

Alaska's Changing Landscape and Well Water Arsenic Presence Testing and Mitigation

by Art Nash and Debasmita Misra

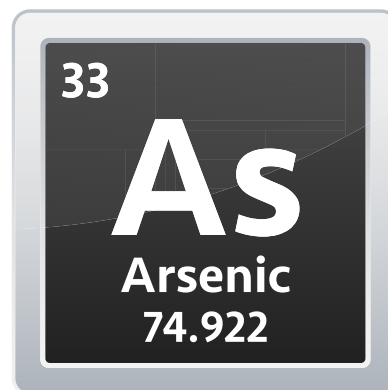
Arsenic is a naturally occurring metal in Alaska and certain geologic processes can accumulate high levels of arsenic. It might be better to refer to “arsenic” as the mineral that occurs in two subsurface conditions — one that has been exposed to oxygen — and the other exists in an anaerobic state. Why should Alaskans be concerned about whether either form is present in their water well? Because at certain concentration levels, inorganic arsenic found in soil, sediment or groundwater can be toxic to human health.

Arsenic has been found in well waters of the more populated areas of Interior and Southcentral Alaska. These are the areas that are experiencing rapid changes due to climatic variations, which can affect the soils that contain arsenic and leach those into groundwater.

Soils containing arsenic also are likely to loosen and migrate due to large seismic events. Such events could free up arsenite (As^{+3}) from the mineral layer, expose it to oxygen and/or migrate it directly into the water table.

Where does arsenic come from?

The heaviest naturally occurring arsenic deposits create a belt across Alaska from the Seward Peninsula east to Anchorage and Kenai and then up to the Interior and west to Norton Sound. Thus, it occurs naturally in the most populated areas of the state. Yet it also has a presence in the less



populated areas, such as Southeast Alaska and on the North Slope near Prudhoe Bay.

Leached arsenic can be found in both public water systems and private wells. However, it is generally detected in public waterworks and mitigated at the community level. Concentrations of arsenic in public water systems or your private well can vary with how much water gets used, changes in the amount of precipitation and in the Interior and North Slope it can be affected by melting permafrost. So there can be a range of concentrations of arsenic in your well over time, as well as a difference in levels of arsenic being pulled into homes in your immediate neighborhood.

Finally, despite your home or water well being located in an area rich with arsenic mineralization in the subsurface bedrock or soil, it may not necessarily affect you.

There are two kinds of arsenic (As^{+3} and As^{+5}). The most damaging is As^{+3} , which exists as a mineral mixed with other rock in an oxygen-free environment, or anaerobic, environment. It is when As^{+3} leaches and moves into groundwater that it becomes available to your well water, which can oxidize into As^{+5} . When you test for arsenic, both As^{+3} and As^{+5} usually will be registered in your lab results.

Routes of entry into the body

As far as your personal contact with either As^{+3} or As^{+5} , it depends on the route of entry of arsenic into your home. From a healthy home's perspective, the most common route of entry into the home is through water fixtures. Unlike lead, it is not the fixtures themselves (or water pipes) that contain the arsenic contaminant. But rather the arsenic is located as a mineral deposit in bedrock below the surface, which can be "freed up" to reach the water well, pulled up through the submersible pump inside the well, and pass through the pressure tank and home piping to your faucet.

Some arsenic is present in dust and thus you can inhale it, yet most of it enters by mouth via water. And it is possible for children to unintentionally ingest arsenic from eating dirt or merely not washing hands after playing in the dirt. Organic arsenic is available in various waterborne foods as well. The most serious route of entry into the body is ingestion. Although not prevalent in Alaska, agricultural pesticides have contained arsenic and can follow watersheds into waterways.

Health concerns from arsenic exposure

The most potent mineral, As^{+3} , can cause discomfort when too much is ingested. Symptoms that may not be individually distinguishable can occur with low-level, acute exposure, such as:

- Being overly tired
- Loose bowels
- Nausea
- Vomit



More specific signs that may come about with prolonged ingested exposure of As^{+3} at high enough levels are tingling sensations in the extremities and/or skin color darkening with appearance of small warts or corns. Inorganic arsenic has been determined to be a carcinogen, which means that it can cause cancer in the liver or bladder upon prolonged ingestion. Lung cancer also can be an effect of As^{+3} exposure by inhalation as well. This route of entry usually is common from worksites such as mines, and waste disposal areas as well as smelters. Skin exposure does not seem to increase the amount of arsenic in the body directly, though it can cause redness and irritation to the skin upon exposure.

How would health professionals find out at the health clinic or doctors office if you have been swallowing large amounts of arsenic? In Alaska, when certain series or panels of blood tests are completed, the Alaska Department of Health and Social Services (DHSS) automatically gets an alert and warning if there is a high level of arsenic detected by strict medical guidelines and protocol. This is what happened in Fairbanks in the mid-2010s.

People who were found to have high levels of arsenic through a blood test were contacted. These people never suspected the possibility of arsenic poisoning when their symptoms developed because they had a system to remove arsenic from their

well water. However, once DHSS had notified the family of their blood test results, the Alaska Department of Environmental Conservation (DEC) tested their well water and found high levels of As^{+3} and As^{+5} in the water they were consuming. Upon further investigation it was found that the mitigation system they were using had not been working properly to capture or remove arsenic from the water.

Testing and mitigation

So how could you as an average homeowner determine the concentration of arsenic in your household drinking water?

- When purchasing a home, see if the disclosure report documents known levels
- Arrange a sample of water to be “quick tested” at a vendor who handles water softeners and conditioning equipment where available. If high ...
- Pick up a lab sample container from a listed environmental analytic service and following the collection instructions, return the vial for testing

The best way is to go to the point of use. That is, the faucet from which you draw your water for drinking and cooking. Let the faucet run for half a minute to flush out any contaminants that may have collected around the faucet from the last use. Then collect the water sample directly into a container provided by the testing company.

Most test kits have you collect your own water in their small, clear plastic, screw lid bottles. These are generally thick so as to be durable for shipping back to an analysis lab. Almost all the labs that analyze tests for presence of As^{+3} and As^{+5} are in the lower 48 states, so you may need to wait a few weeks before getting the results back.

As mentioned above, local water treatment vendors may offer free water analysis. Call ahead as several businesses tend to focus more toward the

cosmetic concerns of water contamination such as the presence of iron or manganese, the PH level, and the softness of the water, and might be used to promote water treatments that the vendor sells. Some vendors do test for arsenic, yet it is usually a quick, cursory test where the two kinds of arsenic are not necessarily separated in results. To find a list of labs that will test comprehensively for both varieties of arsenic, check with DEC or look at the multi-chemical test kits available at a building supply or hardware store.

Once you have detected high levels of arsenic by chemical analysis of your drinking water, what can you do about it?

Health actions

The first action is to check with your medical provider whether you should have an exam or tests to measure arsenic concentrations in your body. Considering that the Maximum Contaminant Level (MCL) for exposure set by the U.S. Environmental Protection Agency (EPA) is ten times higher for food exposure than ingestion (set at 10 ppm, or parts per million for As^{+3} & As^{+5}) and the MCL is 50 times higher for skin exposure than ingestion, you may want to drink water from a public water system (which goes under routine testing) or water treated by a home reverse osmosis systems.

These concentrations of arsenic may be at the sink faucet you will use (point of use) for drinking, or possibly between the well and your storage/pressure tank (point of source). Regular filters are required and this is the most common residential style of treatment. Such systems do require maintenance and are most useful when periodic testing confirms the level of effectiveness in bringing down the arsenic to levels below 10ppm.

In larger scale applications, iron is used as an attractor that will bond with arsenic. Filters will pull the iron out, thus removing the arsenic along with it. In Asia and other areas, simple activated charcoal layers have been used in combination

with other filtering media to pass the water through and remove the contaminants out in the process. Boiling water is not an adequate way to rid your water of As⁺³ or As⁺⁵.

Water is essential, and its purity is important for health. This depends somewhat on your

ability to keep contaminants out of your home, or having the wherewithal to treat the water to lower contaminant levels. By keeping your home structure healthy and contaminant free (or to acceptable levels), you keep the occupants healthy!

www.uaf.edu/ces or 1-877-520-5211/907-474-5211

Art Nash, Energy Specialist, Cooperative Extension Service and **Debasmita Misra**, former Professor, College of Engineering & Mines

In accordance with Federal law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, disability, and reprisal or retaliation for prior civil rights activity. (Not all prohibited bases apply to all programs.) Program information may be made available in languages other than English. Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, and American Sign Language) should contact the responsible State or local Agency that administers the program or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. To file a program discrimination complaint, a complainant should complete a Form AD- 3027, USDA Program Discrimination Complaint Form, which can be obtained online at <https://www.ocio.usda.gov/document/ad-3027>, from any USDA office, by calling (866) 632-9992, or by writing a letter addressed to USDA. The letter must contain the complainant's name, address, telephone number, and a written description of the alleged discriminatory action in sufficient detail to inform the Assistant Secretary for Civil Rights (ASCR) about the nature and date of an alleged civil rights violation. The completed AD- 3027 form or letter must be submitted to USDA by: (1) Mail: U.S. Department of Agriculture Office of the Assistant Secretary for Civil Rights 1400 Independence Avenue, SW Washington, D.C. 20250-9410; or (2) Fax: (833) 256-1665 or (202) 690-7442; or (3) Email: program.intake@usda.gov. This institution is an equal opportunity provider.



Published by the University of Alaska Fairbanks Cooperative Extension Service in cooperation with the United States Department of Agriculture. UAF is an Affirmative Action/Equal Opportunity employer, educational institution and provider and prohibits illegal discrimination against any individual: www.alaska.edu/nondiscrimination.

©2025 University of Alaska Fairbanks.

03-22/AN-DM/01-25

Revised October 2024