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Nitrate/Nitrite in Drinking Water[1]

This document concerns two types of nitrogen in drinking water, nitrate and nitrite. Excessive nitrate/ nitrite in drinking water is a health concern for infants (through 6 months of age) and for women during pregnancy. The U.S. Environ-mental Protection Agency (EPA) has established the maximum contaminant level (MCL) for nitrate at 10 milligrams per liter (mg/L). In addition, EPA has established an MCL for nitrite at 1 mg/L.

Nitrate is a component in fertilizer, and both nitrate/nitrite are found in sewage and sanitary wastes from humans and animals. Blasting is another source of nitrate in bedrock wells. Nitrate/nitrite concentrations are not normally high in New Hampshire wells or surface waters. When nitrate/nitrite are elevated, the surrounding area is often 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.

Where either nitrate and/or nitrite are elevated, more frequent testing for bacteria is warranted. When either nitrates or nitrites are elevated, an evaluation should also be made relative to whether the drinking water source should be tested for pesticides and/or herbicides. Pesticide and herbicide testing typically costs hundreds of dollars per sample.

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 body. Nitrite then interferes with the oxygen carrying capacity of the infant's blood. Symptoms include shortness of breath and blueness of the skin (methemoglobinemia). This is an acute disease in that symptoms can develop rapidly in infants from very minor exposure. Clearly, expert medical advice should be sought immediately if these symptoms occur and responsible parties should provide infants with an alternate source of drinking water.

REDUCING NITRATE / NITRITE IN YOUR WATER SUPPLY

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

1. The material contained in this fact sheet was excerpted from the New Hampshire Department of Environmental Services web site (http://www.des.state.nh.us/ws.htm).

Locating and Abating the Source of the Nitrate/Nitrite

Before implementing any treatment process, it is important to attempt to locate and abate the source of the nitrate/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/nitrite levels. Where the source of nitrate/nitrite is from human or animal waste or wastewater disposal, there is an additional concern that more serious bacterial or viral pollution may be more likely to occur in the future. In this latter situation, increase bacterial testing is also suggested. If the source of the nitrate/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/nitrite and the reduction of those contaminants in the water supply. Predicting this lag time is generally not possible.

Municipal Water

In most cases, municipal water is not available or is too costly to extend. From the perspective of public health and real estate values, public water is preferable to one or more water treatment devices in the basement of a home. Where public water supply is a possibility, we suggest discussing the funding of a pipeline extension with your neighbors. A joint effort will reduce individual costs and provide an area-wide solution if nitrate/nitrite or other contamination is extensive.

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

New Well

A new well may possibly avoid a nitrate/nitrite problem. Such a well would need to take water from a different stratum in the ground to have a reasonable chance of avoiding the contamination. To evaluate the likelihood of success of such a well, we suggest sampling other wells of a similar type in the immediate neighborhood to determine the extent of the contamination.

TREATMENT

Sizing of Treatment Devices: "Whole House" Versus "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/nitrite is an acute contaminant, 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 assured, than "whole house" treatment, with its higher cost, would be necessary.

Treatment Options

Nitrate/nitrite can be removed from water supplies by the following treatment processes: ion exchange, distillation, and reverse osmosis.

Reverse Osmosis (RO)

RO is the most frequently used **point-of-use** sized treatment system for nitrate/nitrite removal. It is the most cost effective method for producing only a few gallons of treated water per day. In the RO process, untreated water from the well, under pressure, flows past a special membrane. The membrane allows water molecules to migrate through while retarding the passage of both nitrate/nitrite and many other contaminants. The contaminants remain on the untreated side of the membrane and leave the device as a concentrate to be "disposed" into a dry well, septic system or sewer. 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 separate faucet typically located at the kitchen sink.

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

In New Hampshire, the typical production efficiency of RO is approximately 25 percent. That is, for every four gallons of untreated water entering the device, only one gallon of treated water is produced. This low efficiency is a result of New Hampshire's cold groundwater temperatures. This reject water returns to the environment thru the leach field. If there are any larger solids in the water, a sediment pre-filter should precede the RO device and is often part of a standard modular design. There is little maintenance required for RO units. A basic point-of-use sized RO device costs approximately $850-950 installed and warranted. Fact sheet WD-WSEB-2-11 provides additional technical information relative to RO treatment.

Water Softening - Anion Exchange

Anion exchange is a treatment process that would be typically used for treating larger volumes as occur in "whole house" treatment. Anion exchange is the technical name for a process similar to that commonly known as water softening. Anion exchange resin media is also available as small point-of-use (POU) cartridges. In anion exchange, water is passed through a special material called a exchange resin. Chloride is added to the treated water as the negatively charged nitrate/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/nitrite compounds are sent to waste into an approved septic system, dry well or sewer.

There are special nitrate specific resins that make nitrate/nitrite treatment process very selective. In addition, this nitrate specific resin reduces the possibility of nitrate dumping 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/nitrite, the anion exchange device is typically installed in the basement. The anticipate cost of whole house anion exchange is approximately $2,000 installed and warranted.

Distillation can also be used to produce a small amount of treated water. Distillation is not widely used however, due to its high operational cost and rejection of heat during summer months. Cost of distillation would be approximately $1,000 plus installation and warranty. It is only feasible for the point-of–use treatment.

TESTING YOUR WATER

EAI Analytical Labs will provide you with your free water testing kit containing: sample bottles, detailed sampling instructions and a tracking form. Bacteria samples bottles are distributed pre-sterilized and all sample bottles contain their necessary preservatives. Kits are available for pickup or they can be mailed to you. If you are interested or have any questions regarding the analysis of your water, please give us a call.