

Manganese in Drinking Water Advice

This document is intended to answer common questions about manganese and drinking water

What is manganese and where does it come from?

Manganese is a common, naturally-occurring mineral found in rocks, soil, groundwater, and surface water. Manganese is a natural component of most foods. Manganese is an essential nutrient and eating a small amount of it each day is important to stay healthy.

How are people exposed to manganese?

The majority of manganese exposure in the general population comes from the food we eat. Grains, beans, nuts and teas are rich in manganese and it is also found in infant formula. A normal, balanced diet typically provides adequate manganese intake. The principal source of exposure to manganese is from food, but in situations where manganese levels in drinking water are elevated, the contribution from drinking water can increase the overall intake of manganese.

Adults and children get enough manganese from the foods we eat. For example, EPA's drinking water health advisory for manganese says:

- food at 3.5 to 7 mg manganese/day is the greatest source of manganese exposure to the general population,
- an average intake from Western and vegetarian diets is 0.7 to 10.9 mg manganese/day,
- an average cup of tea may contain 0.4 to 1.3 mg of manganese, and
- 12% of the population takes manganese supplements that have a median concentration of 2.4 mg/day.

Is manganese regulated?

No. Manganese is not currently regulated as a national primary drinking water standard which means there is no enforceable limit for manganese in drinking water. However, EPA is in the process of determining whether to regulate manganese due to updated health effects information and additional occurrence data. EPA included manganese in the fourth Unregulated Contaminant Monitoring Rule (UCMR4), which requires all public drinking water systems serving over 10,000 people and selected small systems to monitor for manganese. EPA will also consider the health effects in their regulatory determination and evaluate potential risks to adults, children, and infants based on recent studies.

EPA has established a Secondary Drinking Water standard for manganese. EPA's Secondary Drinking Water Standards identify manganese as having technical (staining) and aesthetic effects (taste, color).

More information on EPA's regulatory determination process can be found at the following link: <https://www.epa.gov/dwregdev/how-epa-regulates-drinking-water-contaminants>.

More information on the UCMR4 can be found at the following link:
<https://www.epa.gov/dwucmr/fourth-unregulated-contaminant-monitoring-rule>

Manganese Levels of Concern in Drinking Water

The EPA develops health advisories to provide information on contaminants that can cause human health effects and are known (or anticipated) to occur in drinking water. Health advisories are intended to provide technical guidance to agencies and local officials. Health advisories are set at levels that will protect people from all adverse health effects. Published health advisory levels are based on non-cancer health effects for specified exposure durations; one-day, ten-day, and lifetime.

One-day and 10-day health advisories are considered acute or short-term levels that are not expected to cause adverse effects for up to one or ten days of exposure. These health advisories are intended to protect a 10-kg (22 pound) child consuming 1 liter of water per day.

- For infants up to 6 months of age, EPA identified that water with manganese levels equal to or less than 0.3 mg/L for more than 10 days has shown no adverse health effects and can be used for making formula.
- For the general population, EPA identified that water with manganese concentrations equal to or less than 1 mg/L over a 10-day exposure has shown no adverse health effects.

Lifetime health advisories are considered chronic or long-term levels that are not expected to cause adverse effects after a lifetime of exposure. These health advisories are intended to protect a 70-kg (154 pound) adult consuming 2 liters of water per day.

- For the general population, EPA identified that water with manganese levels equal to or less than 0.3 mg/L over a lifetime exposure has shown no adverse health effects.

The EPA health advisory levels of 0.3 mg/L and 1 mg/L were set based upon typical daily dietary manganese intake levels not known to be associated with adverse health effects. This does not imply that intakes above these levels will necessarily cause health problems. As a precaution, the general population should consider limiting their consumption of drinking water when levels of manganese are above the EPA health advisory to decrease their exposures and to decrease the possibility of adverse neurological effects.

EPA's health advisory information for manganese can be found at the following link:
https://www.epa.gov/sites/production/files/2014-09/documents/support_cc1_magnese_dwreport_0.pdf

Potential Manganese Health Effects

Too much manganese can increase the risk of health problems, particularly for infants under 6 months old. Infants are more at risk than older children and adults because their brains and bodies are quickly developing. Infants exposed to manganese over 0.3 mg/L may experience learning or behavioral problems. Some studies have shown that too much manganese during childhood may also have effects on the brain, which may affect learning and behavior.

Manganese is poorly absorbed through the skin. There are no concerns about manganese exposure through skin contact with food or water containing manganese.

Adult's drinking water with high levels of manganese for many years may experience impacts to their nervous system, resulting in behavioral changes and other nervous system effects, including slow and clumsy movements. Exposure to high levels of manganese can cause harm to the nervous system. A disorder similar to Parkinson's disease called Manganism can result. Tremors, shaking, and an unsteady gait are characteristic of very high exposure to manganese. This type of effect is most likely to occur in the elderly after exposure to high levels of manganese or with individuals exposed to welding vapor that contains high levels of manganese. The EPA's health advisory is intended to protect against this effect.

If you are concerned about your health from manganese exposure, discuss your concerns with your healthcare provider.

Is manganese of concern for infants and young children?

Yes, especially for bottle-fed infants. All commercial baby formulas contain manganese as a nutrient, and if prepared with water that also contains manganese, the infant may get a higher dose than recommended. Some studies suggest that prenatal and early childhood exposures to manganese can have effects on learning and behavior. Thus, it is very important to know what the manganese levels in drinking water are when using it to make baby formula.

When manganese levels in drinking water are above 0.3 mg/L, infants under 6 months of age should immediately stop consuming the water and formula that was prepared with the water.

How do I find out about manganese levels in my drinking water?

Contact your public water system operator or consult your water system's most recent consumer confidence report. Please be aware that not all systems are required to test for manganese.

If you obtain your water from a private well and suspect high manganese in your drinking water, you should contact a lab accredited to analyze for manganese in drinking water and have your supply tested. The following laboratories are certified to test for manganese: Fargo-Cass Public Health Environmental Laboratory, (701) 298-6997; Minnesota Valley Testing Laboratories, (701) 258-9720 or (800) 279-6885; or North Dakota Department of Health, Division of Chemistry, (701) 328-6140.

How do I remove manganese from my water?

Consider filtering your drinking water or using an alternate source of drinking water. Oxidizing filters, reverse osmosis units, or water softeners have been shown to be effective at lowering manganese levels in tap water, depending on the form of manganese in your water (dissolved or particulate. For instance, water drawn from the tap is initially clear but over time develops a brown or blackish hue as it is exposed to the air would indicate that the manganese is dissolved.

If water coming out of the tap immediately colored brown or blackish with particulates settling out, you would consider that particulate manganese). NSF International, the Water Quality

Association, Underwriters Laboratories, and CSA International all certify home water treatment products for contaminant removal. Keep in mind that certification to an NSF/ANSI or other standard or protocol does not mean that a filter, purifier, or treatment system will reduce all possible contaminants. It's important to verify that the filter, purifier or treatment system is certified to the applicable standard for the reduction of the contaminants of most concern.

For more information on home filtration treatment system certification, you can go to the following link: <https://www.nsf.org/consumer-resources/water-quality/water-filters-testing-treatment/standards-water-treatment-systems>.

Filters found in refrigerators, water pitchers, or filters installed on your water tap are not effective at removing manganese and one should check with the filter manufacturer for specific detail.

Boiling water will not remove manganese. Boiling will concentrate manganese.

Each home plumbing and treatment system is unique, and some homes may not have treated tap water available at the taps most used for drinking and cooking. Also, keep in mind that any type of treatment device requires regular maintenance, such as changing filters, cleaning scale buildup, maintaining adequate salt levels in brine tanks, or disinfecting the unit. Failure to properly maintain a unit reduces its effectiveness and, in some cases, may make the water quality worse. Continued maintenance is necessary for the life of the device along with regular water testing to ensure the device is working properly. Ensuring your system is working properly minimizes the need for testing. Follow the manufacturer's recommendations for filter replacements and maintenance.

If you are concerned about your in-home treatment systems effectiveness to remove manganese, water testing is available. The following laboratories are accredited to test for manganese: Fargo-Cass Public Health Environmental Laboratory, 701-298-6997; Minnesota Valley Testing Laboratories, 701-258-9720 or 800-279-6885; or North Dakota Department of Health, Division of Chemistry, 701-328-6140. The fee for the test is around \$25.

You may choose to reduce your exposure to manganese by using another source of water such as bottled water. However, manganese may still be present in bottled water. Contact the bottled water manufacturer for more water quality information.

For more information:

EPA's Office of Ground water and Drinking Water: <https://www.epa.gov/ground-water-and-drinking-water>

EPA's Drinking Water Health Advisory for Manganese:
https://www.epa.gov/sites/production/files/2014-09/documents/support_cc1_magnese_dwreport_0.pdf

EPA's Secondary Drinking Water Standards:

<https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance- nuisance-chemicals>

EPA's Drinking Water Criteria Document for Manganese: <https://www.epa.gov/wqc/drinking-water-criteria-document-manganese>

State Hygienic Laboratory at the University of Iowa Well Water Quality and Home Treatment Systems: <http://shl.uiowa.edu/env/privatewell/homewater.pdf>

Public Health Statement for Manganese from the Centers for Disease Control (The EPA has updated the manganese HALs since this was posted):

<https://www.atsdr.cdc.gov/PHS/PHS.asp?id=100&tid=23>

EPA Region 8 Toxicologist Contact Information:

For additional health related inquiries regarding manganese in drinking water, contact Bob Benson at 303-312-7070.

North Dakota Department of Environmental Quality Contact Information:

For additional questions or information, please contact Drinking Water Program at (701) 328-5211.