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MANAGING FERTILIZERS TO PROTECT GROUNDWATER

Joel Pigg[1], John W. Smith[2], and Diane E. Boellstorff[3]

Well water can become contaminated by the constituents in fertilizers used on agricultural crops and home lawns and gardens. If you store or use fertilizers on your property, take steps to reduce the chances of them reaching your well water.

Inorganic fertilizers contain less than 5 percent of carbon material. Examples are ammonium sulfate and urea ammonium nitrate.

Organic fertilizers typically derive from plants and/or animals. Examples are compost, guano, manure, seaweed, municipal wastes, and processed bone meal.

To enable buyers to compare products and determine the proper application rates, the state of Texas requires that all products sold commercially as fertilizers be labeled with a guaranteed analysis. The analysis lists the minimum percentages of primary, secondary, and micro plant nutrients in the product.

The primary nutrients are nitrogen, phosphorus, and potassium, which plants need in the greatest amounts. Compared to the primary nutrients, the secondary nutrients calcium, magnesium, and sulfur are usually needed in lesser amounts. Plants need only very small amounts of the micronutrients boron, chlorine, copper, iron, manganese, molybdenum, and zinc.

Organic products that are sold as “soil amendments” are not required to be labeled. To determine their nutrient content, send samples for testing at a university or commercial laboratory.

Fertilizers can contaminate groundwater, which is the underground water that replenishes wells and springs. Groundwater is the source of drinking water for many Texans. Millions of gallons of groundwater may be located under the typical homesite, farm, or ranch.

The most common groundwater contaminant from fertilizers and organic soil amendments is nitrogen. The nitrate form of nitrogen (NO_3-N) dissolves very easily in water and can leach downward, particularly through coarse-textured (sandy) soils. Because nitrate is colorless, odorless, and tasteless, it cannot be detected without

[1] Extension Program Specialist – Water Resources
[2] Extension Program Specialist – Water Resources
[3] Professor and Extension Water Resources Specialist – Retired
Texas A&M Department of Soil and Crop Sciences, The Texas A&M University System

testing. The U.S. Environmental Protection Agency (EPA) has set the maximum contaminant level (MCL) for nitrate-nitrogen[1] in drinking water at 10 milligrams per liter (mg/L).

Nitrate-nitrogen can cause severe health effects, specifically methemoglobinemia (sometimes referred to as "blue baby syndrome"). The blood of people with methemoglobinemia is unable to carry enough oxygen to individual body cells.

If you drink water from a private well, and significant amounts of inorganic or organic fertilizer have been applied in your area recently or historically, have your water tested annually to determine whether it contains unhealthy levels of nitrates.

GUIDANCE AND REGULATIONS ON FERTILIZERS IN TEXAS

The Texas State Chemist office (*http://otscweb.tamu.edu/*) works to protect consumers and serve agribusinesses by regulating feeds and fertilizer sales and monitoring animal, human, and environmental health. Texas regulations require fertilizer testing and labeling as well as specific limits on heavy-metal contaminants.

The U.S. Occupational Safety and Health Administration requires that employers include information on any product component present at 1 percent or more (0.1 percent for constituents known to be carcinogens). The information is made available in Material Safety Data Sheets (MSDS) at time of purchase and via the Internet.

Organic fertilizers and soil amendments made from manures and animal carcasses contain bacteria that can contaminate drinking water. For information on producing and using organic materials safely, see the Texas A&M AgriLife Extension publications *Composting Manure and Sludge* (*http://amarillo.tamu.edu/files/2011/01/e479_01.pdf*), *Easy Gardening: Composting* (*https://agrilifelearn.tamu.edu/s/product/easy-gardening-composting/01t4x000004OfjDAAS*) and *Composting Large Animal Carcasses* (*https://agrilifelearn.tamu.edu/s/global-search/composting%20large%20animal%20carcasses?c__results_layout_state=%7B%7D*).

The decisions you make on your property can significantly affect the quality of your drinking water and your family's health. They can also affect your legal liability and property value.

To reduce the risk of contaminating your water supply, follow the product label instructions, review the MSDS, and get training on how to properly apply fertilizers.

[1] Nitrate concentrations in water are reported as 'nitrate-nitrogen (NO3-N)' or total nitrate (NO_3). Use the following to compare the two reporting systems: 10 mg/L nitrate-nitrogen (NO_3-N) = 44.3 mg/L nitrate (NO_3).

The questions in Table 1 may help you identify potential risks associated with fertilizers on your property. If not managed properly, many of these situations can lead to contamination of your drinking water.

If you answer yes or do not know the answer to any question, you may have a high-risk situation on your property. Information on how to address each situation follows.

Table 1. Questions to help landowners determine whether fertilizers may be threatening their well water.

Yes	No	Questions
☐	☐	1. Is your fertilizer storage facility less than 150 feet from your water well?
☐	☐	2. Do you mix and load fertilizers on your property?
☐	☐	3. Do you burn or dispose of fertilizer containers on your property?
☐	☐	4. Do you fertilize your soil without first having it tested?

1. Is your fertilizer storage facility less than 150 feet from your water well?

To store and handle fertilizers properly, you may need to build a new facility or modify an existing structure. Stored fertilizers also pose dangers to firefighters and the environment.

Factors to consider when designing a fertilizer storage facility include ventilation, temperature control, water access, and worker safety (Fig. 1). Get professional help in designing and installing a new or modified storage structure.

To reduce the risk of groundwater contamination:

- Store all fertilizers downslope and at least 150 feet away from any drinking water well. Store them farther away if the soil is sandy or the bedrock is fractured or shallow.
- Make sure that the road access can accommodate deliveries and emergency equipment.
- Design the storage facility to drain contaminated surface water to a confined area if a fire erupts. If you store large amounts of fertilizer, keep it in a confined area with an impermeable drainage pad and a sump basin to collect liquids.
- To minimize the distance that you must move chemicals, mix and load them next to the storage facility.
- Store dry and liquid products separately, and store bags of fertilizer on pallets.
- Make the containment area for big bulk tanks large enough to confine 125 percent of the volume of the

largest container plus 100 percent of the volume of all other storage tanks.

- Post signs and labels identifying contents to alert emergency personnel during fires or spills.
- Lock the facility.

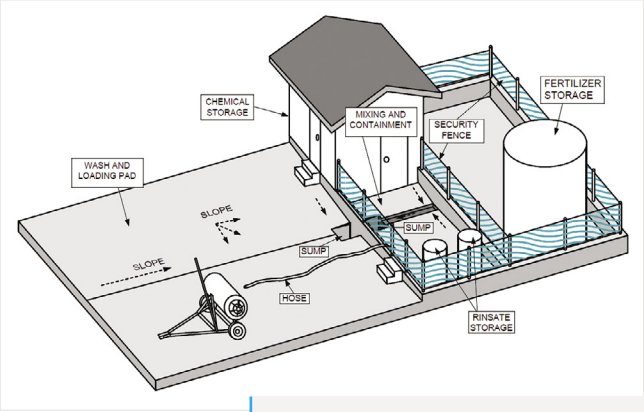

Figure 1. Farm-sized fertilizer facility.

2. Do you mix and load fertilizers on your property?

Spilled regularly in the same place, small amounts of fertilizer and oil can contaminate groundwater. Clean up spills according to the instructions provided by the product manufacturer and on the MSDS.

To minimize spills, follow these basic guidelines:

- Use a separate tank to transport water to the mixing and loading site to avoid working with chemicals near any well.
- Each year, move the mixing site to a different area of the application field to prevent spilled chemicals from building up in the soil.
- Do not mix fertilizers on a gravel driveway or any surface that could allow spills to move quickly into the soil.
- Install devices that prevent back siphoning on hoses, hydrants, or plumbing to prevent liquids from flowing into the water supply.
- Never put the water supply hose in the mixing tank; leave a 6-inch air gap between the hose and top of the sprayer tank.
- Train all personnel to follow exact procedures when handling fertilizer materials, especially anhydrous ammonia and ammonium nitrate.
- Consider using a closed-handling system that transfers chemicals directly from a storage container to the application equipment.
- Use the rinse water (rinsate) for mixing subsequent loads.

The MSDS includes appropriate storage conditions, responses to chemical exposure and spills, and emergency telephone numbers.

3. Do you burn or dispose of fertilizer containers on your property?

Containers such as bags and jugs can leak chemicals if not disposed of properly. Burning fertilizer bags is illegal in Texas. To minimize potential problems:

- Buy fertilizer materials in bulk to minimize the number of containers.
- When possible, buy chemicals in returnable containers.
- Triple-rinse the containers when feasible, and pour the rinsate into the application tanks.
- Follow the product MSDS guidelines on disposing of containers and excess chemicals appropriately.

4. Do you fertilize your soil without first having it tested?

The most important factors affecting the potential for nitrate to pollute groundwater are the rate and timing of fertilizer application.

The following practices will help protect your groundwater:

- **Soil testing:** Annual soil testing enables land managers to determine the most economical and environmentally appropriate application rate of nitrogen fertilizer by crediting residual nutrients. In addition to standard soil samples collected to a depth of 6 inches, deep samples (6 to 18 or 6 to 24 inches) tested for residual nitrogen help optimize application rates. Soil testing services are available from commercial laboratories and the Texas A&M AgriLife Extension Service Soil, Water and Forage Testing Laboratory in College Station (*http://soiltesting.tamu.edu*).
- **Application rate:** To prevent over-application, match the fertilizer application rate with the expected crop yield.
- **Application timing:** Because nitrate is soluble, apply nitrogen fertilizer as close as possible to the time of crop need to ensure maximum plant uptake.
- **Organic amendments:** If an organic soil amendment does not have a fertilizer label, use it sparingly. Or, have it tested to determine the appropriate rate of application.
- **Cover crops:** Where possible, plant cover crops to recover residual nitrogen and reduce potential leaching losses.

- **Coarse-textured soils:** Carefully manage both rate and timing of nitrogen applications on coarse-textured soils. These soils are more likely to allow nitrate leaching.

SUMMARY

The following management practices help reduce the risk of groundwater contamination by fertilizers:

- Avoid storing fertilizers by buying appropriate amounts and sharing leftovers with others.
- Store and load fertilizers at least 150 feet from the well, and downslope if possible.
- Make sure all bags and containers are labeled clearly.
- Secure fertilizers from children, livestock, and pets. If necessary, erect a fence.
- Use a separate tank to provide water for mixing fertilizers instead of using a hose directly from the well.
- To prevent backflow when filling a tank, maintain an air gap of at least 6 inches between the end of the hose and the liquid level in the tank.
- Install anti-backflow devices on your faucets.
- Dispose of all rinsate on the field being fertilized, or save it as mixing water for later loads.
- Do not pour rinsate down a drain or on a gravel surface.

FOR MORE INFORMATION

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- Texas Department of Licensing and Regulation: *https://www.tdlr.texas.gov/*
- Texas Groundwater Protection Committee: *http://www.tgpc.state.tx.us*
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- U.S. Department of Agriculture–Natural Resources Conservation Service: *https://www.nrcs.usda.gov/*
- Joel Pigg: *david.pigg@ag.tamu.edu,* 979-845-1461

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Originally published 2012 by Diane E. Boellstorff, Kristine A. Uhlman, Mark L. McFarland, and John W. Smith
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