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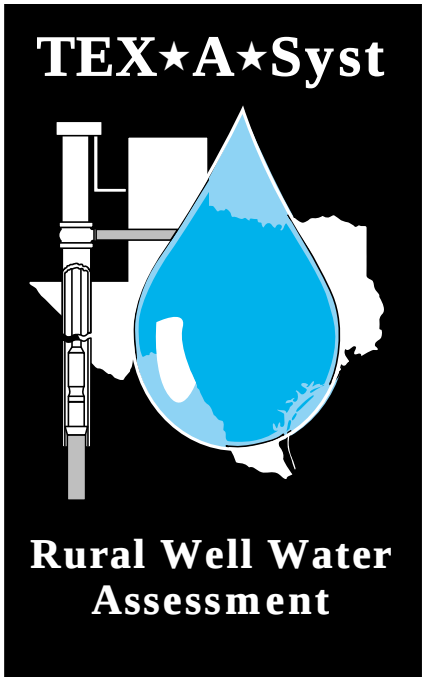

Texas Agricultural Extension Service
The Texas A&M University System

Reducing the Risk of Ground Water Contamination by Improving Fertilizer Storage and Handling

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1. Do you store fertilizers on your property?
2. Do you have special storage facility structures, such as an impermeable floor or curb for spill containment, in your fertilizer storage area?
3. Are you planning to build a new fertilizer storage area on your property, or are you planning to modify an existing structure?
4. Do you have a plan for handling fertilizer in an emergency situation?
5. Do you mix and load fertilizers on your property?
6. Do you need to become more familiar with fertilizer spill procedures?
7. Do you dispose of or burn fertilizer containers on your property?
8. Do you keep records of fertilizer use on your property?
9. Do you buy more fertilizer than you typically need?

If these questions create doubt about the safety of your management practices, this publication will provide helpful information.

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Fertilizer Use Overview

Fertilizers play a vital role in agriculture and also are commonly used in urban areas. Fertilizers increase crop production and improve lawns and gardens dramatically. However, commercial fertilizer is a major source of nitrate, which can contaminate ground water. The nitrate-nitrogen maximum contaminant level (MCL—or level beyond which human health problems can occur) in federal and state drinking water standards is 10 milligrams per liter (mg/l; equivalent to 10 parts per million). Nitrogen levels above the MCL have been found in many water wells in Texas. Other major components of commercial fertilizer, such as phosphorus and potassium, are not generally a ground water contamination concern.

Elevated nitrate levels in drinking water can pose serious risk to infants. Infants under 6 months of age are particularly susceptible to health problems, including the condition known as methemoglobinemia (blue baby syndrome), which is caused by drinking water with elevated nitrate content. Nitrates also can affect adults, but the evidence is less certain.

Young livestock also are susceptible to health problems from high nitrate-nitrogen levels. While livestock may be able to tolerate several times the 10 mg/l nitrate-nitrogen level, 20 to 40 mg/l may prove harmful, especially in combination with high levels (1,000 mg/l) of nitrate-nitrogen from feed sources.

Improper handling of fertilizers can affect ground water by allowing nitrogen to seep through the soil and down into the water. Other potential sources of nitrate are septic systems, livestock yards, livestock waste storage facilities, and silage storage. This bulletin covers the following topics:

1) Building a new storage facility

2) Modifying an existing facility

3) Mixing and loading practices

4) Spills and container disposal

5) Other management factors

6) Evaluation table

Building a New Storage Facility

While a new facility just for fertilizer storage may be expensive, it may be safer than trying to adapt areas designed for other purposes. When planning or building a new storage facility, keep these simple principles in mind:

- The dry storage building or liquid secondary containment structure should be located downslope and at least 100 feet away from the water well. Separation from the water well should be greater in areas of sand or fractured bedrock.
- In the event of a fire, contaminated surface water should drain to a confined area.
- The mixing and loading area should be close to your storage facility to minimize the distance that chemicals are carried.
- The building foundation or secondary containment floor should be well drained and located above the water table. The finished soil grade should be 3 inches below the floor of the storage area and sloped away from the building to provide surface drainage. The subsoil should have a low permeability.
- Bags should be stored on pallets, and dry products stored separately from liquids to prevent wetting from spills.
- If you plan to store large bulk tanks, provide a containment area large enough to confine 125 percent of the contents of the largest bulk container, plus the displaced volume of any other storage tanks.
- A locked storage cabinet or building provides security. Preventing unauthorized use of fertilizer reduces the chance of accidental spills or theft. Post signs or labels indicating that the cabinet or building is a fertilizer storage area. Labels on the outside of the building give firefighters important information about fertilizers during an emergency response for a fire or spill.
- Provide adequate road access for deliveries and emergency equipment.

For information on factors to consider in the design of a storage facility, such as ventilation, water access, temperature control and worker safety, contact your county Extension office or the Texas A&M University Department of Agricultural Engineering.

Modifying an Existing Facility

Modifying an existing facility can be expensive and difficult, but compared to the cost of a major accident or even a lawsuit, storage improvements are a bargain. Also, spilled liquid fertilizer captured by the secondary containment can be recovered; thus, the product is not lost. The last four items in the list above are also important for existing storage management.

The cheapest alternative you may have is to cut back on the amounts stored. If that option is not practical, consider how you can protect the fertilizers you keep in storage (Fig. 1).

Sound containers are your first defense against a spill or leak. If a bag is accidentally ripped, the fertilizer should be confined to the immediate area and promptly recovered. That means having a solid floor and, for liquid fertilizers, a curb. The secondary containment space should be large enough to hold 125 percent of the contents of the largest container, plus the displaced volume of any other storage tanks in the area.

Ideally, your fertilizer storage area should be separated from other uses. If the building must also serve as a machine shed or as housing for livestock, you may find it difficult to meet all the requirements for safe storage.

Stored fertilizers can pose a danger to firefighters and to the environment. Reducing the fire risk in the storage area may be the first step, but other things can be done.

You can reduce the damages by anticipating such emergencies. If a fire should occur, consider where the water will go and where it might collect. In making the storage area secure, also make it accessible, thus allowing you to get fertilizers out in a hurry.

If fertilizer containers are damaged, the stored nutrients may be carried away by water and spread over a large area. A curb around the floor can help confine contaminated water.

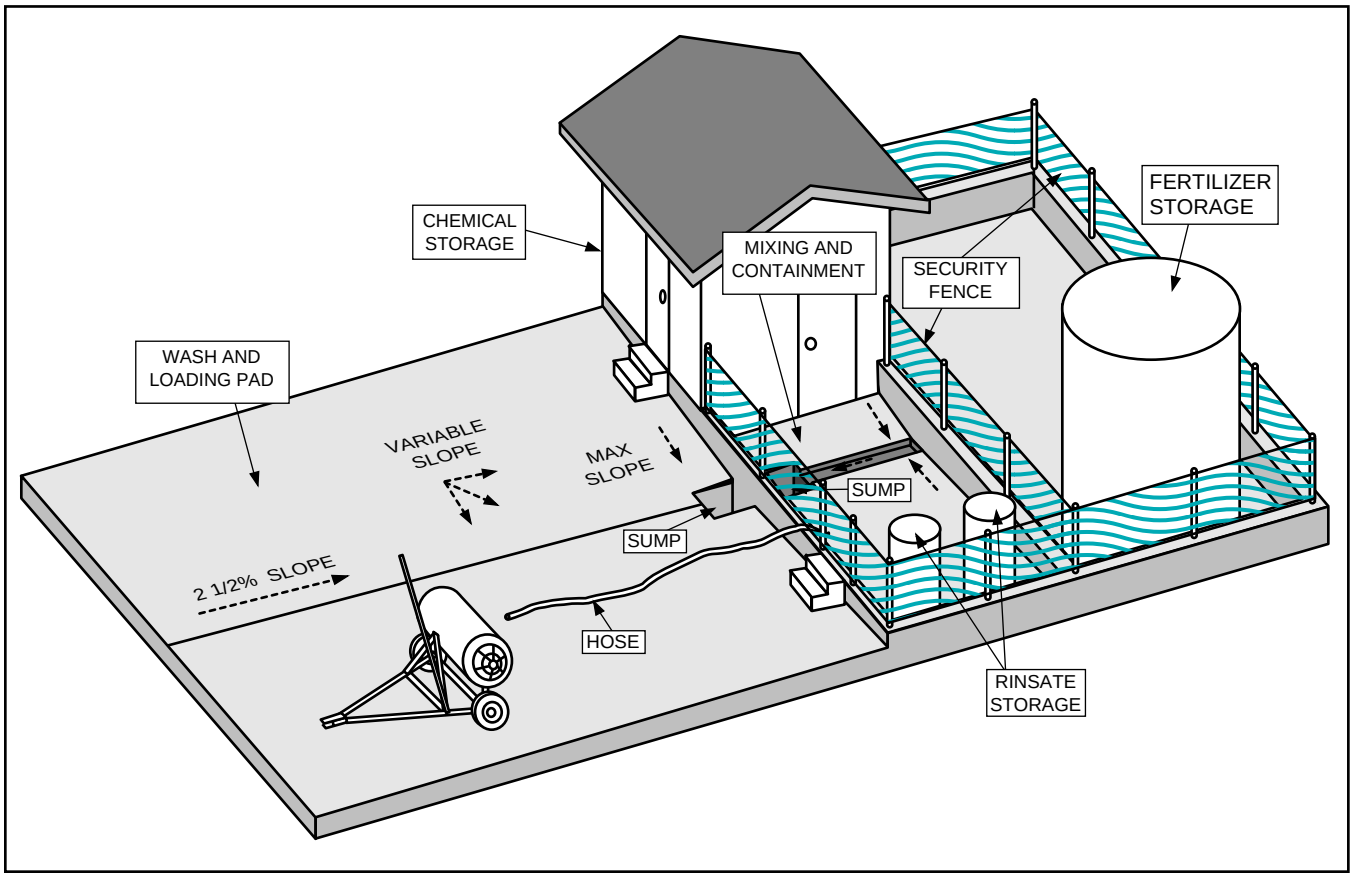

Figure 1. Farm-sized fertilizer facility. Source: Modular Concrete Wash/Containment Pad for Agricultural Chemicals, by. R.T. Noyes and D.W. Kammel, American Society of Agricultural Engineers Paper Number 891613.

Mixing and Loading Practices

Contamination can result from small quantities spilled regularly in the same place. Spills of dry fertilizer should be promptly and completely cleaned up and placed immediately into the application equipment. Cleaning up spills of liquid fertilizers can be much more difficult.

Using a Liquid Fertilizer Mixing and Loading Pad

Containing liquid fertilizer spills and leaks requires an impermeable surface (such as concrete) for mixing and loading. A concrete pad should be large enough to accommodate your equipment and to contain wash water and spills when transferring fertilizers to the sprayer.

Locate the pad adjacent to the storage area. Make sure that water moves away from the well. At sites where runoff could reach the well, construct a diversion to direct runoff to another area.

The size of the pad depends on the equipment you use. Provide space around parked equipment for washing and rinsing. The fertilizers and rinse water should be kept in a confined area, such as a sump, for settling before they are transferred to rinsate storage tanks. Having several rinsate storage tanks allows you to keep rinse water from different fertilizer mixes separate. That way, it can be used for mixing water on subsequent loads.

If you are considering constructing a mixing/loading pad, more detailed information is available from county Extension office or the Department of Agricultural Engineering at Texas A&M University.

Better Management of your Existing Mixing and Loading Site

Take steps to minimize liquid fertilizer spills and leaks and their effects. Even if you do not have an impermeable mixing and loading pad, you can minimize contamination by following some basic guidelines:

- Avoid mixing and loading fertilizers near your well. One way to do this is to use a nurse tank to transport water to the mixing and loading site. Ideally, the mixing site should be moved from year to year within the field of application to avoid build-up of fertilizers in the soil.
- Avoid mixing and loading on gravel driveways or other surfaces that allow spills to sink quickly through the soil. A clay surface is better than sand.
- Install an anti-backsiphon device on the well or hydrants. Never put the hose in the application tank. Provide an air gap of 6 inches between the hose and the top of the application tank.
- Always supervise tank filling.
- Consider using a closed handling system, in which the fertilizer is directly transferred from the storage container to the applicator equipment, such as by a hose. This will ensure that humans and the environment are never inadvertently exposed to the chemical.
- Use rinsate for mixing subsequent loads.

Spill Cleanup

Promptly sweep up dry spills and reuse the fertilizer as it was intended. Dry spills are usually very easy to clean up. Dry pesticide impregnated fertilizer is considered a pesticide and, if spilled, should be recovered and applied to the target crop as it was intended. For liquid spills, recover as much of the spill as possible and reuse it as it was intended. It may be necessary to remove contaminated soil and apply it to fields. Have an emergency response plan for the site. Know where the runoff water will flow, how to handle your particular fertilizers and whom to call for help.

Container Disposal

Bulk deliveries of anhydrous ammonia, liquid fertilizers and dry bulk fertilizers reduce the need to dispose of containers. Many people do, however, use bagged fertilizers. Burning fertilizer bags is illegal in Texas; therefore, bundle the bags and dispose of them in an approved landfill.

Your drinking water is least likely to be contaminated by your disposal practices if you follow appropriate management procedures or dispose of wastes in an approved landfill. Proper offsite disposal practices are essential to prevent contamination that could affect the water supplies and health of others.

Other Management Factors

Reducing fertilizer waste makes financial as well as environmental sense, but it means more than just reducing spills. It also means not buying more than you need and keeping records of what you have on hand. Buying only what you need makes long-term storage unnecessary.

Keeping records may seem like a task unrelated to contamination, but knowing what you have used in the past and what you have on hand allows you to make better purchasing decisions. Keep records of past field application rates and effectiveness. Purchase fertilizers only after careful and complete soil testing to determine your exact needs.

Evaluation Table

The following table can help agricultural producers and rural homeowners determine the risk that drinking water on a given property will be contaminated because of the management practices being used. For each category on the left that is appropriate, read across to the right and circle the statement that best describes conditions on your land. Allow 15 to 30 minutes to complete the table, and skip any categories that do not apply. Note any high risk ratings and take appropriate actions to remedy them. Strive for all low or low-moderate risk ratings.

Drinking Water Well Condition: Assessing Drinking Water Contamination Risk				
	Low Risk	**Low-Moderate Risk**	**Moderate-High Risk**	**High Risk**
Fertilizer Storage				
Dry formulation:				
Amount stored	None stored at any time.	Less than 1 ton.	Between 1 and 20 tons.	More than 20 tons.
Type of storage	Covered on impermeable surface (such as concrete or asphalt). Spills are collected.	Covered on clay soil. Spills are collected.	Partially covered on loamy soils. Spills not collected.	Not covered on sandy soils. Spills not collected.
Liquid formulation:				
Amount stored	None stored at any time.	Less than 55 gallons.	Between 55 and 1,500 gallons.	More than 1,500 gallons.
Type of storage	Concrete or other impermeable secondary containment does not allow spill to contaminate soil.	Clay-lined secondary containment. Most of spill can be recovered.	Somewhat permeable soils (loam). No secondary containment. Most of spill cannot be recovered.	Permeable soil (sand). No secondary containment. Spills contaminate soil.
Containers	Original containers clearly labeled. No holes, tears or weak seams. Lids tight.	Original containers old. Labels partially missing or hard to read.	Containers old but patched. Metal containers showing signs of rusting.	Containers have holes or tears that allow fertilizers to leak. No labels.
Security	Fenced or locked area separate from all other activities, or locks on valves.	Fenced area separate from most other activities.	Open to activities that could damage containers or spill fertilizer.	Open access to theft, vandalism and children.
Mixing and Loading Practices				
Location of well in relation to mixing/loading area with no curbed and impermeable containment area	100 feet or more downslope from well.	50 to 100 feet downslope from well.	10 to 50 feet downslope or 100 to 500 feet upslope from well.	Within 10 feet downslope or less than 100 feet upslope from well.

Drinking Water Well Condition: Assessing Drinking Water Contamination Risk				
	Low Risk	**Low-Moderate Risk**	**Moderate-High Risk**	**High Risk**
Additional Mixing and Loading Practices for Liquid Fertilizer				
Mixing and loading pad (spill containment)	Concrete pad with curb keeps spills contained. Sump allows collection and transfer to storage.	Concrete pad with curb keeps spills contained. No sump.	Concrete pad with some cracks keeps some spills contained. No curb or sump.	No mixing/loading pad. Spills soak into ground.
Water source	Separate water tank.	Hydrant away from well.	Hydrant near well.	Obtained directly from well.
Backflow prevention on water supply	Anti-backflow device installed or 6-inch air gap maintained between hose and sprayer tank.	Anti-backflow device installed. Hose in tank above waterline.	No anti-backflow device. Hose in tank above waterline.	No anti-backflow device. Hose in tank below water line.
Filling supervision	Constant	Mostly constant	Frequent	Seldom or never
Handling system	Closed system for all liquid product transfers.	Closed system for most liquids. Some liquids hand poured. Sprayer fill port easy to reach.	All liquids hand poured. Sprayer fill port easy to reach.	All liquids hand poured. Sprayer fill port hard to reach.
Clean-up and Disposal Practices				
Sprayer cleaning and rinsate (rinse water) disposal	Sprayer washed out in field. Rinsate used in next load and applied to crop.	Sprayer washed out on pad. Rinsate used in next load and applied to crop.	Sprayer washed out at homestead. Rinsate applied on nearby field.	Sprayer washed out at homestead. Rinsate sprayed less than 100 feet from well.

Glossary

Air gap: An air space (open space) between the hose or faucet and water level, representing one way to prevent backflow of liquids into a well or water supply.

Anti-backflow (anti-backsiphoning) device: A check valve or other mechanical device to prevent the unwanted reverse flow of liquids back down a water supply pipe into a well.

Backflow: The unwanted reverse flow of liquids in a piping system.

Backflow prevention device: See anti-backflow device.

Backsiphonage: Backflow caused by formation of a vacuum in a water supply pipe.

Closed handling system: A system for transferring pesticides or fertilizers directly from storage containers to application equipment (through a hose, for example), so that humans and the environment are never inadvertently exposed to the chemicals.

Cross-connection: A link or channel between pipes, wells, fixtures or tanks carrying contaminated water and those carrying potable (safe for drinking) water. Contaminated water, if at higher pressure, can enter the potable water system.

Milligrams per liter (mg/l): The weight of a substance measured in milligrams contained in 1 liter. It is equivalent to parts per million in water measure.

Parts per million (ppm): A measurement of concentration of one unit of material dispersed in 1 million units of another.

Rinsate: Rinse water from pesticide or fertilizer tank cleaning.

Secondary containment: Impermeable floor and walls around a chemical storage area that minimize the amount of chemical seeping into the ground from a spill or leak.

Contact and References

For additional information, contact your county Extension agent or:

- Natural Resource Conservation Service,
- Texas Agricultural Extension Service Water Quality unit (409) 845-0887, or Agricultural Engineering unit (409) 845-7451,
- Texas State Soil and Water Conservation Board, (817) 773-2250.

Internet address: TEX*A*Syst bulletins and links to other water quality sites are contained in a homepage located on the World Wide Web at: http://waterhome.tamu.edu.

TEX*A*Syst is a series of publications to help rural residents assess the risk of ground water pollution, and to describe Best Management Practices (BMPs) that can help protect ground water. The TEX*A*Syst documents were developed from the national Farm*A*Syst ground water protection program. The TEX*A*Syst system is designed to help the user learn more about the environment, existing environmental policies and regulations, and recommended management practices. Thus, the user can voluntarily reduce the pollution risks associated with water wells.

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