

NITRATE CONTAMINATION

Groundwater is the source of drinking water for most communities in northern Michigan. Virtually all rural residents in the area get their water from wells. Because residents in the area are so dependent on groundwater, there is an increasing awareness of the problems that can result from its contamination.

Groundwater contamination can result from naturally occurring substances, or from compounds we have created. Nitrate is a naturally occurring compound composed of nitrogen and oxygen, and is one potential contaminant of groundwater. Human activities are often responsible for creating elevated levels of nitrate in the groundwater. Contamination can be caused by the overuse of chemical fertilizers, and the improper disposal of human and animal wastes. Once in the soil, nitrate is extremely soluble in water and can move easily through the soil into the drinking water supply.

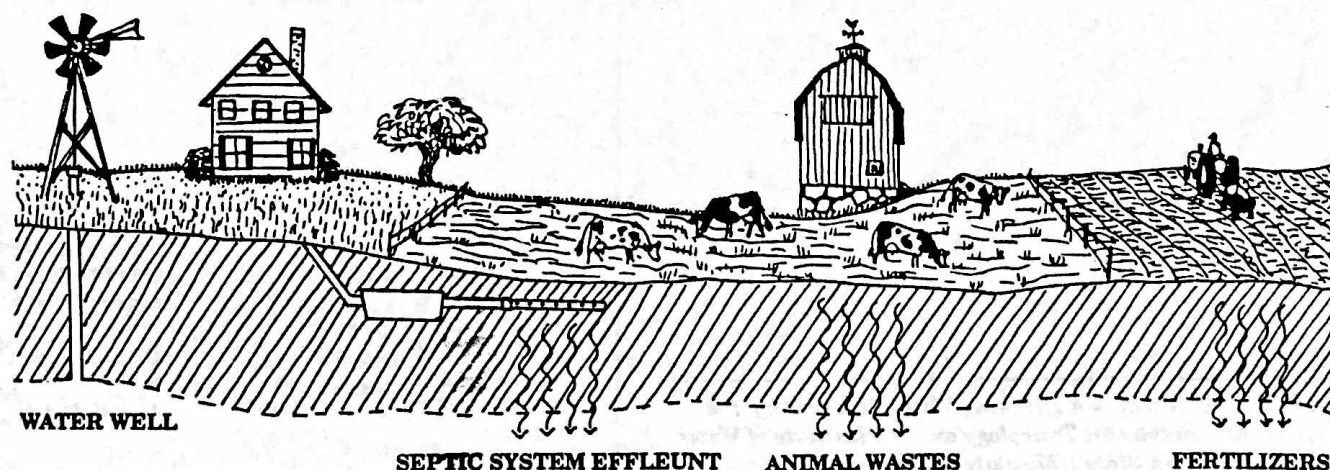
The Health Risks of Nitrate Contamination

The federal government has established a maximum acceptable level, known as the Maximum Contaminant Level, for nitrate in public drinking water supplies. This level is 10 milligrams per liter, and is often expressed as 10 parts per million. Measurements that are this small can be difficult to visualize. It may be helpful to think of 1 part per mil-

lion as a single drop in approximately 15 1/2 gallons of water. The Maximum Contaminant Level of 10 parts per million is equivalent to ten drops in that much water.

The levels of nitrate commonly found in drinking water are not likely to pose health risks for healthy adults. However, the ingestion of excessive amounts of nitrate can cause adverse health effects in very young infants and in some susceptible adults. When nitrate is ingested, it is converted to nitrite. High levels of nitrite in the blood cause a condition known as methemoglobinemia. Normal hemoglobin carries oxygen through the bloodstream, but when nitrite converts hemoglobin to methemoglobin, less oxygen can be transported. As a result, vital tissues including the brain receive less oxygen than they need. Severe cases can result in brain damage and even death.

Infants in the first six months of life are the most susceptible to this problem. They consume more water for their weight, and therefore may be exposed to relatively high amounts of nitrate. Because their physiology is not as fully developed, they cannot handle the contamination as well as adults. Nitrate contamination is also a serious problem for some adults who have specific enzyme deficiencies that make them unable to handle nitrate as easily as healthy adults. Fortunately, methemoglobinemia is easily recognized by doctors and can be readily diagnosed and treated.



Sources of Nitrate Contamination

The most common sources of nitrate are municipal and industrial wastewater, refuse dumps, animal feed lots, and septic systems. Additional sources include runoff from manured or fertilized agricultural land, and stormwater runoff from urban areas. Nitrogen compounds are also emitted into the air by power plants and automobiles, and carried back to earth by rainfall.

Nitrate that reaches the soil may or may not cause groundwater contamination problems for humans. The result depends on the type of soil, the characteristics of the underground water formations, and the depth and construction of wells in the area. It can be very difficult to identify the source of contamination for a specific well because nitrate can move long distances underground with the flow of the groundwater.

The presence of nitrate in the soil can also be an indication of other health threats. If the source of contamination is animal waste or effluent from septic tanks, then bacteria, viruses, and infectious microorganisms may also be present. Contamination of groundwater by fertilizers may also suggest the presence of other agricultural chemicals such as pesticides. Therefore, finding elevated levels of nitrate in a well may indicate that further testing is necessary.

Summary

Nitrate contamination poses risks to infants and some susceptible adults. In addition, nitrate contamination may indicate the presence of other types of contamination. Controlling the sources of nitrate in the environment is an important step toward the protection of our vital groundwater resource.

Compiled from "Nitrate - A Drinking Water Concern" by the Center for Environmental Toxicology and the Institute of Water Research, Michigan State University.

For further Information about controlling nitrate contamination from septic systems, see Groundwater Fact Sheet Number 4.

Other Groundwater Fact Sheets are available on these topics:

What is Groundwater?	Number 1
Household Hazardous Wastes	Number 3
Septic Tank Maintenance	Number 4
Fuel Storage Tanks	Number 5

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