

Boron Fact Sheet

What is boron?

- Boron is a naturally occurring element found in many types of rocks including shale.
- Boron is found in fruits, vegetables, nuts, and legumes.
- Boron is considered an essential nutrient with small amounts necessary for good health.

What are the uses of boron?

- Boron (borate-containing minerals) is used in making a wide variety of products including glass, ceramics, soaps, detergents, fire retardants, and fertilizers.
- Boric acid is used in pharmaceuticals, cosmetics, and toiletries.
- Boric acid is an ingredient of several pesticides.
- Boric acid and boron oxide are used to reduce flammability of cellulose insulation, cotton batting in mattresses, and wood composites.
- Borates are used in the manufacture of adhesives, lubricants, brake fluids, metal working fluids, water treatment chemicals, and fuel additives.
- Boron is often added to multivitamins and other nutritional supplements.

Is boron present in the environment?

- Naturally occurring boron is found in soils, sediments, water, and air.
- Concentrations of boron in surface soil and surface water can vary greatly depending on local geologic formations.
- Boron-containing dust can be released into the air when coal and other fossil fuels are burned.
- Boron compounds can also be released in the air during certain industrial and manufacturing processes and during the application of fertilizers and pesticides.
- Surface water can become contaminated with boron from industrial wastewater and municipal sewage, as well as from air deposition and soil runoff.
- Borates in detergents, soaps, and personal care products can also contribute to the presence of boron in water.



- Boron does not breakdown in the environment.

How are people exposed to boron?

- The primary way people are exposed to boron is by eating foods rich in the substance or by using boron-containing dietary supplements.
- Exposure to boron can occur when ground water containing it is used for drinking and food preparation.
- The average daily dietary intake being 1.0 mg/d.
- Exposure to boron can occur while working in factories where cosmetics, medicines, insecticides and other boron-containing consumer products are made.
- Swimming or bathing in water containing boron may also result exposure to this element.

How does boron enter and leave the body?

- Boron in food or water readily enters the body through the gut.
- Boron can also enter the body through the lungs.
- Small amounts of boron can enter the body through broken skin.
- Boron distributes widely throughout the body, with the possible exception of fat.
- Small amounts of boron can accumulate in the bones.
- Boron does not breakdown. Most of it leaves the body in the urine within a few days.

How harmful is exposure to boron?

- Ingesting large amounts of boron (30 grams boric acid) over short periods of time can harm the stomach, intestines, liver, kidney, and brain.
- Breathing large amounts of airborne boron can result in lung irritation.
- Eye irritation can also result from exposure to airborne boron.

Can exposure to boron cause cancer?

- The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the U.S. Environmental Protection Agency (EPA) are uncertain whether excess boron can cause cancer.

Is there a medical test to show whether I've been exposed to boron?

- There are tests that measure the amount of boron in blood or urine.



- Normal blood boron levels for infants and children range from 0 to 1.25 micrograms per milliliter ($\mu\text{g/mL}$).
- Concentrations of boron in urine in the general population range from 0.07 to 0.66 milligrams/100 milliliters (mg/deciliter).
- Past exposures to boron are difficult to detect since it is rapidly removed from the body.

What is the treatment for boron poisoning?

- Emergency medical care should be sought in cases of suspected boron poisoning.
- Boron poisoning is treated by removing the person from the source of exposure and then with supportive medical care in a hospital setting.
- No specific antidote exists for boron poisoning.

Are there recommendations to protect public health?

- EPA – Exposure to boron in drinking water at concentrations of 4 milligrams per liter (mg/L) or 4000 parts per billion (ppb) or 4000 micrograms per liter ($\mu\text{g/L}$) for 1 day; or 0.9 mg/L or 900 ppb or 900 $\mu\text{g/L}$ for up to 10 days is not expected to cause any adverse effects in a child.
- EPA – Lifetime exposure to 1.0 mg/L (1000 ppb) of boron is not expected to cause any adverse effects.
- Occupational Safety and Health Administration (OSHA) – Legal limit of 15 milligrams per cubic meter (mg/m³) boron oxide dust in air averaged over an 8-hour work day, 40 hour workweek.
- National Academies of Science, Institute of Medicine, Food and Nutrition Board – Dietary Reference Intakes (estimated average daily requirement) for boron are 3 – 6 mg/d for ages 1- 8 and 11 – 20 mg/d for ages 9 and above.
- The World Health Organization has a provisional drinking water guideline of 0.5 mg/L (500 $\mu\text{g/L}$) of boron.

What can I do to prevent exposure to boron?

- Identify and limit sources of exposures.
- While tap and bottled water generally contain safe levels of boron, well water may sometimes be contaminated with enough boron to create a potential health hazard. If drinking water is obtained from a well, it may be wise to have the water checked for boron to ensure its concentration is below current guidelines.
- Reverse osmosis filtration can be used to remove boron from drinking water but it has limited capabilities.



What should I do if I believe I am ill as a result of exposure to boron?

- If you experience symptoms that you think may be related to boron exposure, you should consult your health care provider for evaluation and possible treatment.

Where can I get more information?

For more information, contact:

The Pennsylvania Department of Health, Division of Environmental Health Epidemiology, P.O. Box 90, Harrisburg, Pennsylvania, 17108. Telephone number: 717-787-1708 or visit the following websites:

The U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substance and Disease Registry's Information Center. Telephone number: 800-232-4636.

References

- (1) U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR). Updated November, 2010. Toxicological Profile for Boron.
- (2) Food and Nutrition Board, Institute of Medicine, National Academies; Dietary Reference Intakes (DRIs): Tolerable Upper Intake Levels, Elements searched 8/17/11 at http://fnic.nal.usda.gov/nal_display/index.php?info_center=4&tax_level=3&tax_subject=256&topic_id=1342&level3_id=5140.
- (3) U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, ToxFAQs™; Boron, November 2010.
- (4) Progress in Food and Nutritional Science, The role of boron in nutrition and metabolism, Naghii MR, Samman S. 1991 Oct; 17(4): 331-349.