Nebraska News and Events

Nitrate Mitigation at the Source

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This article is the third installment in a special series for *Wise Water Words* to address the persistent issue of nitrates in drinking water. The first article ("The trouble with nitrates," Spring 2011) summarized the most common sources of nitrates:

- 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 such as legumes

The second article ("Solving nitrate problems at the plant level," Summer 2011) described the treatment options for nitrate reduction and removal, including blending, filtration and source replacement.

The key observation to take away from the previous installments is that there are many sources that contribute to nitrates in our drinking water supply, and once nitrates are present, they are difficult and costly to mitigate. As with so many other things in life, an ounce of prevention can be worth a pound of cure, so the focus of this article is the mitigation of nitrates at their source.

The debate over nitrate source management can be contentious. Because nitrates are a non-point-source problem, responsibility for reducing them is hard to pin down — and it's even harder to make the economic case for who should pay for the prevention.

Reviewing the common sources of nitrates, we'll discuss some current methods of mitigation that are being used or are in the process of being implemented to address the nitrate issue.

RUNOFF FROM FERTILIZED AGRICULTURAL CROPLAND AND PASTURES

Agricultural application of fertilizer requires a license and is monitored. Due to the cost of chemicals, many farmers strive to apply the ideal amount of synthetic fertilizer at optimal conditions to conserve and save on costs. The science and technology of efficient fertilizer application have advanced a lot over the last 30 years. Innovations such as no-till planting; contour farming; genetic engineering of crops; and fertilizer application plans based on soil testing, moisture, and temperature conditions have led to a general reduction in the application of synthetic fertilizer.

In addition to synthetic fertilizers, many farms also land-apply treated manure from their livestock. Because this fertilizer is "free," in a sense, farmers have less incentive to use it as efficiently as synthetic fertilizer; however, regulatory guidance on land-applied manure can have a very important impact on the amount of nutrients that are put onto fields, long before they have the potential to wash into waterways.

To help reduce the impact of both synthetic and manure-based fertilizers, farmers and ranchers are regularly encouraged to dedicate land next to streams and waterways to buffer strips and conservation acreage. This forces runoff from fields to pass through a natural filtration zone before entering the water. However, as grain prices have risen (particularly for corn), so has the pressure to remove land from conservation service and return it to crop production. When corn sells for $6 per bushel (as it does right now) or nearly $8 per bushel (as it did earlier this year), it's much harder to ask farmers to take additional acres out of crop production than when corn was selling for $2 a bushel just six years ago.

RUNOFF FROM LIVESTOCK FEEDLOTS

Regulations continue to become more restrictive on the requirements to capture and contain runoff from livestock feedlots.

RUNOFF FROM FERTILIZED LAWNS AROUND HOMES AND BUSINESSES

Homeowners are encouraged to follow directions on the bags of fertilizer they purchase. However, over-application of fertilizer and over-application of water are both commonplace. The combination of the two results in runoff of nitrates from lawns and absorption of fertilizer into the ground before the grass can capture and use the nutrients. The application of fertilizer by homeowners is not routinely monitored, so public outreach and educational efforts are needed to reduce the amount of excess fertilizer entering the water supply.

SEPTIC SYSTEMS

Regulations on septic systems, including set-back requirements from wells, buildings, and other septic systems, help reduce the contribution these systems can make to nitrate pollution. These new setbacks often make it difficult to install new septic systems if and when the old systems fail. A common mitigation method in developed residential areas is to install centralized sewer collection and treatment systems.

MUNICIPAL WASTEWATER TREATMENT DISCHARGES

State regulations limit the amount of nitrates that can be discharged from wastewater treatment plants into receiving streams and rivers. The reduced limits require that the wastewater treatment plants remove nitrates by providing denitrification. Simply put, denitrification is the anoxic biological reduction of nitrate nitrogen to harmless nitrogen gas.

NATURAL LEACHING FROM NITROGEN-FIXING PLANTS LIKE LEGUMES

The most common mitigation approach is the simple rotation of crops between soybeans (which naturally increase nitrogen in the soil) and corn (which consumes it). Higher corn prices have tilted the rotation of these crops in favor of more acres producing corn and fewer producing soybeans, but future conditions might see the balance tip in favor of more soybean acreage.

As described above, mitigation efforts are currently underway and research has shown that these efforts are successful in reducing nitrate levels in soil and in groundwater. In particular, for select groundwater sources in Nebraska, data indicates that changes in fertilizer application over the years has reduced the level of nitrates in the upper layers of the vadose zone (the zone between the ground surface and water table). The reduced levels of nitrates within the vadose zone will eventually correlate to reduced level of nitrates in the groundwater.

Mitigation techniques are successful, but the time frame between implementing a mitigation technique and observing a noticeable result in the drinking water supply varies based on a number of factors, including soil type, aquifer movement and volume of water pumped, to name just a few. Further education and implementation of mitigation methods will be important to control and reduce nitrate levels in the future. Although it is not always clear how immediate the impact of nitrate mitigation may be on a drinking water source, over the long term, nitrate mitigation does have a positive environmental and economic impact — and is simply the right thing to do.

Student Activities and Research Committee by Xu Li (UNL)

Four UNL/UNO graduate students applied for AWWA student memberships in September. The UNL student chapter and the Young Professionals committee co-organized a social in Ashland on Oct. 5 and tours of the Hickman Water Treatment Facility on Oct. 12 and 13. About 15 UNL and UNO students attended the AWWA/NWEA fall conference in Kearney.

Students attending the 2011 Fall Conference, from left: Taofic Onifade, Daran Rudnick, Xu Li, Mohamed Jalloh, Vivek Sharma, Michael Florek, Hugues Oke, Allison Cole, Jeffrey Mihulka, Kristen Cope, Jake Fisher, Chunmei Bai, Zhe Du, Maria Arellano, Yun Zhang.