
ENVIRONMENTAL Fact Sheet



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WD-DWGB-3-9

2010

Nitrate and Nitrite in Drinking Water

This document concerns two types of nitrogen in drinking water; nitrate and nitrite. Excessive nitrate or nitrite in drinking water is a health concern for infants (through 6 months of age) and for women during pregnancy. The U.S. Environmental Protection Agency has established maximum contaminant levels of 10 milligrams per liter (mg/L) for nitrate and 1.0 mg/L for nitrite.

Nitrate is a component in fertilizer, and both nitrate and nitrite are found in sewage and sanitary wastes from humans and animals. Certain construction activities, such as blasting, can be another source of nitrate in bedrock wells. Fortunately, nitrate and nitrite concentrations are not normally high in New Hampshire wells or surface waters. Nitrate or nitrite levels can become elevated when the surrounding area is heavily developed, used for agricultural purposes, or subject to heavy fertilization. The presence of elevated nitrite generally indicates that the activity producing the nitrite is very recent and/or very nearby. When either nitrate or nitrite is elevated testing for bacteria is advised.

Health Concern

Excessive levels of these nitrogen compounds in drinking water have caused serious illness and sometimes death in infants less than six months of age. This condition results when nitrate is converted to nitrite in the infant's body. Nitrite then interferes with the oxygen-carrying capacity of the blood. Symptoms include shortness of breath and blueness of the skin (methemoglobinemia). This is an acute disease in which symptoms can develop rapidly in infants from very minor exposure. Expert medical assistance should be sought immediately if these symptoms occur.

Reducing Nitrate and Nitrite in a Domestic Water Supply

There are at least four approaches that one could take to reduce exposure to nitrate and nitrite from drinking water: abate the source of nitrate or nitrite, connect to a municipal water system, construct a new well, or install a water treatment device. Each approach is discussed below.

1) Locate and Abate the Source of the Nitrate and/or Nitrite

Before implementing any treatment process, it is important to attempt to locate and abate the source of the elevated nitrate and/or nitrite. Where the source is commercial fertilizers and there is no sanitary (i.e., human or animal) waste disposal concern, the health concern is limited to a direct evaluation of nitrate and/or nitrite levels. Where the source of nitrate and/or nitrite is from human

or animal waste or wastewater disposal, there is an additional concern that more serious bacterial or viral pollution may be likely to occur in the future. In this latter situation, increased testing for bacteria is suggested. If the source of the nitrate and/or nitrite can be located and reduced, treatment may not be necessary. There will typically be a lag between the reduction of the application of nitrate and/or nitrite and the reduction of those contaminants in the water supply. Predicting this lag time is generally not possible.

2) Connect to Municipal Water

In many cases, municipal water may not be available or may be too costly to extend. However, from the perspective of public health and real estate values, a public water supply is preferable to a home with its own private well that requires a variety of treatment. Where obtaining water from a public water supply is a possibility, homeowners may want to discuss the funding of a pipeline extension with neighbors. A joint effort will reduce individual costs and provide an area-wide solution if nitrate and/or nitrite or other contamination is extensive.

An important effort before such discussions with neighbors would be the testing of all wells in the area for nitrate and nitrite. Even if nitrate and nitrite are not present, your neighbors may have other water quality problems, such as arsenic, radon, fluoride, iron and manganese, hardness, and odor, which may influence their willingness to financially support a water main extension.

3) Construct a New Well

Sometimes the installation of a new well may produce water with less nitrate and nitrite. This well would need to take water from a different geologic horizon in order for it to have a reasonable chance of avoiding or lowering the contamination. To help determine whether a new well could produce better quality water the sampling of similar wells in the immediate neighborhood could assist in measuring the extent of the contamination present.

4) Install Water Treatment

Sizing of Treatment Devices: “Whole House” Vs. “Under The Sink”

Water treatment devices come in two sizes: very small (often called under-the-sink or point-of-use), where only a few gallons per day of drinking water need to be treated, and whole house, where all water used within the home is treated. Nitrate and nitrite are acute contaminants, meaning just a glass of water can be injurious. Thus where “point-of-use” treatment is used, pregnant women and infants should not obtain any drinking water from untreated faucets. If that prohibition cannot be guaranteed, then “whole house” treatment, with its higher cost, would be necessary.

Treatment Options

Nitrate and nitrite can be removed from water supplies by reverse osmosis, ion exchange, and distillation.

1) Reverse Osmosis (RO)

RO is the most frequently used point-of-use sized treatment system for nitrate and nitrite removal. It is also the most cost-effective method for producing just a few gallons of treated water per day. In the RO process, untreated water from the well, under pressure, flows through a special

membrane. The membrane allows water molecules to migrate through while preventing the passage of nitrate, nitrite and other contaminants. The contaminants remain on the untreated side of the membrane and are flushed out of the device as a concentrate that is then disposed into a dry well, septic system, or sewer. The treated water accumulates on the other side of the membrane and is held in a small pressure storage tank until needed. When using this option, drinking water and cooking water for pregnant women and infants would be obtained from the treatment unit's separate faucet typically located at the kitchen sink.

One negative result of RO treatment is that the water can become more corrosive due to the removal of the water's alkalinity. Thus new plumbing fittings on the new faucet and the line from the treatment unit should be lead-free.

In New Hampshire, the typical production efficiency of RO is approximately 25 percent. That means, for every four gallons of untreated water entering the device, only one gallon of treated water is produced. Three gallons of wasted water, although not ideal, is still quite small when compared to overall daily usage for a family at home. This low efficiency is a result of New Hampshire's cold groundwater temperatures. The reject water returns to the environment through the leach field. If there are any larger solids in the water, a sediment removal pre-filter should precede the RO device. This is often part of a standard modular design. There is little maintenance required for RO units; please see [WD-DWGB-2-11, "Reverse Osmosis Treatment of Drinking Water."](#)

2) Water Softening - Anion Exchange

Anion exchange is a treatment process that would be typically used for treating larger volumes as in "whole house" treatment. Anion exchange is the technical name for a similar process commonly known as water softening. Anion exchange resin media is also available as small point-of-use cartridges. In anion exchange, water is passed through a special material called anion exchange resin. Chloride is added to the treated water as the negatively-charged nitrate and nitrite ions are removed. When the removal capability of the resin has been exhausted, the treatment system is regenerated.

Once the resin is regenerated, the waste salt brine and dissolved concentrated nitrate and nitrite compounds are sent to waste into an approved septic system, dry well, or sewer; refer to [WD-DWGB-2-12, "Ion Exchange Treatment of Drinking Water."](#)

There are special nitrate-specific resins that make nitrate/nitrite treatment processes selective. In addition, this nitrate-specific resin reduces the possibility of nitrate build up which can create a serious risk to health if normal resins are used and the timing of the regeneration cycle is not properly set. A strong concentration of brine is needed to regenerate nitrate-specific resin.

For a "whole house" treatment of nitrate and/or nitrite, the anion exchange device is typically installed in the basement.

3) Distillation

Distillation can also be used to produce a small amount of treated water. However, distillation is

not widely used due to high operational cost and the reject heat produced; refer to the fact sheet [WD-DWGB-2-15, “Distillation Treatment of Drinking Water.”](#)

Laboratory Testing

The DES Laboratory and a number of private laboratories can test for nitrate and nitrite. Since nitrate levels can vary in concentration over a period of a few days, two or more samples should be taken in order to accurately determine total nitrate and nitrite levels. The DES Laboratory can be contacted at (603) 271-3445 or 3446.

When a treatment process is installed, a sampling schedule for nitrate and nitrite should be established (with the guidance of the treatment company) in order to determine the continued efficiency of the treatment process.

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

<http://des.nh.gov/organization/divisions/water/dwgb/index.htm>

All of the bureau's fact sheets are on-line at

<http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm>

Note: This fact sheet is accurate as of September 2010. The availability of additional information after this date may render this information inaccurate or incomplete.