



# Boron and Drinking Water

## Summary

Boron is a naturally occurring element and is used in many consumer products. People come in contact with boron through food, water, and consumer products containing boron. Once boron is in the environment, it does not break down. Boron has been detected in Minnesota drinking water, groundwater, and surface water.

## Boron

Boron is an element that occurs naturally in the earth's crust and can be found in fruits, vegetables, and some water sources, including bottled water.<sup>1</sup> Boron often binds to oxygen, forming a group of compounds called borates (such as borax and boric acid). Boron and borates are used in manufacturing glass, ceramics, soaps, laundry detergents, bleach, cosmetics, medications, pesticides, personal care products, and other consumer products. Boron is an essential micronutrient for most plants. Evidence suggests it is likely an essential nutrient for animals and humans.<sup>1,2</sup>

## Boron in Minnesota Waters

Boron has been detected in Minnesota drinking water, groundwater, and surface water. Materials in the Earth's crust in the northwestern, southwestern, and northeastern corners of Minnesota contribute to high levels of boron in groundwater in those areas.<sup>3</sup> Boron has been detected in public water systems at concentrations that range from 20 micrograms per liter ( $\mu\text{g/L}$ )\* to 7400  $\mu\text{g/L}$ .<sup>4</sup> Boron has been detected in surface water and groundwater near landfills as well.<sup>5</sup>

\*One microgram per liter ( $\mu\text{g/L}$ ) is the same as one part per billion (ppb).

## MDH Guidance Value

Based on available information, MDH developed risk assessment advice for boron in drinking water at 500 ppb. MDH guidance values are developed to protect people who are most vulnerable to the potentially harmful effects of a contaminant. A person drinking water at or below the guidance value would be at little or no risk for harmful health effects.

## Potential Health Effects

In animal studies, exposure to high levels of boron caused decreased fetal weight and improper fetal development, as well as disruption to the male reproductive system. MDH's guidance value of 500 ppb is designed to be protective of formula-fed infants, who may ingest more boron from food and water, on a per body weight basis, than older children or adults.

## Potential Exposure to Boron

Consuming food or water with boron in it is the main way most people come in contact with boron. People can also come in contact with boron through dust, consumer products, or pesticides that contain boron. People who work in places that mine or process boron may be exposed to higher levels of boron.<sup>2</sup>

## Boron in the Environment

Boron enters the environment through natural and human-made processes. Natural weathering of soils and rocks can release boron into the air, water, or soil. Manufacturing plants that use boron (like glass manufacturing and coal-burning power plants) also release boron.<sup>2</sup> Once boron is in the environment, it does not break down. Rather, the element changes form or attaches to or separates from soil, sediment, and water particles.<sup>6</sup>

## Potential Environment Impacts of Boron

Boron is an essential nutrient for aquatic life and terrestrial plants, but at high concentrations it can have toxic effects. Concentrations of boron observed in Minnesota's surface waters are typically lower than the level that would harm aquatic life.<sup>7</sup>

## Health Risk Assessment Unit

The MDH Health Risk Assessment Unit evaluates the health risks from contaminants in drinking water sources and develops health-based guidance values for drinking water. MDH works in collaboration with the Minnesota Pollution Control Agency and the Minnesota Department of Agriculture to understand the occurrence and environmental effects of contaminants in water.

## References

1. U.S. Environmental Protection Agency. 2008. Health Advisory for Boron. [https://www.epa.gov/sites/production/files/2014-09/documents/drinking\\_water\\_health\\_advisory\\_for\\_boron.pdf](https://www.epa.gov/sites/production/files/2014-09/documents/drinking_water_health_advisory_for_boron.pdf)
2. Agency for Toxic Substances and Disease Registry. 2010. [Toxicological Profile for Boron](https://www.atsdr.cdc.gov/toxprofiles/tp26.pdf) (<https://www.atsdr.cdc.gov/toxprofiles/tp26.pdf>). Accessed December 2016.
3. Minnesota Pollution Control Agency. Date unknown. [Minnesota's Ground Water](https://www.pca.state.mn.us/sites/default/files/pp-mngroundwater.pdf) (<https://www.pca.state.mn.us/sites/default/files/pp-mngroundwater.pdf>). Accessed December 2016.
4. Minnesota Drinking Water Information System. 2016. Data received for "Boron" in November 2016 from the MDH Drinking Water Protection Section.
5. Minnesota Pollution Control Agency. Mn EQuIS. 2016. Data received for "Boron" from Minnesota Pollution Control Agency for EQuIS data. November 2, 2016.
6. U.S. National Library of Medicine. [Hazardous Substances Data Bank](https://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB) (<https://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB>). Searched for "Borax". Accessed December 2016
7. Canadian Council of Ministers of the Environment. 2009. "Canadian Water Quality Guidelines for the Protection of Aquatic Life: Boron."