# TECHNICAL APPLICATION BULLETIN

# Mercury

**Recognized Treatment Techniques For Meeting Drinking Water Regulations For The Reduction Of Mercury From Drinking Water Supplies Using Point-of-Use/Point-of-Entry Devices And Systems**

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Water Quality Association

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**Recognized treatment techniques for meeting drinking water regulations for the reduction of mercury using point-of-use and point-of-entry (POU/POE) devices and systems.**

## Occurrence

Mercury is a naturally occurring metal that has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements to form inorganic mercury compounds. Mercury also combines with carbon to make organic mercury compounds. The most common form of organic mercury, methyl mercury, is produced mainly by microscopic organisms in the water and soil. Organic mercury can accumulate in microorganisms, water plants, and eventually sport fish tissue. It is a cause of consumption warnings for sport fish from some inland lakes and rivers, especially in the northern United States.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, light bulbs, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

The major source of mercury is from natural degassing of the earth's crust in the range of 25,000-150,000 tons of mercury per year. 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. Often mercury from these sources can circulate in the global atmosphere for months from distant continents, across oceans, etc. and finally settle in inland rivers, lakes, and streams anywhere. Water borne pollution may originate in sewage, metal refining operations, or most notably, from chloralkali plants.

While metallic mercury is normally a concern in as a vapor in the air, methyl mercury is often found in sediments and in fish. Mercurous and mercuric salts and compounds can be found in water and would be of concern if present in excessive amounts.

## Health Effects

Eating fish or shellfish contaminated with methyl mercury, breathing mercury vapors in air, or release of mercury from dental work and medical treatments are some of the potentially major sources of excessive mercury intake by humans. The greatest concern for mercury poisoning comes from the food chain especially where fish is common in the diet. A build up of mercury in the food chain presents a greater risk of mercury poisoning due to bioaccumulation and biomagnification, however this should not diminish the concern for mercury in water.

Methyl mercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposures to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

The EPA has set a Maximum Contaminant Level Goal (MCLG) and a Maximum Contaminant Level of 0.002 mg/l (ppm) for mercury in water.
EPA has found mercury in water to potentially cause kidney damage from short-term exposures at levels above the MCL. No Health Advisories have been established for short-term exposures, however. On a chronic basis, mercury has the potential to cause kidney damage from long-term exposure at levels above the MCL. However EPA has not found enough evidence to state whether or not mercury has the potential to cause cancer from lifetime exposures in drinking water.

## Treatment Alternatives

Both inorganic and organic mercury can be theoretically reduced in water with distillation, reverse osmosis and ion exchange (strong base anion, weak base anion and specialty types of ion exchange resin). Also effective are the activated carbon, specialty media adsorption and filtration products, such as solid block and precoat adsorption filter.

Examination of third party testing organizations' listings show a large number of carbon based filters and a few distillers have passed the established testing protocols for the reduction of the inorganic mercury in water by 66% or higher. None of the reverse osmosis systems have yet been tested for such capabilities.

The treatment methods listed herein are generally recognized as techniques that can effectively reduce the listed contaminants sufficiently to meet or exceed the relevant MCL. However, this list does not reflect the fact that point-of-use/point-of-entry (POU/POE) devices and systems currently on the market may differ widely in their effectiveness in treating specific contaminants, and performance may vary from application to application. Therefore, selection of a particular device or system for health contaminant reduction should be made only after careful investigation of its' performance capabilities based on results from competent equipment validation testing for the reduction of mercury.

As part of the installation procedure of Point of Entry Units, system performance characteristics should be verified by tests conducted under established test procedures and water analysis. There after, the treated water should be monitored periodically to verify continued performance. The water treatment equipment must be controlled diligently to ensure that acceptable feedwater conditions and equipment capacity are not exceeded.

| Contaminant | MCL mg/ml | Treatment Methods |
|---|---|---|
| Metallic Mercury (Hg) | 0.002 total mercury | Distillation, Reverse Osmosis, GAC Filters, Solid Block & Precoat |
| Adsorption | | |
| Mercuric ($Hg^{+2}$) | | Filters (i.e., properly designed |
| Mercurous ($Hg^{+1}$) | | |
| Methyl Mercury | | submicron filtration with adsorption media), |

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