# The Trouble with Nitrates

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We welcome some of the first signs of spring: robins chirping, flowers emerging from the ground, and children taking their ball gloves out of storage. But one spring ritual that municipal water utilities could live without is the annual risk of high nitrate levels.

High nitrate levels are primarily a threat to the health of infants, leading to "blue baby syndrome." When drinking water contains high levels of nitrates, the body converts the nitrates to nitrites, which react with the hemoglobin in red blood cells to keep the cells from carrying the amount of oxygen they should. The result is a low blood-oxygen level, which can cause the child's mouth, hands, and feet to turn blue.

Healthy adults are ordinarily under no such threat; our bodies typically absorb comparatively large amounts of nitrates just from dietary vegetable consumption, and safely excrete them. Formula-fed infants are most at risk from exposure to high nitrate levels because water composes such a large portion of their diet, but some adults are susceptible, too, including dialysis patients, people with peptic ulcers and those with some genetic predisposition to the health risk.

The name "blue baby syndrome" is enough just on its own to terrorize water customers. Even worse is the fact that they can't boil the nitrates out of the water — in fact, boiling simply concentrates the nitrates even more. This can give water customers a feeling of helplessness, since boiling is the only approach to water decontamination that many know how to conduct on their own.

The water industry, though, isn't quite as helpless — even if the sources of nitrates are largely beyond our control. Nitrates are known to come from several sources:

- runoff from fertilized agricultural cropland and pastures
- runoff from livestock feedlots
- runoff from fertilized lawns around homes and businesses
- septic systems
- municipal wastewater treatment discharges
- natural leaching from nitrogen-fixing plants like legumes
- lightning (which naturally fixes atmospheric nitrogen into the soil)

All of these sources appear to contribute to the nitrogen pollution that leads to nitrates in the water, and the debate over source management can be contentious. Nobody wants to be blamed for causing something like blue baby syndrome. However, nitrates are highly mobile and can leach into groundwater wherever decaying plants, fertilizers, waste or other organic materials break down. There is also some evidence to suggest that nitrates can be highly persistent in groundwater, lingering for many years beyond the time of their initial introduction.

Agricultural runoff is one– but not the only– contributor to nitrates in groundwater.

Nitrates can be mitigated directly by limiting the land application of fertilizers (both natural and synthetic). From a regulatory standpoint, natural resource districts (NRDs) have some ability to create groundwater management areas to control the volume of nitrates introduced into the soil, which ultimately find their way into the groundwater. Regulations on wastewater discharge help minimize the impact as well. The Nebraska AWWA cooperates with agencies and organizations like local NRDs, the NDEQ, Nebraska DHHS, the Nebraska Department of Natural Resources, and the Nebraska Groundwater Foundation to develop these source-mitigation techniques.

Where regulations fail, though, public education can help farmers, homeowners and business owners alike realize that any excess nitrogen fertilizer they apply to their land not only contributes to water pollution, but represents a waste of their own expenditures. In a sense, all of that excess fertilizer that washes away and contributes to the nitrate problem is "money down the drain" to whomever paid for the fertilizer.

The EPA's drinking water standard for nitrate is 10 mg/L (measured as N), and when a public system fails to stay below this maximum contaminant level, it is required to take corrective action. The standard was chosen because methemoglobinemia hasn't been reported where levels have remained below 10 mg/L. It's possible, though, that there could be chronic effects from long-term exposure to lower levels.

Many of our neighbors who rely on private wells fail to recognize the health risks from nitrates — which is especially unfortunate, since their wells are twice as likely to exceed the nitrate standard as community wells, according to the EPA. Moreover, it costs far more per gallon to provide treatment for nitrates on a private well than it does to treat for a community water system. We will address those treatment options for meeting the federal health standard in the next article in this series, appearing in the summer issue of *Wise Water Words*.