

Documentation for Worksheets
Version 4.0 -
Human Health and Ecological Risk Assessments

Submitted to:

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Revision Notes

Version 4.01 to Version 4.02

This is a minor modification to SERA WSD V4.01-1a dated May 4, 2005, which was released with Version 4.01 of the worksheets. In response to Forest Service comment, a list of abbreviations has been added. Other changes are minor. This revised documentation is being released with Version 4.02 of the worksheets. The Version 4.02 worksheets differ slightly from those of Version 4.01. Series B worksheets now include B05 (dermal permeability) and B06 (first-order dermal absorption rate). These were inadvertently omitted from the Version 4.01. In addition, the **General Notes** worksheets (the second worksheet in the workbook) has been slightly elaborated to include information about the support files used to create the workbook.

Version 4.03

Corrects some minor errors and added some template worksheets. These are detailed in the Documentation for Forest Service Worksheet Program Version 4.0, SERA WSPD V4.03-1a dated August 13, 2005.

Version 4.04

The worksheet driver for 2,4-D has been changed so that the proportion of the consumption of contaminated vegetation by a large bird in the chronic exposure scenario (Worksheet F13b) is not 100% for the central, lower, and upper value. This is consistent with the assumptions for this exposure scenario in all of the workbooks for the other chemicals.

Other worksheet drivers have been modified to include acute and chronic consumption of both contaminated fruit (the old standard) as well as contaminated broadleaf vegetation.

A new macro has been added to the workbooks, Set100PerCentView. This macro simply sets the view for all of the worksheets to 100%. The typical default is 75%. This macro must be called by hitting Alt-F8.

Lastly, the Table of Contents worksheet (the 5th worksheet in each workbook that is named *Contents*) has been enhanced. By double clicking on a worksheet name in column one, you will be taken to that worksheet.

ACRONYMS, ABBREVIATIONS, AND SYMBOLS

a.e.	acid equivalents
AEL	adverse-effect level
a.i.	active ingredient
BCF	bioconcentration factor
bw	body weight
CI	confidence interval
cm	centimeter
DAA	days after application
DAT	days after treatment
d.f.	degrees of freedom
EC _x	concentration causing X% inhibition of a process
EC ₂₅	concentration causing 25% inhibition of a process
EC ₅₀	concentration causing 50% inhibition of a process
EEC	Expected environmental concentration
F	female
FH	Forest Health
g	gram
ha	hectare
HQ	hazard quotient
k _a	absorption coefficient
k _e	elimination coefficient
kg	kilogram
K _{o/c}	organic carbon partition coefficient
K _{o/w}	octanol-water partition coefficient
K _p	skin permeability coefficient
L	liter
lb	pound
LC ₅₀	lethal concentration, 50% kill
LD ₅₀	lethal dose, 50% kill
LOAEL	lowest-observed-adverse-effect level
m	meter
M	male
mg	milligram
mg/kg/day	milligrams of agent per kilogram of body weight per day
mL	milliliter
MW	molecular weight
NOAEL	no-observed-adverse-effect level
NOEC	no-observed-effect concentration
NOEL	no-observed-effect level
NOS	not otherwise specified
OM	organic matter
ppm	parts per million
RfD	reference dose
SERA	Syracuse Environmental Research Associates
UF	uncertainty factor
U.S.	United States
USDA	U.S. Department of Agriculture
U.S. EPA	U.S. Environmental Protection Agency

1. Introduction

As part of a series of Human Health and Ecological Risk Assessments prepared for the USDA/Forest Service between 1998 and now, SERA developed WordPerfect and EXCEL worksheets as an internal tool for many of the calculations used in human health risk assessment (HHRA) and ecological risk assessment (ERA). These worksheets were eventually incorporated as attachments to the risk assessments and are being modified as necessary as additional risk assessments are conducted.

This current version of the worksheets is a substantial modification to previous versions – i.e., Version 2-04 for herbicides and Version 3.01 for agents used to control the gypsy moth. The 2-04 Version worksheets were based on a fully functional set of WordPerfect worksheets with a supplemental but limited set of worksheets in EXCEL to check calculations. The Version 3.01 worksheets were expanded and implemented only in EXCEL. The WordPerfect worksheets are discontinued. The Version 3.01 worksheets, however, did not contain all of the functionality of the more developed WordPerfect worksheets.

The Version 4.0 worksheets contain all of the functionality of the older WordPerfect worksheets as well as some additional features described below. Version 4.0 worksheets are generated using a program developed for the Forest Service. A copy of this program is currently available at www.sera-inc.com. In the near future, a copy of this program should be available at the Forest Service Forest Health Protection web site: <http://www.fs.fed.us/foresthealth/pesticide/work.htm>.

This document addresses only the worksheets that are produced by the program. This documentation encompasses the Version 4.02 release. Unless a new version of this documentation is released, this documentation will also encompass any subsequent releases up to and including Version 4.09.

Documentation for running the program used to develop these worksheets is available at the SERA web site and will probably be available soon at the Forest Service web site.

2. Mini-Documentation for Different Groups of Users

2.1. General Note

The worksheets are contained in a single file, an EXCEL workbook. The worksheets may be used by individuals reviewing or reading the risk assessments, individuals involved in the preparation of environmental documentation, or individuals modifying the worksheets for a different chemical. Each of these uses is discussed in the subsequent subsections.

Note that the worksheets contain macros. If you open the workbook in EXCEL, you may receive a message asking if you want the macros to be enabled. (EXCEL macros can contain viruses.) If you are just going to look at the worksheets (and not modify anything) it does not matter if you allow the macros to be activated. If you plan on changing any values, the macros must be

enabled or some of the automatic rounding and formatting features will not work. If the worksheets do not appear to work at all, your security setting in EXCEL may be set to the highest level. In this case, you will not receive any notice concerning macros but the macros will be disabled and the features of the workbook discussed in this documentation will not work. To check your security setting in EXCEL, use the menu series: Tools –> Macros –> Security.

2.2. Reviewers or Readers

Most individuals involved in reviewing or using the worksheets in combination with the full risk assessment will only need to look at **Series E** and **Series G** worksheets. These are the worksheets that summarize both the exposure assessments and risk characterizations. All of the worksheets which summarize exposures make reference to the more detailed calculation worksheets in which the exposure assessments are derived. These detailed calculation worksheets can be readily identified (see Section 3 for a discussion of the worksheet structure). The calculation worksheets should be very easy to follow and all calculations should be totally transparent. Nonetheless, the rationale for the calculations are described in the risk assessments and documentation for the risk assessments rather than in the worksheets.

2.3. Individuals Involved in the Preparation of Environmental Assessments

These worksheets are designed to make it relatively easy for users involved in the preparation of environmental assessments or environmental impact statements to modify the input parameters for a specific application. Only modest familiarity with EXCEL is needed.

If you want to modify the application rate used in this workbook, go to the **A01** worksheet in the workbook. In this worksheet, change the application rate and/or the application volume(s). For weak acids (i.e., many of the herbicides), this must be entered as units of acid equivalents (a.e.) – i.e., lb a.e./acre. For other compounds, enter the application rate as active ingredient (a.i.) – i.e., lb a.i./acre. Never use units of lbs formulation/acre. If you are uncertain about whether to use a.i. or a.e., refer to the risk assessment or seek further guidance (e.g., a Pesticide Coordinator).

Both the application rate section and the application volume section of this worksheet are structured to allow the input of a central rate as well as the lower and upper bounds of a range. **For the application rate, however, all three values for the application rate – central, lower, and upper – should be identical.** The new method for handling multiple application rates, which was developed near the end of the Version 4.0 effort, is discussed below. In future versions of the worksheets, the lower and upper ranges for application rates will be removed.

The application volumes can be entered as a range if appropriate. Also in Worksheet **A01**, the concentration in field solutions (in units of mg/L) is calculated based on the application rate and application volume. The number of significant digits used in this calculation may be adjusted by changing the pink cells in Worksheet **A01**. The default is to round all calculations of field concentration to 2 significant digits. [Note that this is the only place in the worksheets where values are numerically rounded – i.e., the EXCEL Round() function is used.]

As an alternative to using a range of application rates in Worksheet **A01**, a more flexible method of addressing variations in application rates has been incorporated into the risk summary sheets (Series E and G). Each risk characterization worksheet (e.g., E02, E04, G02, and G03) contains a cell at the top of the worksheet that gives the central application rate from Worksheet **A01**. This is illustrated below for a sample E02 worksheet.

Risk Characterization for Workers at Central Application Rate						
Application Rate:		0.045	lbs/acre			
Application Rate Factor:		1	unitless			
Exposure Worksheet:		E01				TrToxSum
Scenario	Receptor	Hazard Quotient			Toxicity Value	
		Central	Lower	Upper		
Accidental/Incidental Exposures (dose in mg/kg/event)						E01-Std
Contaminated Gloves, 1 min.	Worker	4E-07	6E-07	3E-06	0.87	
Contaminated Gloves, 1 hour	Worker	3E-05	3E-05	2E-04	0.87	

Each risk summary worksheet can be copied and renamed. Once this is done, simply put in a different application rate and change the worksheet title to reflect this. The Hazard Quotients in the new risk characterization worksheet will be automatically adjusted to reflect the new application rate. The cell marked “application rate factor” will change to yield the ratio of the application rate you entered to the central application rate in the **A01** worksheet.

The same worksheet can be copied any number of times and any number of application rates can be modeled. In addition, exposure scenarios that are not dependant on the application rate are properly handled in the risk summary worksheets. Such exposure scenarios are not commonly used in most herbicide risk assessments but may occur in some risk assessments involving granular or powder formulations. The only limitation of this method of considering multiple application rates is that the Table of Contents is not automatically updated and this must be done by hand. As an alternative, the Version 4.0 Worksheet program can be used. See the documentation for this program at the SERA web site: www.sera-inc.com.

Another new feature in the risk summary worksheets involves the display of the hazard quotient (HQ) values. All hazard quotients less than 0.1 are given in scientific notation displayed to one significant place with a normal font – e.g., a hazard quotient of 0.0007243 is displayed as 7E-04. HQ values between 0.1 and <1.0 are given in normal decimal notation displayed to one significant place – e.g., a hazard quotient of 0.2143 is displayed as 0.2. HQ values between 1.0 and <2.0 are given in bold font displayed to one significant place after the decimal – e.g., a hazard quotient of 1.5632 is displayed as **1.6**. HQ’s that are equal or greater than 2.0 are displayed to the nearest integer and are presented in bold font with a bright pink background – e.g., an HQ value of 9.425 is displayed as **9**. The adjustment of the way the hazard quotients are displayed is dynamic. If you change the application rate, the display of the hazard quotients will

be adjusted to follow the above rules. Note that this feature involves only the display of the value and no actual rounding is done. Thus, if you want to view the hazard quotients in a different way, you may change the numeric format of the cell or copy the value in the cell and paste the value to another location.

2.4. Individuals Preparing Worksheets for a Different Chemical

It is possible to use a workbook as a template and to modify the workbook for a new chemical. Experience has shown, however, that this approach is error prone and this use is not supported or recommended. The preferred approach is to download a copy of the workbook for the chemical that you need from the SERA or Forest Service web site. If you need to modify the scenarios that are included in the risk assessment, you should consider using the most recent Version 4.0 Worksheet Program.

3. Workbook Structure

The worksheets are arranged in a manner similar to previous versions:

Worksheet	Content
	Title Page
	General Notes
	Chemical Specific Notes
	Revision Notes
	Table of Contents
Sheet A01	Program Specific Values
Sheets A02 and A03	Standard Values
Series B	Chemical Specific Values
Series C	Worker exposures
Series D	General public exposures
Series E	HHRA Summary Tables
Series F	ERA Exposures
Series G	ERA Summary Tables
	References

As in the previous versions, there are three types of worksheets: data (Series A and B), calculation (Series C, D, and F), and summary (Series E and G).

The Series A and Series B worksheets contain the data that are used in subsequent worksheets. Some cells are **shaded in yellow**. These are the cells whose values are linked to cells in the calculation or summary sheets. Worksheet A01 contains all of the program specific values. The remaining standard values are in Worksheets A02 and A03. The B-Series worksheets contain all of the chemical specific information. This includes chemical and physical properties (Worksheet B01), all toxicity values used in the workbook (Worksheet B02), a summary of chemical specific dermal absorption values (B03), and estimates of water contamination rates – i.e., the concentration in ambient water per pound applied per acre (Worksheet B04).

The C, D, E, F, and G series are calculation worksheets. These worksheets detail or summarize various exposure scenarios but do not contain new data. Some of the cells in these worksheets are linked to data cells in the Series A or Series B worksheets. These cells are **shaded in blue**.

Depending on how recently the risk assessment was completed, the Version 4.0 workbooks may contain some worksheets that were not included in the original risk assessment. Nonetheless, every attempt has been made to ensure that the calculation worksheets are named in EXCEL in the same way that they are discussed in the risk assessment. Some differences do exist in the A and B Series worksheets but these should be relatively simple to resolve.

Calculation worksheets consist of *value cells* and *calculation cells* as well as cells with simple textual information. *Value cells* are named in the first column and designated in the second column by a descriptive code that is used in formulas. For example, in the following excerpt

from a calculation worksheet, four values are defined and designated with the symbols **SA**, **T**, **BW**, and **L**:

Parameter/Assumption	Code / Range	Equation/ Value	Units	Reference/Designation
Surface Area	SA	6030	cm ²	U.S. EPA/ORD 1996
Duration of Exposure		60	minutes	<i>Scenario parameter</i>
	T	1	hours	Eq
Body weight	BW	13.3	kg	U.S. EPA/ORD 1996
Liquid adhering to skin	L	0.008	mL/cm ²	Mason and Johnson 1987

The fourth column of the worksheet gives the units for the value and the last column gives the reference for the value. For example, BW is taken from U.S. EPA/ORD 1996 and the value in this cell is linked to 'A02!\$C\$35 – i.e., cell C35 of worksheet A02. [Note that the dollars signs designate absolute rather than relative addresses. See EXCEL documentation for details of absolute and relative addresses.] All specific references are provide in the final worksheet of the workbook – i.e., the worksheet named References. As noted above, all links to the Series A and Series B worksheets are indicated in calculation worksheets by **blue shading**.

Calculation cells perform operations on data cells or other calculation cells (intermediate results). Calculation cells are distinguished from data cells in two ways. First, an equation appears in the header row above the calculation cells. This equation references data cells or other calculation cells previously defined in the worksheet. Second, the last column contains the designation “Eq”. Calculation cells are illustrated below with an example also taken from Worksheet D01a:

Proportion absorbed over period	Prop	$1 - \exp(-ka T)$		
	Central	0.000219976	hour-1	Eq
	Lower	4.79988E-05		Eq
	Upper	0.00097952		Eq
Absorbed Dose	Dose	$Amnt \times Prop$ $\div BW$		
	Central	2.87E-04	mg/kg bw	Eq
	Lower	2.09E-04		Eq
	Upper	3.91E-03		Eq

As with the data cells in Series A and Series B worksheets, the final calculation (absorbed dose) is **shaded in yellow**. As with the Series A and Series B worksheets, this indicates that these cells are the sources of links in other worksheets – in this case the summary worksheets (Series E and G).

As noted above, the worksheets will clearly show what calculations are being done. However, the rationale for and verbal description of the calculation is presented in the risk assessment. To

find this description, simply open the risk assessment and search to the name of the calculation worksheet.

4. Consistency with Previous Worksheets

The Version 4.0 worksheets are a major modification to the previous worksheets. In the process of developing the Version 4.0 workbooks, a great deal of effort was spent to ensure that the worksheets accurately reflect information and analyses in the risk assessments. In this process, many errors were detected in previous versions of the workbooks. All of the identified major errors and inconsistencies are discussed in the worksheets named **Chemical Notes**. **Chemical Notes** is the third worksheet in all of the Version 4.0 workbooks. If you compare the output of a Version 4.0 workbook to a previous version of the workbook, please pay particular attention to the **Chemical Notes** worksheet. All comparisons are made to either Version 2.04 Workbooks or Version 3 Workbooks. Version 2.03 Workbooks – 2.03 and not 2.04 – contain structural flaws. Version 2.03 Workbooks should not be used and are not discussed further.

Each Version 4.0 workbook also contains a worksheet titled **Revisions**. This worksheet is intended for your use to document any revisions that you have made to the workbook.

5. Utility Macros

Each Version 4.0 workbook contains three simple utility macros: **SetA1**, **Set100PerCentView**, and **SummaryWorksheetsToFront**. Macros are small programs that do a specific task. Macros can be run in EXCEL by pressing the Alt-F8 key (i.e., holding down the Alt key and then pressing the F8 key).

The **SetA1** macro sets cell A1 as the active cell in each worksheet and then sets the title page of the workbook as the worksheet that is visible. This macro is called automatically when the worksheet opens and can be called at any time using Alt-F8. (If you want to disable this macro from being called when you open the workbook, modify or delete the Sub Workbook_Open() function.)

At the request of some users, **Set100PerCentView** is added with Version 4.04. This is a macro that simply sets the view for all of the worksheets to 100%. The typical default is 75%, which is difficult for some people to read.

The **SummaryWorksheetsToFront** macro takes the program worksheet (A01) as well as all of the risk summary worksheets and moves them to the front of the workbook immediately following the title page. This macro may be useful for printing out only the key sheets that may be most relevant to many users. Currently there is no undo feature for this macro. Thus, you may want to save the workbook, call this macro, print out the relevant worksheets, and then exit the workbook without saving. An undo feature may be added in future versions of the workbooks.

The Table of Contents worksheet (the 5th worksheet in each workbook that is named *Contents*) has been enhanced with a “hidden” macro, one that is not invoked by Alt-F8. While in the table of contents of each workbook (the 5th worksheet in the workbook that is named *Contents*), you

can double click on a worksheet name in column one. Doing so will take you to (i.e., activate) that worksheet.

6. Error Reporting and Further Development

While care has gone into the preparation of the Version 4.0 workbooks, past experience has demonstrated amply that some errors (or at least some sources of confusion) may exist in the 4.0 Version worksheets. If you find errors or confusing results while using the Version 4.0 worksheets, please report these by email to either:

sera_inc@msn.com

or

pmistretta@fs.fed.us

In doing so, please start the title of your email with "**WORKSHEET 4.0 ERROR**". It might be helpful to attach a copy of the workbook if you made any modifications.

The Version 4.0 worksheets have been designed to reduce the number of errors, allow for simpler error correction, and permit greater flexibility in the organization and content of the worksheets. If you have any recommendations for improving or elaborating on the worksheets, please send your recommendations to either or both of the above email addresses. Please start the title of this type of email with "**WORKSHEET 4.0 SUGGESTION**".

While there is currently no direct mechanism for further developing the worksheets, it is very likely that worksheet training resources and additional worksheet development will occur with the normal application of these worksheets to the Forest Service risk assessment program. For these reasons, you should also check both the SERA web site and the Forest Service web site before using or modifying the worksheets to ensure that you have the most recent version of the workbook.

Known Issues

Hard returns are not properly translated with merged cells in Excel. Thus, in some worksheets, hard returns appear as two small square boxes. Until a work around is found, you will need to manually put in the hard returns using the Alt-Enter key combination. Similarly, very long notes in merged cells may not be properly displayed. This appears to be an inherent limitation in EXCEL. Again, a work around has not yet been developed. The impact of both of these issues is generally limited to the **Chemical Notes** worksheet.