Healthy Drinking Waters

for

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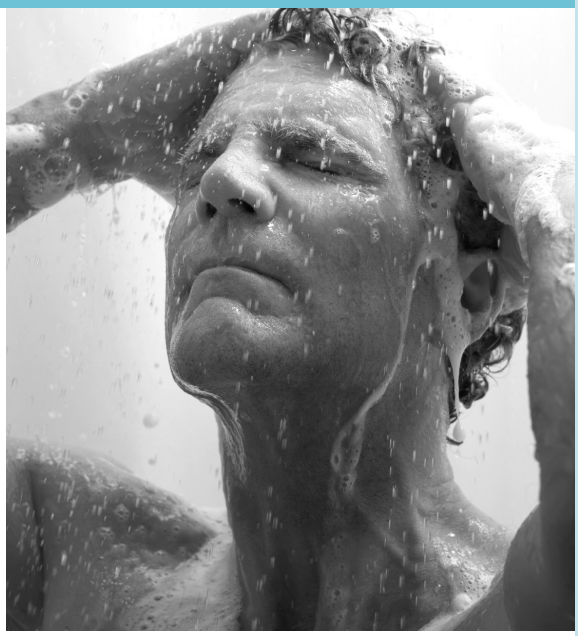
Safe and healthy lives in safe and healthy communities



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Nitrate/Nitrite in Private Drinking Water Wells

Private well owners are responsible for the quality of their drinking water. The U.S. Environmental Protection Agency (EPA) does not regulate private wells. Homeowners with private wells are generally not required to test their drinking water, although local Boards of Health or mortgage lenders may require well water testing. While there is also no state requirement to have your well water tested, the Massachusetts Department of Environmental Protection (MassDEP) recommends that all homeowners with private wells do so, and use a state certified testing laboratory.

The Maximum Contaminant Level (MCL) for nitrate measured as nitrogen in drinking water is 10 milligrams per liter (parts per million) as established by the EPA. In addition, EPA has set an MCL for nitrite in drinking water at 1 milligram per liter (mg/L).

Summary

Nitrogen, a component of protein, is essential to all living things. Nitrogen exists in the environment in many forms. It can change its form as it moves through the nitrogen cycle–nitrate and nitrite are two forms of nitrogen.

- Both the nitrate and nitrite forms of nitrogen in drinking water are a health concern, especially for infants, pregnant women, nursing mothers, and the elderly.
- A water test is the only way to determine the presence and amount of these contaminants in well water.
- Proper well location and construction are important in avoiding nitrate and nitrite contamination in drinking water.
- Best Management Practices to reduce the risk of contamination from fertilizer applications and improper human and animal waste disposal also help to ensure a safe water supply.

Ingestion of drinking water with nitrate concentrations in excess of 10 mg/L may be fatal to infants. Concentrations in excess of 5 mg/l indicate a severe degradation of groundwater quality. In order to guard against nitrate concentrations reaching danger levels, if you have a nitrate concentration exceeding 5 mg/l in your well, you should monitor the nitrate for a trend of increasing concentrations.

NEW ENGLAND Regional Water Program

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EPA United States Environmental Protection Agency New England

If the concentration of either nitrate or nitrite in drinking water is elevated, the choices for addressing the problem include obtaining an alternate water supply or treating the existing well water. An alternate supply may be bottled water for drinking—especially for infant formula—or installing a new well in a different location and at a different depth. Another alternative, if available, is connecting to a public water supply. Home water treatment options include distillation, reverse osmosis, or ion exchange.

It is also recommended that you determine if any practices in and around the home could be contributing to the elevated levels of nitrate/nitrite in groundwater. Take necessary steps to address these potential sources.

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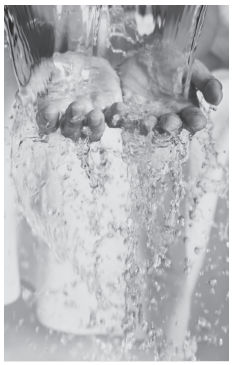

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Potential Health Effects

The primary health hazard from drinking water with nitrate-nitrogen or nitrite-nitrogen is "blue baby syndrome", in which blood lacks the ability to carry sufficient oxygen to the bodies' cells. Most adults are not susceptible to this condition, but infants under six months of age (including pregnant and nursing mothers) and the elderly may be at greater risk than the general population.

A potential cancer risk from nitrate in drinking water and food has been reported. The possibility exists that nitrate can form nitrosamine, which is known to cause cancer. Nitrate must be converted to nitrite before nitrosamine can be formed. The magnitude of the cancer risk from nitrate in drinking water is not known.

Indications of Nitrate and Nitrite

These contaminants are colorless, odorless, and tasteless in water. Nitrate testing is highly recommended for households with infants, pregnant women, nursing mothers, or elderly people. These groups are the most susceptible to health problems due to elevated nitrate and nitrite levels. In addition, if you live in an agricultural area, it is important to test for the presence of these contaminants.

Nitrate-nitrogen occurs naturally in groundwater at concentrations below 1.0 milligram per liter, which is well below the level of concern for drinking water safety. An initial water test for a new well is needed to determine the baseline nitrate concentration in the groundwater source. Nitrate testing should also be part of an annual, routine well water test. Nitrate-nitrogen concentrations above 1.0 milligram per liter indicate potential land use impacts to water quality. You should try to identify the potential land use source that is causing the elevated levels in your drinking water. This may include a malfunctioning septic system or improper fertilizer or animal waste use, storage, or disposal. Drinking water with nitrate-nitrogen concentrations greater than

5.0 milligrams per liter should not be used to prepare infant formula. In this case, you can use bottled water or consider installing a point of use treatment system to remove the nitrate-nitrogen.

Sources of Nitrate and Nitrite in Drinking Water

Nitrogen occurs naturally in the soil in organic forms from decaying plant and animal residues. Bacteria in the soil convert various forms of nitrogen to the nitrate form. This process is part of the nitrogen cycle and is desirable because the majority of the nitrogen required by plants is the nitrate form. However, nitrate is also very soluble and readily moves with water through the soil. If there is excessive rainfall or irrigation water, nitrate can move below the plant's root zone and will eventually reach groundwater.

Sources of nitrate-nitrogen include: septic systems, leaking sewers, compost facilities, and other waste treatment systems, livestock manure, pet waste, excessive commercial fertilizers applied to lawns, gardens, cropland and recreational fields.

If elevated levels of nitrogen are detected in your well water, and you have a septic system, you should also test for bacteria (specifically fecal coliform) to insure that your leaching field is working properly and is not the source of the nitrogen. Refer to the fact sheet on Bacteria for more information.

Proper well siting, construction, and maintenance reduce potential drinking water contamination. This includes locating the well:

- Up-slope from potential contamination sources.
- With adequate separation distances between the well and possible contamination sources.

Testing for Nitrates and Nitrites

To determine if nitrates and nitrites are present, arrange to test your drinking water at a state certified laboratory. Follow laboratory instructions carefully to avoid contamination and to obtain a good sample. Although field test kits are available for measuring nitrate-nitrogen concentration, they are not as accurate as laboratory procedures. Results from field test kits can be affected by the presence of certain chemicals and by temperature variation. Use certified laboratory testing to assure the most accurate and reliable results.

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Interpreting Test Results

The laboratory will report the nitrate or nitrite concentrations as milligrams per liter (mg/L) or as parts per million (ppm), which are equivalent for the concentrations occurring in water (1 mg/L = 1 ppm). Most laboratories report nitrate as nitrate-nitrogen and nitrite as nitrite-nitrogen, which is the amount of nitrogen in that particular form.

Reducing Nitrates and Nitrites in Your Drinking Water

If a water test indicates the presence of elevated nitrate-nitrogen or nitrite-nitrogen levels, you have several choices: obtain an alternate water supply, connect to a public water supply if available, or use a home treatment method to remove or reduce the contaminant.

It may be possible to obtain an alternate water supply by installing a new well in a different location or a deeper well in a different aquifer (water-bearing, saturated zone beneath the earth's surface). If the nitrate-contaminated water supply is coming from a shallow groundwater source, there may be an uncontaminated, deeper aquifer protected by an impervious layer that prevents the downward movement of the contaminated water. A new well should

be constructed to allow surface water to drain away from it, preventing surface water from entering and potentially contaminating the well. Locate the new well up-slope and at an adequate distance away from any potential sources of contamination, such as septic systems, feedlots, animal pens, or underground fuel tanks.

Purchasing bottled water for cooking and drinking is another option for an alternative source of drinking water. This source may be expensive over the long-term and you will need to weigh the costs of this versus installing a new well or a treatment system.

It is also recommended that you determine if any practices in and around your home could be contributing to the elevated contaminant levels in groundwater. These include: location of animal pens and waste, compost piles, septic system operation and maintenance, cesspools, leaky sewer pipes, or lawn and garden fertilizer use. Take necessary steps to address these potential sources.

Three methods can remove or reduce nitrate or nitrite from drinking water: distillation, reverse osmosis, and ion exchange. These home treatment methods are available from several manufacturers

When choosing a treatment system, consider both the initial cost and the operating costs. Operating costs include the energy needed to operate the system, additional water that may be needed for flushing the system, consumable supplies and filters, repairs, and general maintenance.

Regardless of the quality of the equipment purchased, it will not operate well unless maintained in accordance with the manufacturer's recommendations. Keep a logbook to record equipment maintenance and repairs. Equipment maintenance may include periodic cleaning and replacement of some components. Also consider any special installation requirements that may add to the equipment cost. For more information, refer to fact sheet: *Questions to Ask When Purchasing Water Treatment Equipment*.

Resources

UMass Extension

This fact sheet is one in a series on drinking water wells, testing, protection, common contaminants, and home water treatment methods available on-line at the University of Massachusetts website: http://www.umass.edu/nrec/watershed_water_quality/watershed_online_docs.html and Cape Cod Cooperative Extension: 508-375-6699 http://www.capecodextension.org

MA Department of Environmental Protection, Division of Environmental Analysis

Offers assistance, information on testing and state certified laboratories: 617-292-5770 For a listing of MassDEP certified private laboratories in Massachusetts: http://www.mass.gov/dep/service/compliance/wespub02.htm

U.S. Environmental Protection Agency, New England Office

Information and education on where drinking water comes from; drinking water testing and national laws; and how to prevent contamination: http://www.epa.gov/ne/eco/drinkwater

US Environmental Protection Agency

For a complete list of primary and secondary drinking water standards: http://www.epa.gov/safewater

MA Department of Conservation and Recreation, Division of Water Supply Protection

Maintains listing of registered well drillers, information on well location and construction: 617-626-1409 http://www.mass.gov/dcr/waterSupply/welldril/index.htm

NSF International

The NSF International has tested and certified treatment systems since 1965. For information on water treatment systems: 800-NSF-MARK (800-673-6275) http://www.nsf.org/consumer/

Water Quality Association

The Water Quality Association is a not-for-profit international trade association representing the household, commercial, industrial, and small community water treatment industry. For information on water quality contaminants and treatment systems: http://www.wqa.org

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