

Nitrate and Drinking Water

What is nitrate?

Nitrate is an inorganic compound that occurs under a variety of conditions in the environment, both naturally and synthetically. Nitrate is composed of one atom of nitrogen (N) and three atoms of oxygen (O); the chemical symbol for nitrate is NO_3 . Nitrite (NO_2) can be formed from nitrate by a chemical process called reduction. Nitrate does not normally cause health problems unless it is reduced to nitrite.

Where is nitrate found?

Nitrate occurs naturally in drinking water, but elevated levels of nitrate in groundwater usually result from human activities such as over use of chemical fertilizers and improper disposal of human and animal waste. Nitrate is found in municipal and industrial wastewaters, refuse dumps, animal feed lots, and septic systems.

Can nitrate be harmful?

Excess levels of nitrate can cause problems for infants but it does not pose a direct threat to older children and adults. Nitrate does indicate the possible presence of other more serious residential or agricultural contaminants, such as bacteria or pesticides.

Why is nitrate harmful to infants?

Babies consume large quantities of water relative to their body weight, especially if water is used to mix powdered or concentrated formulas or juices. Also, their immature digestive systems are more likely than adult digestive tracts to allow the reduction of nitrate to nitrite. In particular, the presence of nitrite the digestive tract of newborns can lead to a disease called methemoglobinemia or “blue baby” disease.

What is methemoglobinemia?

Methemoglobinemia is the most significant health problem associated with nitrate in drinking water. Blood contains an iron-based compound called hemoglobin, which carries oxygen. When nitrite is present, hemoglobin can be converted to methemoglobin, which can not carry oxygen. In the blood of adults, enzymes continually convert methemoglobin back to hemoglobin, and methemoglobin levels normally do not exceed 1 percent. Newborn infants have lower levels of these enzymes, and their methemoglobin level is usually 1 to 2 percent. Anything above that level is considered methemoglobinemia.

Consuming drinking water with nitrate levels near the drinking water standard does not normally increase the methemoglobin levels of humans beyond infancy. Some individuals, however, may have increased susceptibility to methemoglobinemia due to exposure to antioxidant medications and chemicals, or other conditions that may inhibit the body's ability to reconvert methemoglobin to hemoglobin (such as pregnancy or certain rare diseases).

What are some infant feeding practices to minimize intake of nitrate and nitrite?

1. Breast feeding. Little if any nitrate gets into breast milk, unless the mother is consuming very large quantities of nitrate. Also, bacterial contamination is not a problem when breast milk is consumed directly.
2. Bottle feeding. Use already diluted liquid formulas or use low-nitrate water to dilute concentrated liquid or powdered formulas. Also, mixed formulas should be kept under refrigeration and used promptly to minimize bacterial reduction of nitrate to nitrite.
3. Vegetables. Since many vegetables are high in nitrate, their consumption should be limited until an infant is 4-6 months old and their digestive tract has sufficiently matured. Your physician can help you decide when to add new foods. Vegetables should always be prepared while fresh and refrigerated promptly after cooking to minimize bacterial activity.

How can I lower the nitrate level in my current water supply?

The best solution is to find an alternative water supply for drinking and cooking water purposes. Another possibility is to try to remove or reduce the source of nitrate contamination, although reduction of nitrate concentrations in your well is unlikely to be immediate. Your local water distribution service, municipal company or regional Department of Health may be able to assist you in locating and cleaning up contaminant sources.

Where can I get low nitrate water?

By purchasing bottled water or connecting to city water supplies which comes from large lakes or reservoirs where any source of nitrate is likely to be diluted by the large quantity of water.