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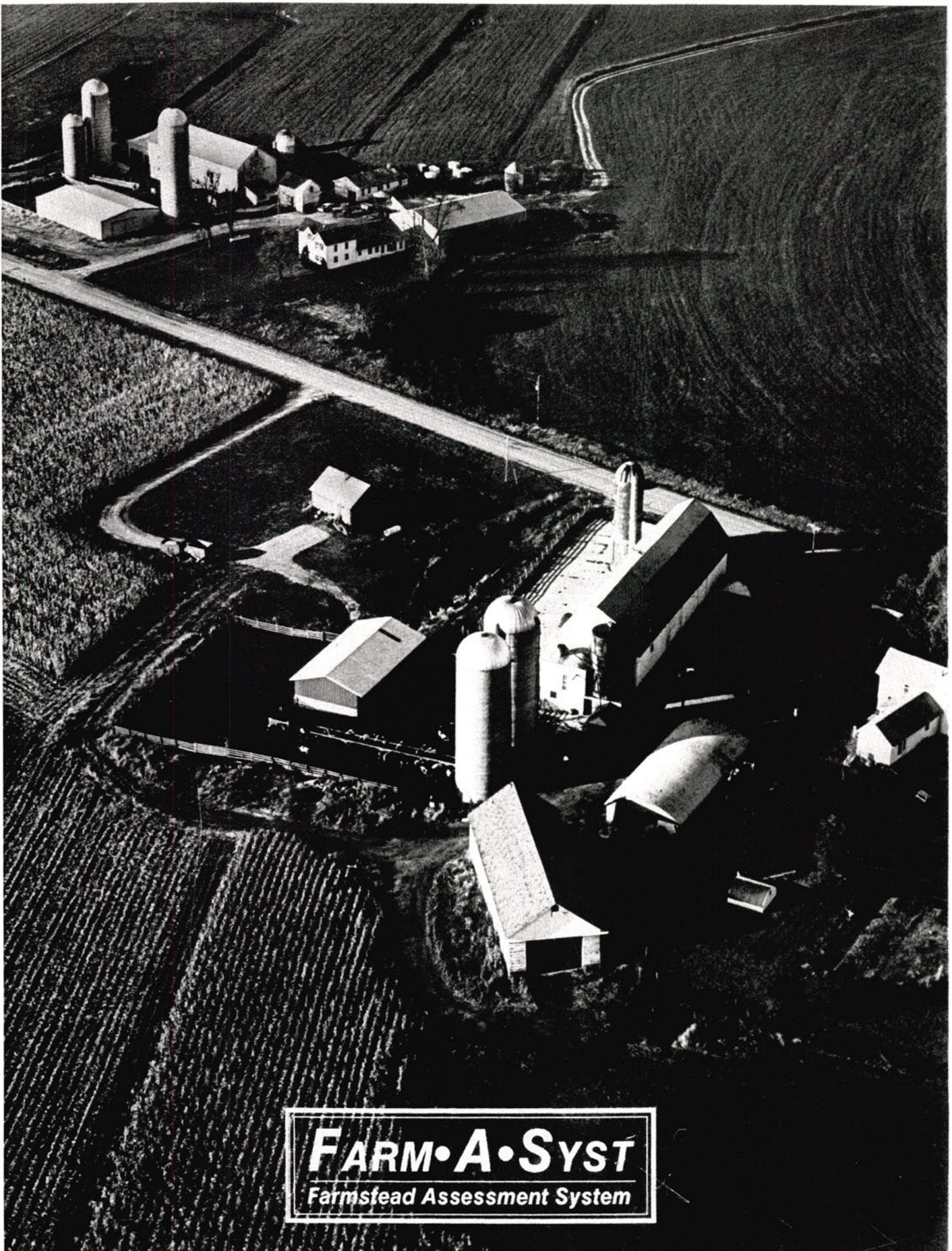
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FARM·A·SYST
Farmstead Assessment System

UNIVERSITY OF WISCONSIN-EXTENSION • COOPERATIVE EXTENSION •
COLLEGE OF AGRICULTURAL AND LIFE SCIENCES • UNIVERSITY OF WISCONSIN-MADISON

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PRESERVATION

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FARM•A•SYST

Farmstead Assessment System

**...helping you protect the groundwater
that supplies your drinking water.**

**A COOPERATIVE PROJECT OF
University of Wisconsin-Cooperative Extension
Minnesota Extension Service
U.S. Environmental Protection Agency Region V**

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North Central Regional Center for Rural Development
U.S. EPA Region V
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Wisconsin Department of Natural Resources
Minnesota Pollution Control Agency**

*With special thanks to staff of state and federal agencies and private and nonprofit
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*Project coordinated at Environmental Resources Center, School of Natural Resources,
College of Agricultural and Life Sciences, University of Wisconsin-Madison,
in cooperation with Minnesota Extension Service and U.S. EPA Region V.*

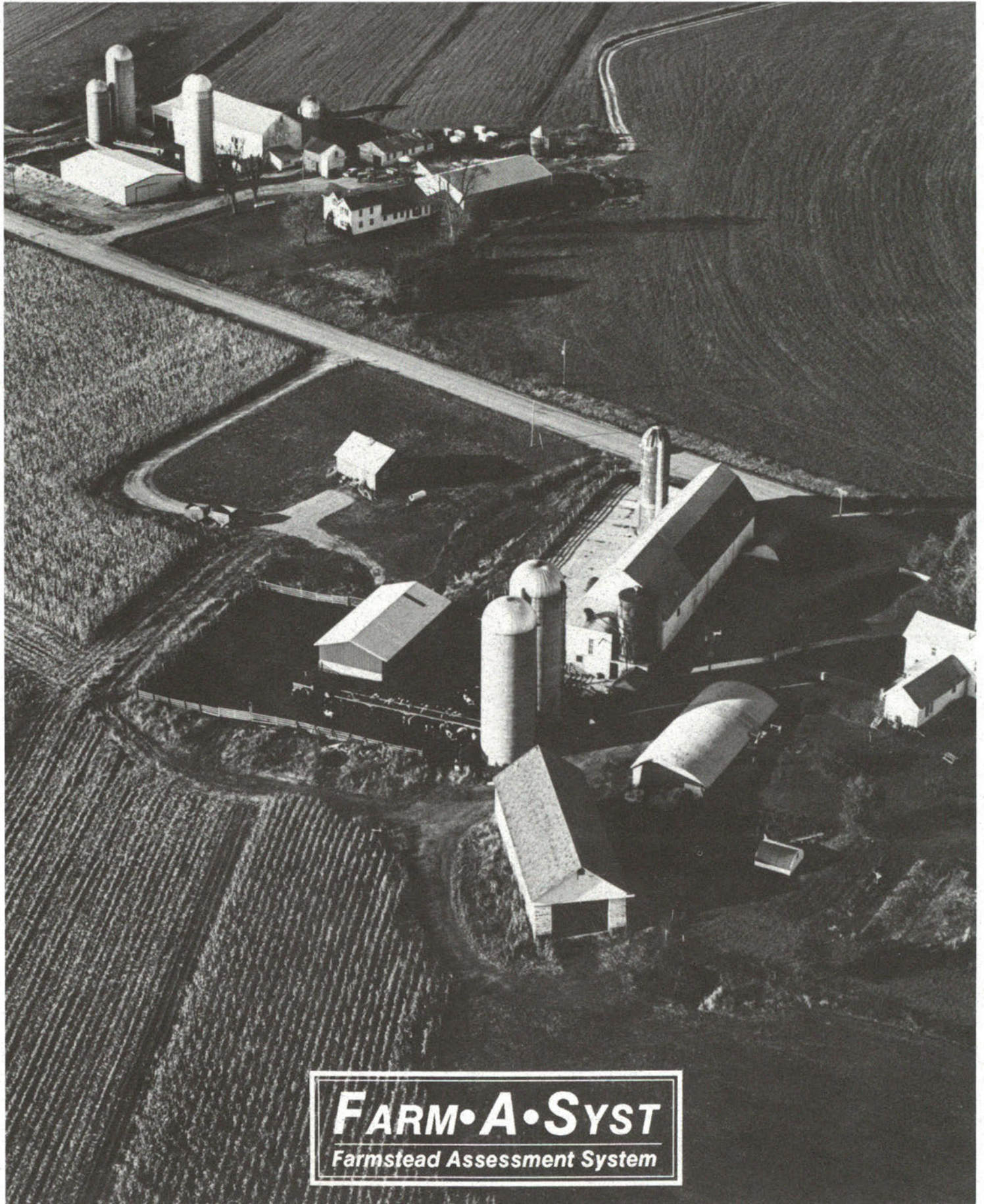
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Worksheet #2

Assessing the Risk of Groundwater Contamination from Pesticide Storage and Handling

Why should I be concerned?

Pesticides are showing up where they're not wanted—in our drinking water. If pesticides are not handled carefully around the farmstead, they can seep through the ground after a leak or spill, or they can enter a well directly during mixing and loading.

Pesticides play an important role in agriculture. They have increased farm production, and they have enabled farmers to manage more acres with less labor. Taking voluntary action to prevent pesticide contamination of groundwater will help assure their continued availability for responsible use by farmers.

Pesticides work by interfering with the life processes of plants and insects. Pesticides are also toxic to people. If pesticides enter a water supply in large quantities—as can happen with spills or backsiphonage accidents—**acute health effects** (toxic effects apparent after only a short period of exposure) can range from moderate to severe, depending on the toxicity of the pesticide and the amount of exposure. Contaminated groundwater used for drinking water supplies may result in **chronic exposure** (prolonged or repeated exposure to low doses of toxic substances), which may be hazardous to people and livestock.

When found in water supplies, pesticides normally are not present in high-enough concentrations to cause acute health effects, which can include chemical burns, nausea and convulsions. Instead, they typically occur in trace levels, and the concern is primarily for their potential for causing chronic health problems from prolonged exposure.

Your drinking water is least likely to be contaminated if you follow appropriate management procedures or dispose of wastes in any location that is **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 the 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 pesticide handling, storage 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 pesticide handling, storage and disposal 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.

How do I complete the worksheet?

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.

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Worksheet #1

Assessing the Risk of Groundwater Contamination from Drinking Water Well Condition

Why should I be concerned?

About 95 percent of this country's rural residents use groundwater to supply their drinking water and farmstead needs. Wells are designed to provide clean water. If improperly constructed and maintained, however, they can allow bacteria, pesticides, fertilizer or oil products to contaminate groundwater. These contaminants can put family and livestock health at risk.

There are documented cases of well contamination from farmstead activities near drinking water wells. The condition of your well and its proximity to contamination sources determine the risk it poses to the water you drink. For example, a cracked well casing allows bacteria, nitrates, oil and pesticides to enter the well more easily. A spill of pesticides being mixed and loaded right near the well could result in the contamination of your family's drinking water supply. Feedlots, animal yards, septic systems, fertilizer applications and waste storage areas could release large amounts of nitrate, contaminating your well.

Preventing well water contamination is very important. Once the groundwater supplying your well is contaminated, it is very difficult to clean up. The only options may be to treat the water, drill a new well, or obtain water from another source. A contaminated well can also affect your neighbors' wells, posing a serious health threat to your family and neighbors.

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 drinking water?

- It will take you step by step through your drinking water well condition and management 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 drinking water well condition and management 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.

How do I complete the worksheet?

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.

Focus on the well that provides drinking water for your home or farm. If you have more than one drinking water well on your farmstead, fill out a worksheet for each one.

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Worksheet #3

Assessing the Risk of Groundwater Contamination from Fertilizer Storage and 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 nitrate. Nitrate-nitrogen levels exceeding the public health standard of 10 milligrams per liter (mg/l; equivalent to parts per million for water measure) nitrate-nitrogen have been found in many drinking water wells. The other major components of commercial fertilizer, phosphorus and potassium, are not generally a groundwater contamination concern.

Nitrate levels in drinking water above federal and state drinking water standards of 10 mg/l nitrate-nitrogen can pose a risk to some infants. 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 particularly 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) of nitrate-nitrogen from feed sources.

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

Your drinking water is least likely to be contaminated if you follow appropriate management procedures or 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 handling, storage 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 handling, storage 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?

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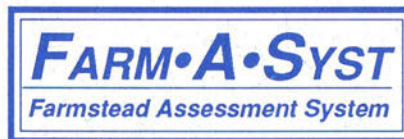
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Worksheet #4

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 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 have the potential to explode. Selling property with an old underground tank may also 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, since 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.

How do I complete the worksheet?

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Worksheet #5

Assessing the Risk of Groundwater Contamination from Hazardous Waste Management

Why should I be concerned?

Consider the variety of products commonly used in households and on farms: paints, solvents, oils, cleaners, wood preservatives, batteries, adhesives and pesticides. In addition, some common disposal practices not only threaten groundwater but also may be illegal.

Small, unusable amounts often wind up spilled, buried, dumped or flushed onto farm property. Minimizing the amounts of these substances used on the farm, along with practicing proper disposal practices, can reduce both health risks and the potential for groundwater contamination. Farmers and their families are generally familiar with the hazards of pesticides commonly used in the farm operation, but they may be less aware of the hazards of other chemicals that make many tasks around the home and farm easier or more efficient.

Improper use of hazardous products may cause toxic health effects. Improper storage may allow chemicals to leak, causing potentially dangerous chemical reactions, toxic health effects or groundwater contamination. Improper disposal allows these dangerous chemicals to enter directly into drinking water through surface water or groundwater.

Your drinking water is least likely to be contaminated by your hazardous wastes if you follow appropriate management procedures or dispose of wastes in any location that is **off your 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 the 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 hazardous waste management 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 hazardous waste management 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.

How do I complete the worksheet?

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Worksheet #6

Assessing the Risk of Groundwater Contamination from Household Wastewater Treatment

Why should I be concerned?

Virtually all farms use a septic system or similar onsite wastewater treatment system. While these systems are generally economical and safe, household wastewater can contain contaminants that degrade water quality for such uses as drinking, stock watering, food preparation and cleaning.

Potential contaminants in household wastewater include disease-causing bacteria, infectious viruses, household chemicals, and excess nutrients, such as nitrate. Viruses can infect the liver, causing hepatitis. They can also infect the lining of the intestine, causing gastroenteritis (vomiting and diarrhea). If coliform organisms (a group of indicator bacteria) are found in your well water, they show that the water is potentially dangerous for drinking and food preparation. Your septic system is one potential source, along with livestock yards and others.

The **quantity** of wastewater can also present an environmental concern. Too much water entering the home treatment system reduces the efficiency of the system and can shorten its life.

Your drinking water is least likely to be contaminated if you follow appropriate management procedures or dispose of wastewater in any location that is **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 the 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 household wastewater treatment 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 household wastewater treatment 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.

How do I complete the worksheet?

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Worksheet #7

Assessing the Risk of Groundwater Contamination from Livestock Waste Storage

Why should I be concerned?

Storing livestock waste allows farmers to spread manure when conditions are right for nutrient use by crops. Accumulating manure in a concentrated area, however, can be risky to the environment and to human and animal health.

Facilities for manure stored in liquid form on the farmstead sometimes leak or burst, releasing large volumes of pollutants. Manure in earthen pits can form a semi-impervious seal of organic matter that does limit leaching potential, but seasonal filling and emptying can cause the seal to break down. Short-term solid manure storage and abandoned storage areas can also be sources of groundwater contamination by nitrates. Manure can contribute nutrients and disease-causing organisms to both surface water and groundwater.

Nitrate levels in drinking water above federal and state drinking water standards of 10 milligrams per liter (mg/l; equivalent to parts per million for water measure) nitrate-nitrogen can pose health problems for infants under 6 months of age, 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. Levels of 20-40 mg/l in the water supply may prove harmful, especially in combination with high levels (1,000 ppm) of nitrate-nitrogen from feed sources.

Fecal bacteria in livestock waste can contaminate groundwater, causing such infectious diseases as dysentery, typhoid and hepatitis. Organic materials that lend an undesirable taste and odor to drinking water are not known to be dangerous to health, but their presence does suggest that other contaminants are flowing into 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 drinking water?

- It will take you step by step through your livestock waste 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 livestock waste 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.

How do I complete the worksheet?

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Worksheet #8

Assessing the Risk of Groundwater Contamination from Livestock Yards Management

Why should I be concerned?

Livestock yards, such as barnyards, holding areas and feedlots, are areas of concentrated livestock wastes. They can be a source of nitrate and bacteria contamination of groundwater. This is especially true if there is no system to 1) divert clean water flow from the livestock yard or 2) collect polluted runoff from the yard for diversion to an area where its effect on surface water or groundwater is minimal. The potential for livestock yards to affect groundwater is greatest if the yard is located over coarse-textured permeable soils, if the water table is at or near the surface, if bedrock is within a few feet of the surface, or when polluted runoff is discharged to permeable soils and bedrock.

Nitrate levels in drinking water above federal and state drinking water standards of 10 milligrams per liter (mg/l; equivalent to parts per million for water measure) nitrate-nitrogen can pose health problems for infants under 6 months of age, 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. Levels of 20-40 mg/l in the water supply may prove harmful, especially in combination with high levels (1,000 ppm) of nitrate-nitrogen from feed sources.

Fecal bacteria in livestock waste can contaminate groundwater if waste seeps into nearby wells, causing such infectious diseases as dysentery, typhoid and hepatitis. Organic materials, which may lend an undesirable taste and odor to drinking water, are not known to be dangerous to health, but their presence does suggest that other contaminants are flowing directly into 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 drinking water?

- It will take you step by step through your livestock yards management 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 livestock yards management 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.

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Worksheet #9

Assessing the Risk of Groundwater Contamination from Silage Storage

Why should I be concerned?

Silage is an essential feed for livestock-based agriculture. When properly harvested and stored, silage poses little or no pollution threat, but improper handling can lead to a significant flow of silage juices (or leachate) from the silo. Leachate is an organic liquid that results from pressure in the silo or from extra water entering the silo. It is usually a problem only when silage is fresh, or just after storage. This loss of leachate represents a major loss of nutrient value from the silage. Canning company wastes, which are often used for silage, frequently contain excess moisture, which increases the potential for leachate to cause groundwater contamination.

Silage liquid is often highly acidic and can be corrosive to concrete and steel. If it enters a stream, its high organic content feeds bacteria that rob the water of oxygen. Groundwater contaminated with silage juices has a disagreeable odor and shows increased levels of acidity, ammonia, nitrates and iron.

Along with the pollutants found in silage leachate, an even greater potential threat is that the low pH created by the presence of acids in silage leachate can free up and release naturally occurring metals in the soil and aquifer, which can increase their concentrations in groundwater. Leachate from 300 tons of high-moisture silage has been compared to the sewage generated daily by a city of 80,000 people.

Nitrate is the most important potential contaminant to consider. Levels of 20-40 milligrams per liter (mg/l; equivalent to parts per million in water measure) can cause livestock problems, especially if feed contains more than 1,000 ppm nitrate-nitrogen. Water with levels over 100 mg/l nitrate-nitrogen should not be used for livestock. Water with over 10 mg/l nitrate-nitrogen should not be used for infants under 6 months of age.

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 drinking water?

- It will take you step by step through your silage 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 silage 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.

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Worksheet #10

Assessing the Risk of Groundwater Contamination from Milking Center Wastewater Treatment

Why should I be concerned?

Dairy wastewater is usually considered a dairy sanitation problem. If not carefully managed, however, dairy wastewater can contaminate both groundwater and surface water.

The amount of wastewater generated varies with milking preparation, equipment used and the number of cows. A 100-cow free-stall operation may use anywhere from 100 to 1000 gallons of water per day in the milking center alone.

Milking center wastewater is contaminated with organic matter, nutrients, chemicals and microorganisms. Poorly designed or mismanaged waste disposal systems can contaminate water with ammonia, nitrate, phosphorus, detergents and disease-causing organisms. If not managed properly, these contaminants can be carried directly to a well or cause groundwater or surface water contamination. Surface water can also be affected by manure, milk solids, ammonia, phosphorus and detergents.

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 drinking water?

- It will take you step by step through your milking center wastewater treatment 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 milking center wastewater treatment 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.

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Worksheet #11

Site Evaluation

Why is the site evaluation important?

How such farmstead practices as pesticide handling or manure management affect groundwater depends in part on the physical characteristics of your farmstead site: soil type, bedrock characteristics and depth to groundwater. That's why evaluating the soils and geologic characteristics of your farmstead is such an important step in protecting the groundwater you drink.

What's involved in completing this evaluation?

This evaluation has four parts:

- Part 1: Evaluating your soil type and depth
- Part 2: Evaluating subsurface and geologic materials, along with depth to groundwater
- Part 3: Determining your overall site evaluation ranking (combining parts 1 and 2)
- Part 4: Doing a farmstead diagram (optional)

Getting the information to complete parts 1 and 2 will require assistance from outside sources, such as your county Soil Conservation Service (SCS) or Extension office. How long this takes will vary depending on availability of information in your county. Once you have the information, though, it should take about an hour to complete the first three parts of Worksheet #11. (The farmstead diagram will take additional time.)

If some of the information you need isn't readily available, the worksheet contains instructions on how to proceed. The more information you can get, the better; but some information is better than no information.

How do soils affect the potential for groundwater contamination?

Soil characteristics are very important in determining whether a contaminant breaks down to harmless compounds or leaches into groundwater. Because most breakdown occurs in the soil, there is a greater potential for groundwater contamination in areas where contaminants are able to move quickly through the soil.

- Sandy soils have large "pore" spaces between individual particles, and the particles provide relatively little surface area for "sorption," or physical attachment of most contaminants. Large amounts of rainfall can percolate through these soils, and dissolved contaminants can move rapidly down through the soil and into groundwater.

*For glossary,
see page 15.*

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Worksheet #12

Overall Farmstead Assessment

As an overall summary of the work you've already done to assess your farmstead structures and activities, this worksheet has two parts:

Part 1: Your first step will be to combine the individual risk rankings for various farmstead structures and activities (from Worksheets 1-10) with your soils ranking and subsurface geologic ranking from Worksheet #11. Combining these rankings will give you a much more accurate picture of the groundwater contamination risk of your various farmstead practices as they are affected—for better or worse—by your particular site conditions.

Part 2: Your second step will be to list any individual farmstead activities from your 10 worksheets that you ranked with 1's (high risk). You've probably been adding to this list as you've completed each worksheet. In this part, you will be looking at individual concerns, giving you very specific information about the groundwater contamination risk of particular farmstead practices.

Getting Started

If you have not already done so, take the boxed risk rankings from the top of the scoring sheet of each of the 10 worksheets you completed and transfer them into the box below. **(For the worksheets you did not complete, leave the boxes blank.)**

Then take your three site evaluation rankings from Worksheet #11 (soils ranking, subsurface ranking and combined ranking) and transfer them into the box below, too. (If you have fewer than three site rankings, just record the ones you have and leave the others blank.) **The figures in this box are all you need to complete parts 1 and 2 of this worksheet.**

FARMSTEAD RISK RANKINGS (from Worksheets 1-10)	SITE RANKINGS (from Worksheet #11)
#1: Well condition _____	Soils ranking #1 _____
#2: Pesticide handling _____	Soils ranking #2 _____
#3: Fertilizer handling _____	Soils ranking #3 _____
#4: Petroleum storage _____	
#5: Hazardous waste management _____	Subsurface ranking _____
#6: Household waste-water treatment _____	Combined ranking #1 _____
#7: Livestock waste _____	Combined ranking #2 _____
#8: Livestock yards _____	Combined ranking #3 _____
#9: Silage storage _____	
#10: Milking center waste-water _____	

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Fact Sheet #1

Reducing the Risk of Groundwater Contamination by Improving Drinking Water Well Condition

1. Well location

Whether a well taps water just below the ground or hundreds of feet deep, its location on top of the ground is a crucial safety factor. Locating a well in a safe place takes careful planning and consideration of such factors as where the well is in relation to surface drainage and groundwater flow. A well downhill from a livestock yard, a leaking tank or a failing septic system runs a greater risk of contamination than a well on the uphill side of these pollution sources.

Surface slope does not always indicate the direction a pollutant might flow once it gets into the ground. In shallow aquifers, groundwater flow is often in the same direction as surface water flow. If the aquifer supplying water to your farmstead well is deep below the surface, though, its slope may be different than that of the land surface. Finding out about groundwater movement on your farm (see Contacts and References) may require special monitoring equipment.

Separation distances

Many states encourage good well location by requiring minimum separation distances from sources of potential pollution, thus using the natural protection provided by soil. However, state well codes may not mention some farmstead activities and structures. For example, in Wisconsin, private well regulations (Wisconsin Administrative Code NR 112) ignore pesticide mixing, pesticide and fertilizer storage not occurring in tanks, vehicle maintenance and farm waste disposal areas. Milkhouse wastewater is not addressed unless it is handled in a soil absorption system or manure storage facility. When no distances are specified, provide as much separation as possible between your well and any potential contamination source—especially if your farmstead is on highly permeable soils or thin soil overlying limestone bedrock, or if the contamination source or activity presents a high risk of contamination.

Minimum separation distances regulate new well installation. Existing wells are required by law only to meet separation requirements in effect at the time of well construction. Make every effort, however, to exceed “old requirements,” and strive to meet current regulations whenever possible.

Both soil and slope can make siting a well a tricky business. Keep in mind that separation distances required by the state are minimums. You may want to choose greater separation distances in some cases, depending on factors at your site. This will help provide reasonable assurance that your well will not be polluted by farmstead activities in the future. Also consider contamination sources on adjacent properties.

Changing the location of your well in relation to contamination sources may protect your water supply, but not the groundwater itself. Any condition likely to cause groundwater contamination should be improved, even if your well is far away from the potential source. Whether or not drinking water is affected, groundwater contamination is a violation of Wisconsin law.

*For glossary,
see page 2 of
Worksheet #1.*

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Fact Sheet #2

Reducing the Risk of Groundwater Contamination by Improving Pesticide Storage and Handling

We'll look at five areas of pesticide management on your farmstead: 1) pesticide storage practices; 2) mixing and loading practices; 3) spill cleanup; 4) container disposal practices; and 5) other management practices.

When handling pesticides, wear proper protective clothing at all times. Personal protection is not addressed in Farm•A•Syst, because its focus is groundwater and drinking water protection. The Contacts and References section provides some safety information sources.

1. Pesticide storage practices

If stored safely in a secure location, pesticides pose little danger to groundwater. Common sense suggests keeping them dry and out of the way of activities that might knock over a jug or rip open a bag. Short-term storage (during seasonal use) poses a lower risk than year-round storage, but **any** storage, regardless of length of time stored, poses a risk to groundwater.

If a spill does occur, an impermeable (waterproof) floor, such as concrete, should virtually eliminate any seepage of chemicals into the ground. Putting a curb around the floor will prevent chemicals from spreading to other areas.

Secondary containment provides an impermeable floor and walls around the storage area, which will minimize the amount of pesticide seeping into the ground if a bulk liquid pesticide storage tank should leak.

A mixing/loading pad provides for secondary containment during the transfer of pesticides to spraying equipment or nurse tanks.

Building a new storage facility

Building a new facility just for pesticide storage may be expensive, but generally it will be safer than trying to modify areas meant for other purposes.

When building a new facility, keep in mind a few principles of safe pesticide storage:

1. Locate the building downslope and at least 100 feet away from your well. Separation from the well should be greater if the site has sandy soils or fractured bedrock near the land surface. The risk of pesticide contamination of groundwater is influenced by properties of both the pesticide and the soil on which it is spilled or applied. (*Pesticides, Surface Runoff, Leaching and Exposure Concerns*, in the Contacts and References section, provides more information on these topics. Also, Worksheet #11, *Site Evaluation*, assists you in ranking your farmstead soils and geologic conditions according to their ability to keep pesticides and other contaminants out of groundwater.)

*For glossary,
see page 2 of
Worksheet #2.*

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Fact Sheet #3

Reducing the Risk of Groundwater Contamination by Improving Fertilizer Storage and Handling

1. Fertilizer storage practices

If stored safely in a secure location, fertilizers pose little danger to groundwater. Common sense suggests keeping fertilizer dry and out of the way of activities that might rip open a bag or allow rain to enter a bulk container.

In the event of such an accident, an impermeable (waterproof) floor, such as concrete, helps to prevent fertilizer seeping into the ground and leaching to groundwater. A curb built around liquid fertilizer storage areas will prevent contaminants from spreading to other areas.

Secondary containment provides an impermeable floor and walls around the storage area, which will minimize the amount of fertilizer seeping into the ground if a bulk liquid fertilizer storage tank should leak.

A mixing/loading pad provides for secondary containment during the transfer of liquid fertilizer to application equipment or nurse tanks. Store piles of dry bulk fertilizer on an impermeable surface under cover or in a building. Treat dry fertilizer impregnated with a pesticide as a pesticide. Store under cover or protected from rain.

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 meant for other purposes. Keep these simple principles in mind:

1. Locate the dry storage building or liquid secondary containment downslope and at least 100 feet away from the well. Separation from the well should be greater in areas of sand or fractured bedrock. Worksheet #11, *Site Evaluation*, can assist you in ranking your farmstead soils and geologic conditions according to their ability to keep contaminants out of groundwater.
2. In the event of a fire, contaminated surface water should drain to a confined area.
3. The mixing and loading area should be close to your storage facility, to minimize the distance that chemicals are carried.
4. The building foundation or secondary containment floor should be well drained and located above the water table. The finished 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.
5. Provide pallets to keep bags off the floor. Store dry products separate from liquids to prevent wetting from spills.

For glossary,
see page 2 of
Worksheet #3.

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Fact Sheet #4

Reducing the Risk of Groundwater Contamination by Improving Petroleum Product Storage

1. Storage tank location

The most important aspect of your liquid petroleum storage tank location is how close it is to your drinking water well. State well regulations (Chapter NR 112 of Wisconsin's Administrative Code) require that petroleum storage tanks be located at least 100 feet from a drinking water well. Minimum separation distances regulate only new well installation. Existing wells are required by law only to meet separation requirements in effect at the time of well construction. Make every effort, however, to exceed "old regulations," and strive to meet current regulations whenever possible.

Even though diesel fuel and fuel oil are more dense than gasoline and move more slowly through the soil, they, too, will eventually reach groundwater.

Every site has unique geologic and hydrologic conditions that can affect groundwater movement. How quickly the petroleum product reaches groundwater will also depend upon local soils. The more porous the soil (sands and gravels, for example), the faster the rate of downward movement to groundwater. You may choose to locate a new tank more than 100 feet away from your well, to provide reasonable assurance that subsurface flow or seepage of contaminated groundwater will not reach your well. If possible, the tank should also be located downslope from the well. Figure 1 illustrates petroleum product seepage into soils.

If you have an above-ground tank, follow existing regulations for underground storage tanks as a guide. To protect against explosion and fire, do not locate tanks (especially above-ground tanks) closer than 25 feet to existing buildings. Previous regulations for siting above-ground storage tanks were concerned more with the explosion potential of tanks than the groundwater pollution potential. State agencies have revised above-ground storage tank regulations to better protect groundwater.

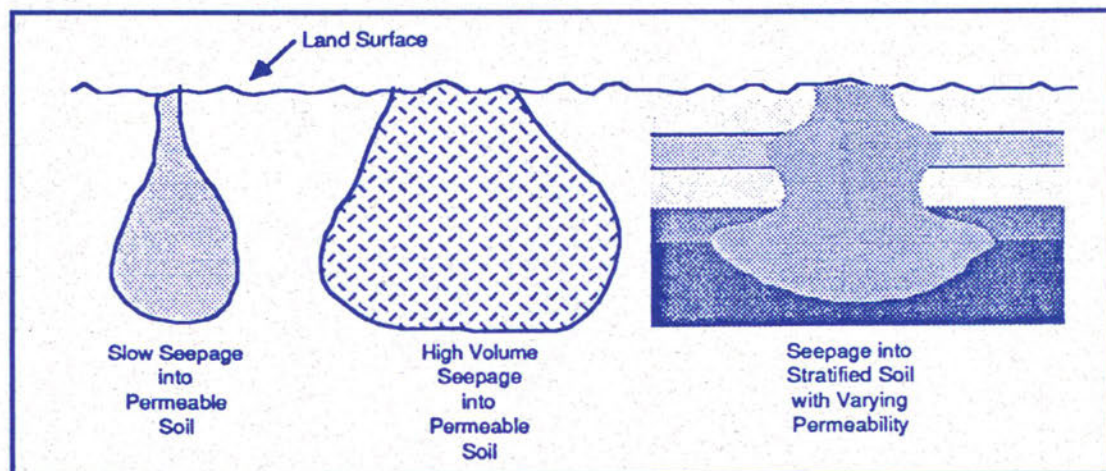


Figure 1: Petroleum product seepage into soils. Source: *Underground Tank Corrective Action Technologies*, EPA/625/6-87-015, January 1987.

For glossary,
see page 2 of
Worksheet #4.

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Fact Sheet #5

Reducing the Risk of Groundwater Contamination by Improving Hazardous Waste Management

Two key steps to minimizing the pollution potential on your farm from farm, household and shed wastes are to minimize the amount of wastes and recycle when possible.

Some hazardous materials, such as lubricating oils or solvents for cleaning metal parts, are an unavoidable part of farm life. Take some time, though, to examine your activities that involve use of hazardous materials, to make sure that you really need all the products you are using. Keep in mind that hazardous waste generated from farm business activities must be managed in accordance with state and federal rules.

When you are certain that you are purchasing and using only essential products, carefully consider how to use the products safely, recycle or reuse them when possible, and dispose of remaining products in a way that will not pose a risk to your drinking water. A few simple management principles apply in every situation:

- Use hazardous products away from your well (150 feet or more), even when all your spills and drips will be contained.
- Return excess product, spills or drips to the original activity. For example, reuse filtered waste antifreeze as water in other radiators; contain oil or grease drips and use for future lubrication needs; dispose of pesticide container rinse water by spreading on fields at the proper application rate for the pesticide.
- Contain any unusable wastes, spills and drips for appropriate disposal.

1. Farm and household trash

This category of potentially hazardous substances includes:

- **Ash and sludge** from burned farm home and garage trash and waste oil
- **Plastic wraps and containers**
- **Personal care products**, such as spot removers; dry cleaning fluids; moth balls; and shoe and leather polishes
- **Hobby products**, such as pesticides used in pet care; artist paints and solvents; undiluted photography and swimming pool chemicals; strong acids
- **Home cleaning and repair products**, such as air fresheners and pest strips; furniture and wood polishes and waxes; lead-based paint; other paints; stains and finishes; paint and finish preparation products; wood-preserving products.
- **Farm business hazardous waste**, including unusable or waste cleaners, solvents, pesticides and other hazardous chemicals that are generated from cleaning, maintaining or general use of farm equipment or farming procedures.

*For glossary,
see page 2 of
Worksheet #5.*

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Fact Sheet #6

Reducing the Risk of Groundwater Contamination by Improving Household Wastewater Treatment

A properly installed and maintained system for treating and disposing of household wastewater will minimize the impact of that system on groundwater and surface water. State and local codes specify how wastewater systems must be designed, installed and maintained. For example, Wisconsin Administrative Code IHLR 83 regulates private sewage systems, and NR 113 addresses servicing these systems.

At a minimum, follow the codes. But also consider whether the minimum requirement is sufficient for your site.

Septic tank/soil absorption system: The most common system

The most common form of onsite wastewater treatment is a septic tank/soil absorption system. In this system, wastewater flows from the household sewer into an underground septic tank.

- There the waste components separate—the heavier solids (sludge) settling to the bottom, and the grease and fatty solids (scum) floating to the top.
- Bacteria partially decompose and liquify the solids.
- Baffles are placed in the tank to provide maximum retention of solids, prevent inlet and outlet plugging, and prevent rapid flow of wastewater through the tank.
- The more liquid portion (effluent) flows through an outlet to the soil absorption field.
- The absorption field is usually a series of parallel trenches (fingers), each containing a distribution pipe or tile embedded in drainfield gravel or rock.
- The effluent leaks out through holes in the pipe or seams between tile sections, then down through the drainfield gravel or rock and into the soil.
- The soil filters out remaining minute solids and pathogens (disease-producing microorganisms), and dissolved substances slowly percolate down to groundwater.

*For glossary,
see page 2 of
Worksheet #6.*

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Fact Sheet #7

Reducing the Risk of Groundwater Contamination by Improving Livestock Waste Storage

Storage of livestock wastes involves simply accumulating wastes in some type of structure until the wastes can be land applied. From an environmental standpoint, this waste storage can be either positive or negative.

Manure storage can provide environmental benefits by allowing wastes to be stored until they can be safely spread, incorporated in the soil and used by a growing crop. The environmental safety of collecting large amounts of manure in one place for an extended period depends on three things:

- 1) the design and construction of the storage facility
- 2) the proper land application of the manure once it leaves the storage facility
- 3) the physical and chemical characteristics of: the soil and subsurface geologic materials within the storage area; and the soil and subsurface geologic materials of the area to which any runoff might flow

Waste storage is an important management option available to livestock producers. Stored manure can be applied to the soil at those times of the year when crops are not actively growing and the soils are open. This allows manure to be injected or incorporated by tillage immediately following application. Handling manure in this way ensures the farmer of the maximum fertilizer value from the waste materials, while reducing risks of groundwater and surface water contamination from the over-application of nutrients.

Stored manure can easily be sampled and tested to determine how much nitrogen, phosphorus and potassium it contains. (When sampling manure, be sure to obtain as representative a sample as possible.) This information, combined with a knowledge of the amount of manure applied per acre, enables a farmer to determine whether additional commercial fertilizer is needed to meet realistic crop production goals.

Waste storage also reduces the need for land application during winter months when soil is frozen. This saves wear and tear on farm equipment, conserves nutrients contained in the manure and minimizes manure nutrient leaching and runoff. Storage is also valuable during extended periods of bad weather and when crops are actively growing, making application impractical.

1. Long-term storage

Livestock wastes can be stored either in solid, semi-solid or liquid states.

- Solid facilities use walls and slabs for stacking of heavily bedded manure.
- Semi-solid facilities use pumps to move manure into containment areas and may separate solids from liquids.
- Liquid facilities hold manure in tanks, pits or bermed areas.

*For glossary,
see page 2 of
Worksheet #7.*

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Fact Sheet #8

Reducing the Risk of Groundwater Contamination by Improving Livestock Yards Management

Besides addressing the potential of livestock yards to pollute groundwater, other good reasons for improving management practices include improved herd health, ease of maintenance and quality milk or meat production.

1. Distance from well

Wells should be located in an elevated area upslope of the livestock yard, so that runoff will not drain into the vicinity of the well. The Wisconsin well code requires a minimum separation of 50 feet between existing livestock yards and new wells. With good farmstead planning, livestock facilities would be 300-400 feet from the house. Since the well is often near the house, it is likely that there would be more than 200 feet between the well and the livestock yard.

Minimum separation distances regulate new well installations, as well as the distance from existing wells to new sources of contamination. Existing wells are required by law only to meet separation requirements in effect at the time of well construction. Make every effort, however, to exceed "old requirements," and strive to meet current regulations whenever possible.

2. Site characteristics

If groundwater protection is a major consideration in siting a livestock yard, soil characteristics are the most important factor. Important soil characteristics include surface and subsoil texture, soil depth, permeability and drainage class. The best site has a deep, well-drained silt loam/clay loam soil with low permeability. A very poor site has shallow soil, or a high water table, or a very sandy/gravelly soil with excessive drainage and high permeability. (For more assistance in assessing your site's vulnerability to groundwater contamination, see Worksheet #11, *Site Evaluation*.)

For existing livestock yards on poor sites, the best options for protecting groundwater might be eliminating the yard and using total confinement for the livestock or providing paved yards and liquid-tight basins to store yard runoff.

3. Clean water diversion

One way of reducing water pollution from livestock yards is to reduce the amount of clean water entering the yard. In all cases, these structures need to be maintained.

- Waterways, small terraces and roof gutters direct water away from livestock yards.
- An earthen ridge or terrace can be constructed across the slope upgrade from a livestock yard to prevent runoff from entering the yard.
- In some areas, if a diversion terrace is not practical, a catch basin with a tile outlet could be installed above the livestock yard.

*For glossary,
see page 2 of
Worksheet #8.*

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Fact Sheet #9

Reducing the Risk of Groundwater Contamination by Improving Silage Storage

1. Silage moisture content

Silage can be made from corn; silage crops, such as grain or alfalfa; and canning company wastes, such as from sweet corn processing. The amount of leachate (silage juices) produced varies with the material stored, its moisture and nitrogen content, and handling and storage conditions. Of these, moisture is the most crucial.

Research indicates that materials stored at 65 percent moisture content or higher can produce leachate. For grass silage, the amount produced varies from a trickle at 75 percent moisture to 79 gallons per ton at 85 percent moisture. About three-quarters of the leachate is produced in the first three weeks of storage, although it can continue to flow for up to three months.

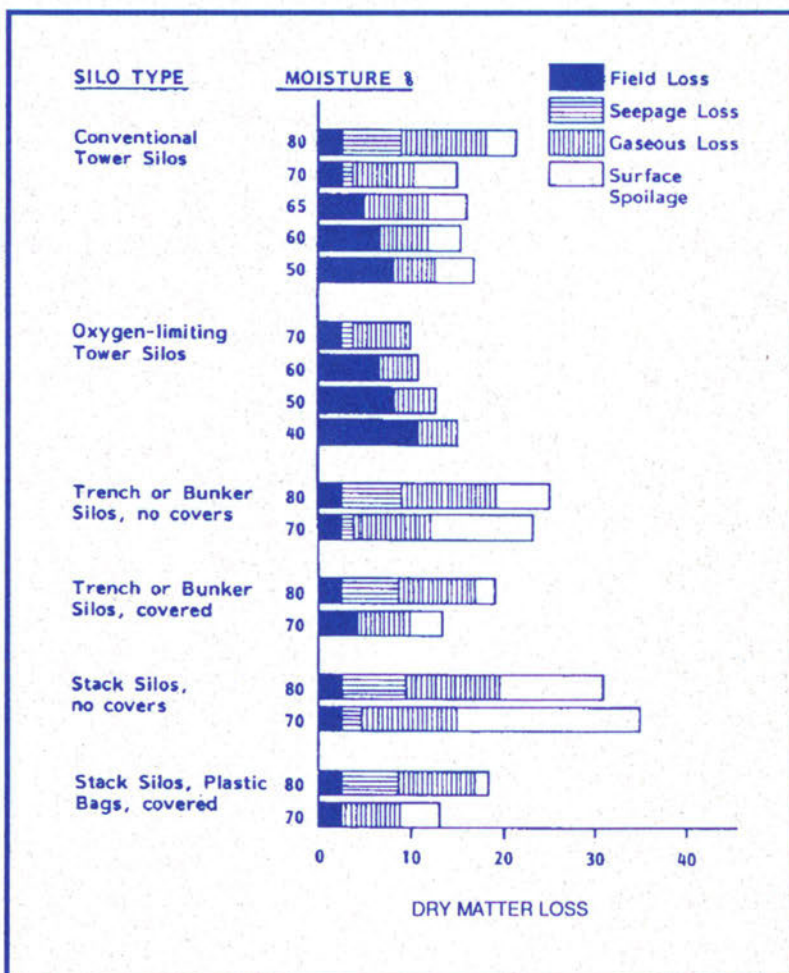


Figure 1: Chart of silage moisture content.
 Source: *Beef Housing and Equipment Handbook, MWPS-6, Fourth Edition, 1987, Midwest Plan Service, Ames, Iowa.*

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Fact Sheet #10

Reducing the Risk of Groundwater Contamination by Improving Milking Center Wastewater Treatment

Wastewater from the dairy milking center, including wastes from the milking parlor (manure, feed solids, hoof dirt) and milkhouse (bulk tank rinse water and detergent used in cleaning), is commonly disposed of in Wisconsin in an underground tank and soil absorption field. Most soil absorption fields have plugged up for one or more of the following reasons:

- Increased volumes of water don't allow adequate detention time in the septic tank.
- Milk solids and fats or manure solids plug the absorption field.
- Sanitizers used in cleaning may reduce bacterial action in the septic tank.
- Solids are not removed from the tank regularly.

When these systems fail, wastewater will most likely surface elsewhere, in a ditch or a cropped field.

From an environmental perspective, delivery of milking center wastewater to a manure storage facility, if available, makes the most sense. Discharge options, from most to least desirable, are: field application, overland flow, slow surface infiltration, below-ground absorption fields and rapid surface infiltration. Except for below-ground absorption fields, these discharge methods are uncommon in Wisconsin.

Your drinking water is least likely to be contaminated if you follow appropriate management procedures or dispose of wastewater in any location **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.

1. No discharge by combining wastes

Combining milking center wastes with manure has the advantage of allowing a common disposal system for both types of waste. A liquid manure storage facility, properly constructed and sized, provides the additional flexibility of storing wastes until they can be applied at the right time to the right sites. (See Figure 1a.)

This option is limited, however, to farmers who handle their manure in slurry form. While it adds to transportation and spreading costs, nutrients from dairy wastewater can be used to meet crop requirements, thus reducing fertilizer costs.

Applying milking center wastes with manure to fields at rates that do not exceed crop needs for nitrogen is least risky for groundwater contamination from both wastes. Care must be taken, however, to keep soil phosphorus levels from accumulating to levels that will harm crops.

Milking center wastewater combined with seepage (from solid manure storage or livestock yard runoff) can be stored in a detention pond. (See Figure 1b.) The contents of the pond can be applied to fields when conditions are appropriate.

*For glossary,
see page 2 of
Worksheet #10.*