

# MANGANESE

In response to concerns regarding water quality issues, the City of Longview has asked a team of health science experts to review water quality data and determine whether some of the components of Longview’s drinking water might have health impacts. This fact sheet was prepared by Intertox, Inc.\* for City of Longview customers to address commonly asked questions.

## What is manganese?

Manganese is naturally occurring and the twelfth most abundant element in the earth’s crust.<sup>1</sup> It can enter air and water from the weathering of rocks and windblown soil. Manganese is most commonly found in nature combined in compounds with oxygen, carbon, or silica.<sup>1</sup>

## How is manganese measured?

Manganese is present in water in either soluble or insoluble forms. It is measured in milligrams (mg) of manganese (either soluble or total) per liter (L) of water, or mg/L. One mg/L is sometimes referred to as a part per million (ppm).

### Average Amount of Manganese in Milligrams (mg) per Serving<sup>2</sup>

FOOD OR BEVERAGE	MG PER SERVING
Green tea (1 cup)	0.4-1.6
Spinach, cooked (1/2 cup)	0.8
Pineapple juice (1/2 cup)	0.6
Almonds (1 ounce)	0.7
Peanuts (1 ounce)	0.6
Instant oatmeal (1 packet)	1.0
Pinto beans, cooked (1/2 cup)	0.4
Brown rice, cooked (1/2 cup)	1.1

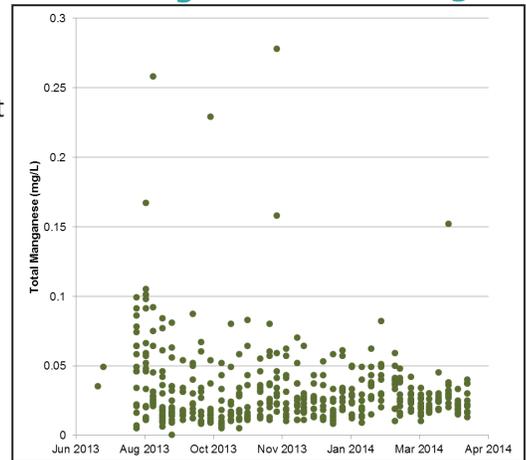
## How small is one part per million?

One part per million is equal to:

- One inch in 6 miles
- One second in 12 days

## What is the concentration of manganese in drinking water in Longview?

Data from water sampling from July 2013 to April 2014 at 23 locations in Longview show an average total manganese concentration of 0.03 mg/L and an average soluble manganese concentration of 0.02 mg/L. Total manganese concentrations ranged from 0.005 to 0.28 mg/L. Soluble manganese concentrations ranged from 0.005 to 0.094



mg/L. The highest concentrations were measured during re-equilibration of the distribution system and have dropped as the system has stabilized.

## What does the government say about how much manganese is acceptable in drinking water?

The U.S. EPA establishes Primary Drinking Water Standards based on health considerations and Secondary Drinking Water Standards based on aesthetics such as taste, odor, color, or corrosivity. U.S. EPA has no Primary Standard for manganese. The Secondary Maximum Contaminant Level (SMCL) is 0.05 mg/L due to metallic taste and black colored stains at levels above the SMCL.<sup>3</sup>

## How much manganese am I exposed to?

Manganese is an essential element in human nutrition. It is present in our diet in grains, beans, nuts, and tea.<sup>2</sup> The U.S. Institute of Medicine set Adequate Intakes (AIs) for manganese in children, adult females, and adult males of 1.2 mg/day, 1.8 mg/day, and 2.3 mg/day, respectively.<sup>2</sup> The U.S. EPA established a reference dose (RfD) for ingestion of manganese from all sources of 0.14 mg per kilogram (kg) body weight per day (equivalent to about 9.8 mg/day for an average adult).<sup>4</sup> A reference dose is an estimate of a daily dose over a lifetime that is unlikely to pose adverse health effects, even for vulnerable or sensitive populations.

A person drinking 2 liters (about 8 ½ cups) of water a day containing the highest level of total manganese measured by the City of Longview would receive at most about 0.6 mg of manganese per day from drinking water, less than a single serving of cooked spinach.

## What can I do about manganese?

While manganese does not pose any health risks at the levels found in drinking water, it can be a nuisance for customers. Manganese may result in the appearance of black colored stains on sinks, toilets, and faucets.

Here are some helpful hints for dealing with manganese stains:

- Use a pumice stick or lemon juice and salt to remove mineral stains on toilets, tubs, and sinks.
- For bathroom or kitchen cleaning, use detergents that include phrases like “removes mineral stains” on the label.
- Cleaners containing oxalic acid or hydrochloric acid (muriatic acid) are effective at removing mineral stains. However, these products are not recommended for septic systems. Read and follow directions for these products carefully.

## What happens to manganese when it enters the body?

Manganese present in drinking water is absorbed in the digestive tract. Little manganese is absorbed through the skin. The amount that is absorbed through the digestive tract depends on a person’s age, with children absorbing more than adults.

Manganese is an essential nutrient for humans. The body needs manganese for normal growth and health. It is involved in the formation of bone, and is a component of enzymes involved in amino acid, cholesterol, and carbohydrate metabolism.<sup>2</sup>

## What type of health effects can be caused by exposure to manganese?

In laboratory animals, exposure to very high levels of manganese caused nervous system disturbances and illnesses involving the kidneys and urinary tract. These illnesses included inflammation of the kidneys and kidney stone formation. Some effects on fertility were also seen in some laboratory animals fed very high levels of manganese.<sup>1</sup> These effects occurred at levels more than 16 times higher than the amount an average child would ingest from Longview’s drinking water at the maximum concentration measured (0.28 mg/L). No birth defects have been observed in animals exposed to manganese.

## Are any health effects expected from the manganese in Longview’s water?



Based on the data analyzed for Longview’s water, no adverse health effects are expected from manganese, even at the maximum concentration measured.

An infant (up to 12 months of age) would have to drink about (21) 8-ounce glasses of water a day containing the highest level of total manganese measured by the City of Longview to ingest an amount equal to the U.S. EPA reference dose of about 1.4 mg/day for an infant. The number of glasses is greater for adults (150) and children (64) due to their substantially greater size.

## Where can I get more information?

The U.S. EPA has a searchable website for Frequently Asked Questions regarding water quality at <http://safewater.supportportal.com/ics/support/KBSplash.asp>

## References

1. ATSDR, 2012. Toxicological Profile for Manganese, from <http://www.atsdr.cdc.gov/ToxProfiles/TP.asp?id=102&tid=23>
2. Linus Pauling Institute, 2001. Micronutrient Information Center: Manganese, from <http://lpi.oregonstate.edu/infocenter/minerals/manganese/>
3. U.S. EPA, 2013. Drinking Water Contaminants, from <http://water.epa.gov/drink/contaminants/index.cfm>
4. U.S. EPA, Integrated Risk Information System: Manganese, from [http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showQuickView&substance\\_nمبر=0373](http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showQuickView&substance_nمبر=0373)

\* Intertox is a health science research firm headquartered in Seattle, Washington. Intertox consists of a multidisciplinary team of experts in the medical and environmental sciences who work with clients to evaluate risks posed by chemicals and biological agents affecting human health.