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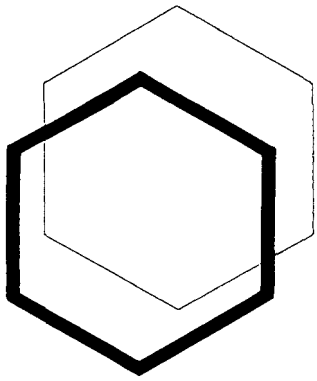

Mercury

Probably best known as the silvery substance in thermometers, mercury has been refined from cinnabar since the 15th or 16th Century B.C. Cinnabar was used as a red paint by primitive peoples long before the process of mercury refining was discovered.

History also chronicles the health hazards of occupational exposure to mercury dating to the time of the Roman conquest of Spain when criminals sentenced to work in the Spanish quicksilver mines had a life expectancy of only three years. However, it was the widespread poisoning of Japanese fisherman and their families from consumption of methyl mercury-contaminated fish in Minamata, Japan, in the fifties, and the recent discovery that most other mercury compounds can be transformed into highly toxic methyl mercury in the environment that generated widespread concern about the health implications of the continued release of mercury into the environment.

This Information Bulletin discusses the hazards of mercury and what the U.S. Environmental Protection Agency (EPA) and others are doing to protect public health from the risk of mercury exposure.

Mercury-- what is it?

Mercury is a heavy metal. At room temperature, in its pure form, it is a silvery liquid which vaporizes easily. Mercury is an important industrial metal because of its particular properties: uniform volume expansion, liquidity at room temperature, electrical conductivity, high density, low vapor pressure, ability to alloy with almost all common metals (except iron and platinum), and ease of vaporizing and freezing.

Over 3,000 industries utilize mercury in manufacturing and processing. In 1973, U.S. consumption of mercury was approximately 1,900 metric tons. Battery manufacturing (29.9%) and chlorine-alkali production (24%) accounted for over half; other major uses included paints and industrial instruments. Because of the inherent toxicity of mercury, it was, until recently, widely used in pesticides. Its use in medicines was for its diuretic properties as well as being used as an antiseptic and preservative. Because other more effective diuretics were found the mercurial use in medicine has declined.

Why is mercury a problem?

Mercury is a problem because of its high toxicity and the potential for human exposure. Although all mercury compounds are toxic, methyl mercury is by far the most toxic, and recent discoveries concerning its production have increased concern about its potential exposure to the public. Scientific evidence points to the existence of a mercury cycle, where, in part, elemental mercury and various mercury compounds are transformed in the environment by natural biological and chemical action into methyl mercury. This conversion process, known as methylation, can occur in bacteria found in waterways and in the intestine of mammals. Since mercury is an element and therefore cannot be broken down into harmless components, once released into the environment, it remains available for methylation for many years.

Approximately 80 percent of the mercury used is eventually released back into the environment. Because it is easily vaporized, air emissions are a major source of human exposure, especially near sewage treatment facilities. The largest contributors to air emissions are chlorine-alkali plants, followed by fossil fuels, municipal incinerators, and mercury mines and smelters. Waterways also receive mercury through waste water discharges from industrial plants and municipal sewage. Landfill disposal of wastes contribute to the soil buildup of mercury. There is growing concern that the use of municipal sewage sludge as fertilizer may be compounding the problem of mercury contamination of the soils.

Mercury taken into the body through air, water and food is absorbed in varying amounts depending on its chemical form and the route of intake. Absorption of mercury present in water and food varies the most, from about 0.01 percent for elemental mercury to nearly 100 percent for methyl mercury. The major food sources of mercury are fish and shellfish.

In the human body, mercury accumulates in the liver, kidney, brain and blood and causes both acute and chronic health effects depending on the form of mercury. Acute poisoning, although seldom seen today, can cause severe gastrointestinal damage, cardiovasular collapse, and acute kidney failure, all of which can result in death.

Chronic symptoms of inorganic and organo-mercury compounds which are most often seen industrial workers and in cases of contaminated food consumption may include birth defects, and central nervous system and kidney damage. Genetic damage is also suspected. Loss of appetite and weight loss are often the first signs of chronic mercury poisoning.

Nervous system damage: The most universal effects of mercury are damage to the nervous system. Increased excitability, mental instability, apathy and a tendency to weep which are often followed by fine tremors in the hands and feet after exposure to mercury vapor. Personality changes such as timidity, nervousness and dizziness or insomnia may also occur. Symptoms of methyl mercury poisoning include tunnel vision, loss of muscle coordination, hearing impairment and impairment of gait.

Kidney damage: Inorganic mercury causes a transient kidney condition evidenced by excessive protein in the urine. The condition does not occur in all persons exposed to toxic doses of mercury. Although we do not know what level causes kidney failure, "high" levels almost always do.

Birth defects: Infants prenatally exposed to methyl mercury compounds ingested by their mothers have been born with primarily neurological defects. Symptoms include mental disturbance, poor muscle coordination, gait impairment, speech difficulties, and difficulties in chewing and swallowing.

Genetic effects: In laboratory tests with insects and plants mercury has been shown to cause chromosomal damage similar to that which causes Downs Syndrome (mongolism) in humans. Scientists are concerned that mercury may cause similar damage in humans, resulting in congenital disorders and possibly cancer, although it has yet to be documented.

What is the government doing about this hazard?

Recognizing the toxic effects of mercury, the Federal government has taken steps to reduce the public's exposure to the chemical and its compounds. EPA has issued effluent guidelines for industry to reduce the release of mercury into water, and is preparing final water quality criteria for mercury. Based on the latest scientific information, the criteria can be used for further regulation of mercury by the Agency or individual states. Both effluent guidelines and water quality criteria are authorized by the Clean Water Act, administered by EPA.

Under the authority of the Clean Air Act, EPA is reviewing the current national air emission standards for mercury together with several other hazardous substances, in order to reduce the risk of mercury exposure through the ambient air. More importantly, under the Clean Air Act, EPA has limited emissions of mercury from certain industries. As hazardous waste, under the provisions of the Resource Conservation and Recovery Act, certain mercury wastes are regulated by EPA from point of origin to final disposal.

In February 1976 EPA ordered an immediate halt to the production, sale and use of most mercurial pesticides. Subsequent to resulting litigation, the original cancellation order was modified to allow registration under the Federal Insecticide, Fungicide and Rodentcide Act of mercurial pesticides only for a few fungicidal uses, such as in-can preservatives in latex paints, mildew inhibitors on outdoor fabrics and in outdoor paints, control of brown mold on lumber, control of winter turf diseases, and control of Dutch Elm Disease (currently being reconsidered).

Because of the risk to workers in industries utilizing mercury, the Occupational Safety and Health Administration is reviewing the current occupational exposure standard of 0.1 milligrams of mercury per cubic meter of air (0.1 mg/m^3) to determine whether or not that standard should be reduced to 0.05 mg/m^3 to assure protection of the workers. The Food and Drug Administration (FDA) is developing methods to determine the concentration of methyl mercury in fish and other foods. In order to protect the public from contaminated fish, the FDA has issued an action level of 1.0 part mercury per million parts fish (1 ppm) in fish and shellfish as the maximum amount of mercury it will allow in those foods.

Research is continuing to define more clearly the tolerable levels of exposure to mercury, the health effects of increased burning of coal and the effects of chronic exposure to low levels of mercury compounds on unborn children. Results of this research will enable regulatory agencies to better assess the threat to public health and to institute appropriate control measures.

In Summary: The toxic effects of mercury, although not completely defined, are of grave concern, as is the continued release of mercury to the environment where it can remain and affect future generations. The Federal government has taken several steps to reduce the public's exposure to mercury, and is investigating means to further reduce the mercury risk in this country.

CHILDREN AT RISK

As in the case with other toxic chemicals such as lead, children are especially susceptible to the adverse effects of methylmercury. Methlymercury easily crosses the placental barrier and concentrates in the fetus more readily than in the mother. Thus, a woman exposed to toxic levels of mercury may not exhibit any signs of mercury poisoning, but her child may be born with brain damage quite similar to cerebral palsy.

Children may also react adversely to mercury exposure after they are born. Mercury can be transmitted through breast milk, as well as through the environmental media of air, water and food. Neurological symptoms are very similar to those seen in adults. In addition, children may develop dermatitis, eczyma and mucous membrane irritation. Acrodynia, or "pink disease" affects only children from four months to four years of age. Characterized by a distinctive rash; coldness, swelling and irritation of the hands, feet, cheeks and nose, usually followed by peeling and ulceration; typical neurological and psychological symptoms, and profuse perspiration, acrodynia has been almost totally eradicated by withdrawal of mercury from common medications used in children (cough medicines, ointments, antiseptics, etc.).