United States Environmental Protection Agency | Office of Water 4601 | EPA 811-F-95-002e- T October 1995

National Primary Drinking Water Regulations

Mercury

Chemical/ Physical Properties

CAS Number: 7439-97-6

Color/ Form/Odor: Silver-white, heavy, mobile, liquid metal. Solid mercury is tin-white. Odorless

M.P.: -38.87° C **B.P.:** 356.7° C

Vapor Pressure: $2x10^{-3}$ mm Hg at 25° C

Density/Spec. Grav.: 13.5 at 25° C

Solubility: 0.06 g/L of water at 25° C; Slightly soluble in water

Soil sorption coefficient: N/A

Odor/Taste Thresholds: N/A

Bioconcentration Factor: Bioconcentration factors of 63,000 for freshwater and 10,000 for salt water fishes. BCFs of 100,000 for invertebrates.

Henry's Law Coefficient: N/A; volatilization from water and soil is significant

Synonyms/Ores: Liquid silver, Quicksilver, Hydragyrum, Colloidial mercury. Important commercial ore is cinnabar, but also found in limestone, calcareous shales, sandstone, serpentine, chert andesite and others.

Drinking Water Standards

MCLG: 0.002 mg/L

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HAL(child): none

Health Effects Summary

Acute: EPA has found mercury to potentially cause kidney damage from short-term exposures at levels above the MCL.

No Health Advisories have been established for short-term exposures.

Chronic: Mercury has the potential to cause kidney damage from long-term exposure at levels above the MCL.

Cancer: There is inadequate evidence to state whether or not mercury has the potential to cause cancer from lifetime exposures in drinking water.

Usage Patterns

Nearly 8 million lbs. of mercury were produced in the U.S. in 1986.

Electrical products such as dry-cell batteries, fluorescent light bulbs, switches, and other control equipment account for 50% of mercury used. Mercury is also used in substantial quantities in electrolytic preparation of chlorine and caustic soda (chlor-alkali industry, mercury cell process; 25%), paint manufacture (12%), and dental preparations (3%). Lesser quantities are used in industrial catalyst manufacture (2%), pesticides manufacture (1%), general laboratory use (1%), and pharmaceuticals (0.1%).

Release Patterns

A joint FAO/WHO expert committee on Food Additives in 1972 quotes the major source of mercury as the natural degassing of the earth's crust in the range of 25,000-150,000 ton of Hg/yr.

Twenty thousand tons of mercury are also released into the environment each year by human activities such as combustion of fossil fuels and other industrial release. Anthropogenic sources of airborne mercury (Hg) may arise from the operation of metal smelters or cement

Toxic Release Inventory - Releases to Water and Land: 1987 to 1993

	Water	Land
TOTALS (in pounds)	6,971	60,877
Top Six States		
TN	164	29,161
LA	431	21,829
DE	117	3,860
OH	29	2,760
AL	1,462	1,001
WV	1,657	454
Major Industries		
Chemical, allied products	12,269	74,720
Electric lamps	0	2,750
Paper mills	2,500	0

manufacture. Water borne pollution may originate in sewage, metal refining operations, or most notably, from chloralkali plants. In general, industrial and domestic products, such as thermometers, batteries, and electrical switches which account for a significant loss of mercury to the environment, ultimately become solid waste in major urban areas.

From 1987 to 1993, according to EPA's Toxic Chemical Release Inventory, mercury releases to land and water totalled nearly 68,000 lbs., of which 90 percent was to land. These releases were primarily from chemical and allied industries. The largest releases occurred in Tennessee and Louisiana. The largest direct releases to water occurred in West Virginia and Alabama.

Environmental Fate

Two characteristics, volatility and biotransformation, make mercury somewhat unique as an environmental toxicant. Its volatility accounts for atmospheric concentrations up to 4 times the level of contaminated soils in an area. Inorganic forms of mercury (Hg) can be converted to organic forms by microbial action in the biosphere.

In aquatic systems, mercury appears to bind to dissolved matter or fine particulates, while the transport of mercury bound to dust particles in the atmosphere or bed sediment particles in rivers and lakes is generally less substantial. The conversion, in aquatic environments, of inorganic mercury compounds to methyl mercury implies that recycling of mercury from sediment to water to air and back could be a rapid process. In a study of mercury elimination from wastewater, 47% of added mercury was removed in presence of a Pseudomonas strain. Uptake of mercury was severely inhibited by sodium chloride, sodium sulfate, and mono- and dibasic potassium phosphate.

In the atmosphere, 50% of the volatile form is mercury (Hg) vapor with sizeable portion of remainder being Hg(II) and methylmercury, 25 to 50% of Hg in water is organic. Hg in the environment is deposited and revolatilized many times, with a residence time in the atmosphere of at least a few days. In the volatile phase it can be transported hundreds of kilometers.

Bioconcentration factors of 63,000 for freshwater fish, 10,000 for salt water fish, 100,000 for marine invertebrates, and 1000 for freshwater and marine plants have been found. As the tissue concentration approaches steady-state, net accumulation rate is slowed either by a reduction in uptake rate, possibly due to inhibition of membrane transport, or by an increase in depuration rate, possibly because of a saturation of storage sites, or both. Acidification of a body of water might also increase mercury residues in fish even if no new input of mercury occurs, possibly because lower pH increases ventilation rate and membrane permeability, accelerates the rates of methylation and uptake, affects partitioning between sediment and water, or reduces growth or reproduction of fish.

Other Regulatory Information

Monitoring:

- For Ground Water Sources:
  - Initial Frequency- 1 sample once every 3 years
  - Repeat Frequency- If no detections for 3 rounds, once every 9 years
- For Surface Water Sources:
  - Initial Frequency- 1 sample annually
  - Repeat Frequency- If no detections for 3 rounds, once every 9 years
- Triggers - If detect at > 0.002 mg/L, sample quarterly.

Analysis:

Reference Source	Method Numbers
EPA 600/4-79-020	245.1; 245.2
Standard Methods	303F

Treatment

Best Available Technologies

Coagulation/Filtration*; Granular Activated Carbon; Lime softening*; Reverse osmosis*

* These treatments are recommended only if influent Hg concentrations do not exceed 10 ug/L

For Additional Information:

- EPA can provide further regulatory and other general information:
  - EPA Safe Drinking Water Hotline - 800/426-4791
- Other sources of toxicological and environmental fate data include:
  - Toxic Substance Control Act Information Line - 202/554-1404
  - Toxics Release Inventory, National Library of Medicine - 301/496-6531
  - Agency for Toxic Substances and Disease Registry - 404/639-6000
  - National Pesticide Hotline - 800/858-7378