

Worksheet 2

Assessing the Risk of Groundwater Contamination from Pesticide Storage & Handling

Why should I be concerned?

Pesticides play an important role in agriculture. They have increased farm production, and they have enabled farmers to manage more acres with less labor. If pesticides are not handled carefully around the farmstead, however, they can seep through the ground after a leak or spill, or they can enter a well directly during mixing and loading. Taking voluntary action to prevent pesticide contamination of groundwater will help assure the continued availability of pesticides for responsible use by farmers.

Pesticides work by interfering with the life processes of plants and insects. Pesticides are also toxic to people. “Pesticides” include herbicides, fungicides, insecticides and rodenticides. 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. Using groundwater with low levels of contaminants 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 at trace levels, and the concern is primarily their potential to cause chronic health problems from prolonged exposure.

Your drinking water is least likely to be contaminated if you follow appropriate management procedures and dispose of wastes off the farm site. However, proper offsite disposal practices, such as an approved sanitary landfill, 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 storage, handling and disposal practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the “risk level” of your pesticide storage, handling 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.

Glossary

Pesticide Storage and Handling

These terms may help you make more accurate assessments when completing Worksheet 2. They may also help clarify some of the terms used in Fact Sheet 2.

Air gap: An air space (open space) between the hose or faucet and water level, representing one way to prevent backflow of liquids into a well or water supply.

Anti-backflow (anti-backsiphoning) device: A check valve or other mechanical device to prevent the unwanted reverse flow of liquids back down a water supply pipe into a well.

Backflow: The unwanted reverse flow of liquids in a piping system.

Backflow prevention device: (See **anti-backflow device**.)

Backsiphonage: Backflow caused by formation of a vacuum in a water supply pipe.

Closed handling system: A system for transferring pesticides or fertilizers directly from original container to applicator equipment (through attached or connected hose, for example), so that humans and the environment are never inadvertently exposed to the chemicals.

Cross-connection: A link or channel between pipes, wells, fixtures or tanks carrying contaminated water and those carrying potable (safe for drinking) water. Contaminated water, if at higher pressure, enters the potable water system.

Dry formulation: Dry formulation pesticides include dusts, granules, water dispersible granules (dry flowables), wettable powders, soluble powders, pellets and baits.

Liquid formulation: There are six basic kinds of liquid formulations including emulsifiable concentrates, microencapsulation, solutions, flowables, aerosols and liquified gases.

Micrograms per liter: The weight of a substance measured in micrograms contained in one liter. It is equivalent to 1 part per billion in water measure.

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

Parts per billion (ppb): A measurement of concentration of one unit of material dispersed in one billion units of another.

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

Rinsate: Rinse water from pesticide or fertilizer tank cleaning.

Secondary containment: Impermeable floor and walls around a chemical storage area that minimize the amount of chemical seeping into the ground from a spill or leak.

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Worksheet 2

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.)
3. Look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."

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

5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for pesticide storage and handling practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
PESTICIDE STORAGE (Including any short-term or seasonal storage)					
1. Amount stored	No pesticides stored at any time.	Less than 1 gallon or less 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.	_____
Types stored:					
2. Leachability (See Pesticide Leachability Chart on pages 6 and 7.)	No pesticides stored.	Pesticides classified as having low leaching potential.	Pesticides classified as having medium leaching potential.	Pesticides classified as having high leaching potential.	_____
3. Liquid or dry formulation	No liquids. All dry.	Some liquids. Mostly dry.	Mostly liquids. Some dry.	All liquids.	_____
4. Location of pesticide storage area in relation to well	400 feet or more downslope from well.	150–400 feet downslope from well.	50–150 feet downslope from well.	Within 50 feet* or upslope from well. Storage in well or pump house.	_____
5. Spill or leak control in storage area	Impermeable surface (such as coated or sealed concrete) does not allow spills to soak into soil. Curb installed on floor to contain leaks and spills.	Uncoated concrete surface with curb has some cracks, allowing spills to get to soil, OR uncoated concrete surface without cracks has no curb.	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.	_____

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

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
PESTICIDE STORAGE (continued)					
6. Containers	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 pesticides to leak. No labels.	
7. Security	Fenced and locked area separate from all other activities.	Fenced area separate from most other activities.	Open to activities that could damage containers or spill chemicals.	Open access to theft, vandalism and children.	
MIXING AND LOADING PRACTICES					
8. Location of mixing/loading area in relation to well	400 feet or more downslope from well.	150–400 feet downslope from well.	50–150 feet downslope from well.	Within 50 feet downslope* or upslope from well.	
9. Mixing and loading pad (Spill containment)	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. Spills soak into ground.	
10. Water source	Separate water tank.	Hydrant away from well.	Hydrant near well.	Obtained directly from well.	
11. Backflow prevention on water supply (skip if using separate water tank)	Anti-backflow device installed or six-inch air gap maintained above sprayer tank.	Anti-backflow device installed. Hose in tank above waterline.	No anti-backflow device. Hose in tank above waterline.	No anti-backflow device. Hose in tank below water line.	
12. Filling supervision	Constant by certified** individual.	Constant by uncertified individual.	Frequent	Seldom or never. Frequently overflows.	
Boldface type: Besides representing a higher-risk choice, this practice also violates Kansas law. *Illegal for new well installation. Existing wells must meet separation requirements in effect at time of construction. **A certified individual is one who is certified by the state of Kansas to use or supervise the use of a restricted-use pesticide.					

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
MIXING AND LOADING PRACTICES (continued)					
13. 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.	
14. Sprayer cleaning and rinsate (rinse water) disposal	Sprayer washed out in field. Rinsate used in next load and applied to labeled crop.	Sprayer washed out on pad at farmstead. Rinsate used in next load and applied to labeled crop.	Sprayer washed out at farmstead. Rinsate sprayed on open areas around farmstead.	Sprayer washed out at farmstead. Rinsate dumped at farmstead or in field.	
CONTAINER DISPOSAL					
15. Disposal location	Triple-rinsed containers returned to dealers or taken to licensed landfill. Bags returned to supplier or hazardous waste collection service used.	Triple-rinsed containers stored on farm until taken to recycling center or licensed landfill.	Disposal of triple-rinsed containers or empty bags on farm.	Disposal of unrinsed or partially filled containers on farm.	
Boldface type: Besides representing a higher-risk choice, this practice also violates Kansas law.					TOTAL Use this total to calculate risk ranking on back page of worksheet.

PESTICIDE LEACHABILITY CHART

HERBICIDES

HERBICIDES			Crossbow	triclopyr & 2,4-D ester	Med	Marksman	dicamba & atrazine
Accelerate	endothall	High	Curtail	2,4-D ester	Low	MCPA Amine	MCPA amine
Alanap Ally	naptalam	High		clopyralid & 2,4-D amine	High	MCPA Ester	MCPA ester
	metalsulfuron-methyl	High	Curtail M	clopyralid & MCPA ester	High	Norron	ethofumesate
Amiben	chloramben	High		DCPA	Low	Option	fenoxaprop
Amitrol T	amitrole	Med	Dacthal		Low	Pinnacle	DPX-M6316
Antor	diethyl-ethyl	Low	Dowpon	dalapon	High	Poast	sethoxydim
Arsenal	imazapyr acid	High	Dual	metolachlor	High	Pramitol	prometon
Arsenal	imazapyr amine	High	Eptam	EPTC	High	Preview	metribuzin & chlorimuron
Assert	imazethabenz	High	Eradicane	EPTC	Med		
Assure	quizalofop-ethyl	Med	Eradicane Extra	EPTC	Med	Princep	simazine
	atrazine	High	Evik	ametryn	Med	Prowl	pendimethalin
Atrazine	difenzoquat	Low	Extrazine II	atrazine & cyanazine	High	Prozine	pendimethalin & atrazine
Balan	benefin	Low		triallate	Med	Pursuit	imazethapyr
Banvel	dicamba	High	Far-Go	fluazifop	Low	Pursuit Plus	imazethapyr & pendimethalin
Basgran	bentazon	High	Fusilade 2000			Pyramin	pyrazon
Betamax	phenmedipham & desmedipham	Low	Galaxie	bentazon & aciflourfen	High	Ramrod	propachlor
	desmedipham	Low		butylate	Med	Ramrod-Atrazine	propachlor & atrazine
Betanex	metolachlor & atrazine	High	Genate Plus	EPTC	Med	Ranger	glyphosate
Bicep	atrazine	High	Genep	chlorsulfuron	High	Reflex	fomesafen
Bladex	cyanazine	Med	Glean	oxyfluorfen	Low	Rescue	naptalam & 2,4-DB
Blazer	acifluorfen	Med	Goal	paraquat	Low		butylate & atrazine
Bronate	bromoxynil & MCPA ester	Low	Gramoxone Extra			Rhino	
	glyphosate & alachlor	Low	Harmony	DPX-M6316 & DPX-L5300	High	Ro-Neet	cycloate
Bronco	triallate & trifluralin	Med	Extra		High	Roundup	glyphosate
	trifluralin	Low	Hoelon	diclofop	Low	Salute	metribuzin & trifluralin
Buckle	bromoxynil	Low	Kerb	pronamide	Low		
Buctril	bromoxynil & atrazine	Low	Krenite	fosamine	Med	Scepter	imazaquin
Buctril-Atrazine	atrazine	High	Laddock	atrazine & bentazon	High	Sensor	metribuzin
Butyrac 200	2,4-DB amine	Med	Lariat	alachlor & atrazine	Med	Sinbar	terbacil
Butyrac	2,4-DB ester	Low			High	Sonalan	ethalfluralin
Cannon	alachlor & trifluralin	Med	Lasso EC	alachlor	Med	Spike	tebuthiuron
	barban	Low	Lasso Micro Tech	alachlor	-	Stampede CM	propanil & MCPA ester
Carbyne	diclobenil	-					
Casoron	chlorimuron	Med	Lasso II	alachlor	Med	Stinger	clopyralid
Classic	lactofen	High	Lasso-Atrazine	alachlor & atrazine	Med	Storm	bentazon & acifluorfen
Cobra		Low			High		
Command	clomazone	Med	Lexone	metribuzin	High	Surflan	oryzalin
Commence	trifluralin & clomazone	Low	Lorox	linuron & chlorimuron	Med	Sutan+	butylate
		Med	Lorox Plus		High	Sutazine+	butylate & atrazine

2,4-D Amine	2,4-D amine	Med	Larvin	thiodicarb	Low	Champion	copper-fixed	-
2,4-D Ester	2,4-D ester	Low	Lindane	lindane	High	Crotothane	dinocap	Low
Tandem	tridiphane	Low	Lorsban	chlorpyrifos	Low	Cyrex	dodine acetate	Low
Thistrol	MCPB	High	Malathion	malathion	Low	Daconil	chlorothalonil	Low
Tillam	pebulate	Low	Malathion/ methoxychlor	malathion & methoxychlor	Low	Dithane	mancozeb	Low
Tordon	picloram	High	Mavrik	fluvalinate	Low	Duter	tin	-
Treflan	trifluralin	Low	Metasystox-R	oxydemetonmethyl	Low	Dyrene	anilazine	Low
Turbo	metolachlor & metribuzin	High	Methoxychlor	methoxychlor	High	Karathane	dinocap	Low
Velpar	hexazinone	High	Mitac	amitraz	Low	Kelthane	dicofof	Low
Vernam	vernolate	Low	Mocap	ethoprop	High	Kocide	copper	-
Weedar	MCPA amine	High	Monitor	methamidophos	High	Magnetic 6	hydroxide	-
Weedmaster	dicamba & 2,4-D amine	High	Nudrin	methomyl	High	Maneb	sulfur	-
Weedone- 2,4-DP	dichlorprop -ester	Med	Orthene	acephate	High	Maneb & Zinc	maneb & zinc	Low
Whip	fenoxaprop	Low	Parathion	parathion	Low	Manzate	mancozeb	Low
		Low	Pennacap-M	methyl	Low	Merteck	thiabendazole	Med
INSECTICIDES								
Ambush	permithrin	Low	Phosdrin	parathion	Low	Orbit	propiconazole	Med
Aqua 8-			Phoskil	mevinphos	Med	Penncozeb	mancozeb	Low
Asana XL	parathion	Low	Pounce	permethrin	Low	Polyram	metiram	Low
Bolstar	esfenvalerate	Low	Pydrin	fenvalerate	Low	Protex	maneb	Low
Broot	sulprofos	Low	Rampart	phorate	Low		triphenyl tin	-
Carzol	trimethacarb	Low	Scout-Xtra	tralomethrin	Low	Ridomil	metalaxyl	High
Counter	formetanate	Low	Sevin	carbaryl	Low	Ronilan	vinclozalin	Low
Cygon	terbufos	Low	Somanil	methidathion	Med	Rovral	iprodione	Low
Cythion	dimethoate	High	Supracide	methidathion	Low	Rubigan	fenarimol	High
Diazinon	malathion	Low	Swat	phosphamidon	High	Super Six	sulfur	-
Dimilin	diazinon	Low	Temik	aldicarb	High	Super Tin	tin	-
DiSyston	diflubenzuron	Low	Thimet	phorate	Low	Telone II	dichloropropene	High
Dyfonate	disulfoton	Low	Thiodan	endosulfan	Low	Terrachlor	PCNB	Low
Dyfonate II	fonofos	Med	Trigard	cyromazine	High	Tersan	benomyl	High
Dylox	trichlorfon	High	Vydate	oxamyl	High	That F	sulfur	-
Endocide	endosulfon	Low	FUNGICIDES				sulfur	-
Endocide Plus	endosulfon & parathion	Low	Agasco TN-IV	tin	-	Thiolux	propiconazole	Med
Force	tefluthrin	Low	Agasco MN F	maneb & zinc	-	Tilt	basic copper sulfate	-
Furadan	carbofuran	High	Bayleton	triadimefon	Low	Top Cop	thiophanate methyl	Low
Guthion	azinphos-methyl	Low	Benlate	benomyl	Med	Topsin	triphenyltin	-
Imidan	phosmet	Low	Blitex	maneb & triphenyl tin	Low	Triphenyl Tin	hydroxide	-
Knox-Out	diazinon	Med	Botran	dicloran	Low	Hydroxide	triphenyltin	-
Lannate	methomyl	High	Bravo	chlorothalonil	Low	Triple Tin	hydroxide	-
Larvadex	cyromazine	High	Captan	captan	Low	Vitavax	carboxin	Low
			Carbamate	ferbam	Med	Vorlex	dichloropropene & methyl-	High
							isothiocyanate	Med

Adapted by using the GLEAMS model using pesticide data from **The SCS/ARS/CES Pesticides Properties Data Base for Environmental Decision Making**, Reviews of Environmental Contamination and Toxicology, 1992, Volume 123.

What do I do with these rankings?

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

$$\frac{\text{total of rankings}}{\text{\# of categories ranked}} \text{ divided by } \frac{\text{\# of categories ranked}}{\text{\# of categories ranked}} \text{ equals } \boxed{\text{risk rank}}^*$$

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

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

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

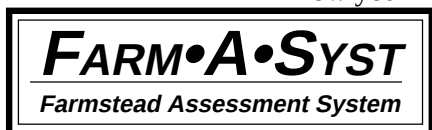
Step 2: Look over your rankings for individual activities:

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

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

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

Step 3: Read Fact Sheet 2, *Improving Pesticide Storage & Handling*, if you haven't already. Consider how you might modify your farmstead practices to better protect your drinking water.



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

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