

# Pesticide Environmental Assessment System

## Development of the Pesticide Environmental Impact Model

One unique aspect of *The Lodi Rules*/Protected Harvest certification model is the use of a pesticide environmental impact model in determining whether a vineyard qualifies for certification. Environmental impact models have been developed as tools to quantify the environmental impact of pesticides.

Because of the process used by the U.S. Environmental Protection Agency to register pesticides, extensive data are available on toxicity and environmental impacts of pesticide active ingredients commonly used in agriculture. However, the data is not readily available to most farmers and pest management specialists, and rarely plays a role in guiding the selection of pesticides used in the field. To make these data more useful to growers, commodity groups, food companies, and IPM advisors experts have created pesticide environmental impact models. American Farmland Trust published a description and comparison of eight of these models (<http://www.aftresearch.org/ipm/risk.htm>).

A new type of pesticide impact model, a multi-attribute pesticide risk model (MATF), was developed for the Healthy Grown® certification program. The Healthy Grown program and Protected Harvest grew out of a collaboration involving the World Wildlife Fund (WWF), Wisconsin Potato and Vegetable Growers Association (WPVGA), and University of Wisconsin (UW). The goals of the WWF-WPVGA-UW potato IPM collaboration included establishment of a pesticide risk measurement system and a method to measure progress along the IPM continuum. The MATF model was initially developed and applied to estimate a 1995 baseline of potato pesticide use and risks (Benbrook et al. 200). It then was incorporated into their certification program. Future work with other certification programs resulted in a modification of MATF into a Pesticide Environmental Assessment System (PEAS) that is used in *The Lodi Rules* program.

In developing PEAS several major changes were made in the basis and focus of the multiattribute toxicity measurement system approach, and the parameters used to estimate individual indices, compared to the Wisconsin collaboration's MATF model. The biggest difference between the Wisconsin project multiattribute model and PEAS is that the Wisconsin model estimates potential pesticide toxicity, without regard to whether the target organisms reflected in the indices are actually exposed.

The basic metric is calculated by multiplying the pounds of a pesticide applied by its toxicity factor. While PEAS uses toxicity factor values similar to the Wisconsin model and also incorporates use rates in estimating per acre toxicity units, it also strives to take into account, to the extent possible, factors impacting likely levels of exposure based on where, when, and how a pesticide is applied. This process leads to a set of use-specific Use Pattern Adjustment Factors (UPAFs). For example, an in-season, liquid foliar application is assumed to pose the highest potential exposure for workers and most non-target organisms, and corresponds to a use pattern adjustment factor (UPAF) value of 1.0 (no downward adjustment in expected exposure levels). A change in use

pattern to, for example, a pre-plant soil-incorporated granular application, would result in a UPAF of 0.2, reflecting the lessened potential for exposure to workers. Accordingly, the Wisconsin MATF model projects potential risks, while PEAS is designed to rank relative risks taking into account factors impacting exposure levels.

Pesticides pose many different types of risks to a diverse array of non-target organisms including people, small aquatic organisms, fish, birds and bees, beneficial insects, soil microorganisms, worms, plants, and other wildlife. The majority of data on pesticide hazards are based on measures of acute lethality to common test organisms after short-term exposures to a defined dose or concentration of a pesticide. To the full extent possible, the relative risk indices in MATF and PEAS are driven by toxicity data collected on the same organism at the same life stage, exposed in the same way for the same duration of time.

Risks can arise from multiple routes of exposure (for people, via food, water, dermal, or inhalation exposure). Some exposures are short-term in nature (acute risks), and others occur steadily over a long period of time (chronic risks).

*The Lodi Rules* PEAS model currently contains five component indices measuring:

- worker acute risks
- dietary risks to people from acute and chronic exposure
- acute risks to small aquatic invertebrates
- acute risks to birds
- acute risks to bees and pest natural enemies

Each of these indices is used independently to assess relative risks to a specific class of organisms on a per acre treated basis. For *The Lodi Rules* program, PEAS is used to calculate multiattribute risks spanning all of the above five indices. Because the certification committee felt that all five indices were equally important, the PEAS model weighs them equally.

## Using *The Lodi Rules* PEAS model

The PEAS model was used to calculate pesticide environmental impact for each formulation of pesticide used in Lodi vineyards. Calculations were based on pesticide use in San Joaquin and Sacramento County vineyards; data on rates were obtained from the California Department of Pesticide Regulation's Pesticide Use Reporting database for 1999 to 2001 (<http://www.cdpr.ca.gov/docs/pur/purmain.htm>). For those unfamiliar with this database, it is a full pesticide use reporting system. Pesticide use data were also obtained from LWWC's BIFS database which has monitored full pesticide use in 70 vineyards throughout California Crush District #11 from 1995 to present.

First, pesticide environmental impact units were calculated for one pound of each pesticide active ingredient. These values were then adjusted in accord with the applicable Use Pattern Adjustment Factor (UPAF), in order to make estimates of environmental impacts per acre treatment reflect

the impacts on exposure of the specific formulation, treatment timing, method of application (such as soil-applied, ground-applied, aerially-applied), and the target site (foliage, soil, etc.). The results were then converted to impact indices for the commonly used unit of each formulated pesticide. For example, sulfur is applied in lbs per acre so the impact index for a pound of sulfur was calculated. On the other hand Pristine is applied in ounces per acre so the impact index for an ounce of Pristine was calculated.

Appendix A contains the environmental impact index of the common unit of application for each pesticide used in Lodi vineyards. A calculation for one application of a pesticide is illustrated using sulfur dust as an example. The environmental impact index for one pound of formulated sulfur dust active ingredient is 0.154 (Appendix A), so the total number of environmental impact units for an application of 15 lbs. of formulated sulfur is  $15 \times 0.154$  or 2.31.

Table II presents the calculation of total environmental impact units for pesticides applied to a representative Lodi vineyard for the entire season of 2004.

**Table II. PEAS Model Environmental Impact Units calculation for a “representative” Lodi vineyard**

<b>Input Date</b>	<b>Chemical Name</b>	<b>Rate/Acre</b>	<b>Units</b>	<b>lbs AI* / Acre</b>	<b>Impact Index/lb AI</b>	<b>Impact Units/Acre</b>
4/13/2004	Sulfur dust	15	lbs	14.70	0.157	2.31
4/22/2004	Sulfur dust	15	lbs	14.70	0.157	2.31
5/3/2004	Sulfur dust	15	lbs	14.70	0.157	2.31
5/13/2004	RoundUp Ultra Dry	0.92	lbs	0.66	0.328	0.06
5/16/2004	Sulfur dust	14	lbs	13.72	0.157	2.15
5/29/2004	Sulfur dust	15	lbs	14.70	0.157	2.31
6/2/2004	Rally 40W	3.88	ozs	0.10	3.137	0.30
6/24/2004	Provado It is Solupak 75% WP	0.63	ozs	0.03	116.28	3.44
6/24/2004	Acramite 50 WS	0.87	lbs	0.44	1.64	0.71
6/24/2004	Pristine	11.49	oz	0.26	0.75	0.20
7/28/2004	Gramoxone Max**	1	pints	0.52	0.32	0.05
7/31/2004	RoundUp Ultra Dry**	0.63	lbs	0.45	0.328	0.04
<b>Total Impact Units for Season:</b>						<b>16.20</b>

\*AI = Active Ingredient

\*\*Herbicide was applied to 1/3 of vineyard acres so Impact Units were calculated accordingly