Water Quality

FARM•A•SYST
Farmstead Assessment System
Worksheet #4

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Assessing the Risk of Groundwater Contamination from

Petroleum Product Storage

Why should I be concerned?

Above-ground and underground storage of liquid-petroleum products such as motor fuel and heating fuel presents a potential threat to public health and the environment. Nearly one out of every four underground storage tanks in the United States may now be leaking, according to the U.S. Environmental Protection Agency. If an underground petroleum tank is more than 20 years old, especially if it's not protected against corrosion, the potential for leaking increases dramatically. Newer tanks and piping can leak, too, especially if they weren't installed properly.

Even a small gasoline leak of one drop per second can result in the release of about 400 gallons of gasoline into the groundwater in one year. Even a few quarts of gasoline in the groundwater may be enough to severely pollute a farmstead's drinking water. At low levels of contamination, fuel contaminants in water cannot be detected by smell or taste, yet the seemingly pure water may be contaminated to the point of affecting human health.

Preventing tank spills and leaks is especially important because of how rapidly gasoline, diesel and fuel oil can move through surface layers and into groundwater. Also, vapors from an underground leak that collect in basements, sumps or other underground structures could explode. Selling property with an old underground tank also may be difficult.

Petroleum fuels contain a number of potentially toxic compounds, including common solvents such as benzene, toluene and xylene, and additives such as ethylene dibromide (EDB) and organic lead compounds. EDB is a carcinogen (cancer-causer) in laboratory animals, and benzene is considered a human carcinogen.

This worksheet focuses on storage of gasoline, kerosene and liquid heating fuels. It does not apply to LP (liquid-propane) gas because leaks vaporize quickly and do not threaten groundwater.

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

How will this worksheet help me protect my groundwater?

- It will take you step by step through your petroleum-product storage 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 petroleum-product storage practices.
- It will help you determine which of your practices are reasonably safe and effective and which practices might require modification to better protect your drinking water.

Follow the directions 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.

Printed with soy ink on recycled paper

Petroleum 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 to your farmstead.)
3. Then 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 ranking for well-management practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LOCATION (all tanks)					
Position of tank in relation to drinking-water well	Tank downslope more than 300 feet from well in medium- or fine-textured soils (silt loam, loam, clay loams, silty clay) with low permeability.*	**Tank at grade or upslope 100-300 feet from well in medium- or fine-textured soils (silt loam, loam, clay loams, silty clay) with low permeability.***	**Tank down-slope 50-100 feet from well** in coarse-textured soil (sands, sandy loam) with high permeability.***	**Tank at grade or upslope less than 50 feet from well** in coarse-textured soil (sand, sandy loams) with high permeability.***	_____
Tank location and local land use (leakage potential)	Well-drained soils. Water table always beneath tank. Above-ground tank more than 50 feet from buildings.	Moderately well-drained soils. Only occasionally high water table.	Located more than 50 feet from buildings. Medium- or fine-textured soils (silt loams, loam, clay loams, silty clay) saturated seasonally.	Located near buildings and in area with fine-textured soils (clay loams, silty clay) often saturated.	_____
DESIGN AND INSTALLATION (all tanks)					
Type and age of tank/corrosion protection	Synthetic tank or new tank protected from rust by cathodic protection and coating.	Steel tank less than 15 years old and coated.	Coated steel tank 15 or more years old. OR bare steel tank less than 15 years old.	Bare steel tank 15 or more years old.	_____
Spill and tank overfill protection	Impermeable catch basin plus automatic shut-off.	Impermeable catch basin plus overfill alarm.	Impermeable catch basin or concrete catch pad.	No protection.	_____
Piping	Piping protected from rust by cathodic protection and isolated from tank, sloped back to tank. Check valve at pump (not at tank).	Piping galvanized but not isolated from tank. Pipe drains back to tank. Check valve at pump.	Pipe galvanized, not isolated or bare. Piping sloped back to tank, but check valve is located at tank (foot valve).	Piping and tank isolated and of dissimilar materials. Un-isolated pipe bare, cannot drain freely to the tank. All pressure pipe systems.	_____
Tank installation	Installed to MDNR specifications.	Installed according to recommendations provided with new tank by seller.	No information on installation.	Installed without backfill, setback, secondary containment, anchors and other protections or by untrained individual.	_____
DESIGN AND INSTALLATION (above-ground tanks only)					
Tank enclosure	Tank surrounded by 6-foot-tall noncombustible fence with lock and well-ventilated. Fire wall in place if setbacks do not conform to code.	Tank surrounded by low fence with lock. Fire wall in place if setbacks do not conform to code.	Tank surrounded by low fence. No lock. No fire wall.	No enclosure.	_____
Secondary containment	Tank placed within concrete dike with pad able to hold 125 percent of tank capacity.	Tank placed within dike and pad made of low-permeability soils,* able to hold 125 percent of tank capacity.	Tank placed on pad.	No secondary containment.	_____
Emergency venting and overfill protection	Protected with emergency venting and pressure/vacuum venting discharging upwardly 12 feet above grade plus automatic overfill shut-off.	Protected with emergency venting and atmospheric vent discharging upwardly. Plus overfill alarm.	Protected with emergency venting and normal venting discharging down toward tank.	No emergency venting.	_____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Piping	Piping protected from rust by cathodic protection and isolated from tank solenoid valve at tank outlet.	Piping galvanized but not isolated from tank. Solenoid valve at tank outlet.	Pipe galvanized, not isolated or bare. Manual valve is located at tank. No solenoid valve.	Piping and tank isolated and of dissimilar materials. Unisolated bare, cannot drain freely to the tank. All pressure pipe systems. No solenoid valve.	_____
Tank installation	Installed to Missouri Department of Agriculture specifications.	Installed according to recommendations provided with new tank by seller.	No information on installation.	Installed without backfill, setback, secondary containment, anchors and other protections, or by untrained individual.	_____
MONITORING (all tanks)					
Tank-integrity testing and leak-detection monitoring	Regular (monthly) leak monitoring.	Daily inventory control and annual tank-tightness testing.	Occasional inventory control and annual tank-tightness testing.	No inventory control, testing or monitoring.	_____
TANK CLOSURE (underground tanks)					
Unused tank	Tank taken from ground. Excavation checked for evidence of contamination.	Tank filled with inert material and excavation checked for evidence of leaking.	Tank removed or filled with inert material. Excavation not checked for contamination.	Tank left in ground (illegal after 12 months).	_____

Extra bold type: Besides representing a higher-risk choice, this practice also violates Missouri law.
* Low-permeability soils, such as clay, allow water to flow through slowly. High-permeability soils, such as sand and gravel, allow much faster water movement.
**Illegal for new well installation. Existing wells must meet separation requirements in effect at time of construction.

Use this TOTAL to calculate risk ranking on back page of worksheet

TOTAL: _____

What do I do with these rankings?

Step 1: Begin by determining your overall petroleum-product storage risk ranking. 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 ranking*

*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 ranking gives you an idea of how your petroleum-product storage **as a whole** might be affecting your drinking water. This ranking should serve only as a **general guide, not a precise diagnosis.** Because it represents an averaging of many individual rankings, it can mask any individual rankings (such as 1's or 2's) that should be of concern. (See Step 2.)

Enter your boxed petroleum-product storage risk ranking on page 1 of Worksheet #9. Later you will compare this risk ranking 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 ranking, 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" in Worksheet #9.

Step 3: Read Fact Sheet #4, *Improving Petroleum Product Storage*, and consider how you might modify your farmstead practices to better protect your drinking water.

Glossary

Petroleum-Product Storage

These terms may help you make more accurate assessments when completing Worksheet #4. They also may help clarify some of the terms used in Fact Sheet #4.

Cathodic protection: One of several techniques to prevent corrosion of a metal surface by reversing the electric current that causes corrosion. A tank system can be protected by sacrificial anodes or impressed current. (See **sacrificial anodes** and **impressed current.**)

Corrosion: Deterioration of a metallic material ("rust") due to a reaction with its environment. Damage to tanks by corrosion is caused when a metal underground tank and its underground surroundings act like a battery. Part of the tank can become negatively charged and another part positively charged. Moisture in the soil provides the connecting link that finally activates these tank "batteries." Then the negatively charged part of the underground tank system — where the current exits from the tank or its piping — begins to deteriorate. As electric current passes through this part, the hard metal begins to turn into soft ore, holes form and leaks begin.

Corrosion protection: One method of corrosion protection is cathodic protection. Steel tanks can be protected by coating them with a corrosion-resistant coating combined with "cathodic" protection. Steel underground tanks also can be protected from corrosion if they are bonded to a thick layer of noncorrosive material, such as fiberglass-reinforced plastic. Also, the corrosion problem can be avoided entirely by using tanks and piping made completely of noncorrosive material, such as fiberglass.

Galvanized: The result of coating an iron or steel structure with zinc. Galvanized materials do not meet corrosion-protection requirements.

Impressed current: This protection system introduces an electric current into the ground through a series of anodes that are not attached to the underground tank. Because the electric current flowing from these anodes to the tank system is greater than the corrosive current attempting to flow from it, the underground tank is protected from corrosion.

Interior liner: A liner for petroleum-storage tanks made of noncorrosive synthetic materials that can be effective in protecting metal tanks.

Inventory control: Measuring and comparing the volume of tank contents regularly with product delivery and withdrawal records to help detect leaks before major problems develop.

Sacrificial anodes: Pieces of metal attached directly to an underground tank that are more electrically active than the steel tank. Because the anodes are more active, electric current runs from the anodes rather than from the tank. The tank becomes the cathode (positive electrode) and is protected from corrosion. The attached anode (negative electrode) is "sacrificed" or consumed in the corrosion process.

Secondary containment: A system, such as a sealed basin and dike, that will catch and hold the contents of a tank if it leaks or ruptures.

Soil permeability: The quality that enables soil to transmit water or air. Slowly permeable soils have fine-textured materials, such as clays, that permit only slow water movement. Moderately or highly permeable soils have coarse-textured materials, such as sands, that permit rapid water movement.

Spill and overfill protection: Spill protection usually consists of a catch basin for collecting spills when the tank is filled. Overfill protection is a warning or prevention of an overfill, such as an automatic shutoff or buzzer. These precautions can prevent a number of small releases over a long period of time from polluting the groundwater.

Tank-tightness testing: A procedure for testing a tank's ability to prevent accidental release of any stored substance into the environment or intrusion of groundwater into an underground tank.

FARM•A•SYST
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