

Manganese in New Mexico Well Water: What Every Home Owner Should Know

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What is Manganese?

Manganese (chemical symbol Mn) is a naturally occurring mineral found in rock and soil, and in ground water. It is a normal and necessary trace element in the human diet. Mn is present in New Mexico well water in varying concentrations. It is detectable as taste (metallic), odor (sulfur) and color (reddish brown staining) at concentrations as low as 0.05 milligrams per liter (mg/L).

What is the EPA National Drinking Water Standard for Manganese?

The Secondary Maximum Contaminant Level (SMCL) for manganese is 0.05. Concentrations above this level are quite problematic from an aesthetic and economic standpoint. This Secondary MCL is not enforceable by law. The health related Primary Contaminants are regulated by the EPA through the Primary Maximum Contaminant Level (PMCL) standards. Manganese has been considered by the EPA and by many states for regulation as a Primary Contaminant due to recent studies indicating toxicity at concentrations as low as 0.3 mg/L (Spangler and Elsner 2006, Francis and Forsyth 1995, Keen and Leach 1988, EPA 2004). The EPA Lifetime Health Advisory (LHA) limit for manganese is 0.3 mg/L. The National Inorganic and Radionuclide Survey (NIRS) Health Reference Level (HRL) is also 0.3 mg/L. Communities in New Mexico with manganese concentrations exceeding this limit include the Albuquerque South Valley, the Village of Corrales and the Los Alamos wellfield.

Is Manganese a Health Risk?

Manganese may cause a variety of serious responses due to chronic oral or inhalation exposure (Francis and Forsyth 1995, Kondakis, et.al. 1989, Spangler and Elsner 2006). Manganese targets the central nervous system. Symptoms include headache, insomnia, disorientation, anxiety, lethargy and memory loss. Long term exposure may result in motor disturbances including a syndrome that resembles Parkinson's. Infants and children, the elderly and patients with liver disease are at highest risk. Acute inhalation exposure may result in flu-like symptoms—fever, sweating, coughing and nausea (Francis and Forsyth 1995). Manganese is known to concentrate in the pancreas and may affect glucose metabolism. Chronic manganese exposure by inhalation may result in immunosuppression resulting in increased incidence of respiratory infections (Adkins, et .al. 1980). There is no evidence that manganese is carcinogenic. Spangler and Elsner (2006) have shown that chronic exposure to manganese contaminated water while showering may result in irreversible neurological damage. Such damage may occur at concentrations below the LHA and HRL standard of 0.3. Exposure to manganese through inhalation during showering was not considered by the EPA when establishing its Secondary MCL of 0.05 mg/L. **Bioavailability:** The authors, and later research indicates that the neurology of the olfactory system offers a direct pathway for vaporized manganese to enter the central nervous system and is thus far more efficient at delivering the toxin to the brain than is oral exposure through food or drinking water.

What Are the EPA Best Available Technologies (BATs) for Removing Manganese?

The EPA lists seven BATs for Manganese. However only two are practical for home owners. For concentrations less than 0.3 mg/L a whole house point of entry (POE) cation exchange water softener with a shallow shell technology (SST) resin media will soften hard water and remove manganese and iron at all points of use throughout the house. For concentrations greater than 0.3 mg/L or in the absence of the SST resin, oxidation/filtration (manganese greensand filter or air injection oxidizer) is the BAT of choice. Point of use (POU) technologies (at the sink) are not recommended due to the need for manganese removal from the shower.

References

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