



Improving Storage and Handling of Fertilizer

Is your well protected from your fertilizer storage and handling facilities?

Fertilizers pose little danger to groundwater if stored safely and applied properly, but nutrients contained in fertilizers can degrade water quality if they enter a well or move into the groundwater. Prevention of fertilizer contamination is the best way to protect water quality.

Ideally, you should not store fertilizer for more than a few days, since a safe fertilizer storage space is expensive to build and maintain, and storage requires more handling of materials than does direct delivery and application by the supplier. However, storage can be an advantage when used to ensure availability during critical application times, when excess materials cannot be restocked, or when used to hedge against price inflation.

Safe storage is based on common sense. It is most important to prevent direct entry of fertilizer into the groundwater by protecting wells. This means storing and loading fertilizers as far from the well as is practical. It is unlikely that all spills can be avoided, so plan to deal with spills before they happen. Loading and mixing areas should be designed with containment and easy clean up in mind. When large volumes of fertilizers are being handled, more extensive back-up containment may be required to prevent a catastrophic accident.

In this fact sheet, best management practices for fertilizer storage and containment are described. Many of the suggestions contained here are recommended for commercial fertilizer operations and farm operations alike. Although current regulations in North Carolina do not specifically pertain to on-farm storage of fertilizers, as a private well user, you are the one most likely to suffer from groundwater contamination on your farm. In addition, you may be liable for fines and cleanup if water quality standards are violated. Some practices may be expensive and difficult to apply to your current storage situation but, compared to the cost of a major accident or even a lawsuit, storage improvements are a bargain. Building a new facility just for fertilizer storage can be expensive, but it may be safer than trying to adapt an area meant for other purposes.

Employment and program opportunities are offered to all people regardless of race, color, national origin, gender, age, or disability. North Carolina State University, North Carolina A&T State University, U.S. Department of Agriculture, and local governments cooperating.



Helping People Put Knowledge to Work

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How can we help?

We have prepared this publication to help you focus on potential problems with your drinking water that may be caused by fertilizer contamination. Read this publication before you begin answering the questions.

Each of the following sections deals with different topics. Next to each topic is a question for you to answer. Your answers will help you to see where you have potential problems.

- If you answer a question either a or b, you have few problems with the storage and handling of your fertilizer.
- If you answer a question either c or d, there may be potential problems with the way you store and handle fertilizer.
- If you answer a question either c or d, you will want to consider making changes in the way you store and handle fertilizer in order to protect your drinking water.

If you would like further help in assessing your fertilizer storage practices, please visit your nearest Cooperative Extension Service Center and talk with your Extension agent.

How safe is your drinking water?

If you drink water from a well or spring, the water comes from the ground. Most groundwater in North Carolina is safe to drink. If pollution gets into groundwater, your well or spring water may not be safe. Many things we all do at our homes and farms can pollute the groundwater.

If groundwater becomes polluted, it is nearly impossible to clean up. Then, the only ways to get safe drinking water are to treat the existing water, drill a new well, or get water from another source. All of these options are expensive and inconvenient.

The North Carolina Farm*A*Syst Program has a series of publications that can help you keep your drinking water safe. These publications will lead you through an evaluation of your farmstead to determine if your water is in danger of becoming or is already polluted with harmful substances from your farmstead area. If there is a problem or a potential problem, the Farm*A*Syst publications have information about how to solve the problems. The publications also list the North Carolina state agencies that can help you solve your drinking water problem.

The goal of the North Carolina Farm*A*Syst Program is to help you protect the groundwater that North Carolina residents depend on for drinking water.

North Carolina Farm*A*Syst Publications

- *Protecting Water Supply*, #1
- *Improving Fuel Storage*, #2
- *Improving Storage and Handling of Hazardous Waste*, #3
- *Improving Septic Systems*, #4
- *Improving Storage and Handling of Pesticides*, #5
- *Improving Storage and Handling of Fertilizer*, #6
- *Improving Storage, Handling, and Disposal of Livestock Waste*, #7
- *Grazing Livestock and Water Quality*, #8
- *Stream Management in the Piedmont and Mountains*, #9
- *Agriculture and Natural Resource Protection*, #10
- *Protecting Your Wetlands*, #11
- *Wildlife on Your Farm*, #12
- *Christmas Tree Production Best Management Practices to Protect Water Quality and the Environment*, #13
- *Managing Pests*, #14

Considerations for Dry Fertilizer Storage

1. How much dry fertilizer do you store for more than two weeks at a time?

The potential for spills and unwanted release of nutrients to ground water increases with the length of time and amount of fertilizer materials stored. Large amounts of materials involve more handling and more opportunities for accidents to occur. Longer storage periods can result in greater risk to the farmstead in the event of fire, flood, or vandalism. Longer periods can also increase the potential for accidental spills from normal activity around the storage area.

When bagged fertilizer is stored, stack the bags to prevent them from falling, check the bags for soundness, and keep the storage area dry. Provide pallets to keep bags off the floor or ground and out of the way of activities that may damage a bag. Store dry products separately from liquids to prevent wetting the bags. Treat dry fertilizer impregnated with a pesticide as a pesticide.

2. What type of dry fertilizer storage do you use?

Should a bag be accidentally damaged, re-bag or use the fertilizer as soon as possible. A dry, hard clean surface underneath the storage area will greatly improve your ability to recover spills and reduce contamination.

Storage areas should be well-drained and located above the water table. Store dry bulk fertilizer on an impermeable surface under cover or in a building to preserve the quality of the fertilizer and reduce the chances of contamination.



1. Circle the amount of dry, bagged, or bulk fertilizer stored on-site for more than two weeks.

- a. None stored at any time.
- b. Less than 1 ton.
- c. Between 1 and 20 tons.
- d. More than 20 tons; OR do not know.

2. Circle the type of dry fertilizer storage you use.

- a. Covered, on impermeable surface (such as concrete or asphalt). Spills are collected.
- b. Covered, on soil with low permeability. Spills are collected.
- c. Partial cover on more permeable soils. Spills not collected.
- d. No cover on sandy soils. Spills not collected; OR do not know.

Considerations for Liquid Fertilizer Storage

3. How much liquid fertilizer is stored for more than 1 month at a time?

Liquid fertilizers pose special hazards, since spills can seep readily into the soil and move to the groundwater. As the volume of liquid fertilizer stored increases, the potential for nutrients to move far from the storage site increases. With increased time of storage, there is an increasing chance of an undetected leak, a broken valve, or a ruptured pipe. Cleanup is difficult and expensive on all but the smallest spills.

4. What is the condition of small storage containers?

Whether liquid fertilizers are stored in five-gallon buckets or in 1500-gallon stainless steel tanks, sound containers and fittings are your first defense against a spill.

Small containers (less than 100 gallons) should be stored away from traffic and clearly labeled. The containers should be free from rust and contain no punctures. Leakage is easier to detect if containers are stored under cover on pallets. This also reduces rusting of metal containers.

5. Are large tanks (and their fittings, repairs, etc.) properly designed for the type and amount of materials stored in them?

Large fertilizer storage tanks should be constructed of materials which are resistant to corrosion, puncture, or cracking. The use of incompatible materials in construction or repair of storage tanks can result in reactions that weaken the container and increase the risk of leaks (Table 1). Materials used for valves, fittings, and repairs should also be compatible with metals used in storage tanks.

Underground storage tanks **should not** be used for fertilizer storage.

Tanks should be designed to handle all operating stresses, taking into account pressures from the amount of material stored, pressure buildup from pumps and compressors, and any other mechanical or hydraulic stresses normally encountered.

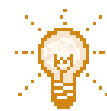
Tanks should be filled only to the capacity for which they are designed, taking into account the density of the material and thermal expansion during storage. A tank designed for storing water at 8.3 pounds per gallon at 60 degrees F may not be strong enough to hold fertilizers weighing 12 pounds per gallon at 90 degrees F.

3. Circle the amount of liquid fertilizer stored.

- a. None stored at any time.
- b. Less than 55 gallons.
- c. Between 55 and 1500 gallons.
- d. More than 1500 gallons; OR do not know.

4. Circle the answer that best describes your small storage containers.

- a. Original containers clearly labeled. No holes, tears, or weak seams. Lids tight.
- b. Original containers are old. Labels partially missing or hard to read.
- c. Containers are old or patched. Metal containers showing signs of rusting.
- d. Containers have holes or tears that allow fertilizers to leak and do not have labels; OR do not know.



REMINDER

If you circle c or d for any question, there may be a problem with your drinking water caused by the condition or practice described in the question.

Table 1. Storage tank container materials to avoid for specific liquid fertilizer materials.

To store this liquid fertilizer:	Cannot use containers made from:
All	Copper, brass, zinc, or copper-based alloys
Phosphorus (greater than 0.1%) or chlorides	Aluminum or aluminum alloys
Solutions with pH<5	Ferrous metals other than stainless steel unless coated with protective substance adequate to inhibit corrosion
Low-pressure N solutions (containing free ammonia greater than 2%). (Aqua ammonia and U.A.N. solutions containing 28 to 32% N are excluded.)	Mild steel, fiberglass, polyolefin, or plastics unless coated with protective substance adequate to inhibit corrosion ¹
Phosphoric acid	No ferrous metals other than type 316, 317, or superior stainless steel unless coated with protective substance adequate to inhibit corrosion ¹
Potassium chloride	No ferrous metals other than stainless steel unless coated with protective substance adequate to inhibit corrosion ¹

¹Allowed if storage is for no more than six months, with the containers completely emptied, cleaned, and inspected for leaks prior to refilling.

Pipes and fittings should be supported to prevent sagging and possible breakage. Pipe runs should be placed over, not through, secondary containment walls.

Tanks should be equipped with a gauging device that allows quick and safe determination of the fluid level in the tank. External tube sight gauges are not recommended. A damaged or broken sight gauge will release the contents of the tank. If a sight gauge is used, there must be a spring-loaded, lockable valve on the bottom of the gauge, and the valve should remain closed except when checking liquid level.

The storage of anhydrous ammonia is regulated by federal law since it is considered an extremely hazardous substance. If you store 500 pounds or more of anhydrous ammonia, you are required to report this chemical to the 3 following groups:

- 1) Your local fire department
- 2) Your local emergency committee
- 3) North Carolina Division of Emergency Management (919-733-3942)

5. Circle the answer that best describes your large storage tanks.

- a. Properly designed tank constructed of appropriate materials, filled to correct capacity. Used for less than six months of the year. Pipes and valves properly supported and constructed of appropriate materials. Liquid level easily monitored with gauge.
- b. Appropriate corrosion-resistant construction (inspect for patches). Used to store liquid materials for less than six months a year. External sight gauge with shut off valve.
- c. Inappropriate material used in tank construction. Fertilizer solution stored for more than six months a year at high capacity. External sight gauge with no shut-off valve.
- d. Corrosion clearly evident on interior and exterior walls of tank and around fittings. Tank used for fertilizer solution storage year-round. Unsupported pipes serve as steps and walkways for dry access. Valves and joints wrapped with rags and tape. No liquid level gauge. Frequently contains less fertilizer than expected;
OR do not know.

6. Where is your liquid fertilizer stored?

In the event of an accident, secondary containment provides an impermeable (waterproof) floor and curb (or walls) around the liquid storage area, which will prevent nutrients from spreading. It also minimizes the amount of fertilizer seeping into the ground and eventually leaching into the groundwater. You should provide a large enough secondary containment area to confine 110 percent of the contents of the largest tank, plus the displaced volume of any other storage tanks, pipes, and equipment. Storage tanks within a secondary containment area should be anchored to prevent flotation in the event of a spill. A leak of starter fertilizer solution into the secondary containment area to a depth of 16 inches or more could float an empty 13,000 pound tank!

Every storage tank should be clearly labeled to indicate the fertilizer content and grade.

A variety of construction techniques and materials are approved for secondary containment of fertilizers. Many of these are different from and less expensive than those required for pesticides. For more information, contact the North Carolina Department of Agriculture or your county Cooperative Extension Service Center.

7. How do you secure your fertilizer storage area?

Ideally, your fertilizer storage area should be separate from other activities. If the building must also serve as a machine shed or housing for livestock, you may find it difficult to meet all the requirements for safe storage. Locking materials in a building or fenced area limits easy access and reduces the chance of accidental spills, theft, or vandalism.

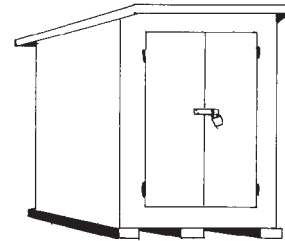
If you plan to store fertilizers in large bulk tanks, the tanks should be located away from pesticides and at least 500 feet from the well.

Fires in a fertilizer storage area can pose a danger to firefighters and to the environment. Provide signs or labels indicating that the area is used for fertilizer storage. Labels on the outside of the building and on tanks give firefighters information about potential hazards that may be important during an emergency response to a fire or spill.

If a fire should occur, consider where the water will go and where it might collect. In the event of a fire, contaminated surface water should drain to a confined area. A curb around the floor can help confine contaminated waters. In making the storage area secure, also make it accessible, allowing you to get fertilizers out in a hurry. Provide adequate road access for deliveries and emergency equipment.

6. Circle the type of liquid fertilizer containment used.

- a. Concrete or other impermeable secondary containment does not allow spills or leaks to contaminate soil.
- b. Clay-lined secondary containment. Most of spill can be recovered.
- c. Tanks stored on somewhat permeable soils (loam). No secondary containment. Most spills cannot be recovered.
- d. Tanks stored on permeable soils (sand). No secondary containment. Spills contaminate soil; OR do not know.



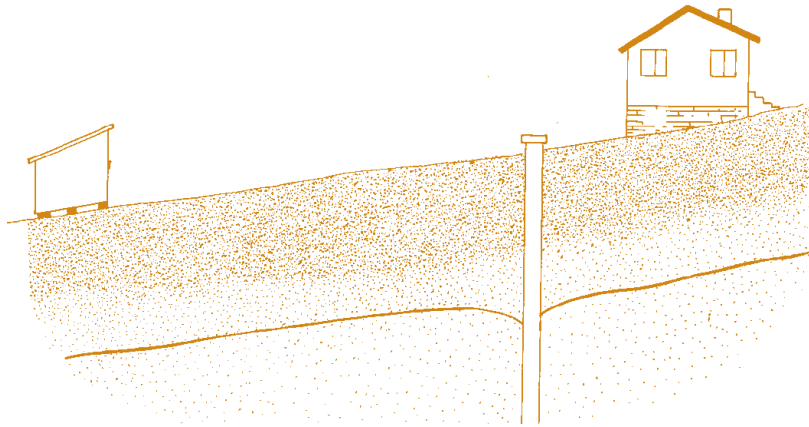
7. Circle the answer that best describes the security of your fertilizer storage area.

- a. Fenced or locked area separate from all other activities, or locks on valves.
- b. Fenced area separate from most other activities.
- c. Open to activities that could damage containers or spill fertilizers.
- d. Open access to theft, vandalism, and children; OR do not know.

Mixing and Loading Practices

8. Where is your well located in relation to storage, mixing, and loading areas?

Groundwater contamination can result from small quantities of fertilizer spilled regularly in the same place. A mixing/loading pad provides added safety for containing spills during the transfer of dry or liquid fertilizers to application equipment or nurse tanks.



Fertilizer storage shed placed a sufficient distance from well

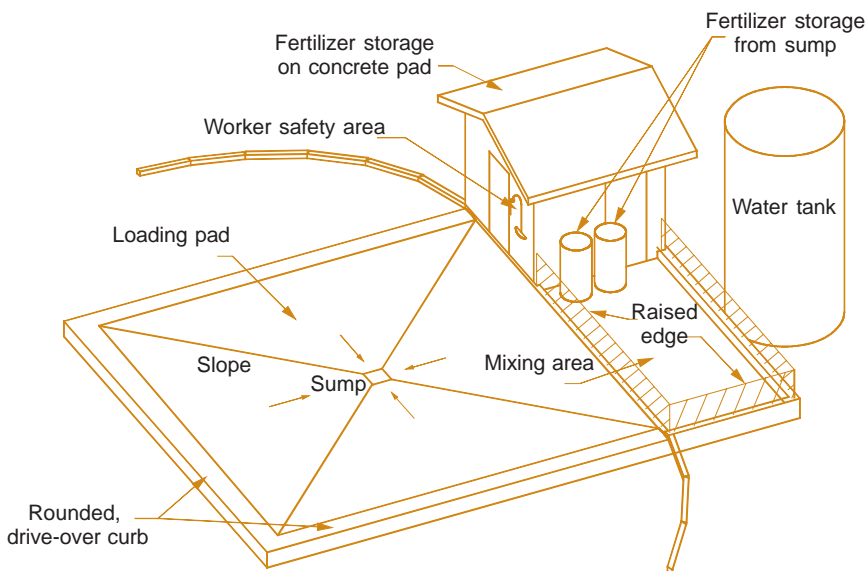
The mixing and loading area should be in a well-drained area close to your storage facility and away from any ditches or surface water. The well should be located a minimum of 100 feet upslope or 500 feet downslope from the storage and mixing/loading areas. Make sure that water from your mixing and storage area moves away from the well. At sites where runoff could reach the well, construct a diversion to redirect runoff to another area.

8. **Circle the location of the well in relation to the mixing/loading area.**
 - a. Well is 100 feet or more upslope from mixing/loading area.
 - b. Well is 50 feet to 100 feet upslope from mixing/loading area.
 - c. Well is 10 to 50 feet upslope, or 100 to 500 feet downslope from mixing/loading area.
 - d. Well is within 10 feet upslope or 100 feet downslope from mixing/loading area; OR do not know.

9. What type of mixing/loading area do you have?

For dry fertilizers, a pad with a hard impermeable surface allows quick and easy cleanup, resulting in minimal contamination of the groundwater or the spilled fertilizer. Spills of dry fertilizer should be promptly and completely cleaned up and placed immediately into the application equipment. Cleanup water should not flow into ditches, streams, or nearby water bodies. The loading pad should be large enough to easily accommodate your equipment and to contain spills equal to the volume of the largest container to be loaded in the area.

Liquid fertilizer spills and leaks are bound to occur from time to time, and their cleanup is much more difficult than that of dry fertilizers. Liquid fertilizer requires an impermeable surface (such as asphalt or concrete) for mixing and loading. Any cracks and seams in the pad should be sealed as they develop. Before using asphalt on a pad used to load both fertilizers and pesticides, check current recommendations.



Fertilizer loading and storage facility

The optimum size of the mixing/loading pad for liquid fertilizers depends on the equipment you use. It should provide space around the parked equipment for washing and rinsing. A curb around the whole area should be able to contain any wash water or leaks up to the volume of the largest mobile container to be loaded on the pad. The curbed area should be sloped to move the liquid to a confined area, such as a sump. This allows the fertilizer and rinse water to settle and be easily transferred to rinsate storage tanks. Having several rinsate storage tanks allows you to keep rinse water from different fertilizer or chemical mixes separate. The collected liquid can be used as filling solution on subsequent loads.

- 9. Circle the answer that best describes your mixing and loading area.**
- a. Concrete mixing/loading pad with curb keeps spills contained. Sump allows collection and transfer to storage.
 - b. Concrete pad with curb keeps spill contained. No sump.
 - c. Concrete pad with some cracks keeps some spills contained. No curb or sump.
 - d. No mixing/loading pad. Permeable soils (sands). Spill soaks into ground; OR do not know.

Note: Unless the pad is clean, collected rainfall should be treated as dilute fertilizer solution and applied to the field. A cover over the mixing/loading area will reduce the amount of contaminated rainfall collected.

If you are considering constructing a mixing/loading pad, more detailed information is available from the North Carolina Department of Agriculture or your county Cooperative Extension Service Center.

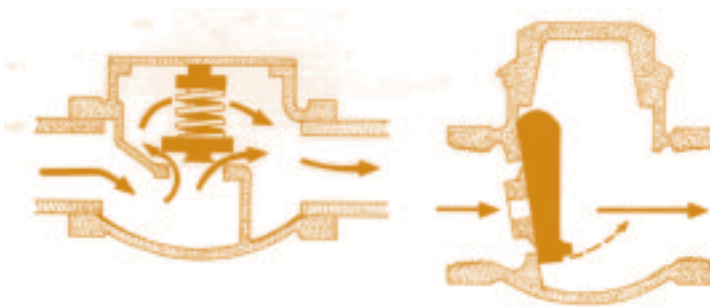
10. Where is the water supply for the mixing and loading area?

Even if you don't 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 within the field of application from year to year.
- Avoid mixing and loading on gravel driveways or other surfaces that allow spills to sink quickly into the soil. A clay surface is better than sand.

11. Do you have anti-siphoning devices installed in water supply lines directly connected to the well?

Nutrient solutions can move both ways through water supply lines. Backflow commonly occurs at water inlets to a tank and on tanks filled from the bottom. Even a hose submerged in a pool of liquid can back-siphon fertilizer solutions if the system loses pressure. Supply lines can become direct channels for fertilizer solution into the well unless prevented from doing so by an anti-back-siphon device. These devices should be installed on the well or on any water hydrants used for filling fertilizer tanks. For added measure, never put the hose inside the sprayer tank, and make sure there is an air gap of at least 6 inches between the hose and the top of the sprayer tank.



Examples of check valves

10. Circle the answer that best describes the water supply for your mixing and loading area.

- a. Separate water tank.
- b. Hydrant away from well.
- c. Hydrant near well.
- d. Directly obtained from well; OR do not know.



11. Circle the answer that best describes your backflow prevention devices.

- a. Anti-backflow device installed or 6-inch air gap maintained above fertilizer tank during filling.
- b. Anti-backflow device installed. Hose in tank above waterline.
- c. No anti-backflow device. Hose in tank above water line.
- d. No anti-backflow device. Hose in tank below water line; OR do not know.

12. How frequently do you supervise the filling of application equipment?

Always supervise sprayer filling. A watched tank seldom overflows.

13. What type of handling and filling system do you use for mixing fertilizer solutions?

Consider using a closed handling system in which the fertilizer is directly transferred from the storage container to the application equipment, for example, by a hose. A closed handling system helps ensure that humans and the environment are never accidentally exposed to the fertilizer.

14. How do you handle rinsate from equipment cleanup?

If possible, spray equipment should be rinsed in the field where the fertilizer is applied and safely away from the well. When spray equipment is rinsed on the loading/mixing pad, rinse water should be treated as dilute fertilizer solution. Nutrient concentrations in the collected rinsate are apt to be high enough to contaminate groundwater and surface waters, but low enough that they can be used as filling solutions for subsequent loads without affecting nutrient concentrations.

What to do if you have a fertilizer spill.

For dry spills, promptly sweep up 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 for which it was intended.

For liquid spills, recover as much of the spill as possible and reuse as it was intended. Some contaminated soil may need to be removed and field applied if possible.

In the state of North Carolina, the only fertilizer spill that must be reported is a spill of 100 pounds or more of anhydrous ammonia. To report this type of spill, **call 911**.

12. Circle the answer that best describes your supervision of filling of application equipment.

- a. Constant.
- b. n/a.
- c. Frequent.
- d. Seldom or never; OR do not know.

13. Circle the answer that best describes your handling system.

- a. Closed system for all liquid product transfers.
- b. Closed system for most liquids. Some liquids hand poured. Fertilizer tank fill port easy to reach.
- c. All liquids hand poured. Fertilizer tank fill port is easy to reach.
- d. All liquids hand poured. Fertilizer tank fill port hard to reach; OR do not know.

14. Sprayer cleaning and rinsate (rinse water) disposal.

- a. Sprayer washed out in field. Rinsate used in next load and applied to labeled crop.
- b. Sprayer washed out on pad at farmstead. Rinsate used in next load and applied to labeled crop.
- c. Sprayer washed out at farmstead. Rinsate sprayed less than 100 feet from well.
- d. N/A; OR do not know.

Contacts

- North Carolina Department of Agriculture, Plant Industry Division: 919-733-3933
- North Carolina Division of Emergency Management: 919-733-3942
- Your local North Carolina Cooperative Extension Service Center

Related publications

- *Environmental Handbook for Fertilizer and Agrichemical Dealers*. 1990. J. Harold Priken (ed.), Tennessee Valley Authority.



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