TECHNICAL APPLICATION BULLETIN

Barium

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

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

Occurrence

Barium is a divalent cation and alkaline earth metal that can be found in naturally occurring mineral deposits. The most common ores are found in Alaska, Arkansas, California, Georgia, Kentucky, Montana, Nevada, and Tennessee. Barite, a natural barium sulfate ore, was produced at 38 mines in these states in 1973, with Nevada supplying 50% of the tonnage. It is used in making a wide variety of electronic components, in metal alloys, bleaches, dyes, fireworks, ceramics and glass. Barium is released to water and soil in the discharge and disposal of drilling wastes, from the smelting of copper, and the manufacture of motor vehicle parts and accessories.

Health Effects

The health effects of the different barium compounds depend on how well the compound dissolves in water. Barium compounds that do not dissolve well in water are not generally harmful and are often used by doctors for medical purposes. If the sulfate concentration in the water is high, then the precipitation of barium as a sulfate salt reduces its potential for adverse health effects.

Those barium compounds that dissolve well in water may cause harmful health effects in people. Ingesting high levels of soluble barium compounds that dissolve well in water over the short term has resulted in difficulties in breathing, increased blood pressure, changes in heart rhythm, stomach irritation, brain swelling, muscle weakness, and damage to the liver, kidney, heart, and spleen.

Animal studies have found increased blood pressure and changes in the heart from ingesting barium over a long time. Based on such studies, the United States Environmental Protection Agency (USEPA) has set a Maximum Contaminant Level Goal (MCLG) at 2.0 milligrams per liter (mg/L) or parts per million (ppm) in water. The federal Safe Drinking Water Act Maximum Contaminant Level (MCL) also has been set at the same (2.0 ppm) level by EPA.

Treatment Alternatives

When proper regeneration procedures are employed, barium along with calcium and magnesium are effectively exchanged to sodium by conventional Point-Of-Entry (POE) cation-exchange water softeners. Barium break through occurs after hardness due the three times greater affinity of barium ions over either calcium or magnesium ions for cation-exchange water softening resins.
Point-of-Use (POU) reverse osmosis and distillation are also effective at reducing barium concentrations in drinking water.

There are many POU and POE units of this type tested and certified for effective barium reduction. Consumers can make use of such information by contacting the Water Quality Association, NSF International, and Underwriters Laboratories.

Any treatment method that concentrates barium, as is the case with ion exchange softening, reverse osmosis, and distillation may cause precipitation. Barium sulfate will precipitate at concentrations of 2 ppm or greater. If the sulfate level in the raw water is greater than 2 ppm, barium sulfate precipitation is likely. Over time this precipitation may coat and foul the system. Barium sulfate is very insoluble and difficult to clean and may thus require replacement of membrane modules, the resin media, or even distiller heating elements after some time of usage.

As part of the installation procedure of a POE system, its performance characteristics should be verified by tests conducted under established test procedures and water analyses. There after, if high barium is found to be present in the influent water, 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.

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 specific contaminant to be reduced.

Contaminant	**MCL**	**Treatment Methods**
Barium (Ba^{+2})	2 mg/L	Cation Exchange Softening Reverse Osmosis, Distillation

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