

WD-DWGB-3-3

2007

Beryllium in Drinking Water

Beryllium occurs naturally in New Hampshire's bedrock geology. As such, it can dissolve into water and be present in the water from bedrock (artesian) wells. Beryllium (symbol Be) has only recently been adopted as a maximum contaminant level (MCL) in the US EPA's Safe Drinking Water Act, thus the DES data base of occurrences in New Hampshire is limited.

Locations where beryllium has been present in drinking water samples include the Mt. Washington Valley and the west portion of the Kancamagus Highway. The occurrence frequency of beryllium above the MCL in bedrock wells appears to be less than 1 percent. Other areas of the state that are noted for mineral deposits containing beryllium are Acworth/Alstead, Lake Pautuckaway, and areas having the geological formations known as two-mica granite and Conway granite. Beryllium has no taste, color or odor, and thus the only way to determine its presence and concentration in drinking water is by laboratory analysis.

In dug wells, which secure their water from the sand and gravel strata, beryllium concentrations should be generally very low and would not be expected to exceed the MCL.

Health Affects

Beryllium compounds have been associated with damage to the bones and lungs and induction of cancer in laboratory animals, such as rats and mice, when those animals are exposed at high levels over their lifetime. There is limited evidence to suggest that beryllium may pose a cancer risk to humans via drinking water exposure. Therefore, EPA based the health assessment on non-cancer effects with an extra uncertainty factor to account for possible increased risk of cancer. The MCL for beryllium is 0.004 mg/L.

Testing Your Well

Although specific locations have been identified where beryllium has been more frequently found, DES recommends, that all bedrock wells be tested for beryllium. The cost of a beryllium test is \$15 per sample at the DES Laboratory. If beryllium is determined to be present above quantification limits, DES recommends another test before forming a conclusion about the concentration of beryllium in the water supply. A second test is appropriate since water quality can vary due to rainfall, length of pumping, season of the year, etc.

Methods to Reduce Beryllium in a Water Supply

There are three approaches that one could take to reduce exposure to beryllium from drinking water: an extension of town water, construction of a new well of a different type, or installation of a water treatment device.

Town Water

In most cases, town water is not available or is too costly to extend to more rural areas of town. From the perspective of public health and real estate values, town water is preferable to major water treatment devices in a home. Where town water is a possibility, we suggest discussing the funding of an extension with your neighbors. A joint effort will reduce individual costs and provide an area-wide solution, if the contamination is extensive. A preparatory step to such discussions would be the testing of all wells in the area for their beryllium concentration. Even if beryllium is not present, your neighbors in a given area may have other water quality problems such as radon, other radionuclides, fluoride, arsenic, iron and manganese, hardness, and odor, which may influence these neighbors to financially support an extension of town water. For more suggestions on water quality testing please see fact sheet WD-DWGB-2-1 "[Suggested Water Quality Testing for Private Wells.](#)"

New Wells

If the new well option is selected, a dug well or point well (installed in the sand and gravel) would be the best option for minimum beryllium concentrations. Unfortunately, in many areas of New Hampshire, the soil type, depth and year-round sustained water table are not favorable for such wells. A new bedrock well would likely have beryllium if your present bedrock well has an elevated beryllium concentration. The likelihood of avoiding beryllium in a new bedrock well can be estimated by having your neighbors test their bedrock wells for beryllium and then reviewing all data.

Treatment to Remove beryllium

The other approach to reducing beryllium in drinking water is to install a water treatment process. Only the water used for drinking and for cooking needs to be treated to remove beryllium. A point-of-use treatment system producing approximately two to four gallons of water per day should be adequate. This size device installs easily in the generally kitchen area and is often called an "under-the-sink" or point-of-use sized system.

Treatment devices can be sized as either of the whole house size or the point-of-use size. Point-of-use is safe for beryllium and can reduce capital and operational costs. There are three treatment methods that will remove beryllium.

1) Reverse Osmosis (RO)

In the RO process, raw water flows past a membrane. Some of the water molecules migrate through the membrane, while others, including **beryllium** remain on the raw water side of the membrane. The rejected raw water concentrate is discharged to the wastewater system, which discharges to the leachfield, dry well or sewer. The treated water that migrates through the membrane, accumulates in a small storage tank until needed.

In New Hampshire, the typical production efficiency of RO is approximately 25 percent. This is due to New Hampshire's cold groundwater temperatures. To prevent solids in the water from clogging the membranes a sediment prefilter is normally installed. An under-the-sink sized RO device costs approximately \$1,100 (2007). There is little day-to-day maintenance associated with RO devices, and it is most effective on point-of-use treatment devices. For more information on RO, please see fact sheet WD-DWGB-2-11 "[Reverse Osmosis Treatment For Drinking Water.](#)"

2) Activated Alumina

Where much larger volumes of treated water are needed, the treatment process known as activated alumina generally becomes more cost effective. In this process well water passes through the alumina media typically contained in a fiberglass containment canister (approximately 12 inches diameter and approximately 4 feet tall). The beryllium "sticks" to the

surface of the alumina by the process called adsorption. Aluminum is not given off by this media. Activated alumina also removes arsenic, uranium, and fluoride effectively.

Where alumina is used, maintenance would consist of replacing the alumina cartridge periodically. The used alumina may be disposed of along with your household trash. When initially installed extra effort and monitoring should be done to determine the precise relationship between gallons processed and the media's longevity for both the target contaminant, and other contaminants preferred by the media. This testing frequency can be reduced in the future if the same media type continues to be used. Activated alumina can be used with both point-of-use and whole-house treatment systems.

3) Ion Exchange

Ion exchange is the generic name for water softening. beryllium has a plus 2 valance. Although this is not the treatment method of choice, ion exchange could in certain cases, where the mineral concentration of the raw water is high and where larger volumes of treated water are desired, be worth a trial. The method is considered experimental until proven. Ion exchange is used with whole-house treatment systems.

How Much Water Needs to be Treated

Based on the present MCL of 0.004 mg/L and typically New Hampshire beryllium levels, only water used for drinking and cooking needs to be treated to remove beryllium. A treatment system producing one to five gallons of water per day should be adequate. This point-of-use sized device installs easily under-the-sink and is relatively inexpensive.

Periodic Maintenance and Sampling

During startup, and subsequent operation, periodic laboratory testing is necessary to ensure the effectiveness of the treatment process chosen. Once proven to be effective in your situation, sampling frequency over the long term can be reduced.

Installation Layout

For further information concerning the layout of a water treatment system and its purchase, DES suggests reviewing the fact sheet WD-DWGB-2-5 "[Considerations when Purchasing a Water Treatment System.](#)"

For More Information

Please contact the Drinking Water and Groundwater Bureau at (603) 271-2513 or dwgbinfo@des.nh.gov or visit our website at www.des.nh.gov/dwgb. All of the bureau's fact sheets are on-line at www.des.nh.gov/dwg.htm.

Note: This fact sheet is accurate as of October 2007. Statutory or regulatory changes, or the availability of additional information after this date may render this information inaccurate or incomplete.