

Arsenic and Uranium in Private Drinking Water Wells in Massachusetts

Why might arsenic and uranium be present in private well water?

Some areas of New England may contain naturally higher levels of arsenic and uranium in bedrock than other areas of the region. Arsenic can be found in two different forms: organic arsenic and inorganic arsenic. The inorganic forms of arsenic are generally found in groundwater and pose a greater health concern than the organic forms of arsenic which are present in some foods (e.g. fish) and are considered less toxic. Through natural processes, arsenic and uranium can leave the rock and enter the groundwater. If groundwater containing arsenic and/or uranium serves a private well, then arsenic and/or uranium may be present in well water.

Have studies been done to evaluate the potential impacts of arsenic and uranium in private wells located in Massachusetts?

Yes. Beginning in 2008, the U.S. Geological Survey (USGS) conducted a study to assess concentrations of arsenic and uranium in private bedrock well samples collected by private well owners located in Massachusetts. The USGS and the Massachusetts Department of Environmental Protection (MassDEP) jointly funded the private well study. The purpose of the USGS private well sampling study was to assess correlations between mapped bedrock geology and concentrations of arsenic and uranium in well water. The USGS researchers analyzed water samples from 478 private bedrock wells in 116 area cities and towns and found that 13 percent exceeded federal drinking water standards for arsenic, and 3 percent exceeded standards for uranium. Based on information available on water testing results, the probability that an individual's well poses an immediate health concern is low, however, the USGS study indicated that it is prudent for private well owners to have their wells tested. The final USGS report *Arsenic and Uranium in Water from Private Wells Completed in Bedrock of East-Central Massachusetts – Concentrations, Correlations with Bedrock Units, and Estimated Probability Maps* is available online at <http://pubs.usgs.gov/sir/2011/5013/>.



Was the Massachusetts Department of Public Health (MDPH) involved in the USGS study?

Yes. To address any potential concerns about individual health impacts associated with arsenic and/or uranium detected in private well water samples, MDPH offered urine testing as a public service to a subset of participants of the USGS study. Urine testing allows for an interpretation of an individual's water testing results in terms of possible health impacts. Results indicated some of the 37 individuals who participated in the urine sampling had arsenic and/or uranium detected in their urine at levels greater than those typically detected in the general population, but none had arsenic or uranium in their urine at levels of health concern.

What are the potential health effects associated with high levels of arsenic in drinking water?

Short-term exposure to drinking water with higher levels of inorganic arsenic (≥ 300 parts per billion [ppb]) may lead to nausea, vomiting, diarrhea, cardiovascular effects, and brain effects (i.e. encephalopathy), as well as decreased production of red and white blood cells and impaired nerve function. Long-term ingestion of drinking water with low levels of inorganic arsenic (< 300 ppb) may lead to a pattern of skin changes (e.g. patches of darkened skin, small "corns" or "warts" on the palms, foot soles, and torso) and damage to the nervous system (i.e., peripheral neuropathy). Several studies have also shown that long-term exposure to inorganic arsenic can increase the risk of certain cancers including lung, skin, bladder, liver, kidney, and prostate cancers.

What are the potential health effects associated with high levels of uranium in drinking water?

The primary health effect from exposure to elevated levels of uranium is kidney damage. However most of the effects seen in humans have been due to high short-term exposures, and some occupational studies have shown a reversal of kidney effects after exposure ends. Chronic exposures can also result in kidney effects. Health effects from exposure to naturally occurring uranium in drinking water are associated with the chemical toxicity of uranium. USEPA set its drinking water standard for uranium primarily on its chemical toxicity, but, as a precaution, also considered the potential for uranium to cause cancer after a lifetime of drinking water exposure, under the assumption that any constituent that has radioactive properties could cause cancer.



How do private well owners determine if they should be concerned about exposure to high levels of arsenic and uranium in their drinking water?

MDPH recommends that all private well owners have their well water tested for contaminants such as arsenic and uranium at varying frequencies using guidance from their local Board of Health and from MassDEP <https://www.mass.gov/info-details/protect-your-family-a-guide-to-water-quality-testing-for-private-wells>. Although private wells are not subject to regulatory standards for public drinking water supplies, it is recommended for health purposes that well owners follow the advice of regulatory agencies and reduce levels below the current drinking water standards.

What are the current drinking water standards for arsenic and uranium?

The public drinking water standards for arsenic and uranium are 10 micrograms and 30 micrograms per liter of water, respectively. Drinking water standards are set by the US Environmental Protection Agency to protect public health. Actual health risks depend on the three key factors: the level of arsenic and uranium in the drinking water; the amount of water actually consumed from the private well; and how many years the water is consumed. Risks increase as the amount of water consumed from the private well increases, and as the number of years that water is consumed increases.

Should I seek medical advice if arsenic and/or uranium are detected in my private well at levels greater than the regulatory standards for public drinking water supplies?

The need to follow-up with a physician depends on a number of factors. These include: 1) how much greater the levels detected in your well are above the public drinking water standards, 2) whether you use your private well as your primary source of drinking water and for how many years you have consumed the water, and 3) whether or not you have a treatment system in place. If your drinking water levels are high, your private well is your primary source of drinking water, and you feel you are experiencing some of the health impacts listed above that have been associated with exposure to arsenic or uranium in drinking water, you should seek medical advice from your health care provider.



Who should I contact if I have questions about how urine testing can be used to measure exposure to arsenic and uranium in drinking water?

A urine test is the most reliable and efficient means of detecting exposure to arsenic and uranium within a short period of time of the exposure (i.e. a few days). Residents, or their medical care providers, with questions about the use of a urine test to evaluate exposure to arsenic and/or uranium from a private well can contact the MDPH/BCEH Division of Environmental Toxicology, Hazard Assessment and Prevention to learn more about appropriate urine testing methods. For example, it is important to select a urine test that will identify inorganic forms of arsenic present in groundwater that are of potential health concern vs. organic forms that are present in some foods and considered less toxic. The MDPH/BCEH Division of Environmental Toxicology, Hazard Assessment and Prevention can also provide assistance with interpretation of urine test results.

How can I learn more about water treatment options for my private well?

It is important to note regulatory standards are designed to be protective of health and MDPH recommends residents seek guidance from MassDEP on taking steps to reduce arsenic and uranium in drinking water if their well results are above regulatory standards for public drinking water. For guidance on water treatment options for arsenic and uranium in private wells, you may contact MassDEP at 617-292-5500 or visit <http://www.mass.gov/eea/agencies/massdep/water/drinking/private-wells.html>

What if I have further questions about arsenic or uranium in private well water and my health?

If you have any health questions about arsenic and uranium in private well water, you may contact the following:

Division of Environmental Toxicology, Hazard Assessment and Prevention
Bureau of Climate and Environmental Health
Massachusetts Department of Public Health
250 Washington Street
Boston, MA 02108
617-624-5757

