



Site assessment for groundwater vulnerability to pesticide contamination

E.A. Kerle, P.A. Vogue, J.J. Jenkins, and J.H. Huddleston

The procedure described below helps you assess the potential for a pesticide to reach groundwater on a specific site (field, nursery lot, turfgrass, orchard, or right-of-way). This site assessment procedure helps you consider soil, site, and pesticide information to make informed decisions about pesticide management and avoid pollution of water resources.

An integrated pest management approach may include chemical and non-chemical alternatives to pest management. This worksheet is designed to assess groundwater vulnerability to pesticide contamination by comparing the pesticide movement ratings of chemical alternatives.

This assessment has two parts. Part 1, *Site diagram*, provides space and instructions to sketch a diagram of your site and gives a brief explanation of surface water vulnerability to help you assess potential risks.

Subsurface materials (below the root zone) also influence the potential for pesticides to move toward groundwater. This site assessment does not address subsurface materials. For more information about the influence that subsurface materials at your site may have on transmitting pesticides to groundwater, refer to *Home*A*Syst* Worksheet #10, *Site Evaluation*.

Part 2, *Groundwater vulnerability rating*, helps you complete a worksheet that compares pesticides' tendency to move toward groundwater. You will generate specific groundwater vulnerability ratings for your soils and the pesticides you would use.

You will need

- A county soil survey or knowledge of your soil types
- *OSU Extension pesticide properties database*
- *OSU Extension soil sensitivity database*

Other helpful materials

- U.S. Geological Survey topographic map for your area
- PNW Plant Disease, Weed, and Insect Control handbooks for current year
- EM 8561, *Understanding pesticide persistence and mobility for groundwater and surface water protection*
- EM 8559, *How soil properties affect groundwater vulnerability to pesticide contamination*
- EM 8546, *Home*A*Syst*, particularly Worksheet #10, *Site Evaluation*
- Product labels from pesticides you use

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Part 1, Site diagram

Date _____

A diagram or map of your farm or site can provide useful information to help you understand how the physical layout of the land affects the vulnerability of groundwater and surface water to pesticide contamination.

1. Sketch a diagram of your site, including the location of each field, on these pages. Show surrounding roads, surface water bodies, hills, and other natural or engineered features. (A U.S. Geologic Survey topographic map may be helpful.)

2. Include the following features in your diagram:

- Location of each field with approximate dimensions and acreage, percent slope, and aspect.
- Water resources. Include drinking or irrigation water wells, abandoned wells, reservoirs, lakes, ponds, rivers, streams.
- Buffer strips at the edge of fields—type of vegetation.
- Prevailing wind direction, if appropriate.

3. Give all fields, including fallow fields, a unique name or number (Field ID) so you can tell them apart on Worksheet 1.

4. Identify your soil type(s) using the county soil survey. If feasible, lightly sketch in the location of the different soil types.

Factors that affect surface water vulnerability

Not all surface water bodies are equally vulnerable to pesticide contamination. The highest risk situations involve a combination of the following conditions:

- field located directly upslope and adjacent to a pond or stream,
- pesticide application to foliage or soil surface immediately before heavy rainfall or irrigation that induces runoff or erosion,
- soil with high erosion or runoff potential, and
- pesticide application to a frozen field.

If any of your fields fit the conditions for surface water vulnerability, consider management practices that reduce erosion and runoff. The best management practice to prevent surface water contamination from pesticides is to practice good soil and water conservation.

For areas with high wind erosion potential, plan applications for low wind times or take other precautions to reduce the potential for pesticide loss by wind erosion. These could include planting windbreaks or incorporating the pesticide in the soil, rather than applying it to the soil surface.



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Part 2, Groundwater vulnerability rating

Determining your rating

1. Make enough copies of Worksheet 1 (pages 6 and 7) to provide one table per field for each pest management event. A completed example is provided for your reference (below).
2. Fill in your field ID, crop, and target pest in the heading of each copy.
Proper pest management requires correct identification of the target pest. Verify pest identification with your County extension agent or a competent consultant.

3. Organize the soil information for each field:

- a. Write in the soil types for each field in Column 1.
- b. Locate each soil type in the *OSU Extension soil sensitivity database*. Write the corresponding soil sensitivity rating for each in Column 2. The database contains sensitivity ratings for both irrigated and non-irrigated soils. Use whichever is appropriate.

The soil sensitivity rating is the potential for soil to transmit pesticides to groundwater. It is based on the soil sorption potential and the soil leaching potential. For more information, consult EM 8559, *How soil properties affect groundwater vulnerability*.

If you know that your soil is different than described in the soil survey, consider completing the soil sensitivity rating procedure in Home **Syst* worksheet #10, part 1, step 3 to get a more accurate rating. Characteristics that could make your soil different from the soil survey include deep tilling, cuts, or fill used to prepare seedbed, a nursery lot, or turfgrass.

4. Organize the important pesticide characteristics that affect groundwater vulnerability to contamination.

- a. List your pesticide choices in Column 3. Pesticide alternatives for the target pest may be identified in the current Pacific Northwest pest control handbooks or other appropriate sources of information. Doublecheck product labels for current registration and other regulatory information; legal restrictions could change after the handbooks are printed.

- b. Locate each pesticide in the *OSU Extension pesticide properties database*. The database is arranged alphabetically by each pesticide's common name.

- c. Find and record the Groundwater Ubiquity Score (GUS) and pesticide movement rating for each pesticide in Columns 4 and 5. The pesticide movement rating, developed at Oregon State University, is another way of stating the GUS.

- d. While you have the database in front of you, glance at the other properties of the pesticides you have chosen. Record any comments or questions in the last column. This might include additional information about properties that are rated as very high or as extremely low, or personal experiences in using them.

5. Determine your groundwater vulnerability rating—the potential for a specific pesticide applied to a specific soil to move towards groundwater.

- a. Use the groundwater vulnerability table, page 5, to find the soil sensitivity rating for your soil type on the left edge. Locate the movement rating for a pesticide along the top edge. The two intersect at their groundwater vulnerability rating.

For example, if the soil sensitivity is low and the pesticide movement rating is very high, the groundwater vulnerability rating is moderate. Determine the rating for each soil and pesticide combination and record the results in Column 6.

Field ID 1E2a Crop Summer fallow after winter wheat Target Pest Canada thistle Date 7/8/94

1 Soil type	2 Soil sensitivity rating	3 Pesticides recommended for control of pest	4 GUS value	5 Pesticide movement rating	6 Groundwater vulnerability rating	7 Comments
Shano	Low	clopyralid	5.16	very high	moderate	copy. has high water sol. Time applic. when no storms are forecast
		2,4-D amine	2.00	moderate	low	



Groundwater vulnerability table

Soil sensitivity rating	Pesticide movement rating					
	Extr. low	Very low	Low	Moderate	High	Very high
Very low	Very low	Very low	Very low	Low	Moderate	Moderate
Low	Very low	Very low	Low	Low	Moderate	Moderate
Moderate	Very low	Low	Low	Moderate	Moderate	High
High	Low	Low	Moderate	Moderate	High	Very high
Very high	Low	Moderate	Moderate	High	Very high	Very high

The Groundwater vulnerability chart has been adapted from the Oregon Water Quality Decision Aid, a risk screening tool to evaluate groundwater vulnerability to pesticide contamination.

Interpreting your rating

Any low rating (extremely low, very low, or low) indicates that groundwater contamination is unlikely when the specified pesticide is applied on the specified soil according to label directions. However, be aware of mitigating circumstances that still could result in groundwater contamination.

A moderate, high, or very high rating indicates that the combination of soil and pesticide properties may lead to increased vulnerability of the groundwater to contamination. You might consider using a lower-rated alternative. You also could modify pesticide management practices to reduce the potential for pesticide movement to groundwater. Ensure that you understand the reason(s) for the rating, and apply that knowledge in your pesticide management practices.

The groundwater vulnerability rating is one piece of information to consider when evaluating management practices that may influence water quality. However, it is based on a limited number of soil and pesticide properties that affect pesticide mobility. Other variables, such as application rate, application method and timing, irrigation management, climate, or site-specific topography, may be equally or more important for the protec-

tion of water quality at your site. Familiarize yourself with the complexity of factors that affect pesticide persistence and mobility. Use as much information as possible when evaluating your site, so that your decisions are based on knowledge and experience.

Note choices or changes in your management practices in Column 7. Also note if no change was warranted.

Please note

The pesticide evaluation in this site assessment is based only on the GUS value, which considers pesticide half-life and the sorption coefficient. Many other factors and properties, including water solubility and volatility, influence the fate of a chemical in the environment and the potential for it to contaminate groundwater. Although these other parameters are not used in this assessment, any additional information that is available should be considered. For more information consult EM 8561, *Understanding pesticide persistence and mobility for groundwater and surface water protection*.



Field ID _____

Crop _____

Target Pest _____

Date _____

1 Soil type	2 Soil sensitivity rating	3 Pesticides recommended for control of pest	4 GUS value	5 Pesticide movement rating	6 Groundwater vulnerability rating	7 Comments

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Field ID _____ Crop _____ Target Pest _____ Date _____

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Ordering information

Extension publications

This publication and its companion pieces, EM 8559, *How soil properties affect groundwater vulnerability* (50¢), and EM 8561, *Understanding pesticide persistence and mobility for groundwater and surface water protection* (\$1.00), are available from:

Publications Orders
Agricultural Communications
Oregon State University
Administrative Services A422
Corvallis, OR 97331-2119

We offer discounts on orders of 100 or more copies of a single title. For price quotes, please call (503) 737-2513.

Other publications also available from the above address:

PNW Weed Control Handbook, \$19.50
PNW Plant Disease Control Handbook, \$19.50
PNW Insect Control Handbook, \$19.50

EM 8546, *Home*A*Syst*, a set of 20 publications, \$12.00.

Other documents

The *OSU Extension soil sensitivity database* is available from:

Extension Soil Science
Ag and Life Sciences II, Room 301
Corvallis, OR 97331-7306
(503) 737-5712

The *OSU Extension pesticide properties database* is available from:

Extension Agricultural Chemistry
Oregon State University, Weniger Hall 333
Corvallis, OR 97331-6502
(503) 737-1802.

Agricultural chemistry staff also are developing two informative slide sets to be available in 1994. The first will cover pesticide fate in the environment; the second will discuss risk screening tools for site evaluations.

Other materials

County soil surveys are available from your local Extension office.

U.S. Geological Survey topographic maps may be available at your local bookstore or library, or from:

U.S.G.S. Map Distribution
Box 25286, Federal Center
Denver, CO 81225
(303) 236-7477



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