultimately reaches the bottoms of ponds, lakes, rivers, and streams. So does mercury from mineral deposits, mines, polluting industries, and improperly discarded commercial products. There, microorganisms methylate it to the more toxic methylmercury. This is passed up through the food web from plankton to small fish, small fish to larger, and finally to the predatory fish at the top of the web. Species regularly listed on state and federal fish advisories include swordfish, shark, king mackerel, tilefish, and tuna—both steaks and canned.

Women of childbearing age, pregnant women, nursing mothers, infants, and young children are the target populations for these advisories. (Unlike other PBTs, mercury resides in the flesh of the fish and, therefore, cannot be trimmed away or cooked off.) Based on a standard set by the US FDA and suggested by various studies, the EPA and various state agencies have recommended limits to consumption of certain fish. Sensitive populations, such as pregnant women and young children, should limit their intake of predatory fish. Maximum consumption varies with the age and weight of the individual and is listed in the relevant fish advisories. The EPA, for example, recommends no more than one can of tuna a week for pregnant women, and for children, even less.

## Public health concerns

The public as well as the health care community is concerned that mercury could play a role in the development of subtle yet serious learning and other neurodevelopmental disorders. Biological plausibility for this linkage exists, corroborated by recent population studies. In 2000, the National Academy of Sciences estimated that as many as 60,000 newborn infants

annually could be at risk for neurological damage from *in utero* exposure to mercury. The same year, the Centers for Disease Control and Prevention suggested that up to 10 percent of American women may harbor potentially hazardous levels of mercury.

Controversies surrounding mercury—besides the question of maximum safe ingestion levels—include possible health effects of mercury from dental amalgam released while chewing food and gum and drinking hot liquids. No evidence exists that the amounts released are a danger to health, but many citizen groups claim that health effects do exist.

The mercury-based vaccine preservative thimerosal (containing ethylmercury) will no longer be found in most immunizations in the United States due to the public’s concerns and a recommendation by the Institute of Medicine in 2001 that it be removed “as a precautionary measure.”

Mercury has been a familiar and useful substance in household products, industry, and medicine. It is now clear, however, that serious potential health risks are associated with exposure from environmentally cycled mercury that enters the human food web. The public health community must meet the challenge of evaluating sources of mercury exposure and finding ways to prevent this toxic metal from harming human health. 🐟

## Resources

Hospitals for a Healthy Environment (H2E)  
[www.h2e-online.org/](http://www.h2e-online.org/)

NLM/NIH Overview of mercury health effects  
Medline Plus  
[www.nlm.nih.gov/medlineplus/mercury.html](http://www.nlm.nih.gov/medlineplus/mercury.html)

Mercury Chemical Action Plan  
Washington Departments of Ecology and Health  
[www.ecy.wa.gov/biblio/0303001.html](http://www.ecy.wa.gov/biblio/0303001.html)

Find more resources online at  
[www.nwcp.org/nph](http://www.nwcp.org/nph)

## Author

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## NW Efforts to Reduce Mercury Exposure

**H2E:** In 1998, the American Hospital Association and the U.S. Environmental Protection Agency entered into a Memorandum of Understanding (MOU) to eliminate mercury from medical facilities by 2005. The MOU also includes provisions for reducing solid and hazardous waste. The program—Hospitals for a Healthy Environment (H2E)—is gaining momentum. Since its inception, hundreds of medical facilities, including a number in the Northwest, have taken a pledge to work toward the stated goals.

**Ecology’s PBT/Hg Chemical Action Plan:** Also in 1998, the Washington Department of Ecology proposed a plan for reduction and, where possible, elimination of PBTs in our environment. A “starter list” of PBTs known to be environmental contaminants in Washington State was developed, and in 2001, mercury was chosen from that list as the first PBT for which a “Chemical Action Plan” would be devised. Other states, including Oregon, have developed similar plans; mercury heads the list of each plan. The Washington Departments of Ecology and Health jointly released the plan to the public in January.

**City of Vancouver, WA, PBT/Hg Exhibit at WREC:** Over the past year, the staff of the City of Vancouver, WA, Solid Waste Division and Water Resources Education Center has developed an exhibit on PBTs and mercury. Opened in April 2003, it includes graphics and interactive panels demonstrating the mercury cycle, places where mercury-containing items can be found, and the health effects of mercury exposure.