TECHNICAL NOTES

Pest Management: Pesticide Environmental Risk Assessment Using WIN-PST, Version 3.0

Introduction

The Natural Resources Conservation Service (NRCS) policy specifies that evaluation and interpretation of environmental risks associated with pest management and pesticide use are required for the pest management component of a conservation plan.

NRCS's Windows Pesticide Screening Tool (WIN-PST) is a "Tier 1" or basic level screening tool, based on the Soil/Pesticide Interaction Screening Procedure (SPISP2) developed by Goss and Wauchope (1990). It is designed to evaluate the potential for off-site movement of pesticides through leaching, dissolved in runoff or attached to sediment in runoff. The SPSIP2 algorithm is based on GLEAMS (Groundwater Loading Effects of Agricultural Management Systems – Leonard et al. 1987) model results, with hypothetical soil and pesticide combinations under an extreme artificial rainfall regimen. Those soil and chemical properties with the greatest impact on transport (most sensitive parameters) were incorporated into SPISP2. Basic management techniques that can impact off-site movement and rainfall probabilities were also incorporated into the model. The soil and chemical properties and management/rainfall information used by SPISP2 and WIN-PST are listed in Table 1.

WIN-PST uses these soil and chemical properties to determine the capacity of a soil to retain a pesticide at the point of application, regardless of climate or management inputs. Then, pesticide toxicity (long-term only) is combined with the potential for exposure (off-site movement, with rainfall/management inputs) to determine the relative hazard rating (likelihood of exceeding the toxicity threshold when applied at typical rates). This is the soil/pesticide interaction report generated by WIN-PST. Those soil/pesticide combinations with a hazard rating of INTERMEDIATE **or greater** require planned mitigation in order to meet quality criteria.

The USDA-NRCS National Water and Climate Center developed and supports the WIN-PST tool. A new version of WIN-PST (Version 3.0) was released in November 2005. There has been no change in the soil/pesticide interaction methodology, but the new version provides a new user interface, and allows users to save soils, pesticides or soil/pesticide scenarios that they typically utilize. Soils data are taken directly from the SSURGO Access files used by Toolkit and other Field Office applications. Reports can be saved as Acrobat "pdf" documents or can be saved to an EXCEL spreadsheet.

Installation of WIN-PST 3.0

WIN-PST 3.0 must be installed by an administrator on XP and NT platforms. Make sure that *All Users* is chosen during installation (the default is "All Users"). If *Only Me* is selected, only the administrator will be able to fully use the program. To download the program, click on the link http://www.wsi.nrcs.usda.gov/products/W2Q/pest/winpst.html and select *WIN-PST 3.0 - NRCS Download Site (FTP)*.

Collecting Input Data for Use in WIN-PST 3.0

A data collection worksheet (Attachment 1) is provided for the planner's use to collect pesticide use information from the producer. The worksheet is not required, but the specific information requested should be recorded, and is needed to run the tool. Additionally, the planner will need to know the major soil(s) where the producer is applying pesticides.

Setting Up and Using Win-PST 3.0

A complete user guide for WIN-PST 3.0 is available at:
ftp://ftp.wcc.nrcs.usda.gov/downloads/pestmgt/Getting_Started.pdf

The User Guide should be downloaded and available on your computer for reference purposes.

WIN-PST version 3.0 is an updated user interface for WIN-PST. A brief summary describing setup and use of the tool is provided below.

Location of the WIN-PST Program
WIN-PST 3.0 is installed into **C:\Program Files\USDA\WIN-PST 3** on your computer. Go to the START button at the bottom left of your screen (start menu). Select **All Programs**, then **Engineering Applications,** and click on **Win-PST 3** to open the program.

Selection of Soils Database
 The **Select Soils and Pesticides** screen will appear when you open WIN-PST. Before you can use it, you will need to select the soils database for your county. WIN-PST 3.0 now uses the SSURGO - ACCESS soils database file used in Toolkit.

- Click on the **Open New** tab at the top left of the screen, then select **Data Management**. This opens the Data Management screen where you will select the appropriate soils database.
- Put a check mark in the box at the bottom left of the screen to use the **SSURGO MDB** *file*.
- Use the browse button on the bottom right to locate the SSURGO ACCESS database for your county. If you see a temporary error message, IGNORE IT. Find your SURRGO database and double-click on it.
- The **Survey Areas to Use** section should show your survey area (highlighted in dark green). Click on the > (right arrow button) to select that area and move it to the right.

- Close the data management window by clicking the **Close** button at the bottom right.

Selecting Soils

Make sure you are on the Soils page (click on the **Soils** tab at the top if needed).

- Use the **Locate Records** search function to quickly find soils, either by **Comp_Name** or **MUSYM**. The grid will move to the first record that begins with or contains the letter(s) typed in.
- Select a soil (entire row will be highlighted in dark green) and click the **ADD** button to place it in the soil "queue" at the bottom. You can edit certain soil properties (such as slope, OM, depth, etc.) if desired.
- If you want to delete a selected soil, select that soil from the list in the queue. Then click on the **DEL** button at the left.
- Once you have added the soils of interest, then you can select the pesticides used.

Selecting Pesticides

You can select pesticides using active ingredient (**AI** page) or product name (**Products** page) by selecting the desired tab at the top.

- Use the **Locate Records** search function to quickly find pesticides, either by **Name** or **EPA Reg No**. The grid will move to the first record that begins with or contains the letter(s) typed in.
- Select a pesticide (entire row will be highlighted in dark green) and click the **ADD** button to place it in the pesticide "queue" at the bottom. You can change the default management associated with the pesticide applications by clicking on **App_Area**, **App_Method**, and/or **App_Rate** for the selected pesticide. You can evaluate the same pesticide with different management simply by adding each choice individually to the pesticide queue.
- If you want to delete a selected pesticide, select that pesticide from the list in the queue. Then click on the **DEL** button at the left.
- Formulations may have more that one active ingredient. In this case, rate the entire product by the most hazardous active ingredient.

Selecting Rainfall Probability

- Click on the **Interactions** tab at the top of the screen.
- Select the appropriate rainfall probability.
- The default setting is High, signifying a high probability that significant rainfall OR irrigation will occur soon (typically within a few days) after pesticide application.

Creating Scenarios

You can save soils and/or pesticides in the current queue to use at a later date or to create typical scenarios for your area. It is not necessary to save scenarios to create a WIN-PST report.

- To save the scenario you have created, click on the **Save** button on the right bottom. A **Scenario** pop-up screen appears.
- Enter a name on the **Jobname** line on the pop-up screen.

- You do not need to fill in **Categories 1-3**, but you can use these categories to provide information to help you identify specific groupings.
- Select **OK** to save the scenario under the given name. You can pull up or select saved scenarios from the Scenario page for future reports.
- If you select a saved scenario and click on **ADD**, it will add all the saved soils and/or pesticides to the current queue of soils and pesticides (provided you have already selected some).
- Any soil or pesticide can be removed from the queue by selecting it (highlight) and clicking the **DEL** button.

Creating Reports

To create reports, click on the **Reports** button at the bottom right of the screen. The **Reports** pop-up screen appears.

Exporting reports to Excel (**Mandatory**):
- The Pest Management component of a conservation plan <u>MUST</u> include the Idaho Pest Management Worksheet. In order to use this Excel spreadsheet, be sure to put a check in the EXPORT box next to **Interactions Path\File Name**. It must be located at the following path:

  C:\Program Files\USDA\WIN-PST 3\Exports\Interactiondata.xls.

- This path is the default path – **<u>DO NOT CHANGE IT</u>**. Select either the **Excel Only** or the **Both** radio button at the bottom.
- Click on the **Export** button. Select **OK** when the message asks to overwrite the existing file for the Excel file and the text file.
- **The Idaho Pest Management Excel spreadsheet will harvest the information from the interactions report and assist in developing the pest management component of your conservation plan.**

Printing/Saving text reports (optional):
- You can enter producer information to be written to the printable report by placing a check in the **User Data** box. Then type in the producer name, tract and field numbers.
- If you want to print out a report, then put a check in the Interactions.rpt under the **Select Reports** window. You may also select the pesticides and/or soils reports, if interested in more specific information. If you click on the plus (+) sign next to any of the report check boxes, then you can select the specific information you want the report to include.
- You can preview the reports and then print them out. Either select a destination printer or select **Adobe pdf** to save the report to your computer.

Procedure for Risk Analysis and Interpretation

A resource inventory for any plan should include all pesticides used, application method and timing of use. Attachment 1 provides a data collection form you can use to provide this information. With this information, an environmental risk analysis can be conducted using WIN-PST 3.0 that is specific to site conditions (refer to section A). For more general planning purposes, WIN-PST checklists developed for Idaho can also be used to evaluate potential risk (refer to section B). Both procedures are described below.

A. Utilizing WIN-PST Version 3.0 and the Idaho Pest Management Worksheet for Planning

Acquiring Interaction Data and Making Interpretations
Once you have run WIN-PST 3.0 and exported the interactions report to the Excel file, then open the Idaho Pest Management Worksheet (Excel spreadsheet).

- When the dialog box opens, select **Update** to harvest the information from the interaction report. The program is looking for a specific filename in a specific location (c:\Program Files\USDA\WIN-PST 3\Exports\ Interactiondata.xls).
- If you have altered the file name and path from the default file name and path, the spreadsheet WILL NOT WORK.
- There is also an **Update** button at the top right on the **Worksheet** page of the spreadsheet that will perform the same function.

The pesticides and soils from the interaction report, with the interaction ratings, will automatically populate the spreadsheet.

- **IMMEDIATELY rename the spreadsheet and save to your computer.**
- When the data has been imported into the spreadsheet, click on the **Show Pesticide Hazard** button at the upper left of the **Worksheet** page.
- The hazard rating results are color-coded for easy visualization of hazardous chemicals (red for Extreme, Orange for High, Yellow for Intermediate hazard).
- This **Worksheet** is a summary report of the WIN-PST interaction report and can be printed out, if desired, and placed in the planning folder.

To evaluate the hazards and determine appropriate mitigations needed (if any), click on the **Jobsheet** tab.

- Click on the **Evaluate Risk** button to determine if mitigating practices are needed to address loss or hazard issues, and for which transport modes.
- A red highlighted YES will appear in any Hazard Category/Mode of Transport combination if the risk is Intermediate or greater, thus requiring mitigation.
- This provides an interpretation of the results and clearly indicates whether mitigation is required.
- **Proceed to "Determining Management and Mitigation Requirements" after next section.**

B. Utilizing Idaho WIN-PST Checklists and the Pest Management Worksheet for Planning

A comprehensive sensitivity analysis of WIN-PST has been completed. The analysis evaluated a matrix of various soil characteristics from a subset of the state-wide soils database. WIN-PST checklists have been developed based on this analysis for the majority of pesticide products currently used in Idaho. There are eight different checklists, based on soil texture. The checklists can be used in lieu of completing site-specific WIN-PST runs for basic planning purposes. For more specific studies, or where more detailed information is desired, the WIN-PST 3.0 program should still be used. The checklists provide an indication of the human and/or aquatic life hazard, as well as the mode(s) of off-site transport. The planner still needs to provide a description of the planned mitigation practices based on hazards and transport mechanisms indicated on the checklists. These practices and techniques should be tailored to the specific site. **Completion of the Pest Management Worksheet – "Jobsheet for Checklist" is MANDATORY.**

- Identify the pesticides used based on producer records, or have the producer check off the pesticides used right on the Checklist. Using the WIN-PST "Data Collection Worksheet" may be helpful.
- Identify the representative soils where pesticides are applied – need to know soil texture and whether a high water table exists.
- Use the current WIN-PST checklist (http://www.id.nrcs.usda.gov/technical/win_pst.html) for the appropriate soil texture. There are eight different checklists available based on soil texture (sand; fine sands or loamy sands; sandy loam; sandy clay loam; loam; silt loam; silty clay or silty clay loam; clay or clay loam).
- Check off all pesticides used. Include pesticides used for all crops in rotation if producer has the information.

- Identify any hazardous chemicals and their mode(s) of off-site transport.
    - **H** in any column indicates an INTERMEDIATE or greater risk to HUMANS
    - **F** in any column indicates an INTERMEDIATE or greater risk to FISH/AQUATIC LIFE
    - A blank in any column indicates a WIN-PST 3.0 rating of LOW or VERY LOW
  - Shaded chemicals are EXTREME hazard or pesticides detected in Idaho groundwater (refer to table endnotes).

  - Columns for different modes of transport are shown.

    - **Leaching**
    - In solution with **Runoff**
    - Via **Erosion**, adsorbed to soil particles

  - If <u>ANY</u> pesticides applied by the producer have an INTERMEDIATE OR GREATER RISK level for fish or humans, then mitigating practices or techniques are required.

  - Use **Idaho Pest Management Worksheet** (Excel spreadsheet) to interpret risk and identify appropriate mitigating practices. Open the **Idaho Pest Management Worksheet**. When the dialog box opens, select **Don't Update**, then **IMMEDIATELY rename the spreadsheet and save to your computer.**

- Click on the **Jobsheet for Checklist** tab at the bottom. Summarize the Win-PST checklist results by clicking YES or NO under each Loss/ Hazard category and associated transport mode (leaching, runoff, erosion).

Determining Management and Mitigation Requirements

WIN-PST soil/pesticide interaction ratings with LOW or VERY LOW generally meet RMS criteria and don't require mitigation. However, where alternative Integrated Pest Management (IPM) methods are available, use of pesticides with LOW or VERY LOW ratings may not be appropriate. Pesticides with interaction ratings of INTERMEDIATE or greater require mitigation. Higher hazard pesticides may require more extensive mitigation, depending on the transport mode and conditions. For example, hazard ratings of HIGH or EXTREME for leaching is difficult to mitigate without the use of a less hazardous pesticide.

WIN-PST ratings are estimated at the edge of the field or bottom of the rooting zone so impacts to surface or ground water are not measured directly. Significant attenuation of chemical contaminants may occur prior to reaching surface or ground water. Many mitigation strategies attempt to maximize this attenuation to reduce impacts to water quality. Regardless of the hazard ratings obtained, ALL pest management plans must incorporate IPM principles of pest management.

- Proceed to **IPM Approaches** on the **Jobsheet** (or Jobsheet for Checklist). Basic scouting and pest inventory is a <u>mandatory</u> component of the pest management plan. Basic information on scouting is available on the Idaho NRCS intranet at:

  ftp://ftp-fc.sc.egov.usda.gov/ID/technical/pdffiles/ipm_checklistguidance1_1105.pdf

- If additional techniques are available (such as cultural practices or advising caution for high hazard pesticides), then select these choices from the right hand column.
- Are leaching risks indicated? If so, choose appropriate practices in the "Practices to Address Leaching Risks" section. For irrigated crop and pasture, irrigation water management is one of the most important mitigation practices.
- Do the same for runoff and/or erosion risks. Practices selected may help retain soil within the field and/or reduce runoff from the field or may reduce transport or filter runoff between the field and the surface water body.
- If there are specific recommendations or sensitive areas, indicate these in the "Additional Comments" section.

Once completed, the resulting Pest Management Plan provides the basic interpretation of risk and the recommended mitigation to achieve surface and ground water quality criteria for pesticides. The Idaho Pest Management Worksheet is required where Conservation Practice 595 applies.

Environmental analysis of recommended pesticides is done within the framework of an Integrated Pest Management (IPM) program. Use IPM guidance by crop when available, or general IPM principles. IPM is an important component of pest management, and can reduce the reliance on pesticides of all hazard levels. IPM includes:

- Scouting and pest inventory
- Use of established economic thresholds before control measures are utilized
- Non-chemical methods of prevention, avoidance, and control
- Substitution of high-hazard chemicals (NRCS does NOT make pesticide recommendations; producers need to consult crop advisors or Extension personnel)

Further guidance on IPM strategies in available at:

http://www.uidaho.edu/wq/wqpubs/cis938.html

References

Goss, DW, and DR Wauchope. 1990. The SCS/ARS/CES pesticide properties database: II. Using it with soils data in a screening procedure. IN: DL Weigmann (ed). Pesticides in the Next Decade: The Challenges Ahead, Proceedings of the Third National Research Conference on Pesticides, November 8-9, 1990.

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Leonard, RA., WG Knisel, and DA Still.1987. GLEAMS: Groundwater Loading Effects of Agricultural Management Systems. Trans., Amer. Soc. of Agric. Engrs. 30:1403-1418.

USDA-NEDC Course: Pest Management in Conservation Planning, Module 5, Part D.

USDA-NRCS-New Mexico. 2005. Pest Management Job Sheet.

USDA-NRCS. 2005. WIN-PST Version 3.0, "Getting Started Guide". Climate and Water Center.

Table 1. Soil and chemical properties, and management techniques, used in the WIN-PST screening tool to evaluate the potential for off-site movement of pesticides.

SOIL PROPERTIES	CHEMICAL PROPERTIES	MANAGEMENT/RAINFALL
Surface horizon thickness	Solubility	Extent of application to field (i.e. broadcast vs. banding/spot treatment)
Organic matter content at surface	Soil half-life	Rate of application
Subsurface texture	Organic carbon partitioning coefficient (Koc)	Method of application (foliar, surface, incorporated)
Hydrologic soil group		Likelihood of rainfall/irrigation following application
Slope		
Preferential flow potential		
High water table		

Table 2. Parameters Contained in the Soils Database

Parameter Code	Definition
MUSYM	Map unit symbol
PCT_COMP	Component percent of map unit
COMP_NAME	Component name
TEXTURE	Textural class
HYDRO	Hydrologic soil group
USER_OM	Percent organic matter in first horizon, user can adjust
USER_DEPTH	Depth of the first horizon, user can adjust
KFACT	Soil erodibility factor
SLOPEGR15	Indicates slope is greater than 15%
CRACKSGR24	Indicates that macropores connected to the surface or preferential flow exists within the top 2 feet
HWT_LT_24	Indicates that a high water table exists within the top 2 feet
SLP	Rating factor – soil leaching potential
SSRP	Rating factor – soil solution runoff potential
SAPR	Rating factor – soil adsorbed runoff potential
HI_DEPTH	Default depth of first horizon
OM_H	The high range of organic matter for the soil, default value
OM_L	The low range of organic matter for the soil, default value
PHH	The highest pH for the soil
PHL	The lowest pH for the soil
ROCKDEPTHH	High range of depth to rock, default value
ROCKDEPTHL	Low range of depth to rock, default value
SEQNUM	Sequence number
SHRINKSW	Shrink-swell properties
SLOPE_H	High range of slope for the soil, default value
SLOPE_L	Low range of slope for the soil, default value
SSANAME	State soil survey name
WTBEG	The beginning date for the presence of a high water table
WTDEPH	High range of depth to water table, default value
WTDEPL	Low range of depth to water table, default value
WTEND	Then ending date for presence of a high water table
WTTKIND	Type of high water table (e.g., apparent, seasonal)

Table 3. Parameters in Pesticide Database (Active Ingredient Selection and Products Selection).

Parameter Code	Definition
Active Ingredient:	
NAME	Name of the active ingredient, common chemical name
PCCODE	PC code associated with the active ingredient
PH	pH at which the active ingredient property is valid
HL	Field half-life of the active ingredient
KOC	Soil sorption coefficient
SOL	Water solubility
APP_AREA	Management factor – application area (broadcast or banded or applied to less than 50% of the field)
APP_METHOD	Management factor – application method (surface, soil incorporated, or foliar)
APP_RATE	Management factor – application rate (standard is > 0.25 lb ai/ac, ultra low is < 0.1 lb ai/ac, otherwise low)
PLP	Rating factor – pesticide leaching potential
PSRP	Rating factor – pesticide solution runoff potential
PARP	Rating factor – pesticide adsorbed runoff potential
HUMANTOX	Long-term human toxicity
HUMANTOXT	Long-term human threshold in ppb
MATC	Maximum acceptable toxicant concentration, long-term threshold for fish in ppb
STV	Sediment toxicity value, long-term threshold for fish (KOC x MATC)
EATHUMAN	Exposure adjusted toxicity class, based on long-term human toxicity thresholds
EATMATC	Exposure adjusted toxicity class, based on long-term fish toxicity threshold
EATSTV	Exposure adjusted toxicity class, based on long-term sediment toxicity threshold
CAS_NO	Chemical abstract service registration number
Product:	
NAME	Product name as sold
EPAREGNO	EPA pesticide registration number
PC_NAME	Produce name
PC_CODE	PC code associated with the active ingredient
PC_PCT	Percent active ingredient in the product
APP_AREA	Management factor – application area (broadcast or banded or applied to less than 50% of the field)
APP_METHOD	Management factor – application method (surface, soil incorporated, or foliar)
APP_RATE	Management factor – application rate (standard is > 0.25 lb ai/ac, ultra low is < 0.1 lb ai/ac, otherwise low)

PESTICIDE DATA COLLECTION SHEET

Crop	Target Pest	Product Name or Active Ingredient (AI)	% AI	Broadcast or Banded	Application: Surface, Foliar or Soil Incorporated	Rate: Standard, Low or Ultra Low