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OSU Extension Pesticide Properties Database

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The *OSU Extension Pesticide Properties Database* is organized alphabetically by common name. Eight parameters describing pesticide physical and chemical properties are presented. The database includes pesticides that may not currently be registered for use in Oregon, but may have been used historically or may currently be registered for use in other states.

This database relies heavily on *Pesticide Properties in the Environment* (Hornsby et al.) for the parameter values. The values for pesticides that were not listed in *Pesticide Properties in the Environment* either were derived by OSU Extension Service personnel or were obtained from *The Pesticide Manual: A World Compendium* (Tomlin).

The **soil half-life** is a measure of the persistence of a pesticide in soil. Pesticides can be categorized on the basis of their half-life as *nonpersistent*, degrading to half the original concentration in less than 30 days; *moderately persistent*, degrading to half the original concentration in 30 to 100 days; or *persistent*, taking more than 100 days to degrade to half the original concentration. A "typical soil half-life" value is an approximation and may vary greatly because persistence is sensitive to variations in site, soil, and climate.

The **sorption coefficient** (K_{oc}) describes the tendency of a pesticide to bind to soil particles. Sorption retards movement and also may increase persistence because the pesticide is protected from degradation. The higher the K_{oc}, the greater the sorption potential. K_{oc} is derived from laboratory data. Many soil and pesticide factors may influence the actual sorption of a pesticide to soil.

The **GUS** or **Groundwater Ubiquity Score** is an empirically derived value that relates pesticide persistence (half-life) and sorption in soil (sorption coefficient, K_{oc}). The GUS may be used to rank pesticides for potential to move toward groundwater. GUS is derived as follows:

$$GUS = \log_{10}(\text{half-life}) \times [4 - \log_{10}(K_{oc})]$$

The **pesticide movement rating** is derived from the GUS. Movement ratings range from *extremely low* to *very high*. Pesticides with a GUS less than 0.1 have an *extremely low* potential to move toward groundwater. Pesticides with a GUS greater than 4.0 have a *very high* potential to move toward groundwater.

Water solubility describes the amount of pesticide that will dissolve in a known amount of water. Most of the values reported were determined at room temperature (20°C or 25°C). The higher the solubility value, the more soluble the pesticide. Highly soluble pesticides are more likely to be removed from the soil by runoff or by moving below the root zone with excess water.

Vapor pressure is a measure of the tendency of a pesticide to volatilize. The values in this database are listed in scientific notation. Pesticides with vapor pressures less than 1.0×10^{-8} (1.0 E-08) have a low potential to volatilize. Pesticides with vapor pressures greater than 1.0×10^{-3} (1.0 E-03) have a high potential to volatilize.

The **Henry's law constant** (K_h) describes the tendency of a pesticide to volatilize from water or moist soil. It is calculated using the pesticide's vapor pressure, water solubility, and molecular weight. This database reports the Henry's law index in scientific notation as dimensionless units. Pesticides with high numbers have a high potential to volatilize from moist soil.

pKa values are given for pesticides that are weak acids or bases. The pKa is the measure of the strength of an acid or base (as conjugate acid) relative to water. It describes the pH at which the dissociated and associated forms of the acid or base are present in equal parts. pKa can affect water solubility, soil sorption, volatile loss, and chemical and biological degradation over a range of soil pH values (generally 4–10).

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Related OSU Extension materials

How Soil Properties Affect Groundwater Vulnerability to Pesticide Contamination, EM 8559, by J.H. Huddleston (1994). $1.00

A general introduction to the key factors involved in determining a soil's leaching potential and sorption potential. Explains the role of permeability, water table conditions, organic matter content, and clay content.

Determination of Soil Sensitivity Ratings for the Oregon Water Quality Decision Aid, EM 8708, by J.H. Huddleston (1998). $2.50

A detailed technical discussion of the development and interpretation of the soil sensitivity ratings used in OWQDA, including such factors as throughflow potential, runoff potential, and hydraulic loading.

Introduction to the OSU Extension Soil Sensitivity Database, EM 8707, by J.H. Huddleston, W.R. Mendez, M. Brett, E.A. Kerle, and P.A. Vogue (1998). 50¢

A brief introduction to the factors included in the OWQDA soil sensitivity database, including through-flow potential, runoff potential, and hydraulic loading.

An Overview of the Oregon Water Quality Decision Aid (OWQDA), EM 8705, by J.H. Huddleston (1998). $1.00

An introduction to the OWQDA, including a brief explanation of the soil sensitivity and pesticide movement ratings.

Oregon Water Quality Decision Aid Computer Software, EM 8706, by J.H. Huddleston (1998). $25.00

Fully automated version of OWQDA, including the complete pesticide properties database and the complete soil sensitivity database.

The OSU Extension Soil Sensitivity Database (1998).

Hard copy version of the soils database for using OWQDA manually. *Order this publication from the OSU Department of Soil Science (541-737-5712).* There is a nominal fee for photocopying and mailing.

Site Assessment for Groundwater Vulnerability to Pesticide Contamination, EM 8560, by E.A. Kerle, P.A. Vogue, J.J. Jenkins, and J.H. Huddleston (Revised 1998). $1.50

Step-by-step instructions for using OWQDA manually and worksheets for recording your data.

Understanding Pesticide Persistence and Mobility for Groundwater and Surface Water Protection, EM 8561, by E.A. Kerle, J.J. Jenkins, and P.A. Vogue (1994). $1.50

An introduction to key factors involved in determining the potential for pesticides to reach groundwater and surface water. Explains the role of photo-, chemical, and microbial degradation; sorption, plant uptake, volatilization, wind erosion, runoff, and leaching.

How to order

To order copies of the above publications (except for *The OSU Extension Soil Sensitivity Database*), or the OWQDA computer software, send the complete title and series number, along with a check or money order for the amount listed, payable to Oregon State University, to the address below. We offer discounts on orders of 100 or more copies of a single publication and of 10 or more copies of a single computer software program. Please call 541-737-2513 for price quotes.

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Additional references

Gustafson, D.I. 1989. Groundwater ubiquity score: A simple method for assessing pesticide leachability. *Environmental Toxicology and Chemistry* 8:339–357.

Hornsby, A.G., R.D. Wauchope, and A.E. Herner. 1996. *Pesticide Properties in the Environment* (Springer, New York).

Tomlin, C.D.S., ed. 1997. *The Pesticide Manual: A World Compendium*, 11th edition (British Crop Protection Council).