

Arsenic in Groundwater

Arsenic is a naturally occurring element that can be found in rocks, soils, and minerals. In soil, arsenic is found naturally at concentrations ranging from 0.1 to 40 mg/kg (Agency for Toxic Substances and Disease Registry [ATSDR], 2015). In a natural setting, arsenic typically exists in two forms, or valences, depending on the availability of oxygen in groundwater.

Arsenic usually occurs as arsenate in shallow aquifers with high oxygen levels. In contrast, arsenic exists as arsenite in deeper, anaerobic groundwater.

Common sources of arsenic in groundwater include natural geologic deposits, agricultural activities, industrial processes, and landfills and waste sites. Arsenic can leach into groundwater from:

- Mineral deposits, such as volcanic ash or sedimentary rocks that contain arsenic-bearing minerals
- Runoff from pesticides and fertilizers that contain arsenic
- Industrial processes, such as mining and smelting of arsenic-containing ores, as well as the use of arsenic-based chemicals in various industries
- Landfills and hazardous waste sites if proper containment measures are not in place. In the past, arsenic was used as a pesticide and preservative, and as a result, some groundwater sources could have been contaminated with arsenic from its application.



Health Impacts

Arsenic is a toxic substance that is commonly found in well water in many parts of the world. Chronic exposure to arsenic in drinking water can lead to serious health problems, including:

- **Cancer:** Long-term exposure to arsenic has been linked to an increased risk of various types of cancer, such as skin, lung, bladder, liver, and kidney.
- **Cardiovascular disease:** Arsenic has been shown to increase the risk of cardiovascular disease, including heart disease and stroke.
- **Neurological effects:** Arsenic exposure has been linked to cognitive decline, memory loss, and other neurological problems. There is evidence that suggests that long-term exposure to low levels (≥ 0.005 mg/L) of arsenic from drinking water might result in lower IQ scores in children.
- **Skin lesions:** Chronic arsenic exposure can lead to the development of dark patches on the skin, a condition known as arsenicosis.
- **Reproductive problems:** Arsenic has been linked to a range of reproductive problems, including decreased fertility and increased risk of miscarriage.
- **Immune system suppression:** Arsenic exposure has been shown to weaken the immune system, making people more susceptible to infections and other diseases.
- **Diabetes:** Arsenic exposure has been associated with an increased risk of type 2 diabetes.

Short-term exposure to very high levels of arsenic can cause stomach pain, nausea, vomiting, diarrhea, headaches, weakness, and even death (ATSDR, 2015). If you have concerns about health problems that could be related to arsenic in your well water, discuss them with your doctor.

Treating Arsenic in Groundwater

It is important to regularly test well water for arsenic and to take steps to treat it if elevated levels are found. If you are concerned about arsenic in your drinking water, speak with a qualified water treatment professional or public health specialist.

For private wells contaminated with arsenic, the most common treatment options are:

- **Reverse Osmosis:** This process uses a semi-permeable membrane to remove impurities including arsenic.
- **Ion Exchange:** This method removes arsenic from water by exchanging arsenic ions with another ion in a resin bed.
- **Distillation:** This process involves boiling sample water, gathering the steam from the water and cooling it to turn it back into water. Distillation removes minerals, metals, and other contaminants, including arsenic by separating them into the boiler. It results in nearly pure water.
- **Activated Alumina System:** This method uses alumina media to absorb a wide range of contaminants from well water. This type of filter typically removes arsenic by oxidizing it with chlorine bleach or hydrogen peroxide.

The most cost-effective method for removing arsenic from a private water supply is currently reverse osmosis (University of Florida, 2014). Reverse osmosis can be up to 95% effective for removal of arsenate (Massachusetts Department of Environmental Protection, 2023). Most reverse osmosis systems installed in homes are called point-of-use systems.

Consult with a water treatment professional to determine the best treatment option for your specific well. The appropriate method depends on the concentration and form of arsenic in your water, in addition to other characteristics of your well.

Resources

- Arsenic in Well Water | Minnesota Department of Health
- Arsenic in Well Water: What You Need to Know | WellOwner.org
- Get Informed on Arsenic | Water Research Center

Tips to Maintain a Healthy Well

- **Know** your private well and take pictures of the following to reference later if there is damage:
 - Storage or pressure tanks
 - Pump
 - Treatment system, including filters
 - Electrical components
- **Know** your well depth and pump setting if using a submersible pump.
- **Test** your water annually for coliform and nitrate, and every 3–5 years for a complete analysis to determine if there have been any changes to the water quality.
- **Check** your private well periodically for any damage or maintenance problems. Always hire a qualified professional well contractor to service your well.
- **Keep** the contact information for a licensed well contractor, local health department, university extension service, licensed electrician, and water testing laboratory handy.

- Arsenic in Your Well Water: What Homeowners Can Do if Your Well Has Too Much Arsenic | Maine Department of Health

References

- Agency for Toxic Substances and Disease Registry. (2015). ToxFAQs for arsenic. <https://www.cdc.gov/TSP/ToxFAQs/ToxFAQsDetails.aspx?faqid=19&toxid=3>
- Massachusetts Department of Environmental Protection. (2023). *Arsenic in private well water FAQs*. <https://www.mass.gov/info-details/arsenic-in-private-well-water-faqs>
- University of Florida. (2014). Inexpensive, easy way to filter arsenic from water. *ScienceDaily*. www.sciencedaily.com/releases/2014/11/141103142207.htm