THE DANGERS OF ELEVATED NITRATES

AND HOW TO REDUCE THEM

by Stanley Diamond

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Nitrates: Where Do They Come From?

Nitrate, a nitrogen and oxygen compound (NO3), is a naturally occurring nutrient that is always present in our surface and groundwater supplies. Nitrates are normally produced in nature by lightening, and in groundwater the concentrations seldom exceed 3 to 4 milligrams per liter (mg/l).

How Do They Become Dangerous?

Nitrates are an essential source of nitrogen for plants, and are a main ingredient in fertilizer. However, nitrates that are applied as fertilizers may be transported by rainfall, runoff, irrigation and other surface water flows over, into and through the soils in the ground, raising the levels of nitrates in groundwater. Human and animal wastes, which contain nitrates, can also raise nitrate levels in groundwater if not properly managed.

The nitrates become dangerous when the groundwaters with the higher nitrate levels are drawn and consumed by humans.

Who is at Risk the Most

Those most at-risk when nitrates are high are infants that are younger than six months in age, as they can become very ill and possibly die. The high level of nitrates can cause a condition called **“blue-baby syndrome”**, where there is a severe reduction in the amount of oxygen their blood will carry. Symptoms that infants may exhibit when exposed to high nitrates include:

- blueness around mouth, hands and feet
- marked lethargy
- trouble breathing
- vomiting
- diarrhea
- increased saliva
- loss of consciousness
- seizures
- death (in rare instances)

If any of these symptoms occur medical attention should be sought immediately.

Infants are not the only ones that can be adversely affected though. Others that could become ill include pregnant women, as well as individuals with reduced gastric acidity and people who lack an essential enzyme required to generate hemoglobin.

What Are Regulators and Utilities Doing?

The Environmental Protection Agency (EPA) has set the maximum contaminant level of nitrates in drinking water at 10 mg/L. All water utilities are required to regularly monitor the quality of drinking water. Areas prone to higher nitrate levels are required to monitor more frequently. Once the maximum contaminant level has been violated, the water utility must issue a public notice and take measures to reduce the concentrations in the drinking water.

Ways to Reduce Nitrate Concentrations in Existing Wells

1. Keep agricultural activities back from the wells.

2. Grade areas around wells to direct surface runoff away from the wells.

3. Use best management practices when farming in the vicinity of the wells, which include:

    - Use the most appropriate fertilizers for soil conditions
    - Do not over apply fertilizers
    - Apply fertilizers only when weather conditions are suitable
    - Avoid over irrigation
    - Rotate crops and plant crops that require less fertilizer

- Remove crop stubble from fields after harvesting crops
- Use no-till and cover crop practices
- Avoid using controls on drainage systems to retain water in the fields

Ways to Treat Nitrates in Drinking Water

Carbon absorption filters, mechanical filters, and standard water softeners do not remove nitrates. The most common treatment process employed for lowering nitrate concentrations is the ion exchange process. All of the effective treatment processes are complex and are expensive to design, construct, and operate.

If the source water has significant iron and manganese, the water may need to be aerated and filtered prior to the ion exchange process. The costs of handling the residuals from the various treatment processes can also add significantly to the overall cost to lower the nitrates.

Elevated Nitrates and Boil Order Notices

When nitrate concentrations in drinking water exceed the maximum contaminant level (MCL), water utilities are required to issue public notices.

Indiana's required public notice language when nitrate MCL's are violated clearly states:

1. "DO NOT GIVE THE WATER TO INFANTS." - Infants below the age of six months, who drink water containing nitrates in excess of the MCL could become seriously ill, and if untreated, may die.

2. "Water, juice and formula for children under 6 months of age should not be prepared with tap water." - Bottled water or other water low in nitrates should be used until the nitrate concentrations are lowered to acceptable levels.

3. "DO NOT BOIL THE WATER" - Because the nitrates remain behind when the water evaporates making the nitrates concentrations even higher.

A Potentially Lethal Combination

Those same public water utilities are required to issue boil order public notices when fecal coliform bacteria have been found in the drinking water, systems pressure drop too low, and/or there have been main breaks or repairs that could allow contaminants to get into the drinking water.

The boil order notices, however, and the associated guidance to retail establishment, do not include any of the cautionary language about **not giving the boiled water to infants**.

When public water systems with elevated nitrates issue boil order public notices that do not include such cautionary language they could unintentionally be placing the health of some of their customers at risk.

Those public water systems should consult with IDEM as to what additional language should be issued with their boil order public notices to make certain their customers have the information they need to protect themselves.

Best Practices and Additional Public Health Warnings

Utilities that produce water with elevated nitrate concentrations (5 mg/l and higher) should add language to their boil order public notices warning that the boiled water should NOT be consumed by pregnant women or infants!

Suggested language to be added to boil order notices:

“Boiling water can increase the concentration of nitrates in the water. Infants below the age of six months who drink water containing high concentrations of nitrates could become seriously ill and, if untreated, may die. Water, juice, and formula for children under six month of age should NOT be prepared with tap water that has been boiled. Bottled water or other water low in nitrates should be used for infants during the boil order period.”

Conclusion

For more information on nitrates and how to reduce them, contact Wessler Engineering at 317-788-4551 or Stanley S. Diamond, P.E., BCEE, at Stand@wesslerengineering.com.

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