



Groundwater and Your Health

Boron in Drinking Water

Some boron is present in most drinking water -- usually at a level too low to present a health threat. Much of the boron found in groundwater and drinking water is naturally-occurring, but some comes from the production of consumer and agricultural products. This fact sheet will tell you about health concerns and treatment options for boron in drinking water.

Boron is an element that is present in our environment. It is often found in rock and soil, and is slowly released into the water. Plants use boron that is obtained from soil. Some boron also gets into the environment from manufacturing of commercial products or pesticides. Because boron is widespread in our environment and in the food chain, we all have some of it in our bodies. It is estimated that people take in an average of 10 to 25 milligrams of boron every day from the food they eat.

Is boron toxic?

Any substance or chemical you take into your body in excess can be toxic. How "toxic" something is depends on many factors: how much of it you take in; the period of time you are exposed to it; whether your contact is by eating, drinking, breathing or touching it; the susceptibilities and resilience of the individual person; and the potency of the substance.

In animal studies, ingestion of high levels of boron affected the testes and sperm of males, and caused birth defects in the offspring of pregnant females. These reproductive and developmental effects occurred at much higher levels of boron than are commonly found in drinking water. There is some uncertainty as to the health effects of low levels of boron in humans when the studies examined high levels of boron in animals. Because of the uncertainties in knowledge about the health effects of boron, the Minnesota Department of Health (MDH) issues conservative drinking water advice, to err on the side of protecting human health.

Some research has suggested that small amounts of boron in drinking water may actually offer a beneficial effect for persons with certain conditions, such as arthritis. However more study is needed to better understand the toxicity and any possible benefits related to boron.

What is considered a safe level of boron?

The U.S. Environmental Protection Agency (EPA) does not have a standard for boron in drinking water, and it is therefore not federally regulated in public drinking water supplies. The Minnesota Department of Health sets health-based standards for some groundwater contaminants, called "health risk limits" (HRLs). The health risk limit is a concentration of a contaminant that is safe to ingest daily over a lifetime.



The Minnesota Department of Health (MDH) estimates that it is safe to drink water containing up to 600 parts per billion (ppb)¹ of boron every day for a lifetime. This estimate is protective for all people. If boron is found at a concentration of greater than 600 ppb in drinking water, the MDH recommends that you consider using an alternative source of water for drinking and cooking over the long term. Water with greater than 600 ppb may still be used for other household uses, such as bathing and washing. For an explanation of the methods used to determine a health risk limit, see the MDH fact sheet, "How Health Risks Are Evaluated."

It is assumed that the average person drinks two liters of water every day. If you were to drink this amount of water with 600 ppb of boron every day, this would contribute 1,200 micrograms, or 1.2 milligrams, per day to your daily intake of boron. The average person takes in an estimated 10-25 milligrams of boron every day from food, air, and soil. Thus, the amount from groundwater would usually contribute only a small portion to the total amount of boron you take in.

How do you know if boron is in your drinking water?

You cannot taste or smell boron in your drinking water. If you want to test your well water for boron, send your sample to a qualified laboratory. State or local government agencies do not pay for the testing of private wells.

Even if a nearby water well has already been tested for boron, you cannot use the test results to estimate the boron levels in your own well. The levels can vary from one well to the next, even within a small geographic area. Test results can also vary over time.

How can you reduce boron in drinking water?

If boron is present in your water supply at concentrations in excess of 600 ppb, the MDH recommends that you consider taking steps to reduce your exposure to boron in water used for drinking and food preparation. You can reduce your consumption of boron either by finding an alternate water supply that has a lower boron concentration or by treating your existing water supply to reduce the boron concentration.

Alternate Water Supply

Alternate water supplies include using bottled water, connecting to a public water supply (if available), or constructing a new well. Because boron is not a regulated contaminant in drinking water, public water supplies or bottled water companies are not required to test water for boron, and information on boron concentrations in the water may not be available. The MDH is currently testing community water supplies in northeastern Minnesota to determine boron levels.

Drilling a New Well

There is currently very little information available about the distribution of boron in groundwater, although the boron in northeastern Minnesota seems to be associated with some of the geologic materials of the North Shore. Boron coming from rock and soil may

¹one part per billion (ppb), or 1 microgram per liter of water ($\mu\text{g/L}$), is equivalent to one drop in 16,000 gallons of water.

be found in groundwater at any depth, so drilling a deeper well may not result in less boron in your water.

Water Treatment

Reverse osmosis (RO) and **distillation** are the most common methods for in-home treatment of water to reduce boron. Reverse osmosis removes boron and other dissolved solids by forcing the water under pressure through a membrane with microscopic pores. Distillation removes boron by boiling the water, leaving the dissolved solids and boron behind. The steam cools and condenses into mineral-free water in a separate reservoir. Both treatment methods are slow in producing treated water -- RO can take 3 to 6 hours to process one gallon of water; distillation can take 5 hours or longer to process one gallon of water.

Be sure that you select a water treatment unit that suits your needs. There are many different kinds of RO units and distillers. A reverse osmosis unit often requires pretreatment of the water and typically wastes 50% or more of the incoming water. Power consumption is relatively high in distillers, and some models may also waste a considerable amount of water for cooling and flushing. Other treatment methods which may be effective in reducing boron in your water, such as anion exchange, also have operating costs and limitations which should be considered.

Before purchasing a water treatment device, have your drinking water tested for boron. Also test the drinking water after the treatment unit is installed to assure that it is performing as expected. Follow the operating and maintenance instructions carefully. Water treatment units require maintenance. Work with a reputable dealer to select a water treatment unit. Find out if the unit has been certified by a third party evaluator such as NSF-International or UL.

For More information...

For more information about boron and drinking water, health concerns, and treatment methods, call your local health department or the Minnesota Department of Health. MDH has district offices in Bemidji, Duluth, Fergus Falls, Mankato, Marshall, Rochester and St. Cloud. You can call or write to MDH at:

Minnesota Department of Health
Division of Environmental Health
121 East Seventh Place
Box 64975
St. Paul, Minnesota 55164-0975
(612) 215-0700

To request this information in another format, call (612) 215-0700.
TDD: MN Relay Service (612) 215-0707 or toll-free 1-800/627-3529.

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