

Worksheet 3

Assessing the Risk of Groundwater Contamination from Fertilizer Storage & Handling

Why should I be concerned?

Fertilizers play a vital role in agriculture. Over the years, they have increased farm production dramatically. Commercial fertilizer is, however, a major source of nitrogen in several chemical forms, including nitrate. Nitrate-nitrogen levels exceeding the public health standard of 10 milligrams per liter (mg/l; equivalent to parts per million for water measure) have been found in many drinking water wells. The other major components of commercial fertilizer, phosphorus and potassium, can be of contamination concern with surface water sources.

Infants under 6 months of age are particularly susceptible to health problems from high nitrate-nitrogen levels, including the condition known as methemoglobinemia (blue baby syndrome). Nitrate can also affect adults, but the evidence is much less certain.

Young livestock are also 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, levels of 20-40 mg/l may prove harmful, especially in combination with high levels (1,000 ppm or more) of nitrate-nitrogen from feed sources.

Farmstead handling of fertilizers can affect groundwater by allowing materials containing nitrate to seep through the ground after a leak or spill. Other potential farmstead sources of nitrate are septic systems, livestock lots, livestock waste storage facilities and silage storage.

Your drinking water is least likely to be contaminated if you follow appropriate management procedures and dispose of wastes **off the farm site**. However, proper offsite disposal practices are essential to avoid risking contamination that could affect the water supplies and health of others.

The goal of Farm•A•Syst is to help you protect your groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your fertilizer storage, handling and disposal practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the “risk level” of your fertilizer storage, handling and disposal practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

Follow the direction at the top of the chart on the next page. It should take you about 15–30 minutes to complete this worksheet and figure out your ranking.

Glossary

Fertilizer Storage and Handling

These terms may help you make more accurate assessments when completing Worksheet 3. They may also help clarify some of the terms used in Fact Sheet 3.

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 original container 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, enters the potable water system.

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

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

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Worksheet 3

Fertilizer Storage and Handling: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.

2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that **best** describes conditions on your farmstead. (Skip and leave blank any categories that don't apply.)
3. Look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."

4. Directions on overall scoring appear at the end of the worksheet.

5. Allow about 15–30 minutes to complete the worksheet and figure out your risk rank for fertilizer storage and handling practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
FERTILIZER STORAGE (Including short-term or seasonal storage)					
Dry formulation					
1. Amount stored		Less than 1 ton.	Between 1 and 20 tons.	More than 20 tons.	
2. Type of storage	Covered on impermeable surface (such as concrete or asphalt). Spills are collected.	Covered on clay soil or cracked concrete. Spills are collected.	Partial cover or on loamy soils. Spills not collected.	No cover or on sandy soils. Spills not collected.	
Liquid formulation					
3. Amount stored		Less than 55 gallons.	Between 55 and 1500 gallons.	More than 1500 gallons.	
4. Type of storage	Impermeable secondary containment (such as coated or sealed concrete) does not allow spill to contaminate soil. Curb to contain leaks and spills.	Clay-lined secondary containment or uncoated concrete with some cracks or no curb. 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.	
5. Location of storage area in relation to well	400 feet or more downslope from well.	150–400 feet downslope from well.	50–150 feet downslope from well.	Within 50 feet* or upslope from well.	

Boldface type: Besides representing a higher risk choice, this practice violates Kansas law.
*Illegal for new well installation. Existing wells must meet separation requirements in effect at time of construction.

FERTILIZER STORAGE (continued)				YOUR RANK
	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)
6. Bags	Original bags clearly labeled. No holes or tears. Bags sealed.	Labeling missing or hard to read.	Bags have holes but are patched.	Bags have holes or tears that allow fertilizers to leak. No labels.
7. Security	Fenced and locked area separate from all other activities.	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				
8. Location of mixing/loading area in relation to well	400 or more feet downslope from well.	150 to 400 feet downslope from well.	50 to 150 feet downslope from well.	Within 50 feet downslope* or upslope from well.
ADDITIONAL MIXING AND LOADING PRACTICES FOR LIQUID FERTILIZER				
9. Mixing and loading pad (spill containment)	Concrete mixing/loading 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.
10. Water source	Separate water tank.	Hydrant away from well.	Hydrant near well.	Directly obtained from well.
11. Backflow prevention on water supply	Anti-backflow device installed. Six-inch air gap maintained above 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 waterline.
12. Filling supervision	Constant by owner.	Constant by hired help.	Frequent.	Seldom or never. Frequently overflows.

Boldface type: Besides representing a higher risk choice, this practice violates Kansas law.

*Illegal for new well installation. Existing wells must meet separation requirements in effect at time of construction.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
ADDITIONAL MIXING AND LOADING PRACTICES FOR LIQUID FERTILIZER (continued)					
13. 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.	_____
CLEANUP AND DISPOSAL PRACTICES					
14. Fertilizer bag disposal	Returned to supplier, or taken to approved sanitary landfill.	_____	Disposal of empty bags on farm.	Disposal of partially filled bags on farm.	_____
15. Sprayer cleaning and rinsate (rinse water) disposal	Sprayer washed out in field. Rinsate used in next load and applied to labeled crop.	Sprayer washed out on pad at farmstead. Rinsate used in next load and applied to labeled crop.	Sprayer washed out at farmstead. Rinsate sprayed on open areas around farmstead.	Sprayer washed out at farmstead. Rinsate dumped at farmstead or in nearby field.	_____
TOTAL					

Use this total to calculate risk ranking on back page of worksheet.

What do I do with these rankings?

Step 1: Begin by determining your overall fertilizer management risk rank. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____	divided by	_____	equals	*
total of rankings		# of categories ranked		risk rank

*Carry your answer out to one decimal place.

3.6–4=low risk 2.6–3.5=low to moderate risk 1.6–2.5=moderate to high risk 1–1.5=high risk

This rank gives you an idea of how your fertilizer management practices **as a whole** might be affecting your drinking water. It should serve only as a **very general guide, not a precise diagnosis**. Because it represents an **average** of many individual rankings, it can mask any **individual** rank (such as 1's or 2's) that should be of concern (see Step 2).

Enter your boxed fertilizer management risk rank on page 1 of Worksheet 9. Later you will compare this risk rank with other farmstead management rankings. Worksheet 8 will help you identify your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and Worksheet 9 will show you how these site conditions affect your risk rankings.

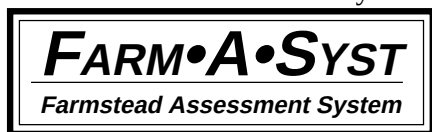
Step 2: Look over your rankings for individual activities:

- **Low-risk** practices (4's)—ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk** practices (3's)—provide reasonable groundwater protection
- **Moderate-to-high-risk** practices (2's)—inadequate protection in many circumstances
- **High-risk** practices (1's)—inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk rank, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of Worksheet 9.

Step 3: Read Fact Sheet 3, *Improving Fertilizer Storage & Handling*, if you haven't already. Consider how you might modify your farmstead practices to better protect your drinking water.



The Farmstead Assessment System is a cooperative project of the Cooperative Extension Service, Kansas State University, and the Kansas Department of Health and Environment.

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