MassDEP
Massachusetts Department of Environmental Protection

Arsenic in Private Well Water: Frequently Asked Questions

Private Well Owners: Important information, please read below.
Residents on Public Water Supply: This information does not apply to you.

Arsenic is a naturally occurring contaminant in some groundwater in Massachusetts, most frequently in bedrock aquifers in the central part of the state and in the Merrimack River Valley. Drinking water from bedrock wells, also called drilled or artesian wells, and less frequently from shallow or dug wells, may contain arsenic.

Where does arsenic come from?

Arsenic (chemical symbol As) occurs naturally in soil and bedrock in many parts of the United States, including parts of Massachusetts. During the 1800s it was mined commercially in New Hampshire, but since 1985 arsenic used in the U.S. has been imported. Activities that could have left arsenic residuals include apple orchard spraying, coal ash disposal, and use of some pressure treated wood. Arsenic has no smell, taste, or color when dissolved in water, even in high concentrations, and therefore only laboratory analysis can determine the presence and concentration of arsenic in water.

How can arsenic affect my health?

Arsenic ingestion can result in both chronic (long-term) and acute (short-term) health effects. Acute effects can include nausea, vomiting, neurological effects such as numbness or burning sensations in the hands and feet, cardiovascular effects and decreased production of red and white blood cells which may result in fatigue. Chronic effects include changes in skin coloration and skin thickening and small corn-like growths that can develop especially on the palms of the hand and soles of the feet. Chronic exposure to arsenic is also associated with an increased risk of skin, bladder, and lung cancer. There is also evidence that long-term exposure to arsenic can increase risks for kidney and prostate cancer. Your health risks are determined by the following factors:

- the concentration of arsenic in your water,
- the amount of water you consume each day,
- the length of time you have been consuming the water,
- your dietary intake of arsenic (in the foods that you eat), and
- your individual sensitivity to arsenic.

What is the regulatory standard for arsenic in drinking water?

The current drinking water standard or Maximum Contaminant Level (MCL) set by the U.S. Environmental Protection Agency (EPA) is 0.010 mg/L or parts per million (ppm). This is equivalent to 10 ug/L (micrograms per liter) or 10 ppb. In 2001, the U.S. Environmental Protection Agency (EPA) reduced the regulatory MCL from 50 ppb to 10 ppb on the basis on bladder and lung cancer risks. The MCL is based on the average individual consuming 2 liters of water a day for a lifetime. Long term exposure to drinking water containing arsenic at levels higher than 10 ppb increases the chances of getting cancer, while for lower arsenic water levels the chances are less.

If your water has arsenic levels above 10 ppb, you should obtain drinking water from another source or install a home treatment device. Concentrations above 10 ppb will increase the risk of long-term or chronic health problems, the higher the level and length of exposure, the greater the risk. It is especially important to reduce arsenic water concentrations if you have children or are pregnant. Children are at greater risk (to any agent in water) because of their greater water consumption on a per unit body weight basis. Pregnant women may wish to reduce their arsenic exposures because arsenic has been found at low levels in mother's milk and will cross the placenta, increasing exposures and risks for the fetus. If your water has arsenic levels above 200 ppb, you should immediately stop drinking the water until you can either obtain water from another source or install and maintain treatment.

What about bathing/showering, or other uses?

Unless your arsenic level is over 500 ppb , showering, bathing and other household uses are safe. Arsenic is not easily absorbed through the skin and does not evaporate into the air.

Do I have arsenic in my water?

If you have a private well constructed in bedrock, you should have the water tested to determine if arsenic is present. For a searchable

listing of MassDEP Certified Laboratories see MassDEP's Certified Laboratories /dep/water/drinking/au/aulabs.htm web page. The cost for a homeowner to test for arsenic may range from $15 to $30.

Where can I have my well water tested for arsenic?

For a searchable listing of MassDEP Certified Laboratories see MassDEP's Certified Laboratories /dep/water/drinking/au/aulabs.htm web page.

What can I do if my water has high arsenic levels?

If the arsenic level in your well water is above 10 ppb there are a number of treatment methods available. However, before selecting a treatment method, there are a number of factors that need to be considered.

First, there are typically two varieties, or species, of arsenic in water: "arsenic 3" and "arsenic 5." This is significant because "arsenic 3" is very difficult to remove from water and must be changed or "oxidized" to "arsenic 5" before it can be removed. A laboratory can determine how much of each kind of arsenic is in your water, with a method called "speciation." Speciation will add additional cost to the analysis. Ask the laboratory what they require for this process as it may require additional samples. See MassDEP's Certified Laboratories That Test for Arsenic Speciation web page. Oxidants that can convert arsenic 3 to 5 include: liquid chlorine (bleach), hydrogen peroxide, and ozone. Chlorine is the most readily available oxidant for home water treatment.

The second factor is whether you want point-of-use (at the tap) treatment that is installed under the kitchen sink and that has a special tap for drinking water, or whole house treatment (point-of-entry) that treats all the water that enters the house. The third factor is the possible presence of other constituents in the water, such as iron and manganese, which might hinder the effectiveness of arsenic removal and will need to be removed before the arsenic treatment. Arsenic removal methods or systems include anion exchange, reverse osmosis, activated alumina, and other types of adsorptive media filters. Each method has its advantages and disadvantages. Information on these treatment methods is listed below:

Anion exchange units operate using the same principle as a water softener. In this case the arsenic is exchanged for chloride. The systems are generally used to treat water for the entire house and generally require little maintenance.
Reverse osmosis (RO) is generally installed as a point-of-use treatment system and usually requires pre-filtration to remove sand and grit that might foul the RO membrane. RO is considered ineffective at removing arsenic 3.

Adsorptive filter media are used in both point-of-use and whole house treatment systems. There are several varieties of adsorptive media available including activated alumina (AA) and other types of media including some with proprietary ingredients. Activated alumina and most of the other adsorptive media will either not remove arsenic 3 or are not very efficient at the removal of arsenic 3. The efficiency of removal is dependent on the pH of the water, and may require pre-treatment to adjust pH. If substantial arsenic 3 removal is required a typical installation would consist of a single adsorptive media cartridge with a pre-oxidation cartridge ahead of the adsorptive media cartridge. There is an ongoing cost of replacing the adsorptive media cartridges about every six months. The used media can be disposed of as a non-hazardous waste.

Reverse osmosis (RO) and adsorptive media are most commonly used for point-of-use systems. A recent cost survey conducted by New Hampshire Department of Environmental Services (NHDES) indicated that the median cost to install a point-of-use treatment system was $1,200, with median annual maintenance costs of $343. RO treatment systems are generally less expensive than adsorptive media systems.
Adsorptive media and anion exchange are most commonly used for whole house treatment systems. The same NHDES survey indicated a median cost of $3,000 to install a whole house treatment system, with median annual maintenance costs of $550. Anion exchange treatment systems are generally less expensive than adsorptive media systems.

The above costs from the NHDES survey did not include costs for the installation and maintenance of pre-oxidation treatment which may be required depending upon the concentration of arsenic 3.

Who can I contact for more information or questions?

If you have questions regarding this fact sheet, contact Joe Cerutti of the Boston Drinking Water Program at (617) 292-5859 or email: joseph.cerutti@state.ma.us mailto:joseph.cerutti@state.ma.us