

# Water Quality

**FARM•A•SYST**

Farmstead Assessment System

**Worksheet #2**

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## 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.

Pesticides work by interfering with the life processes of plants and insects. Pesticides also may be toxic to people. If pesticides enter a water supply in large quantities — as can happen with spills or back-siphonage accidents — **acute exposure** (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 contami-

nated if you follow appropriate management procedures and properly dispose of wastes in a 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.

### 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.

# Pesticide 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
<b>PESTICIDE STORAGE</b>					
<b>Amount stored</b>	No pesticides stored at any time.	Less than 1 gallon, or more than 10 pounds of each pesticide.	More than 1 gallon, or more than 10 pounds of each pesticide.	More than 55 gallons, or more than 550 pounds of each pesticide.	_____
<b>Location of pesticide storage area in relation to well</b>	300 feet or more downslope from well.	150-300 feet downslope from well.*	50-150 feet downslope from well.*	Within 50 feet or upslope from well.*	_____
<b>Types stored:</b> <b>Leachability</b> <i>(See chart, page 3.)</i>	No pesticides stored.	Pesticides classified as having low leaching potential.	Pesticides classified as having medium leaching potential.	Pesticides classified as having high leaching potential.	_____
<b>Liquid or dry formulation</b>	No liquids. All dry.	Some liquids. Mostly dry.	Mostly liquids. Some dry.	All liquids.	_____
<b>Spill or leak control in storage area</b>	Impermeable surface (such as concrete), does not allow spills to soak into soil. Curb installed on floor to contain leaks and spills.	Impermeable surface with curb installed has some cracks, allowing spills to get to soils. OR impermeable surface without cracks, has no curb installed.	Permeable surface (wooden floor), has some cracks. Impermeable surface, has no curb. Spills could contaminate wood or soil.	Permeable surface (gravel or dirt floor). Spills could contaminate floor.	_____
<b>Containers</b>	Original containers clearly labeled. No holes, tears or weak seams.	Original containers old. Labels partially missing or hard to read.	Containers old but patched. Metal containers show signs of rusting.	Containers have holes or tears that allow chemicals to leak. No labels.	_____
<b>Security</b>	Fenced or locked area separate from all other activities.	Fenced area separate from most other activities.	Open to activities that could damage containers or spill chemicals.	Open access to theft, vandalism and children.	_____
<b>MIXING AND LOADING PRACTICES</b>					
<b>Location of well in relation to mixing/loading area with no curbed and impermeable containment area</b>	150 feet or more from well.	100-150 feet downslope from well.*	50-100 feet downslope from well,* or 100-500 feet upslope.	Within 50 feet downslope, or within 100 feet upslope from well.*	_____
<b>Mixing and loading pad (Spill containment)</b>	Concrete pad with curb keeps spills contained. Sump allows collection and transfer to storage.	Concrete pad with curb keeps spills contained. No sump.	Concrete pad with some cracks keeps some spills contained. No curb or sump.	No mixing/loading pad. Permeable soil (sand). Spills soak into ground.	_____
<b>Backflow prevention on water supply</b>	Anti-backflow device installed or 6-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. <b>Hose in tank below water line.</b>	_____
<b>Water source</b>	Separate water tank.	Hydrant away from well.	Hydrant near well.	Obtained directly from well.	_____
<b>Filling supervision</b>	Constant supervision.	Frequent.	Seldom.	Never.	_____

*continued on next page*

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
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### MIXING AND LOADING PRACTICES (continued)

Handling system	Closed system for all liquid and dry product transfers.	Closed system for most liquids. Some liquid and dry product hand poured. Sprayer fill port easy to reach.	All liquids and dry product hand poured. Sprayer fill port easy to reach.	All liquids and dry product hand poured. Sprayer fill port hard to reach.	_____
Sprayer cleaning and rinsate (rinse water) disposal	Sprayer washed out in field.	Sprayer washed out on pad at farmstead. Rinsate used in next load and applied to labeled crop.	Sprayer washed out at farmstead. Rinsate sprayed less than 100 feet from well.	Sprayer washed out at farmstead. <b>Rinsate dumped at farmstead or in field.</b>	_____

### CONTAINER DISPOSAL

Disposal location	Triple-rinsed containers returned to dealers or taken to licensed landfill or municipal incinerator. Bags returned to supplier, or hazardous waste collection service used.	Unrinsed containers and empty bags taken to licensed landfill, municipal incinerator or dump.	Disposal of unrinsed containers or empty bags on farm. Disposal of triple-rinsed containers on farm.	Disposal of partially filled plastic or paper containers on farm. Bags buried in field or burned on farm.	_____
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**Extra bold type:** Besides representing a higher-risk choice, this practice also violates Missouri law.

\*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:

## Pesticide Leachability Chart

The pesticides listed on this chart are identified by **brand name, common name and rating for movement by leaching (low, medium or high)**. Identify the pesticides stored on your farmstead from the listing below. Note the "leachability factor" for each pesticide you store. Then give yourself an overall "leachability ranking" (low, medium or high), based on which ranking best represents the pesticides you store. Then use this ranking to complete the "Leachability" section on the assessment worksheet.

### Herbicides

Alanap	naptalam	-	Bronco	glyphosate & alachlor	Low	Dual	metolachlor	Med
Ally	metsulfuron-methyl	-	Buckle	trifluralin	Low	Eptam	EPTC	Med
Amiben	chloramben	-	Buctril	bromoxynil	Low	Eradicane	EPTC	Med
AmitrolT	amitrole	Med	Buctril-	bromoxynil & atrazine	Low	Extra	EPTC	Med
Antor	diethatyl-ethyl	Low	Atrazine	atrazine	High	Evik	ametryn	Med
Arsenal	imazapyracid	High	Butyrac 200	2,4-DB amine	Med*	ExtrazineII	atrazine & cyanazine	High
Arsenal	imazapyramine	High	Butyrac	2,4-DB ester	Low*	Far-Go	trifluralin	Med
Assert	imazethabenz	High	Cannon	alachlor & trifluralin	Med	Fusilade 2000	fluazifop	Low
Assure	quizalofop ethyl	Low*	Carbyne	barban	-	Galaxie	bentazon & aciflourfen	High
Atrazine	atrazine	High	Casoron	dichlobenil	High	GenatePlus	butylate	Med
Avenge	difenzoquat	Low	Classic	chlorimuron	-	Genep	EPTC	Med
Balan	benefin	Low	Cobra	lactofen	-	Glean	chlorsulfuron	-
Banvel	dicamba	High	Command	clomazone	Med	Goal	oxyfluorfen	Low*
Basagran	bentazon	High	Commence	trifluralin & clomazone	Low	Gramoxone	paraquat	Low
Betamix	phenmedipham & desmedipham	Low	Crossbow	tricypr & 2,4-D ester	Med	Extra		
Betanex	desmedipham	Low	Curtail	2,4-D ester	Low*	Harmony	DPX-M6316 & Extra DPX-L5300	-
Bicep	metolachlor & atrazine	Med	CurtailM	2,4-D amine	High	Herbicide 273	endothall	Low
Bladex	cyanazine	Med	Dacthal	DCPA	Low	Hoelon	diclofop	Low
Blazer	acifluorfen	Med	Dowpon	dalapone	High	Kerb	pronamide	Low
Bronate	bromoxynil & MCPA ester	Low				Krenite	fosamine	Low

Laddock	atrazine & bentazon	High
Lariat	alachlor & atrazine	Med
Lasso EC	alachlor	High
Lasso Micro	alachlor	Med
Tech		-
LassoII	alachlor	Med
Lasso-Atrazine	alachlor & atrazine	High
Lexone	metribuzin	High
Lorox	linuron	Med
LoroxPlus	linuron & chlormuron	Med
Marksman	dicamba & atrazine	High
MCPA Amine	MCPA amine	-
MCPA Ester	MCPA ester	Low
Norton	ethofumesate	High
Option	fenoxaprop	Low
Pinnacle	DPX-M6316	-
Poast	sethoxydim	-
Pramitol	prometon	High
Preview	metribuzin & chlormuron	High
Princep	simazine	High
Prowl	pendimethalin	Low
Prozine	pendimethalin & atrazine	Low
Pursuit	imazethapyr	-
Pursuit Plus	imazethapyr & pendimethalin	-
Pyramin	pyrazon	Low
Ramrod	propachlor	High
Ramrod-Atrazine	propachlor & atrazine	Low
Ranger	glyphosate	High
Reflex	fomesafen	Low
Rescue	naptalam & 2,4-DB	High
Rhino	butylate & atrazine	Med*
Ro-Neet	cycloate	Med
Roundup	glyphosate	Med
Salute	metribuzin & trifluralin	Low
Scepter	imazaquin	Low
Sencor	metribuzin	High
Sinbar	terbacil	High
Sonalan	ethalfluralin	Low
Spike	tebuthiuron	High
Stampede	propanil & MCPA ester	Low
CM	clopyralid	Low
Stinger	bentazon & acifluorfen	High
Storm		High
Surflan	oryzalin	Med
Sutan+	butylate	Low
Sutazine+	butylate & atrazine	Med
2,4-D amine	2,4-D amine	High
2,4-D ester	2,4-D ester	Med
Tandem	tridiphane	Low*
Thistrol	MCPB	Low
Tillam	pebulate	-
Tordon	picloram	Med
Treflan	trifluralin	High
Turbo	metolachlor & metribuzin	Low
Velpar	hexazinone	Med
Vernam	vernolate	High
Weedar	MCPA amine	Low
Weedmaster	dicamba & 2,4-D amine	-
Weedone-	dichlorprop	High

2,4-DP	ester	Low*
Whip	fenoxaprop	Low

## Insecticides

Ambush	permithrin	Low
Aqua8-		
Parathion	parathion	Low
AsanaXL	esfenvalerate	Low
Bolstar	sulprofos	Low
Broot	trimethacarb	Low**
Carzol	formetanate	Low
Counter	terbufos	Low
Cygon	dimethoate	Med
Cythion	malathion	Low
Diazinon	diazinon	Med*
Dimilin	difluzenzuron	Low
DiSyston	disulfoton	Low
Dyfonate	fonofos	Med
DyfonateII	fonofos	Med
Dylox	trichlorfon	High
Endocide	endosulfon	Low
Endocide Plus	endosulfon & parathion	High
Force	tefluthrin	Low*
Furadan	carbofuran	-
Guthion	azinphos-methyl	High
Imidan	phosmet	Low
Knox-Out	diazinon	Med*
Lannate	methomyl	High
Larvadex	cyromazine	High*
Larvin	thiodicarb	Low
Lindane	lindane	Med
Lorsban	chlorpyrifos	Low
Malathion	malathion	Low
Malathion/ methoxychlor	malathion & methoxychlor	Low
Mavrik	fluvalinate	-
Metasystox-R	demeton-s-methyl	Low
Methoxychlor	methoxychlor	High**
Mitic	amitraz	Low
Mocap	ethoprop	High
Monitor	methamidophos	High
Nudrin	methomyl	High
Orthene	acephate	Low
Parathion	parathion	Low*
Pennacp-M	methyl parathion	Low
Phosdrin	mevinphos	Med
Phoskil	parathion	Low*
Pounce	permethrin	Low
Pydrin	fenvalerate	Low
Rampart	phorate	Low
Scout-Xtra	tralomethrin	-
Sevin	carbaryl	Low
Somanil	methidathion	Med
Supracide	methidathion	Med
Swat	phosphamidon	-
Temik	aldicarb	High
Thimet	phorate	Low
Thiodan	endosulfan	Low
Trigard	cyromazine	High*
Vydate	oxamyl	Low

## Fungicides

AgSCO TN-IV	tin	-
AgSCO MNF	maneb & zinc	Low**
Bayleton	triadimefon	-
Benlate	benomyl	Med
Blitex	maneb & triphenyltin	High
Botran	dicloran	Low**

Bravo	chlorothalonil	Low
Captan	captan	Low
Carbamate	ferbam	Med
Champion	copper-fixed	-
Crothothane	dinocap	Low**
Cyprex	dodineacetate	Low**
Daconil	chlorothalonil	Low
Dithane	mancozeb	Low
Duter	tin	-
Dyrene	anilazine	Low
Karathane	dinocap	Low**
Kelthane	dicofol	Low**
Kocide	copper hydroxide	-
Magnetic	sulfur	-
Maneb	maneb	Low**
Maneb& Zinc	maneb & zinc	Low**
Manzate	zinc	-
Merteck	mancozeb	Low
Orbit	thiabendazole	-
Penncozeb	propiconazole	Med**
Polyram	mancozeb	Low
Protex	metiram	Low**
Ridomil	maneb	Low**
Ronilan	triphenyltin	-
Rovral	metalaxyl	High
Rubigan	vinclozalin	Low**
SuperSix	iprodione	Low*
SuperTin	fenarimol	High
TelonelI	sulfur	-
Terrachlor	tin	-
Tersan	dichloropropene	Med
ThatF	PCNB	Low*
Thiolux	benomyl	High
Tilt	sulfur	-
TopCop	sulfur	-
Topsin	propiconazole	Med**
Triphenyl Tin Hydroxide	basicoppersulfate	-
TripleTin	thiophanatemethyl	Low**
Vitavax	triphenyltin hydroxide	-
Vorlex	triphenyltin hydroxide	-
	carboxin	Low
	dichloropropene & methyl-isothiocyanate	Med

\* The rating is an estimate, but reasonably accurate compared to estimated ratings footnoted \*\*.

\*\* The rating is a guess, and subject to a higher degree of error than estimates footnoted with a single asterisk.

Adapted from Becker, R.L., et al. 1990, *Pesticides: Surface Runoff, Leaching, and Exposure Concerns*. Minnesota Extension Service. Data were derived from U.S. Dept. of Agriculture SCS/ARS Pesticides Properties Data Base, Version 1.9, August 1989, developed by R.D. Wauchop et al., and ratings derived by D.W. Goss.

Chart modified annually. Contact your Natural Resources Conservation Service (NRCS) or local University Extension center for the most recent version.

# What do I do with these rankings?

## Step 1:

Begin by determining your overall well-management risk ranking. Total the rankings for the categories you completed, and divide by the number of categories you ranked:

_____ divided by _____ equals	<input type="text"/>
<small>total of rankings</small>	
<small>*Carry your answer out to one decimal place.</small>	
<small>risk ranking*</small>	

- 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 well-management practices 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 well-management 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 #1, *Improving Drinking-Water Well Condition*, and consider how you might modify your farmstead practices to better protect your drinking water.

## Glossary

*These terms may help you make more accurate assessments when completing Worksheet #1. They also may clarify some terms used in Fact Sheet #1.*

**Abandoned water well:** A well that is permanently discontinued or that is in such disrepair that its continued use for obtaining groundwater is impractical or may be a health hazard.

**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 unwanted reverse flow of liquids back down a water-supply pipe into a well.

**Aquifer:** A water-bearing formation (soil or rock horizon) that transmits water in sufficient quantities to supply a water well.

**Bored wells:** Wells constructed using augers, scoops, drag lines or similar equipment. These holes are usually of large diameter and are constructed in alluvial or glacial material.

**Casing:** An impervious durable pipe placed in a well to prevent the walls from caving and to seal off surface drainage or undesirable water, gas or other fluids to prevent them from entering the well.

**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.

**Drilled wells:** Wells not dug or driven, including those constructed by a combination of jetting or

driving. These wells are normally 4 to 8 inches in diameter.

**Driven-point (sand point) wells:** Wells constructed by driving assembled lengths of pipe into the ground with percussion equipment or by hand. These wells usually are smaller in diameter (2 inches or less), less than 50 feet deep and can be installed in areas of relatively loose soils, such as sand.

**Dug wells:** A well in which the side walls may be supported by material other than standard weight steel casing. Water enters a dug well through the sides and bottom.

**Groundwater:** The water in the zone of saturation in which all of the pore spaces of the subsurface material are filled with water. The water that supplies springs and wells is groundwater.

**Grout:** Slurry of cement or bentonite clay used to seal the annular space between the outside of the well casing and the bore hole. Also used in sealing abandoned wells.

**Milligrams per liter (mg/l):** The weight of a sub-

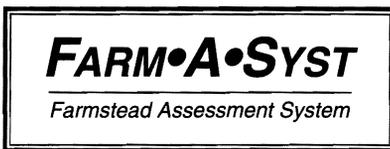
stance measured in milligrams contained in 1 liter. It is equivalent to 1 part per million in water measure.

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

**Pressure grout:** Refers to the process of applying grout material under pressure to the annular space of a well to seal it and thus prevent vertical movement of fluids through the annular space. Grout must be introduced from the bottom of the annular space.

**Water table:** The upper level of groundwater in a zone of saturation. Fluctuates with climatic conditions on land surface and with aquifer discharge and recharge rates.

**Well cap (seal):** A method or device used to protect a well casing or water system from the entrance of any external pollutant at the point of entrance into the casing.



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