

## Nitrates in Our Waterways

Nitrogen is essential for plant and animal life. Most organisms are unable to use the nitrogen that is present as a gas in the air. Instead, nitrogen enters the food chain in the form of ammonia ( $\text{NH}_3$ ) or nitrate ( $\text{NO}_3^-$ ) ions that can be absorbed by plants. A **nitrate** ion is composed of a nitrogen atom and three oxygen atoms ( $\text{NO}_3^-$ ).

Nitrate compounds, such as sodium nitrate or potassium nitrate, occur in minerals, plants, and animals. They form the starting material that organisms use to make the many compounds necessary for life. Proteins, enzymes, nucleic acids, hormones, and vitamins all contain nitrogen.

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### Why Test Water for Nitrates?

You learned in Lesson 8 that plants need phosphates for proper growth and maturity. Proper growth and maturity also require nitrates.

Aquatic plants can obtain the nitrogen they need from dissolved nitrates in a river or stream. As with phosphates, too much nitrate in a waterway can encourage excessive growth of aquatic weeds and algae. This excessive plant growth can degrade the quality of a waterway through eutrophication.

So, one reason waterways are tested for nitrate levels is to monitor and control eutrophication. A second reason directly relates to human health risks, specifically health risks to infants and unborn children. Drinking water that contains high amounts of nitrates may cause “blue babies” or **infant methemoglobinemia** (meht HEE muh Gloh Bih nee mee uh). This is a medical condition of infants in which oxygen does not properly bind to hemoglobin, the oxygen-carrying molecule in the blood. To avoid this condition, pregnant women and infants should not drink water that contains more than 20 mg/L of nitrates.

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### Human-Based Sources of Nitrates

Nitrogen-containing fertilizers are used on agricultural land and city lawns in larger quantities than any other kind of fertilizer. Farmers supply nitrogen to their crops in various forms. About 80 percent of fertilizer nitrogen is in the form of ammonia, 19 percent is nitrates, and only 1 percent in organic nitrates.

Nitrate fertilizers are usually applied as a water-soluble solid. (In fact, most common nitrates are water-soluble.) Though some of this nitrate is absorbed

by plants, some dissolves and washes into rivers and streams via runoff and groundwater.

In the Mississippi River watershed alone, an estimated 4.2 million metric tons (9.2 billion pounds) of nitrogen-based fertilizers are applied to croplands each year. Some of this amount finds its way into rivers and streams. Excess nitrates in rivers and streams also comes from wastewater from treatment plants and home septic systems.

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### Reducing Nitrate Levels in Rivers and Streams

Limiting the use of nitrate fertilizers would decrease nitrate levels in waterways. An alternative way to supply plants with adequate amounts of nitrogen is by a form of crop rotation. Crop rotation involves varying which crops are planted in a particular field. To increase nitrogen naturally, one season a crop is planted that converts nitrogen from the air into nitrogen in the soil. Such plants are called **nitrogen-fixing plants**. The next season, a crop that requires nitrogen is planted. The most common type of nitrogen-fixing plants are legumes, which includes peas, clover, and soybeans.

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### Questions

1. Why are nitrates important for plants and other organisms?
2. Give two reasons why waterways should be tested for nitrates.
3. What are two common sources of nitrates in a waterway?
4. What can be done to reduce excess nitrate levels in a river or stream?