
WinMACCS, a MACCS2 Interface for Calculating Health and Economic Consequences from Accidental Release of Radioactive Materials into the Atmosphere

User's Guide and Reference Manual WinMACCS Version 3*

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CONVENTIONS USED IN THIS DOCUMENT

The following table describes a set of conventions that are used throughout this document:

Table 0-1. Legend to Assist in Understanding this Document

Italicized words	Titles of windows, names of buttons and other text that is displayed on the computer screen. Example: Click on the <i>Browse</i> button
→	Main menu selection, where → indicates choosing a submenu or menu item. Example: Select <i>File</i> → <i>Exit</i> indicates that the user is to select the <i>Exit</i> entry listed in the <i>File</i> menu found at the top of the application.
\	Folder separator or folder indicator. Example: \Data is the name of a folder found in the project directory.
/	Node separator used to indicate forms or categories found in the WinMACCS project window. Example: The entry <i>General/Properties</i> is the name of a form in the category <i>General</i> found in the WinMACCS project window.

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1 WINMACCS OVERVIEW

1.1 Background

MACCS2 Version 1.12 has been widely distributed and used throughout the Department of Energy (DOE) complex, by private industry, and by the Nuclear Regulatory Commission (NRC) and its subcontractors. It has also been distributed to Cooperative Severe Accident Research Program (CSARP) members and other international organizations. Its successor, MACCS2 Version 1.13, is similar to Version 1.12 but contains a number of bug fixes and is compiled on a newer FORTRAN compiler. Both of these versions require the user to create and edit ASCII input files and to run batch processes to perform a consequence analysis.

In 2001, the NRC initiated an effort to create a Windows-based interface and framework for performing consequence analyses. This effort was intended to address the following needs:

- To simplify and make more intuitive the effort required to create or modify input files;
- To reduce the likelihood of user errors in performing consequence analyses;
- To enable the user to simply and conveniently account for uncertainties in input data; and
- To displace the original batch framework with a Windows-based framework.

The result of this development effort is the WinMACCS code. WinMACCS is currently integrated with an updated version of MACCS2, COMIDA2, and LHS (Latin Hypercube Sampling) to perform all of the required functionality. The original MACCS2 framework is preserved; MACCS2 can still be run in stand-alone fashion as a batch process. However, there are significant advantages for migrating to the WinMACCS framework for running consequence calculations.

Chapter 1 of this manual explains the WinMACCS framework and components; Chapter 2 describes how to install WinMACCS onto a Windows computer; Chapter 3 provides a tutorial that should be the starting point for the novice user; and Chapter 4 contains a reference document for the WinMACCS interface.

1.2 WinMACCS Framework

1.2.1 Software used to Develop WinMACCS

Development of this software is under a Windows XP Professional (Version 2002 Service Pack 2) operating system within the Sandia National Laboratories (SNL) common operating environment (COE). The COE includes Microsoft Office 2003 and Internet Explorer 6.0 installed on the development machines.

Microsoft Visual Basic Pro 6.0 (Service Pack 5) was used to develop the user interface. Compaq Visual FORTRAN Professional, Version 6.6B, was used in the development of the modeling

engines, MACCS2, and COMIDA2. The Microsoft database library, DAO 3.6, is used to communicate with the project database.

Several third party packages were purchased for use in the WinMACCS development as follows:

- True Data Grid Pro 7.0, published by Component One, is used for the data grids in WinMACCS.
- Teechart Pro ActiveX Version 6.0, published by Steema Software, is used to create plots in WinMACCS.
- Professional Wise Installation System 9, published by Wise Solutions, is used to create the software installations file, setup.exe.
- Microsoft Visual SourceSafe, version 6.0a, is used for version control.

Latin Hypercube Sampling (LHS), published by Sandia National Laboratories, is used to perform sampling from user-defined probability distributions that represent uncertain input parameters. LHS is licensed by Sandia National Laboratories.

1.2.2 WinMACCS Components

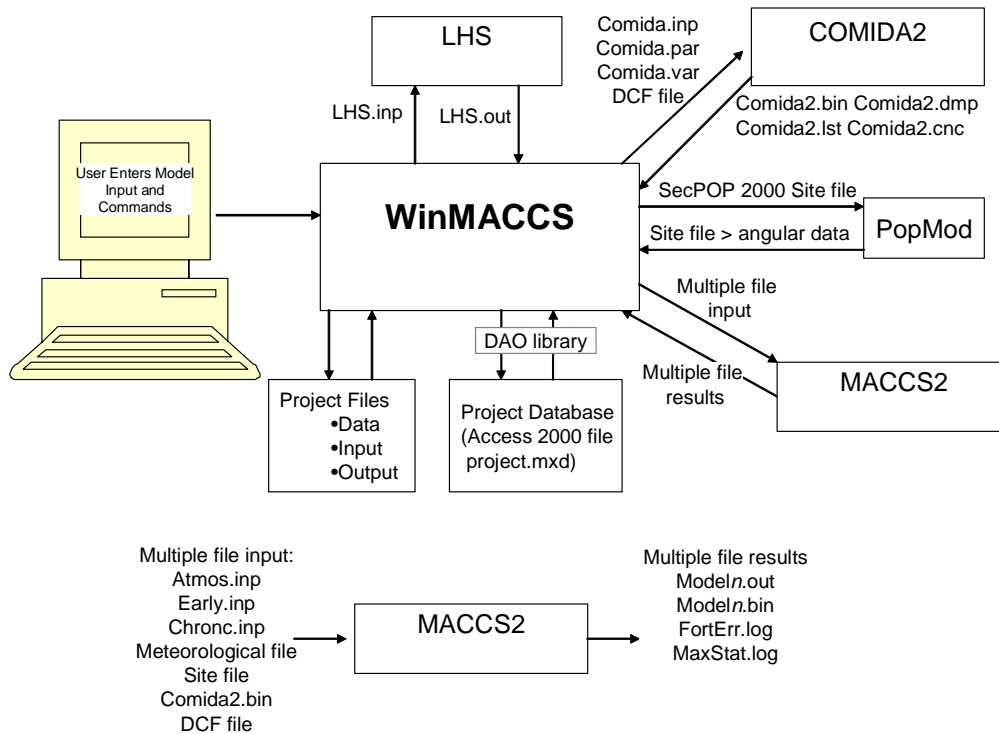


Figure 1-1 WinMACCS Components

Components illustrated in Figure 1-1 are as follows:

User Enters Model Input and Commands

After installing WinMACCS on a Windows-based operating system, a project file can be opened. The user interacts with the WinMACCS application to modify model input, initiate deterministic and uncertain simulations, and view MACCS2 output.

WinMACCS

The executable, WinMACCS.exe, was created using a Visual Basic compiler. Multiple instances of WinMACCS are supported. This allows the user to run multiple calculations simultaneously on a computer, which is especially useful when the computer has more than one processor.

Using WinMACCS, the user can do the following:

- Modify model input variables and model settings. These settings are saved in the project database.
- Initiate a MACCS2 deterministic simulation. WinMACCS builds the MACCS2 input files using the values saved in the project database.
- Initiate a COMIDA2 simulation to create the binary file containing food chain data that is used by MACCS2.
- Initiate a MACCS2 simulation with uncertain input parameters represented by probability distributions. WinMACCS initiates LHS to generate values of the uncertain variables and builds the MACCS2 input files for each simulation.
- Run successive MACCS2 simulations without using LHS. In this case, which is called cyclical execution, MACCS2 input can be varied using successive input files. One application of this feature is to run successive MACCS2 simulations using multiple source terms from MELCOR simulations. The interface utility, MELMACCS, can be used to create the input files containing the source-term data. This feature is called cyclical because it can be combined with sampling of uncertain input data. The input files are cycled if there are more realizations than input files.
- View, export, and aggregate results of MACCS2 simulations in various formats such as text, Microsoft Excel, JPEG, BMP, XML and HTML.

Latin Hypercube Sampling (LHS)

The executable file, Lhs.exe, generates values of uncertain variables using LHS. This program is initiated from WinMACCS.

The following input files are required:

- Lhs.inp – generated by WinMACCS. This file contains the probability distribution types and values and the number of samples to generate.
- Sipra.inp – software settings used by LHS.

The following output files are generated:

- Lhs.out – contains results from LHS execution, i.e., sampled values. This file is read by WinMACCS and it is used to create MACCS2 and COMIDA2 input files using the sampled values.
- Lhs.err – present if an error is detected during LHS execution.
- Lhs.msg – contains details of LHS execution.

COMIDA2

The executable file, Comida2.exe, is a semi-dynamic food chain model that estimates annual concentrations (dose-to-source ratios) given a set of radionuclides and transfer coefficients for each crop type considered.

The input files are generated by WinMACCS. Uncertainty is supported in this input. The following input files are required:

- Comida2.inp, a model input file
- Comida2.var, a model input file
- Comida2.par, a model input file
- A dose Conversion Factor (DCF) file

The following output files are generated by COMIDA2:

- Comida2.bin, which is used as input to MACCS2
- Comida2.dmp, a detailed output file
- Comida2.lst, a detailed output file
- Comida2.cnc, a detailed output file

PopMod

The executable, PopMod.exe, was created using a Visual Basic compiler. This software reads an ASCII population file, created by SECPOP2000. PopMod creates a new population file containing more compass sectors. The work of PopMod is primarily formatting. No new information is added to the new site data file.

This software is used when the user is unable or does not want to rerun SECPOP2000 to create a file with a finer grid mesh (i.e., support of more compass directions). SECPOP2000 supports exactly 16 compass sectors, hence a finer polar grid was not available.

The purpose behind the development of this software is to support a finer polar grid used for evacuation studies using WinMACCS and MACCS2.

The following input is required:

- Site data file
- Number of angular sectors, greater than number in site data file
-

The following output file is generated:

- New site data file

MACCS2

The executable, *MACCS2.exe*, was created using Compaq Visual FORTRAN Professional. The modeling engine can be initiated via either WinMACCS or a command prompt window.

The following input files may be required (depending on models chosen). These files are either created by WinMACCS or supplied by the user if the modeling engine is initiated via a command prompt window:

- ATMOS input (atmospheric transport, dispersion, and deposition parameters)
- EARLY input (parameters pertaining to the emergency phase, up to the first seven days after the accident, including mitigative actions such as evacuation, sheltering, and dose-dependent relocation)
- CHRONC input (parameters pertaining to the intermediate and long-term phases)

The following auxiliary files are always required by MACCS2:

- *Maccs2.tmp* is a text file containing the paths and names for the MACCS2 input files. (WinMACCS assigns the name *Maccs.tmp* using the *-i* option in the *MACCS2.exe* command. See Appendix A for more details.)
- *Indexr.dat* is an ASCII file containing decay-chain information. This file is included as part of the installation.

The following data files are optionally required by MACCS2 (depending on models chosen):

- Meteorological file describing weather conditions for one or more years
- Site file describing population, land use, and economic parameters
- Dose conversion factor (DCF) file used to calculate health effects from various radionuclide exposures for each pathway
- *Comida2* binary file, created by *COMIDA2.exe*, is used to define food-chain doses.

Output Files Created by MACCS2. WinMACCS names the MACCS2 output files *model1.out*, *model2.out*, etc., where the number corresponds to the sample number. If the calculation is deterministic, then only *model1.out* is created. In the following description of the files created by WinMACCS, *n* is an integer that differentiates each of samples that are evaluated.

- Modeln.out is a readable text file containing output from MACCS2.
- Modeln.bin is a binary file containing output from MACCS2. This file can be viewed as text or it can be used to create plots within the WinMACCS interface.
- FortErr.log is created when MACCS2 terminates abnormally. A trace of the offending call stack is written to this file. (WinMACCS assigns the name ModelnFortErr.log using the -p option in the MACCS2.exe command. See Appendix A for more details.)
- MaxStat.log contains the character string “OK” when MACCS2 terminates normally, “NO” when MACCS2 terminated abnormally or when MACCS2 does not complete the simulation. This file contains an error message if termination is due to an error detected by MACCS2 (as opposed to an error detected by the Windows operating system). (WinMACCS assigns the name ModelnMaxStat.log using the -p option in the MACCS2.exe command. See Appendix A for more details.)

Project Files

1. Data files managed by WinMACCS consist of auxiliary files such as the site file, the meteorological file, the COMIDA2 binary file(s), and the DCF file(s).
2. Input files are created by WinMACCS using the model input settings. This set can include Atmosn.inp, Earlyn.inp, Chroncn.inp, Comidan.inp, and Lhs.inp input files

Output files are created by MACCS2 and its preprocessors (e.g., LHS and COMIDA2). One or more MACCS2 output files, Modeln.out, are normally created. Other files may or may not be created, depending on settings in WinMACCS.

Project Database

An Access 2000 database file is created from a database template file, Initialize2000.mdb, by WinMACCS when a new project is created. The project database is modified by WinMACCS using the Microsoft DAO 3.6 library. The database includes the following:

- Model input values input by user,
- Model default values,
- Model variable descriptions and limits,
- Information to construct model input forms, and
- Information to construct model input files,
- LHS results
- MACCS2 results read from binary result files.

2 INSTALLATION OF WINMACCS

2.1 System Requirements

The WinMACCS software requires the following:

- A personal computer with Microsoft Windows NT, 2000, or XP Pro installed
- Screen resolution set to a minimum of 1024 by 768
- 500 MG of free disk space for installation

2.2 Installing from CD-ROM

To install WinMACCS, run Setup.exe as follows:

1. Click on the Microsoft Windows *Start* button and select the *Run* command.
2. Click on the *Browse* button and locate Setup.exe on the installation CD.
3. Click *Open*.
4. Click *OK* in the *Run* dialog box.

The WinMACCS installation procedure executes. A numeric key is required to complete the installation. This key is provided with the WinMACCS CD.

On certain installations, MDAC (Microsoft Data Access Components) automatically installs before WinMACCS installs. Some system files are updated in this case. This is a Microsoft update that is required for WinMACCS to store projects as database files.

2.3 Troubleshooting Installation Problems

When the installation is complete, the user can select *readme* or *WinMACCS help* from the *WinMACCS* program group for additional information. The file *readme.txt*, identical to *readme* from the *WinMACCS* program group, is also on the installation CD in case the installation was unsuccessful.

Users should contact their system administrator for assistance if difficulty is experienced installing MDAC.

2.4 Uninstalling WinMACCS

From the *Start* menu, select *Uninstall* from the *WinMACCS* program group. There is no uninstall for MDAC. Microsoft considers this to be a system upgrade and does not offer an uninstall procedure.

3 TUTORIALS

The following tutorials demonstrate how to modify an existing WinMACCS project and how to convert a legacy MACCS2 project into a WinMACCS project. Following the tutorials are some guidelines for constructing a new project from scratch, i.e., without the benefit of an existing project.

Tutorial One demonstrates how to:

- Open the existing sample project, sample1
- Modify parameters in sample1
- Create uncertain parameters
- Access WinMACCS online help
- Modify models
- Run simulation
- View and export results







Tutorial Two demonstrates how to:

- Import MACCS2 1.12 or 1.13.1 input files to create a sample WinMACCS project
- Connect the meteorological file, site data file, dose conversion factor file and COMIDA2 file with the imported project
- Understand how specific input cards are related to the models selected for the imported example
- Understand the importance of knowing the type of dose conversion factor (DCF) file before importing a sample project into WinMACCS. Auto recognition of FGR-11 and 12 type DCF file is not supported in the import process.
- Understand that some modifications to the older input are required to run MACCS2. In particular, it is necessary to enter chemical group names in ATMOS (variable GRPNAM), to enter CHRONC shielding factors, and to ensure that WTRAC sums to 1 across EARLY scenarios.
- Understand that if the number of EARLY evacuation scenarios (cohorts) is two or more, the value is not changed to one while importing a MACCS2 input set even if the imported file contains only one evacuation scenario. The number of evacuation scenarios must be set to one in the Project Properties form.

3.1 Tutorial One

Table 3-1. Loading the Project	
User Action	WinMACCS response
Double-click on the WinMACCS icon on the desktop or select <i>WinMACCS</i> from the WinMACCS group within the Windows <i>Start</i> Menu.	WinMACCS starts and displays pull-down menus on the top of the screen. <i>File</i> and <i>Help</i> are accessible.
Choose <i>File</i> → <i>Open Project</i> . Change directory to <i>WinMACCS Samples</i> \Tutorials.	WinMACCS shows available sample project folders.
Double-click on the <i>sample1</i> folder.	Folder opens and shows three sub-folders: <i>Data</i> , <i>Input</i> , and <i>Output</i> plus the project file <i>sample1.mxd</i> .
Double-click on <i>sample1.mxd</i> .	WinMACCS loads the project and displays two tabs on the bottom of the <i>Project</i> window: <i>Parameters</i> and <i>Files</i> . Above the tab, WinMACCS displays a list containing the following headings: <i>GENERAL</i> , <i>ATMOS</i> , <i>EARLY</i> , <i>CHRONC</i> , and <i>COMIDA2</i> .
Select <i>File</i> → <i>Save As</i> from the main menu. Verify that the current directory is called <i>WinMACCS Projects</i> . Type <i>Sample 1</i> in the <i>Project Name</i> field.	A new copy of the sample project, Sample 1, is created in the default WinMACCS project directory, WinMACCS Projects. The path shown in the caption of the main WinMACCS window is as follows: <i>C:\WinMACCS Projects\Sample 1</i>
Click on the <i>Files</i> tab in the window.	Above the tab, WinMACCS displays a list containing the following headings: <i>Data</i> , <i>Input</i> , and <i>Output</i> .

Table 3-2. Viewing Parameters

User Action	WinMACCS response
Click on the <i>Parameters</i> tab in the <i>Project</i> window.	Each + button, when clicked, displays sub-lists until the lowest level is reached. At the lowest levels, black bullets appear next to the names of variables. For example, <i>METCOD</i> is one of the variables under <i>ATMOS/Property Form Parameters</i> .
Open the <i>ATMOS</i> or <i>EARLY</i> heading by clicking on the + button. Peruse the different lists by clicking on the + buttons. Notice the solid green octagon.	 A solid green octagon next to a form entry means that all of the variables under that entry are required and have been properly defined.
	 A solid orange diamond next to a form entry means that all of the optional variables under that entry have been properly defined.
	 An empty orange diamond next to a form entry means that the optional variables have not been defined.
	 An empty red octagon means that there are variables that must be defined before proceeding with a MACCS2 simulation.
	 A solid gray octagon containing a diagonal line means that the variables are not used in a MACCS2 simulation because they are not needed under the current choices. This symbol also indicates that all of the variables have been defined.
	 An empty gray octagon containing a diagonal line means that the variables are not used in a MACCS2 simulation because they are not needed under the current choices. This symbol also indicates that not all of the variables that have been defined.
Choose <i>ATMOS/Property Form Parameters</i> . Double-click on the box next to <i>METCOD</i> .	The <i>Property Form Parameters</i> form opens. At the bottom of the form, the variable type "Integer" and range of values "[1,5]" is shown, as well as a description of the <i>METCOD</i> variable. Values on this form are read only; the values indicate choices made on <i>GENERAL/Properties/Properties</i> form.







Click inside the other variable boxes.	Notice that the variable type, range, and description change for each variable.
Close <i>the</i> property form by clicking <i>OK</i> or <i>Cancel</i> .	<i>Property Form Parameters</i> form closes.
Click on the ATMOS/Deposition category	<p>Notice that this entry on the Parameters tab contains a list of several forms, namely Wet/Dry Depos Flags, Wet Deposition, and Dry Deposition.</p> <p> A solid green octagon means the information under that category is required and has been properly specified. This also means that there are no optional variables in this category. No more user attention is required.</p>
Click on the ATMOS/Radionuclides category	<p>Notice that the Pseudostable Radionuclides form is optional.</p> <p>  A yellow diamond, empty or solid, indicates that there is at least one optional form in this category.</p>
	<p> An empty red octagon means that there are forms in this category containing variables that must be defined before proceeding with a MACCS2 simulation.</p>
Click on the EARLY/Dose Model category	<p>Notice that none of these forms are used in a simulation consistent with the current model settings on the <i>Properties Form</i>.</p> <p>  All forms in this category have a grey symbol, hence the category symbol is grey. No user attention is required.</p>

Table 3-3. Changing Active Models to Include EARLY

User Action	WinMACCS response
<p>Click on the + sign next to <i>General</i>. Click the + sign next to <i>Properties</i>. Double-click on the solid green octagon next to <i>Properties</i>.</p>	<p>The <i>Project Properties</i> window opens with tabs showing different model options. The model definition state is displayed in color at each of the tab headings. A solid green octagon indicates that the data have been defined; if there were an empty red octagon on this form, it would indicate that the data were not defined or the data were inconsistent with other choices.</p> <p>Only tabs relevant to the ATMOS module, namely <i>Scope</i>, <i>Dispersion</i>, <i>Weather</i>, and <i>Plume Rise</i>, have a solid green octagon next to them in this example. The rest of the headings are prefixed with a solid gray octagon containing a diagonal line, indicating the model selections are valid but are not needed.</p>
<p>Press F1 on the keyboard.</p>	<p>An online help window opens describing the selected tab in the <i>Properties Window</i>. Pressing the F1 key opens a context-sensitive help window for all windows in WinMACCS.</p>
<p>Close the WinMACCS help form.</p>	
<p>Click on the <i>Scope</i> tab. Add <i>Early Consequences</i> to the calculation scope by clicking the <i>box</i> beside <i>Early Consequences</i>.</p>	<p>A check appears inside the <i>Early Consequences</i> box. Notice that all of the labels within the <i>Parameters</i> tab in the <i>Project</i> window under the <i>EARLY</i> heading continue to have gray icons associated with them, indicating that the requirements of the EARLY module have not yet been displayed.</p>
<p>Click the <i>Show Required Forms</i> button.</p>	<p>The EARLY module is temporarily activated. Notice that many of the labels within the <i>Parameters</i> tab in the <i>Project</i> window in the <i>EARLY</i> category now have a solid green octagon associated with them. Notice that the icons next to the tab headings in the <i>Properties</i> window associated with the EARLY module now have solid green octagons associated with them.</p>
<p>Click the OK button to save the changes.</p>	<p>The <i>Project Properties</i> window closes.</p>

Table 3-4. Running a Project


User Action	WinMACCS response
Choose <i>Execute</i> → <i>Run Models</i> on the top menu.	The <i>Run Models</i> window opens.
Click <i>Run Simulation</i> .	WinMACCS executes the run and shows the steps in the process in the <i>Results</i> window at the bottom of the screen (e.g., “ <i>Verifying data are defined</i> ”). A progress bar in the <i>Run Models</i> window shows the number of the simulation in progress. Notice one of the messages written in the Results window is “ <i>Model execution SUCCESSFUL</i> ,” indicating that the simulations were successful. If an error had occurred, an error condition would have been reported in the <i>Results</i> window.
Close <i>Run Simulation</i> box by clicking on the  .	

Table 3-5. Viewing Run Results




User Action	WinMACCS response
Click on the <i>Files</i> tab on the bottom of the <i>Project</i> window.	Above the tab, WinMACCS shows a list containing the following headings: <i>Data</i> , <i>Input</i> , and <i>Output</i> .
Click the + next to <i>Input</i> .	
Double-click on the input file for Latin Hypercube Sampling, <i>LHS.inp</i> . (<i>LHS.inp</i> contains a summary of uncertain variables and their distributions.)	<p>Notice that the following variables were sampled:</p> <p>CWASH1, Normal (.000095, .00003)</p> <p>CWASH2, Bounded Normal (.8, .1, 0,1)</p> <p>EFFACA(1), Uniform (1,10)</p> <p>VDEPOS(1), Continuous Linear (CCDF)</p> <p>(.01, 0), (.02,.4), (.025, 1)</p> <p>WinMACCS created MACCS2 input files <i>Atmos1.inp</i>, <i>Early1.inp</i>...<i>Atmos6.inp</i>, <i>Early6.inp</i>, one set of files for each realization from LHS using the data in <i>LHS.out</i>.</p>
Close <i>LHS.inp</i> by clicking on the  .	The text editor closes.
Click on the + next to <i>Output</i> .	<i>Model1.out</i> through <i>Model6.out</i> are displayed.
Double-click on <i>Model2.out</i> . Search for <i>AVERAGE INDIVIDUAL RISK ERL FAT/TOTAL 0.2-0.5 km</i> . (The early fatality risk due to all radionuclides to the average individual at a spatial range of .2 to .5 km.)	Notepad starts and <i>Model2.out</i> opens. The second number in the row (mean risk) should be 6.23E-02.
Close <i>Model2.out</i> by clicking on the  .	The text editor closes.

Table 3-6. Sample Effect of Changing a Single Input Parameter

User Action	WinMACCS response
Click on <i>Parameters</i> tab in the <i>Project</i> window.	
Go to <i>ATMOS/Release Description/Inventory Scale Factor</i> . Double-click on <i>CORSCA</i> .	<i>Radionuclide Inventory Scaling Factor</i> window opens.
Modify the value of <i>CORSCA</i> from 0.715 to 1.43. Click <i>OK</i> .	<i>Radionuclide Inventory Scaling Factor</i> window closes.
Follow the same execution procedures specified under “Running a Project,” above.	WinMACCS executes run with the changed input.
Check the output files as instructed above under “Verify Run Results,” opening file <i>Model2.out</i> .	<i>AVERAGE INDIVIDUAL RISK ERL FAT/TOTAL 0.2-0.5 km</i> from all causes should be larger than before (i.e., 8.60E-02 as compared with 6.23E-02).
Close <i>Model2.out</i> .	

Table 3-7. Changing Parameters from Uncertain to Deterministic

User Action	WinMACCS response
<p>Click on the <i>Files</i> tab in the <i>Project</i> window. Click on the + in front of the <i>Input</i> category. Double-click on <i>LHS.out</i>. (LHS.out lists the uncertain variables in the model and their values.)</p>	<p>Four variables with distributions and parameters are listed: CWASH1, CWASH2, EFFACA(1), and VDEPOS(1).</p>
<p>Close the <i>LHS.out</i> window via <i>File→Exit</i> or by clicking the  in the upper left of the window.</p>	<p>LHS.out window closes.</p>
<p>Click on the <i>Parameters</i> tab. Open the <i>Wet Deposition Data</i> window by clicking on <i>ATMOS/Deposition/Wet Deposition</i>. Double-click on <i>CWASH1</i>.</p>	<p>A <i>Parameter Modification</i> form containing both the <i>CWASH1</i> and <i>CWASH2</i> boxes displays the word <i>Uncertain</i>.</p>
<p>Click the <i>Make Uncertain</i> button.</p>	<p>The <i>CWASH1</i> distribution window opens. A pull-down menu of distribution types appears with <i>Normal</i> indicated.</p>
<p>Click on the down arrow and select <i>Constant</i>, the first choice on the pull-down menu.</p>	<p>A blank text box labeled <i>Value</i> appears.</p>
<p>Enter 9.5E-5 into the text box. Click <i>OK</i>.</p>	<p>The <i>CWASH1</i> window closes and the value 0.000095 appears in the <i>CWASH1</i> box of the <i>Wet Deposition Data</i> window.</p>
<p>Repeat the previous three steps for <i>CWASH2</i>, setting CWASH2 to 0.8.</p>	<p>The <i>Wet Deposition Data</i> window now shows 0.8 for <i>CWASH2</i>.</p>
<p>Click <i>OK</i>.</p>	<p>The <i>Wet Deposition Data</i> window closes.</p>
<p>Click on the <i>Edit→Find Parameter</i> window.</p>	<p>The <i>Open Parameter Form</i> window appears.</p>

<p>Scroll down to <i>EFFACA</i> using the scroll bar.</p> <p>Click on <i>EFFACA</i>.</p> <p>Click <i>OK</i>.</p>	<p>The <i>Early Fatality Effects</i> window opens with the word <i>Uncertain</i> highlighted under the column heading <i>EFFACA</i>.</p>
<p>Click on the word <i>Uncertain</i> in row one under the column heading <i>EFFACA</i>.</p>	<p>The <i>EFFCA</i> window opens showing a normal distribution and its associated parameters.</p>
<p>Click on the <i>Make Uncertain</i> button.</p>	<p>The form used to assign uncertainty for the <i>EFFACA</i> variable opens.</p>
<p>Change the distribution to <i>Constant</i> and enter in the value of 3.8.</p> <p>Click <i>OK</i>.</p>	<p>The <i>EFFACA</i> window closes and the <i>Early Fatality Effects</i> window shows 3.8 as the value of <i>EFFACA</i> for <i>A-Red Marr</i>.</p>
<p>Click <i>OK</i>.</p>	<p><i>Early Fatality Effects</i> window closes.</p>
<p>Change the value of <i>VDEPOS(1)</i> to 0.01 using the method used to modify <i>EFFACA</i> above.</p>	
<p>Choose <i>File</i>→<i>SaveAs Project</i>.</p>	<p>WinMACCS creates a new project, <i>sample1 deterministic</i>.</p>
<p>Specify “<i>sample1 deterministic</i>” for the Project name.</p>	
<p>Choose <i>Execute</i>→<i>Run Models</i>→<i>Run Simulation</i>.</p>	<p>WinMACCS executes ATMOS and EARLY only once and generates one output file. Notice that it was not necessary to change the number of simulations to one. WinMACCS automatically runs one simulation if there are no uncertain variables and the <i>MACCS2 Cyclical File Set</i> option is turned off. (See the Help file for more information on the <i>Cyclical File Set</i> option.)</p>
<p>Click on the <i>Files</i> Tab.</p> <p>Double-click on <i>Output\Modell.out</i>.</p>	<p>Modell.out opens.</p>
<p>Look for the value of AVERAGE INDIVIDUAL RISK ERL FAT/TOTAL 0.2-0.5 km</p>	<p>AVERAGE INDIVIDUAL RISK ERL FAT/TOTAL is 9.19E-02.</p>



<p>Close the Model1.out window via <i>File→Exit</i> or by clicking the  in the upper left of the window.</p>	<p>Model1.out closes.</p>
<p>Choose <i>PostProcessing→Create Custom Report</i>.</p>	<p>A window summarizing all of the MACCS2 output requests is opened. Click on the check box shown in the <i>Report</i> column for all of the entries where the <i>Report Description</i> column is labeled <i>Individual Risk</i>. There are five entries.</p>
<p>Click the <i>Create Report</i> button.</p>	<p>A report named <i>Summary.out</i> is created and placed in the project Output directory.</p>
<p>Click on the <i>Files</i> tab in the <i>Project</i> window. Click on the + next to <i>Output</i>. Double-click on <i>Summary.out</i>.</p>	<p>The summary report, <i>Summary.out</i>, opens in Notepad. Scroll down to the entry labeled Request 2 Individual Risk The Average Individual Risk corresponding to the entry from the Model1.out file is reported: Evacuation Overall ERL FAT/TOTAL [.16,.52](km) "Average Individual Risk (none)" 9.187E-02 (The <i>Summary.out</i> file can be used to report overall statistics when multiple realizations are being calculated with sampled variables. However, it can also be used to conveniently calculate additional quantile information for a single calculation.)</p>
<p>Close file <i>Summary.out</i>. Click <i>OK</i> in window <i>Create a Custom Report</i>.</p>	<p>Selections made in check boxes are saved when this window is closed.</p>
<p>Double-click on <i>General/Reporting Options</i> on the <i>Parameters</i> tab.</p>	<p>A window labeled <i>Reporting Options</i> opens.</p>
<p>Enter the following quantiles: .50, .75, .99; Click OK Create a new summary report by opening the <i>Create a Custom Report</i> window and clicking <i>Create Report</i>. Open the report <i>Summary.out</i>.</p>	<p>Data corresponding to user chosen quantiles are calculated by interpolating values from the CCDF's that MACCS2 calculates.</p>

Table 3-8. Viewing Results as Plots

User Action	WinMACCS response
Choose <i>PostProcessing</i> → <i>Graphical Results</i> → <i>Results over all Weather Trials</i> .	A <i>Results Over All Weather Trials</i> window opens with the version of MACCS2 used in the simulation displayed in the Window caption.
Click the + next to <i>Total Centerline Ground Concentration</i> . Click on <i>Plume 1 CS-137 [4.83,5.63](km)</i> . Click on <i>Add</i> .	Result is placed on chart.
Click <i>Modify Axis</i> .	The <i>Modify Axis Bounds</i> window opens with options for X- and Y-axis and their bounds. In addition, the user may choose a linear or a logarithmic scale for X and Y. The minimum and maximum values must be specified for the logarithmic scale; the linear scale can either be automatically set or manually set by the user.
Click <i>OK</i> in the <i>Modify Axis Bounds</i> window.	The <i>Modify Axis Bounds</i> window closes.
Select <i>PostProcessing</i> → <i>Graphical Results</i> → <i>Edit Plots</i> → <i>Modify Titles</i> .	The plot title and axis labels can be modified.
Close the <i>Modify Titles</i> window by clicking the <i>Cancel</i> button.	
Click the <i>Select</i> button on the plot window.	The data points representing the complimentary cumulative distribution function (CCDF) are shown. Notice that the sample number is also shown and is labeled LHS1. Only one sample is displayed on this plot because this was a deterministic simulation. Otherwise, there would be a curve for each LHS realization (LHS1, LHS2, LHS3 ...). The bottom of the plot window displays details describing the selected plot series in blue lettering.
Click the <i>Select</i> button again.	The plot is now in an unselected state. Notice that the bottom of the plot window displays the words “Selected Series: NONE.”

<p>Click the <i>Bulls-eye</i> button. </p>	<p>The plotted values are now displayed as text.</p>
<p>Click the <i>Bulls-eye</i> button again.</p>	<p>The text values are no longer displayed.</p>
<p>Select <i>PostProcessing</i>→<i>Graphical Results</i>→<i>Edit Plots</i>→<i>Export Plot</i>.</p>	<p>A <i>Save As</i> window appears. Notice the different file formats available, including JPEG image, MS Excel, and ASCII text.</p>
<p>Enter "MyData" in the text box labeled <i>File Name</i>.</p> <p>Select <i>MS Excel (*.xls)</i> in the <i>Save as Type</i> pull-down menu.</p> <p>Click <i>Save</i>.</p>	<p>WinMACCS saves the data as an Excel file called <i>MyData.xls</i> in the <code>\WinMACCSSamp\sample1\Output</code> directory.</p>
<p>Repeat this, but now select <i>Windows BMP Image (*.bmp)</i> in the <i>Save as Type</i> pull-down menu.</p>	<p>WinMACCS saves the data as a .bmp file called <i>MyData.bmp</i> into the <code>\WinMACCSSamp\sample1\Output</code> directory. This file can be opened in MS Paint.</p>
<p>Double-click on file <i>MyData.xls</i> and <i>MyData.bmp</i> in the <i>Output</i> directory found under the <i>Files</i> tab in WinMACCS.</p>	<p>If MS Excel is installed on your computer, Excel starts and <i>MyData.xls</i> opens.</p> <p>The .bmp file opens in the associated application, usually MS Paint.</p>

3.2 Tutorial Two

Table 3.9 Import IN1A.INP, ATMOS Sample Problem A	
User Action	WinMACCS response
Double-click on the WinMACCS icon on the desktop or select <i>WinMACCS</i> from the WinMACCS group from the Windows <i>Start</i> Menu.	WinMACCS starts and displays pull-down menus on the top of the screen. <i>File</i> and <i>Help</i> are accessible.
Choose <i>File</i> → <i>New Project</i> .	<p>Navigate to the folder <i>WinMACCS Projects</i> if it isn't already the folder shown. Enter the name <i>Sample 2</i> in the <i>Project Name</i> field. Click <i>OK</i>.</p> <p>A new project is created. The <i>Project Properties</i> form is opened. This form is used to select the appropriate models for the simulation.</p> <p>Notice that only the ATMOS model is checked. This is the default setting for new projects.</p>
Click the <i>Cancel</i> button.	Models are determined by the content of the MACCS2 input files to be imported. It is not necessary to select models.
On the <i>Parameters</i> tab of the <i>Project</i> window, click the plus sign, +, to the left of the headings GENERAL, ATMOS and EARLY.	<p>Notice the empty red octagons next to categories of data in the GENERAL and ATMOS categories that are required but are not yet defined.</p> <p>Notice the filled in green octagon next to the heading <i>Property Form Parameters</i>. These are variables that are defined and can be changed only by using the Property Form. They have default predefined values.</p> <p>Notice the grey octagons with the slash through them in the EARLY category. These data are not required because the default setting of the EARLY model is off for new projects.</p>
<p>Select <i>File</i>→<i>Import MACCS2 Input File</i> from the main menu. Locate the ATMOS input file titled IN1A.INP. A copy of this file is in <i>\Program Files\WinMACCS\MACCS2 Samples</i></p> <p>Click <i>Open</i>.</p>	<p>The file IN1A.INP is read by WinMACCS. The data in this file is loaded into the interface. The progress of processing this file can be seen in the WinMACCS <i>Results</i> window.</p> <p>The ATMOS empty red octagons have turned into solid green octagons, indicating that the data on these forms are now defined.</p> <p>The EARLY model is now on. This is because a variable,</p>

	<p>ENDAT1, in the file IN1A.INP, was set to .FALSE. indicating that the EARLY model should be executed.</p>
<p>Expand the <i>Results</i> window by moving the mouse to the Title bar on that window. When the mouse turns to a double sided arrow, click, drag, and release to resize the window.</p>	<p>The first line indicates the name of the file that is being imported is as follows:</p> <p><i>Importing MACCS2 input file C:\Program Files\WinMACCS\MACCS2 Samples\IN1A.INP</i></p> <p>The next line shows that the file is being read for the first time, to determine which models are turned on in WinMACCS.</p> <p><i>Processing input lines that define models</i></p> <p>The next lines report which MACCS2 input images are used to determine the model settings. These are listed as follows:</p> <p><i>Saving Maccs2 Data for input line: NUM_DIST</i></p> <p><i>Saving Maccs2 Data for input line: RDPLHEAT</i></p> <p><i>Saving Maccs2 Data for input line: OCENDAT1</i></p> <p><i>Saving Maccs2 Data for input line: M1METCOD</i></p> <p><i>Saving Maccs2 Data for input line: M4NSMPLS</i></p>
<p>Open the file that was imported in Notepad. To do this, locate the file in Windows explorer. The file is in <i>\Program Files\WinMACCS\MACCS2 Samples</i></p> <p>Right click on the name IN1A. Select <i>Open With →Notepad</i></p>	<p>The input lines that are used to define the models are shown in the <i>Results</i> window. These input lines can be located in the file IN1A.INP. The value on those lines determines the value of a WinMACCS model setting. The following are the images from the file IN1A.INP with the effect on WinMACCS explained:</p> <p>NUM_DIST001 50; causes Dispersion Model to be set to Lookup Tables</p> <p>RDPLHEAT001 3.7E+6 1.7E5 ;causes Plume Rise Model to be set to Power Model</p> <p>OCENDAT1001 .FALSE.; causes the EARLY model to be enabled</p> <p>M1METCOD001 2; M4NSMPLS001 4; causes the Weather Model to be set to Uniform Bin Sampling.</p> <p>The models that are set in WinMACCS can be viewed on the Properties form.</p>
<p>WinMACCS imports data in two stages. First, the basic model settings</p>	<p>The second stage, only the data relevant to the current model settings are extracted.</p>

<p>are imported and values in the Project Properties are modified. Then, the variables relevant to the updated model settings are extracted from the file.</p>	<p>Example output in the <i>Results</i> window from the second pass is:</p> <p><i>Processing input lines for file section 1</i></p> <p><i>Saving Maccs2 Data for input line: RIATNAMI</i></p> <p><i>Saving Maccs2 Data for input line: GENUMRAD</i></p>
<p>After the first period in column one is encountered in file IN1A, WinMACCS looks for change card data. Change card data refers to input cards that change only variables referenced in the change card set. The new data set is then used to rerun the model. MACCS2 only supports change cards for ATMOS and EARLY.</p>	<p>In this example, even though a change card set is defined in IN1A.INP, those data are not retained by WinMACCS. WinMACCS only supports change case data for EARLY. The data not being retained are shown in the following output:</p> <p><i>Processing input lines for card set number 2.</i></p> <p><i>No data to import for file section 2</i></p> <p><i>Processing input lines for file section 3</i></p> <p><i>No data to import for file section 3</i></p> <p>Notice that IN1A had exactly 2 sections (one change card set). WinMACCS attempted to read a third section before encountering the End of File.</p>
<p>Select <i>Edit</i>→<i>Project Properties</i>. Uncheck <i>Early Consequences</i>. Click <i>OK</i>.</p>	<p>The EARLY model was turned off. This can be verified by observing that all of the icons to the right of the EARLY categories and forms are now grey with a slash through them.</p>
<p>Click the plus sign, +, to the left of the heading <i>GENERAL</i><i>File Specifications</i>. Double click on the form name <i>Meteorological File</i>.</p>	<p>The form titled <i>Specify Meteorological File</i> is opened.</p>
<p>Click on the button labeled Browse. Locate file titled MetsurMxHt.inp. A copy of this file is in <i>\Program Files\WinMACCS\MACCS2 Samples</i>. Click <i>OK</i>.</p>	<p>Metsur.inp is an older version of this file. This file contains one year of site specific meteorological data consistent with sample problem A. The hourly meteorological data on MetsurMxHt.inp and Metsur.inp are identical. However, additional data consisting of the morning mixing height was added to MetsurMxHt.inp. This line was added to enable MACCS2 to read this file without generating an error when the <i>Adjust mixing height based on time of day</i> check box is checked on the <i>Weather</i> tab of the <i>Properties</i> form.</p> <p>The Meteorological file names for sample problem A can be found by viewing a line in the batch file used to run the old MACCS2 suite in the file Runem.bat as follows:</p> <p>CALL RunMACCS2 IN1A IN2A IN3A_N METSUR SURSIT</p>

	LISTA_N.																						
<p>Click the plus sign, +, to the left of the heading <i>ATMOS\Radionuclides</i>. Double click on the form name <i>Chemical Names</i>.</p>	<p>Notice that the variable, GRPNAM, has not been defined. This is new and was not defined in the file IN1A.INP. However, the number of chemical groups, MAXGRP, is set to nine.</p>																						
<p>Bring the file IN1A.INP back into the foreground. Search for the string RDRELFRC using <i>Edit→Find</i> from the main menu of Notepad. Notice that the chemical group names have been inserted as a comment two lines above the RDRELFRC line. Enter the names in the <i>Chemical Names</i> form. Click <i>OK</i>.</p>	<p>The values used here are for labeling and documentation. Any nine entries can be added. However, the nine entries in IN1A.INP that are entered, one per line on the form, are as follows:</p> <table border="1" data-bbox="711 642 1235 982"> <thead> <tr> <th></th> <th>GRPNAM</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Xe/Kr</td> </tr> <tr> <td>2</td> <td>I</td> </tr> <tr> <td>3</td> <td>Cs</td> </tr> <tr> <td>4</td> <td>Te</td> </tr> <tr> <td>5</td> <td>Sr</td> </tr> <tr> <td>6</td> <td>Ru</td> </tr> <tr> <td>7</td> <td>La</td> </tr> <tr> <td>8</td> <td>Cd</td> </tr> <tr> <td>9</td> <td>Ba</td> </tr> <tr> <td></td> <td>*</td> </tr> </tbody> </table>		GRPNAM	1	Xe/Kr	2	I	3	Cs	4	Te	5	Sr	6	Ru	7	La	8	Cd	9	Ba		*
	GRPNAM																						
1	Xe/Kr																						
2	I																						
3	Cs																						
4	Te																						
5	Sr																						
6	Ru																						
7	La																						
8	Cd																						
9	Ba																						
	*																						
<p>Select <i>Execute→Run Models</i> from the main menu. Click on the <i>Run Simulation</i> button on the <i>Run Models</i> form.</p>	<p>The ATMOS model runs. Successful execution can be verified by observing that the Results window contains the following:</p> <p>Running model as follows:</p> <pre>"C:\Program Files\WinMaccs\MACCS2.exe" -i "C:\WinMACCS Projects\Sample 2\Maccs.tmp" -p "Model1"</pre> <p><i>Model execution SUCCESSFUL</i></p> <p><i>OK</i></p> <p><i>Run Completed</i></p>																						

Table 3.10 Import IN2A.INP, EARLY Sample Problem A

User Action	WinMACCS response
<p>Import file IN2A.INP by using the <i>File→Import MACCS2 Input File</i> feature.</p>	<p>Notice in the <i>Results</i> window that the variables read to define the models are listed. They are as follows:</p> <p><i>Saving Maccs2 Data for input line: MIENDAT2</i></p> <p><i>Saving Maccs2 Data for input line: MIIPLUME</i></p> <p><i>Saving Maccs2 Data for input line: PDPOPFLG</i></p> <p><i>Saving Maccs2 Data for input line: MIORGDEF</i></p> <p><i>Saving Maccs2 Data for input line: MIOVRRID</i></p> <p><i>Saving Maccs2 Data for input line: EZEVATYP</i></p> <p><i>Saving Maccs2 Data for input line: EZLASMOM</i></p> <p><i>Saving Maccs2 Data for input line: EFNUMEFA</i></p> <p><i>Saving Maccs2 Data for input line: EINUMEIN</i></p> <p><i>Saving Maccs2 Data for input line: LCNUMACA</i></p> <p><i>Saving MACCS2 Data for input line: EZLASMOM for scenario 2</i></p>
<p>Open the file, IN2A.INP, in Notepad. Select <i>Edit →Project Properties</i>.</p>	<p>The models that have been turned on based on the imported variables.</p> <p>The following are the images from the file IN2A.INP with the effect on WinMACCS explained:</p> <p>MIENDAT2001 .FALSE.; causes the CHRONC model to be enabled</p> <p>MIIPLUME001 2; causes <i>Wind Shift with Rotation</i> model to be enabled.</p> <p>PDPOPFLG001 FILE; causes <i>Site Data Specification</i> to be set to <i>Import from File</i>.</p> <p>MIORGDEF007 'L-EDEWBODY' ; causes the dose conversion factor file type to be set to <i>File Created by DOSFAC2</i>. If MIORGDEF007 'ICRP60ED'; was present, the model would have been set to FGR-13.</p> <p>MIOVRRID001 .FALSE.; causes the <i>Wind Rose</i> set to the default, uniform distribution.</p> <p>EZEVATYP001 'RADIAL'; EZLASMOM001 15; causes</p>

	<p>the <i>Evacuation Model for Scenario One</i> to be set to <i>Radial</i>. If EZLASMOV001 = 0; was present, the model would have been set to <i>None</i>.</p> <p>EFNUMEFA001 = 2; EINUMEIN001 = 7; LCNUMACA001 = 7; each of these correspond to check boxes in the <i>Early Effects</i> tab in the <i>Project Properties</i> window. A zero value has the effect of unchecking the box, where a non-zero value causes the related check box to be checked.</p> <p>EZLASMOV001 = 0; This is part of the first change set, and has the effect of adding an additional evacuation scenario and setting the evacuation type to None. This can be observed by looking at the <i>Evac/Rotation</i> tab of the <i>Project Properties</i> window.</p>
<p>Check the <i>Results</i> window for any warning messages, indicating a problem with the import procedure.</p>	<p>Notice the warning message written to the <i>Results</i> window: <i>WARNING - Check the Properties form for model settings. When importing older MACCS2 input files, some models are not specified.</i></p> <p>One rule, with the exception of the dose conversion factor file (default is the new FGR-13 file type), is that new models added after MACCS2 1.13.1 are turned off by default.</p> <p>If an input file using an older FGR-11/12 dose conversion factor file is imported, WinMACCS cannot detect the file type. In this case, the WARNING message above is applicable. It is necessary to open the <i>Project Properties</i> form and select the radio button <i>Federal Guidance Report (FGR-11 and -12)</i> on the <i>Dose</i> tab.</p>
<p>Click the <i>Scope</i> tab of the <i>Project Properties</i> window. Uncheck <i>Late Consequences</i>. Click <i>OK</i></p>	<p>In preparation for running ATMOS and EARLY only, the CHRONC (corresponding to Late Consequences) model was turned off. This can be verified by observing that all of the icons to the right of the CHRONC categories and forms are now grey with a slash through them.</p>
<p>Click on the + next to the headings GENERAL, ATMOS, EARLY and CHRONC if these headings are not already open.</p> <p>Click on the + next to the category <i>File Specifications</i>.</p>	<p>The forms that still need attention are displayed.</p>

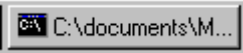
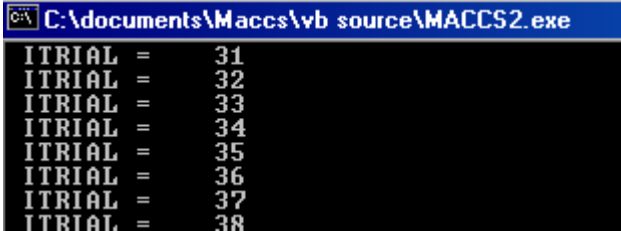
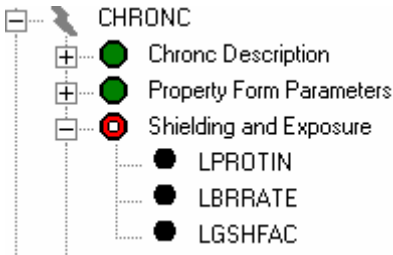
<p>Define the site file by double clicking on the form name <i>GENERAL/File Specifications/Site File</i>. Click on the <i>Browse</i> button to find the file Sursit.inp, and then click on <i>OK</i>.</p>	<p>User is prompted to answer the question <i>Do you want to update the spatial grid to be consistent with the site file?</i></p> <p>Answer Yes. This updates the values of variable SPAEND. SPAEND and the site file should be consistent.</p>
<p>In a similar manner, open the form Dose Conversion Factor File. Select the file DOSDATA.INP.</p>	<p>The Dose conversion factor file name is specified in the file IN2A.inp on the following lines: DCF_FILE001 'DOSDATA.INP'</p>
<p>Select <i>Execute</i>→<i>Run Models</i> from the main menu. Click on the <i>Run Simulation</i> button on the <i>Run Models</i> form.</p> <p>Click on the entry on the task bar:</p> 	<p>The ATMOS and EARLY model are now running. The progress is displayed in the command prompt window.</p>  <pre> C:\documents\Maccs\vb source\MACCS2.exe ITRIAL = 31 ITRIAL = 32 ITRIAL = 33 ITRIAL = 34 ITRIAL = 35 ITRIAL = 36 ITRIAL = 37 ITRIAL = 38 </pre>

Table 3.11 Import IN3A.INP, CHRONC, Sample Problem A

User Action	WinMACCS response
<p>Import file IN3A_N.INP by using the <i>File→Import MACCS2 Input File</i> feature.</p> <p>Select <i>Edit →Project Properties</i>.</p> <p>Check <i>Late Consequences</i>. Click <i>OK</i></p>	<p>The <i>Results</i> window displays the variables read to define the models. They are as follows:</p> <p><i>Saving Maccs2 Data for input line: CHFDPATH</i></p> <p>The CHRONC model is now enabled. The CHRONC model was not turned on automatically because the variable to enable this model is ENDAT2 in the MACCS2 EARLY input file, IN2A.INP.</p>
<p>Open the file IN3A_N.INP in Notepad. Locate the line starting with the character string <i>CHFDPATH001</i>.</p>	<p>The following image is from the file IN3A_N.INP with the effect on WinMACCS explained:</p> <p><i>CHFDPATH001 'NEW'</i>; causes the <i>COMIDA2 food model User supplies COMIDA2 File</i> option to be on.</p> <p>It is not possible to import the option <i>Create COMIDA2 File</i> because this is a WinMACCS and not a MACCS2 option.</p>
<p>Click on the + next to the headings GENERAL, EARLY and CHRONC if these headings are not already open.</p> <p>Double click on the form name <i>Shielding and Exposure</i> in CHRONC.</p> 	<p>Notice that the CHRONC variables LPROTIN, LBRRATE and LGSHFAC are not defined. These are new variables that do not have images in the imported file.</p>
<p>Click on the + next to the EARLY category <i>Emergency Scenario One</i>.</p> <p>Double click on the form name <i>Shielding and Exposure</i> in the EARLY category <i>Emergency Scenario One</i>.</p> <p>Enter the related data in the row labeled <i>Normal</i> into the CHRONC</p>	<p>LPROTIN is set to 0.41, LBRRATE is set to 2.66E-4, and LGSHFAC is set to 0.33.</p> <p>Adding these CHRONC variables ensures that consistent values are independent of the EARLY evacuation scenarios. Before this modification to MACCS2, the values used during the last EARLY evacuation scenario were used in CHRONC.</p>

Shielding and Exposure form.	
Bring the file IN3A_N.INP back into the foreground. Search for the string BIN_FILE001 using <i>Edit→Find</i> from the main menu of Notepad.	The complete line is as follows: <i>BIN_FILE001 'SAMP_A.BIN'</i> This identifies the name of the COMIDA2 binary file. This file contains food chain data.
Define the COMIDA2 file by double clicking on the form name <i>GENERAL/File Specifications/COMIDA2 File</i> . Click on the <i>Browse</i> button to find the file Samp_a.bin, and then click on <i>OK</i> .	The COMIDA2 file must be created using the dose conversion factor file that is used in the calculation. MACCS2 compares the headers of these two files to ensure compatibility.
Select <i>Execute→Run Models</i> from the main menu. Click on the <i>Run Simulation</i> button on the <i>Run Models</i> form.	MACCS2 runs successfully.

Table 3.12 Changing Input to Run One Evacuation Scenario

User Action	WinMACCS response
<p>Open the file, IN2A.INP, in Notepad if it isn't already open.</p> <p>Select <i>File</i>→<i>SaveAs</i> from the Notepad menu.</p> <p>Enter the name IN2A_1EVAC.INP</p> <p>Save a copy of IN2A_1EVAC.INP in the directory <i>\WinMACCS Samples\Tutorials\</i></p> <p>Scroll to the bottom of the file. Delete the last set of change cards, from the line following the first line with a period in column one to the last line in the file.</p> <p>Select <i>File</i>→<i>Save</i></p>	<p>The file that has exactly one evacuation scenario. The following lines were deleted:</p> <pre>***** * EMERGENCY RESPONSE SCENARIO NUMBER 2 ***** * EVACUATION ZONE DATA BLOCK, LOADED BY EVNETW, STORED IN /NETWORK/ /OPTIO/ * * SPECIFIC DESCRIPTION OF THE EMERGENCY RESPONSE SCENARIO BEING USED * EZEANAM2001 'NO EVACUATION, RELOCATION MODELS APPLY EVERYWHERE' * * WEIGHTING FRACTION APPLICABLE TO THIS SCENARIO * EZWTFRAC001 0.05 * * LAST RING IN THE MOVEMENT ZONE * EZLASM001 0 (A ZERO TURNS OFF THE EVACUATION MODEL) .</pre>
<p>Import file IN2A_1EVAC.INP by using the <i>File</i>→<i>Import MACCS2 Input File</i> feature.</p>	<p>Notice that the number of evacuation scenarios was not set to one, but remains two. This can be observed by noticing that the icon to the left of EARLY/Additional Emergency Scenarios/Emergency Scenario Two is not grey with a line through it.</p> <p>WinMACCS is unable to know for certain that the user does not want to run an additional scenario because they omitted EARLY change cards. The user must input this information directly.</p>
<p>Select <i>Edit</i>→<i>Project Properties</i>.</p> <p>Click on the Evac/Rotation tab.</p> <p>Set the <i>Number of Scenarios</i> to 1.</p> <p>Click <i>OK</i>.</p>	<p>Number of evacuation scenarios has been set to one.</p> <p>Notice the icon to the left of the <i>EARLY/Additional Emergency Scenarios</i> category is grey with a slash indicating that it is not used.</p>

<p>Select <i>Execute</i>→<i>Run Models</i> from the main menu. Click on the <i>Run Simulation</i> button on the <i>Run Models</i> form.</p>	<p>MACCS2 failed. The following message is displayed in the <i>Results</i> window:</p> <p><i>Model execution FAILED. Open output file for details.</i></p> <p><i>NO</i></p> <p><i>ERROR: WTFRAC must be between .999 and 1.001 when running only one evacuation cohort.</i></p> <p><i>!!! ERROR--FORCING ABNORMAL EXIT !!! called by INEVAC</i></p> <p>Error message indicates that WTFRAC is invalid. WTFRAC values for all evacuations need to add to approximately one. Previous versions of MACCS2 reassigned the value to be one when there was one evacuation scenario. The current version requires consistency.</p>
<p>Select <i>Edit</i>→<i>Find Parameter Window</i> from the main menu.</p> <p>Click on the entry <i>WTFRAC</i>.</p> <p>Click the <i>OK</i> button.</p>	<p>The form named <i>Basic Parameters for Scenario One</i> is opened. Type the value 1 for <i>WTFRAC</i>. Click <i>OK</i>.</p>
<p>Click on the <i>Run Simulation</i> button on the <i>Run Models</i> form.</p>	<p>MACCS2 runs successfully.</p>

The following are a few guidelines for creating a new project from scratch:

- When a new project is created by selecting *File*→*New Project* from the main menu, the WinMACCS *Properties* form is opened. The settings on this form should be reviewed and changed as needed. After this has been reviewed, click *OK* to save the settings. The settings on each tab of this form determine the icons next to the forms that are required, not required, and are optional.
- Starting at the top of the *Parameters* tab, fill in the required forms in order. A form is required if the icon is a hollow red octagon. Settings on the WinMACCS *Properties* form can be modified as needed. It is not required that the forms be filled out in order, but it may be helpful because information on some forms is required on other forms. Filling out the forms in order avoids any such conflicts.
- When all of the empty red octagons have been converted to solid green octagons, then select *Execute*→*Run Models* from the main menu. Click on *Run Simulation* to run. Look in the *Results* window to verify that the execution was successful. The output files from the execution can be opened by double clicking on the file names on the *Files* tab.
- It may be easier to debug the input if only the ATMOS model is enabled the first time MACCS2 is executed. After ATMOS is running successfully, change the main model to include EARLY on the *Properties* form. If needed, continue with CHRONC and COMIDA2 as each set of model input is debugged.

4 USER INTERFACE REFERENCE GUIDE

4.1 WinMACCS Project

The following sections describe how WinMACCS project files are organized on the user's file system and how these files are accessed and modified by using WinMACCS.

4.1.1 WinMACCS Project File Structure

A WinMACCS project folder contains the following components:

- A database file (e.g., myProject\myProject.mxd). This file is an Access 2000 database file. In addition to WinMACCS settings, this file contains the parameter values used to build the MACCS2 input files when a simulation is run.
- Three subdirectories as follows:
 1. myProject\Data\ contains user specified input files, such as the site file, the meteorological file, and the dose conversion factor file.
 2. myProject\Input\ contains input files created by WinMACCS each time the user requests a MACCS2 simulation.
 3. myProject\Output\ contains output from a MACCS2 execution.

To move the location of the project, the user can simply move (or drag and drop) the directory myProject\, the files, and subdirectories to a new location.

4.1.2 Overview of the Project Graphical Structure

When a project is opened using the *File*→*Open Project* command or a new project is created using the *File*→*New Project* command, a *Project* window and a *Results* window are opened. The *Project* window is used to modify parameter values and view related project files. Figure 4-1 shows the main components of a project.

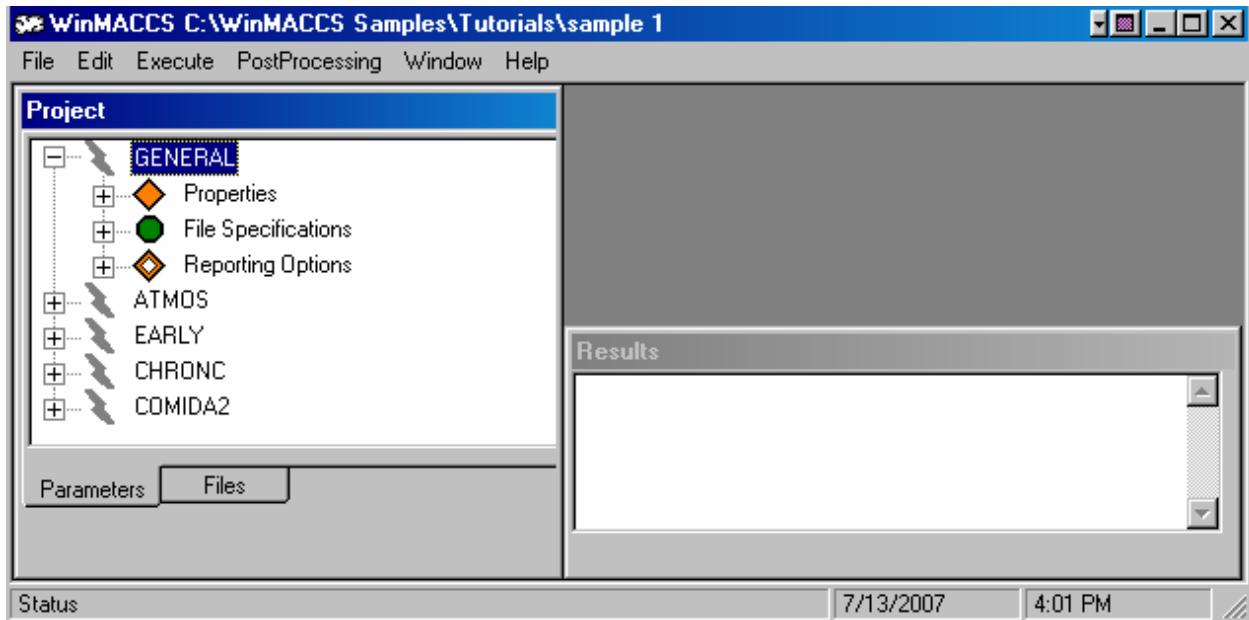


Figure 4-1 Project and Results Windows

- The caption at the top of the window indicates the name of the open project and the location of that project. In the example shown in Figure 4-1, the file C:\WinMACCS Samples\Tutorials\sample 1 is open.
- The main menu options are *File*, *Edit*, *Execute*, *PostProcessing*, *Window*, and *Help*.
- The *Project* window contains two tabs, the *Parameters* tab and the *Files* tab.
 - The *Parameters* tab contains a list of forms that are used to modify variables and to create file links. Forms are opened by double-clicking on their names.
 - The *Files* tab contains links to active files. A file is opened in a text editor by double-clicking on its name.
- The *Results* window displays the results of a user initiated action, such as importing a file or running a simulation.

4.1.3 Parameters Tab

The parameters are organized in a tree structure to facilitate access. The example in Figure 4-2 shows the main categories: *GENERAL*, *ATMOS*, *EARLY*, *CHRONC*, and *COMIDA2*. *GENERAL* contains a category named *Properties* a category named *File Specifications* and a form named *Reporting Options*. More information under the *Properties* and *File Specification* categories can be viewed if the + is clicked to display more detail.

Within the *ATMOS* category, the *Radionuclide* category has been completed, as shown by the solid orange diamond next to the category name. The orange color of the symbol indicates that there is at least one form in this category that is optional.

Within the *ATMOS* category, the *Deposition* category detail is shown. The empty red octagon indicates that there is missing information in this category. The *Wet/Dry Depos Flags* and *Wet Deposition* forms have been completed, as indicated by the solid green octagons. The *Dry Deposition* form still needs attention, as indicated by the red octagon next to the form name. This form contains two variables: *NPSGRP* and *VDEPOS*. If the form name or the variables are double-clicked, the corresponding parameter modification form is opened.

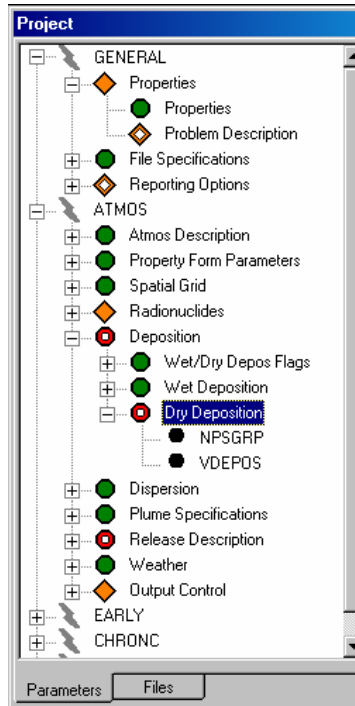




Figure 4-2 Parameters Tab

Notice that each entry in the tree has a related icon. This icon reflects the state of the object. The objects and icons are as follows:

 Input associated with a major code module is represented by a lightning bolt icon.

GENERAL, *ATMOS*, *EARLY*, *CHRONC*, and *COMIDA2* are the major categories. The *GENERAL* category contains the links to the minor model settings (for example, the weather sampling method) and the links to the auxiliary files to be used in a simulation. There are a number of categories within each module. These categories contain forms that are used to specify input parameters. An example of a category is *Plume Specifications*.

Forms within categories are represented with icons as follows:

-  An empty red octagon indicates that the user needs to complete this form before running MACCS2.
-  A solid green octagon indicates that the user has completed this form and that the data defined on this form are needed to perform a calculation.

- ◆ A solid orange diamond indicates that the user has completed this optional form. The data defined on all forms with an orange diamond are used in a subsequent calculation.
- ◇ An empty orange diamond indicates that the user has not completed this optional form.
- ◊ A solid gray diamond with a diagonal line indicates that the user has completed this form, but the data are not needed under the current model choices.
- ◊ An empty gray diamond with a diagonal line indicates that the user has not completed this form, but it is not required and can be ignored.
- There is a black circle next to each parameter name. The parameter names are listed for easy navigation of WinMACCS. Parameters are given the same names as the MACCS2 input variables. Double-clicking on a parameter object causes the related form to open, with the focus at the selected parameter value.

Double-clicking on a form or on a variable name associated with a form causes it to open it for editing.

Icons next to category names summarize the form states as follows:

- ◻ An empty red octagon indicates that the user needs to complete at least one form in the category before running MACCS2.
- A solid green octagon indicates that the user has completed all necessary forms in this category for the choices currently specified. It also indicates that there are no optional forms within this category.
- ◆ A solid orange diamond indicates that the user has completed all required forms in this category for the model choices that are currently specified. There are optional forms within this category that may or may not have been completed.
- ◇ An empty orange octagon indicates that the category contains only forms that are optional and that no forms in this category have been completed. It is not necessary to complete any forms in this category before proceeding with a calculation.
- ◊ A solid gray octagon with a diagonal line indicates that the user has completed at least one of the forms in the category, but because of the current model selections, the data are not used when running MACCS2.
- ◊ An empty gray octagon with a diagonal line indicates that the user has not completed any of the forms in the category, but does not need to because of the current model choices.

The *Properties* form found in the *GENERAL* category allows the user to modify the model choices that are used in a subsequent MACCS2 calculation. Data entry on this form can modify the status of the categories and forms as indicated by the icons listed above.

4.1.4 Files Tab

There are three categories on the *File* tab: *Data*, *Input*, and *Output*. Each of these categories corresponds to files stored in the project subdirectories *Data*, *Input* and *Output*.

The structure emulates the directory structure displayed when the project is viewed in Windows Explorer, with differences noted below in the detailed description of each of the three file categories.

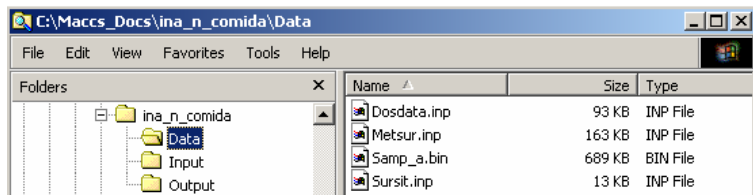


Figure 4-3 Data\ directory as seen from Windows Explorer

4.1.4.1 Data Files

This category contains data files specified by the user under the *General/File Specifications* category on the *Parameters* tab of the *Project* window.

Double-clicking on a file name opens the selected file in Notepad for editing. The user can modify the file and save it. The modified file is used when MACCS2 is run. Files in the *Data* directory other than those in *File Specifications* (Figure 4-1) are not shown in this view.

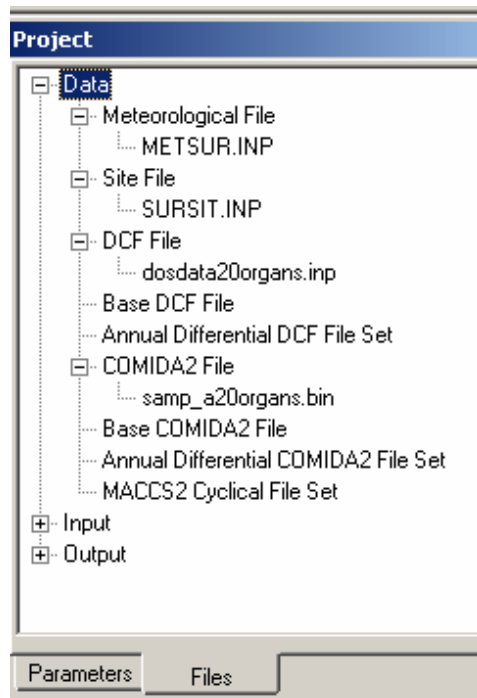


Figure 4-4 Project Data Directory

Not all of the files shown in Figure 4-4 are necessarily used when MACCS2 is run. Which files are used depends on the models that have been selected on the *Properties* form. For example, if the module *Early Consequences* is not selected, the DCF file is not needed for the simulation.

These file links can be modified by double-clicking on the form or variable name in the *GENERAL/File Specifications* category, as shown in Figure 4-5.

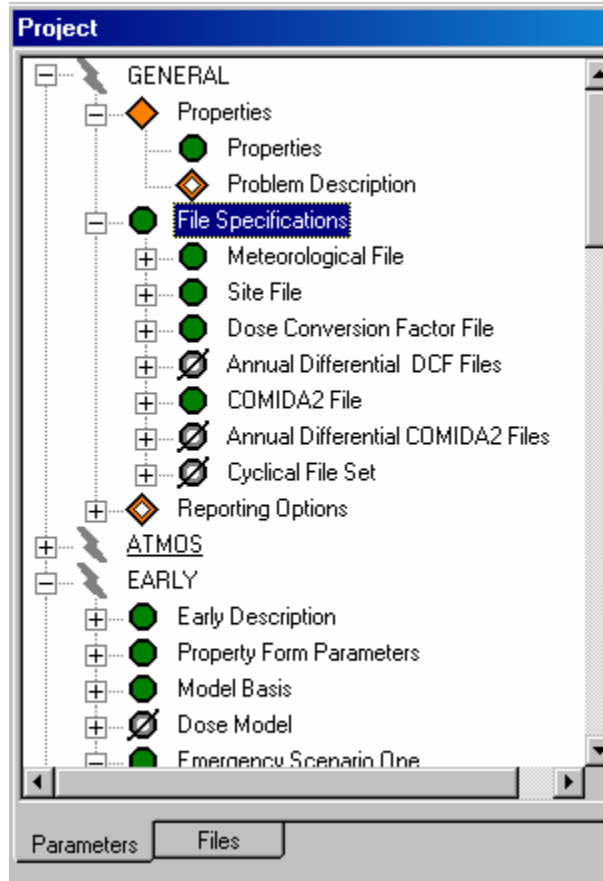


Figure 4-5 File Specifications

Model settings that affect the inclusion of data files are modified from the *Project Properties* form shown in Figure 4-6.

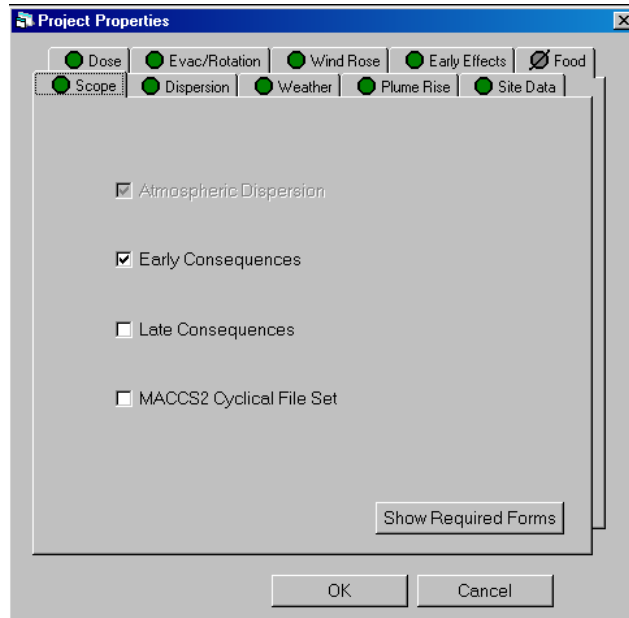


Figure 4-6 Project Properties Form

Table 4-1. Auxiliary Files Used by WinMACCS

Name of File Variable	Conditions When File(s) Is (Are) Required	Related Tab in Properties Form	Files from sample problems
<i>Meteorological File</i>	Required when meteorological file sampling is used. For information regarding the file format, see section A.1 of the MACCS2 User's Guide (Chanin and Young, 1997).	Weather	Metsur.inp MH8810.inp Metsur_morning.inp
<i>Site File</i>	Required when an <i>EARLY</i> simulation is chosen and population is not uniform. This file can be created using SECPOP2000. See section A.3 of the MACCS2 User's Guide (Chanin and Young, 1997).	Scope and Site Data	Sursit.inp SRS_F.inp
<i>DCF File</i>	Required when an <i>EARLY</i> simulation is chosen and the <i>Linear No Threshold (LNT)</i> dose model is selected. This file can be created by the preprocessor DOSFAC2 or FGRDCF. DCF files based on Federal Guidance Report 13 are included with the sample problems. See section A.2 of the MACCS2 User's Guide (Chanin and Young, 1997).	Scope and Dose	DosData20Organs.inp (created by DOSFAC2) and DOSD825.inp, DOSD60.inp(both created by FGRDCF) FGR13DCF.inp
<i>Base DCF File</i>	Required when the <i>Annual Threshold</i> or <i>Piecewise-Linear</i> dose model is selected.	Scope, Dose, and Food	dosData20Organs.inp FGR13DCF.inp

Name of File Variable	Conditions When File(s) Is (Are) Required	Related Tab in Properties Form	Files from sample problems
<i>Annual Differential DCF File Set</i>	Required when the <i>Annual Threshold</i> or <i>Piecewise Linear</i> dose model is selected. Each of the DosData20Organs files was created using a special version of DOSFAC2. The FGR13DCF files are based on interpolated and integrated adult absorbed-dose rate data for organs following a unit intake via ingestion or inhalation in the first year. Annual doses are contained in DosData20Organs nn .inp and FGR13DCF nn .inp, where nn is a two-digit integer that corresponds to dose received in year nn from an exposure that occurred in year one.	Scope, Dose, and Food	dosdata20organs01.inp dosdata20organs02.inp ... dosdata20organs50.inp Or FGR13DCF01.inp FGR13DCF02.inp ... FGR13DCF50.inp
<i>COMIDA2 File</i>	Required when doing a <i>CHRONC</i> simulation with the <i>COMIDA2</i> food-pathway option and the user is supplying a COMIDA2 file. This is a binary file created by the COMIDA2 preprocessor using the same DCF file specified above.	Scope and Food	samp_a20Organs.inp samp_d.bin fgr13samp_a.bin
<i>Base COMIDA2 File</i>	Required when doing a <i>CHRONC</i> simulation with the <i>Annual Threshold</i> or <i>Piecewise Linear</i> dose model. This file was created using the Base DCF File as input into COMIDA2.	Scope, Dose and Food	samp_a20organs.inp fgr13samp_a.bin
<i>Annual Differential COMIDA2 File Set</i>	Required when the <i>Annual Threshold</i> or <i>Piecewise Linear</i> dose model is selected. Each of these files was created using the corresponding DCF file specified in the Annual Differential DCF File Set as input into COMIDA2.	Scope, Dose, and Food	samp_a20organs01.inp samp_a20organs02.inp ... samp_a20organs50.inp fgr13samp_a01.bin fgr13samp_a02.bin ... fgr13samp_a50.bin

Name of File Variable	Conditions When File(s) Is (Are) Required	Related Tab in Properties Form	Files from sample problems
<i>MACCS2 Cyclical File Set</i>	Required when <i>MACCS2 Cyclical File Set</i> was selected under <i>Properties</i> . Each file contains MACCS2 and/or COMIDA2 input lines (ATMOS, EARLY, CHRONC, and/or COMIDA2). These files can be created using MELMACCS, an interface that creates MACCS2 input from a MELCOR plot file.	Scope	

Map files that are displayed behind the spatial grid on the forms supporting the input of the network evacuation direction and the network and radial evacuation speeds are also placed in the /Data directory. These .gif files are created to be sized to the spatial grid entered by the user in WinMACCS by a separate software program called MapGen. MapGen reads an interface file containing information about the spatial grid written by WinMACCS and creates the map files from this interface file. See section 4.8.2.

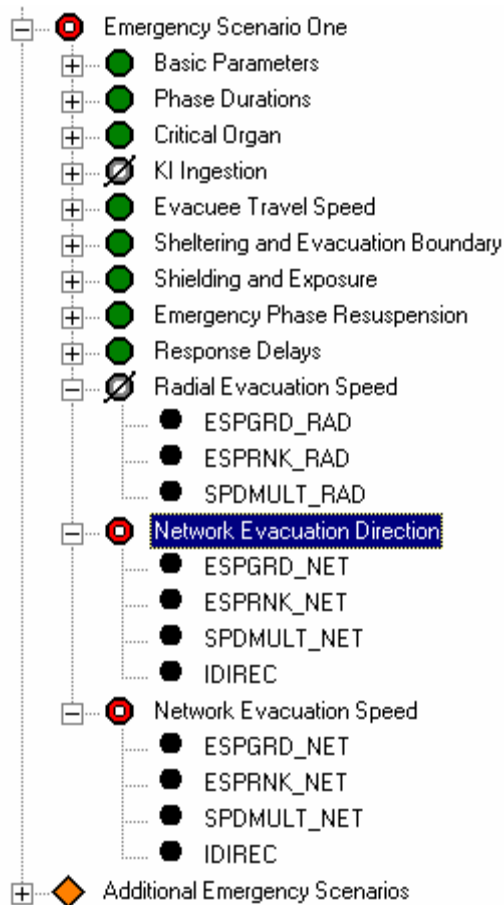


Figure 4.7 Forms that use Maps

4.1.4.2 Input Files

This category contains input files that are normally created by WinMACCS before running a MACCS2 simulation. If the main menu option, *Execute*→*Refresh Template Input Files before Running* is not checked, then the template files *atmosTemplate.txt*, *earlyTemplate.txt*, *chroncTemplate.txt*, and *comidaTemplate.txt* are not recreated from the settings within WinMACCS before running a simulation. This feature allows the user to edit these files and run a simulation using the edited files.

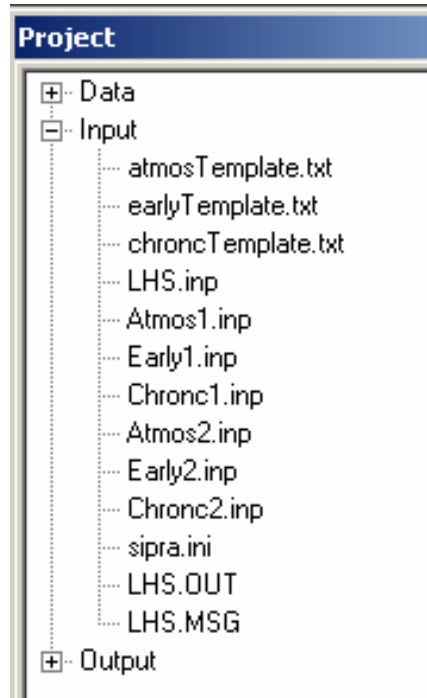


Figure 4-7 Input Files

All files in the user's project directory Project\Input\ are shown in the *Project* window. Selecting main menu option *File*→*Refresh File View* causes the hard drive to be queried and refreshes the *Project* window. Double-clicking on a file causes it to be opened in Notepad.

WARNING: The Input directory is not a good place to put any files that the user wants to keep! The Data (Project\Data\) and root directories (Project\) are safe places to store files because they are never deleted by WinMACCS. The user can also create additional directories for archiving files under the Project\ directory.

The following example reflects a run with a scope of *Atmospheric Dispersion, Early Consequences, Late Consequences*, and *COMIDA2*. In this example, some variables are sampled and two simulations are requested.

Table 4-2. Files created by WinMACCS

Name of File	Conditions When File Is Created	Description
atmosTemplate.txt	Created if option <i>Execute</i> → <i>Refresh Template Input Files before Running</i> is checked.	File atmosTemplate.txt is used to create input files Atmos1.inp and Atmos2.inp.
earlyTemplate.txt	Created if option <i>Execute</i> → <i>Refresh Template Input Files before Running</i> is checked and <i>EARLY</i> module is selected under the <i>Scope</i> tab in the <i>Properties</i> form.	File earlyTemplate.txt is used to create input files Early1.inp and Early2.inp.
chroncTemplate.txt	Created when option <i>Execute</i> → <i>Refresh Template Input Files before Running</i> is checked and <i>CHRONC</i> module is selected under the <i>Scope</i> tab in the <i>Properties</i> form.	File chroncTemplate.txt file is used to create input files Chronc1.inp and Chronc2.inp.
Atmos1.inp Early1.inp Chronc1.inp Atmos2.inp Early2.inp Chronc2.inp	Input files are created consistently with the model scope. For example, when the user has only specified <i>Atmospheric Dispersion</i> and <i>Early Consequences</i> on the <i>Scope</i> tab in the <i>Properties</i> form, then Atmos1.inp, Atmos2.inp, Early1.inp, and Early2.inp are created using atmosTemplate.txt and earlyTemplate.txt. Chroncn.inp is not created.	Files are created using the template files in conjunction with data from LHS.out relevant to each simulation. If any of the variables are uncertain, this information is encoded in the relevant template file. The actual values used in simulation <i>n</i> correspond to realization <i>n</i> in the LHS.out file.

Name of File	Conditions When File Is Created	Description
LHS.inp	Created whenever uncertain variables are defined.	This file contains input to LHS that indicates the number of observations, probability distributions, variable names, and correlations between sampled data.
Sipra.ini	Created whenever uncertain variables are defined.	This file contains LHS settings and is copied from Program Files\WinMACCS directory into the \Project\Input\ directory. This file is read by LHS. If this file needs to be changed, it should be modified in the Program Files\WinMACCS directory.
LHS.out LHS.msg	Created whenever uncertain variables are defined.	These files are created by LHS. LHS.msg is a detailed output file describing the run. LHS.out contains results in an easy to parse format. LHS.out is used to create the input files to MACCS2.
comidaTemplate.txt	Created when the <i>Late Consequences</i> option is selected on the <i>Scope</i> tab in the <i>Properties</i> form and the <i>Create COMIDA2 File</i> option is selected on the <i>Food</i> tab in the <i>Properties</i> form.	This file is similar to the other template files. It is used with LHS.out to create the three input files required by COMIDA2, namely <i>Comidan.inp</i> , <i>Comidan.par</i> , and <i>Comidan.var</i> , where <i>n</i> is the simulation number.
Comida1.inp Comida2.inp	Created when the <i>Late Consequences</i> option is selected on the <i>Scope</i> tab in the <i>Properties</i> form and the <i>Create COMIDA2 File</i> option is selected on the <i>Food</i> tab in the <i>Properties</i> form.	This is one of three input files required by COMIDA2.
Comida1.var Comida2.var	Created when the <i>Late Consequences</i> option is selected on the <i>Scope</i> tab in the <i>Properties</i> form and the <i>Create COMIDA2 File</i> option is selected on the <i>Food</i> tab in the <i>Properties</i> form.	This is one of three input files required by COMDIA2. It contains radionuclide data.

Name of File	Conditions When File Is Created	Description
Comida1.par Comida2.par	Created when the <i>Late Consequences</i> option is selected on the <i>Scope</i> tab in the <i>Properties</i> form and the <i>Create COMIDA2 File</i> option is selected on the <i>Food</i> tab in the <i>Properties</i> form.	This is one of three input files required by COMDIA2. It contains food-pathway data.

If the *Execute*→*Refresh Template Input Files before Running* from the main menu is checked (the default setting), then:

- When the *Run* button is clicked on the *Run* form, all of the files in the Project\Input directory are deleted.

If the *Execute*→*Refresh Template Input Files before Running* from the main menu is unchecked, then:

- When the *Run* button is clicked on the *Run* form, all of the files in the Project\Input directory are deleted except for the files *atmosTemplate.txt*, *earlyTemplate.txt*, *chroncTemplate.txt*, and *comidaInpTemplate.txt*
- The option allows the template files to be manually edited before running WinMACCS. While this option would not normally be selected by a user, it is helpful if there are new models in MACCS2 that are not yet supported in WinMACCS.

If the user has checked the box labeled *Delete Atmos, Early, Chronc and COMIDA2 Input Files* on the *Advanced Execution Parameters* form, the input files that aren't used as templates are deleted after they have been used. In the example above, this means that *Atmos1.inp*, *Atmos2.inp*, *Early1.inp*, *Early2.inp*, *Chronc1.inp*, *Chronc2.inp*, *LHS.inp*, *Comida1.inp*, *Comida2.inp*, *Comida1.par*, *Comida2.par*, *Comida1.var* and *Comida2.var* are deleted if specified by the user. See 4.10.2 for more information.

4.1.4.3 Output Files

This category contains output files created by MACCS2 and COMIDA2.

The entries under the category *Output* are file names found in the user's project directory Project\Output\ excluding the binary MACCS2 result files, which end with a .bin extension. They are created when the *Run* button is clicked on the *Run* form. Select main menu option *File*→*Refresh File View* to query the hard drive and refresh the file list.

The Output directory is a convenient place to store files because they are listed in the file view of the project.

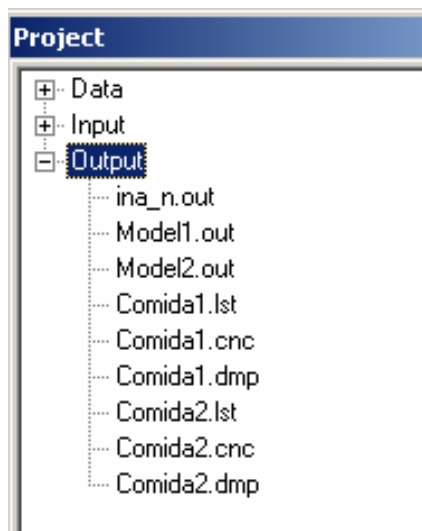


Figure 4-8 Output Files

WARNING: Do not name any files in the output directory *Modeln.out*, *Modeln.bin*, *Comidan.cnc*, *Comidan.dmp*, or *Comidan.lst*. These files are deleted from the *Output* directory each time a simulation is run. Likewise, never put any files in the *Project\Input* directory. These are all deleted each time a simulation is run.

Double-clicking on a file opens it in Notepad. The following example reflects a simulation with a scope including *Atmospheric Dispersion* and *Early* and *Late Consequences*. *Comida2* is run to create the .bin files used by the *Late Consequences* module. In the example, two simulations are requested.

Table 4-3. Output files created by MACCS2 and COMIDA2

Name of File	Description
Model1.out Model2.out	These are the output files created by MACCS2 corresponding to each of the LHS samples.
Model1.bin Model2.bin	These are the binary result files created by MACCS2 corresponding to each of the LHS samples. These files are not shown in the <i>Project\Output\</i> directory in WinMACCS.
Comida1.lst Comida2.lst Comida1.cnc Comida2.cnc Comida1.dmp Comida2.dmp	These are output created by COMIDA2 for each of the LHS samples.

If the user has checked the box labeled *Delete MACCS2 and COMIDA2 Output Files* on the *Advanced Execution Parameters* form, the text output files are deleted after each simulation.

Similarly, if the user has checked the box labeled *Delete MACCS2 and COMIDA2 Binary Result Files* the binary result files are deleted after the reports have been created. See 4.10.2 for more information.

4.1.5 Results Window

The *Results* window is found at the bottom of the application window. This is created when a project is opened.

The *Results* window communicates progress during

- MACCS2 simulations.
- The importing of MACCS2 binary files after selecting an entry from *PostProcessing*→*Graphical Results* from the main menu.
- The importing of MACCS2 input files after selecting *File*→*Import MACCS2 Input File* from the main menu.

Text shown in this window can be selected and copied to the Windows clipboard by using the copy and paste functions available when right clicking the mouse. Alternatively, the user can use the control-C option to copy text from this window.

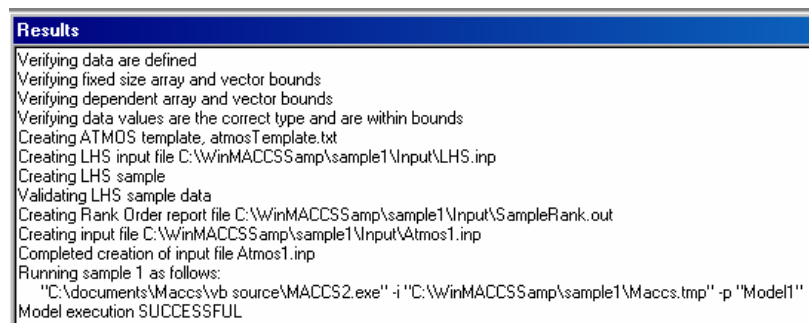


Figure 4-9 Sample Results Window

4.2 Main Menu Options

Figure 4-10 shows the main menu options listed at the top of the WinMACCS application.



Figure 4-10 The Main Menu

This section describes each of the menu selections in detail.

4.2.1 The File Menu

By selecting items on the *File* menu, the user can:

- Manage WinMACCS projects via the New Project, Open Project, Save Project, SaveAs Project, and Close Project commands.
- Refresh the view of the project files using *Refresh File View*.
- Convert MACCS2 files into WinMACCS projects with the utility *Import MACCS2 Input File*.
- View a MACCS2 binary output file in a text format using utility *Export Binary Results as Text*.

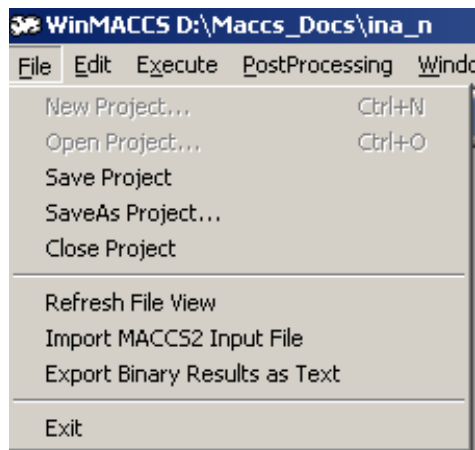


Figure 4-11 The File Menu

File menu commands are as follows:

File*→*New Project

This command creates a new WinMACCS project.

The user is required to type a name for the project in the *Project Name* text box. This name is used as a directory name and as the prefix of the .mxd (MACCS document) project file. The user is limited to enter only names that are legal names for windows directories and files. Optionally, the user can change the drive and parent directory for this new directory.

By default, the project location is on the drive where WinMACCS is installed. If the program was installed on the C:\ drive, then the default project directory is C:\WinMACCS Projects\.

Click *OK* to close this window and complete the operation of creating a new project. Click *Cancel* to close this window without creating a new project.

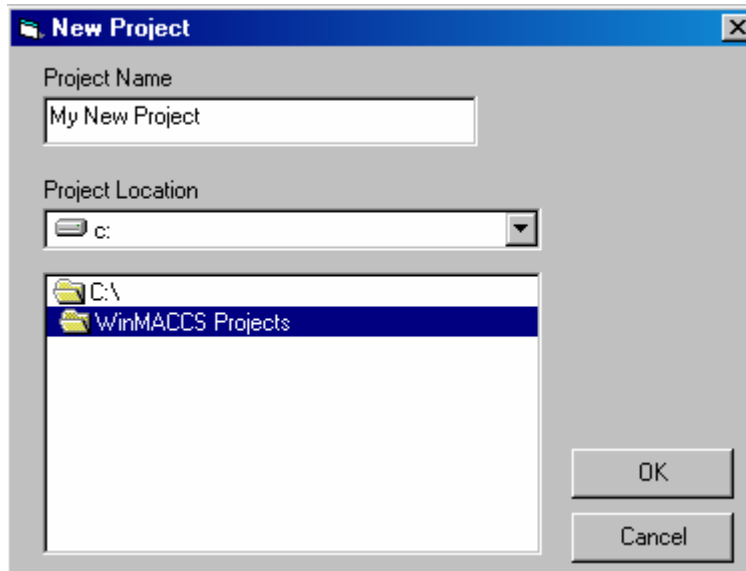


Figure 4-12 New Project Form

File→Open Project

This command opens an existing WinMACCS project. The user selects the .mxd file in the project root directory.

If the project file is not the same version as WinMACCS, a box similar to one shown in Figure 4-13 is displayed.

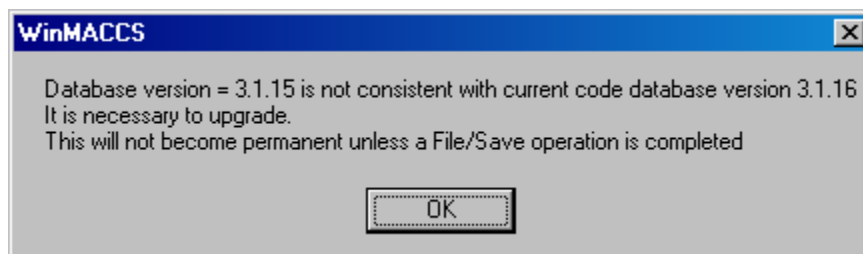


Figure 4-13 Database Inconsistency

Click *OK* to upgrade the database to the current version of WinMACCS. This does not modify the original .mxd file. To modify the original file, select *File→Save*. To retain the old project, select *File→SaveAs*.

File→Save Project

This command saves the changes made to the project variables and settings.

File→SaveAs Project

This command copies the current project to a new project. The directory structure and all files are copied to the new project.

File→Close Project

This command closes the current project. You must close the current project before opening another project. The interface supports only one project at a time. However, you can have multiple instances of WinMACCS running at a time provided each instance has a different project opened.

File→Refresh File View

This command refreshes the data displayed on the project *Files* tab.

File→Import MACCS2 Input File

This command prompts the user to select a MACCS2 input file. The file contents are read and data values are substituted into WinMACCS variables.

The MACCS2 input file does not need to be completed. The MACCS2 input lines are read and the values overlaid onto the existing project. If vector or array data are present in the MACCS2 input file, all values associated with that vector or array are cleared before the new data are overlaid onto the project. Only the data relevant to the model settings are imported into the project.

The model settings are modified while importing a MACCS2 input file. For example, the MACCS2 input file modifies the weather model if a METCOD card, indicating the weather model, is included in the file. If the model settings are modified, then the data relevant to those modified settings are imported. Data not relevant to model settings are skipped.

File→Export Binary Results as Text

This option opens a MACCS2 binary output file in text format. These files are found in the Project\Output\ directory, one for each simulation. The binary output files are the same files that are used by the WinMACCS postprocessor to display MACCS2 results graphically.

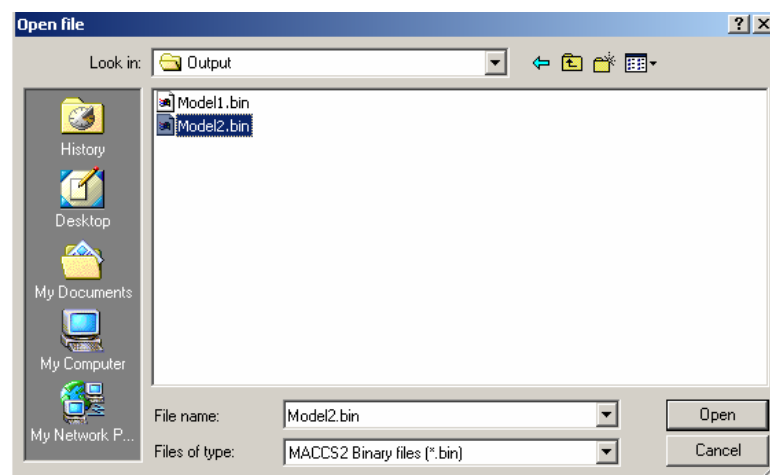


Figure 4-14 Import Binary File as Text

File*→*Exit

This option terminates WinMACCS.

4.2.2 The Edit Menu

By selecting items on the *Edit* menu, it is possible to:

- Modify data grids on parameter modification forms using commands from the submenu *Edit*→*Grid*.
- Correlate uncertain variables and enforce a rank order of sampled variables from the submenu *Edit*→*Correlate Uncertain Variables*.
- Reset parameters on parameter modification forms to the default values using the command *Reset Form Variables to Default*.
- Open parameter modification forms by choosing the variable name when using the command *Edit*→*Find Parameter Window*.
- Open the *Project Properties* window to modify basic modeling choices.

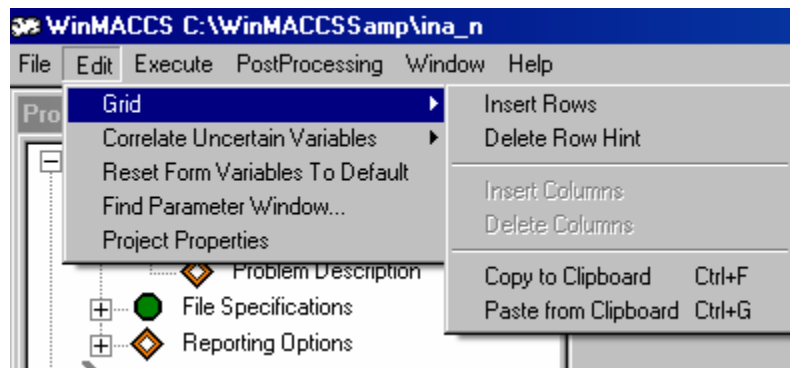


Figure 4-15 Edit Menu

Edit*→*Grid

The options available in the *Edit*→*Grid* submenu are enabled if a parameter modification form containing a grid has focus. For example, variable SPAEND is displayed in a grid contained in form *ATMOS/Radial Grid*.

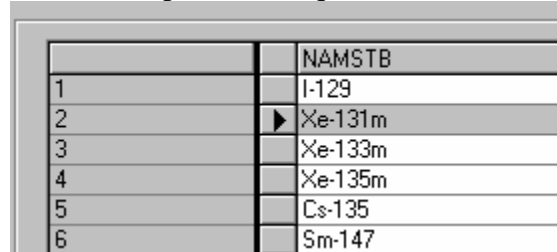
There are two types of grids within the parameter modification forms, namely vector and array grids. Arrays are variables with both rows and columns, where vectors may display multiple variables on a single grid, one variable for each column.

If a parameter form that contains an array (e.g., *ATMOS/Release Description/Release Fractions*) is opened, then the additional array operations, *Edit*→*Grid*→*Insert Columns* and *Edit*→*Grid*→*Delete Columns*, are enabled.

If a parameter form contains an array or vectors with a fixed number of rows (for example, vector variables CYSIGA, CYSIGB, CZSIGA and CZSIGB all require exactly six rows), then the operations *Edit*→*Grid*→*Insert Rows* and *Edit*→*Grid*→*Delete Row Hint* are not enabled.

Edit→Grid→Insert Rows

This option is used to insert rows in a grid. A row on the grid must be selected before this operation can be completed. To select a row, click on the small box between the row number and the data in the desired column. The row is highlighted as shown below. After the *Insert Row* option is selected, a *Grid Insert* form opens and requests more detail regarding the insert.



	NAMSTB
1	I-129
2	Xe-131m
3	Xe-133m
4	Xe-135m
5	Cs-135
6	Sm-147

Figure 4-16 Grid Showing a Selected Row

Edit→Grid→Delete Row Hint

This option is an aid to give the novice user instructions on how to delete a row in the grid. Selecting this option opens the following window.

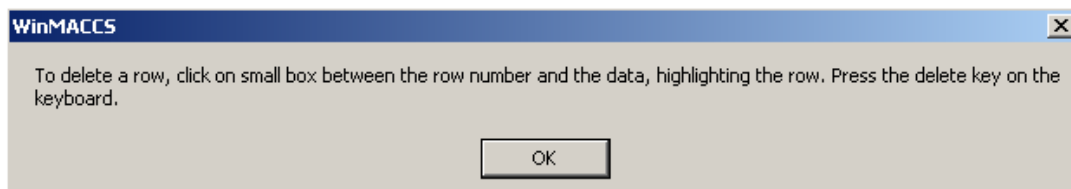
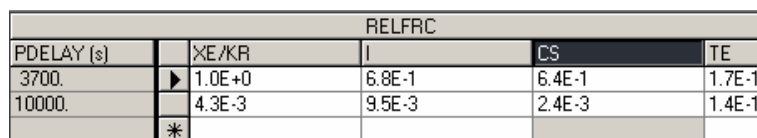


Figure 4-17 How to Delete a Grid Row

Edit→Grid→Insert Columns

This option is used to insert columns in an array. A column of the array must first be selected by clicking the column header. A selected column is shown in Figure 4-18. After the *Insert Columns* option is selected, a *Grid Insert* form opens to ask for more detail regarding the insert.



	RELFRC			
PDELAY (s)	XE/KR	I	CS	TE
3700.	1.0E+0	6.8E-1	6.4E-1	1.7E-1
10000.	4.3E-3	9.5E-3	2.4E-3	1.4E-1
	*			

Figure 4-18 Grid Showing a Selected Column

Edit→Grid→Delete Columns

This option is used to delete the currently selected array column.

Edit→Grid→Copy to Clipboard

This option is used to copy a portion of the grid data to the Windows clipboard. To do this, first select a portion of the grid in WinMACCS by holding the right mouse button down, dragging over the desired area, and then releasing the mouse. Then, either type the keyboard short-cut for copying (Ctrl+F) or select *Edit→Grid→Copy to Clipboard*. The data can be easily pasted into another application, such as MS Excel, with the keyboard shortcut (Ctrl+V). Note that the shortcut for copying from the grid is different than the standard Windows shortcut because these are distinct operations.

Edit→Grid→Paste from Clipboard

This option is used to transfer a portion of the grid data from the Windows clipboard into the grid. Before this can be done, first click on a cell in the grid to define the position of the paste operation. To complete the paste operation, either type the keyboard short-cut for pasting (Ctrl+G) or select *Edit→Grid→Paste from Clipboard*. Note that the shortcut for pasting onto the grid is different than the standard Windows shortcut because these are distinct operations.

This operation works well for transferring data from an MS Excel spreadsheet into the grid. If data are not being transferred from Excel, then it is helpful to know that a TAB character separates cells and a new line (i.e., the Enter key) separates rows in a text file.

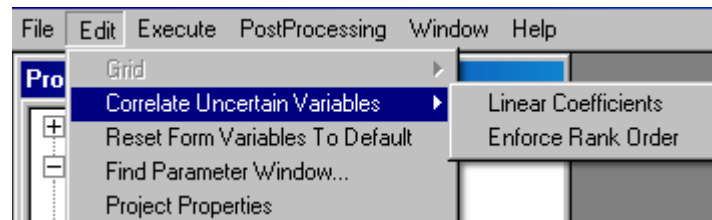


Figure 4.19 Correlate Uncertain Variables

Edit→ Correlate Uncertain Variables→ Linear Coefficients

This option opens the *Correlate Uncertain Variables* form, which allows the user to correlate uncertain variables. This is only relevant when LHS is being used to sample a set of uncertain variables.


Edit→ Correlate Uncertain Variables→ Enforce Rank Order

This option opens the *Enforce Rank Order of Uncertain Variables* form, which allows the user to force a chosen uncertain variable (shown as the *Reorder Parameter*) to be reordered after sampling. The revised order is the same as the basis uncertain variable (shown as the *Reorder Basis*). The relative order can either be ascending or descending.

Edit→Reset Form Variables to Default

This option is used to conveniently replace all the data on a form with the default values. This option operates in two modes as follows:

- If the form is open and has focus, the values are set to the default values.

Note: This is not the same operation as the Erase button  on the parameter form. The Erase button clears all values from the form, but does not replace variables with their default values.

- If the form is not open, then the variables defined on that form are reset to their default values. This has the effect of un-defining all data on that form. This operation does not affect read-only variables on the form. Read-only variables have gray backgrounds.

Note: This is the only way to remove data from required forms. Simply deleting data from a form and saving the empty values by clicking the *OK* button is not allowed.

Edit*→*Find Parameter Window

This option opens the *Open Parameter Form* to assist in locating input variables within the user interface.

Edit*→*Project Properties

This option is used to modify the basic model choices.

4.2.3 The Execute Menu

By selecting items on the *Execute* menu, it is possible to:

- Toggle the options, Validate Data before Running and Refresh Template Input Files before Running.
- Trigger importing the binary results files after execution is completed, and creating a statistical summary report without further user action.
- Open the *Run* form to initiate a MACCS2 simulation.

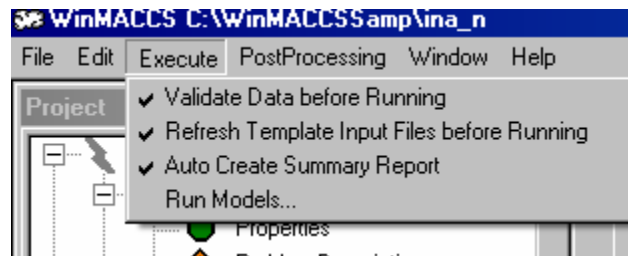


Figure 4-19 The Execute Menu

Execute*→*Validate Data before Running

This is a toggle that supports the following modes:

- If it is checked, the data are tested for consistency before a simulation.
- If it is unchecked, the consistency testing is skipped. This may be desired if a minor modification was made and the user doesn't want to wait for the consistency check to be performed before executing MACCS2.

This setting does not persist after the project file is closed.

Execute→Refresh Template Input files before Running

This is a toggle that supports the following modes:

- If it is checked, the template files are deleted and recreated based on the variable values and settings in the project after the *Run Simulation* button is clicked on the *Run* form.
- If it is unchecked, the template files are not recreated. This option is used to allow direct editing of the MACCS2 input files. In this case, the user can directly modify the file *atmosTemplate.txt*, *earlyTemplate.txt*, *chroncTemplate.txt* and *comidaTemplate.txt*. The template files are then used by WinMACCS to create the actual MACCS2 input files. Links to these files can be found in the *Files* tab in the Project window.

WARNING: Changing variables in a template file does not modify variables in the database. The files used with MACCS2, *atmos1.txt*, *early1.txt*, etc., are always recreated using the template files.

This setting does not persist after the project file is closed.

Execute→Auto Create Summary Report

This is a toggle that supports the following modes:

- If it is checked and if reporting has been requested, then after execution of all samples has been completed, the binary files are imported into the project database and the requested report is created without additional action by the user.
- If it is not checked, then reports are not created after execution. The user has the option to create reports through the *Create Custom Report* form that can be opened by selecting *PostProcessing→Create Custom Report* from the main menu. Reporting probabilities can also be requested after execution through the *General→Reporting Options* form.

This setting persists after the project file is closed.

Execute→Run Models...

The option is used after the model data are defined and it is desired to initiate a simulation.

4.2.4 The PostProcessing Menu

By selecting items on the *PostProcessing* menu, it is possible to:

- Open various graphics windows using the *Scalar Results*, *Statistical Summary Results*, and *Results over all Weather Trials* commands.
- Modify the axis labels and plot title using the *Modify Titles* command.
- Select graphs (i.e., plot series) in a graphics window using *Select Next Series*, *UnSelect*, and *Delete Selected Series* commands.
- Save the graphics window as a file, or save the data displayed in the graphics window as a file using the *Export Plot* command.
- Create custom reports using the *Create Custom Report* command for user defined probabilities.

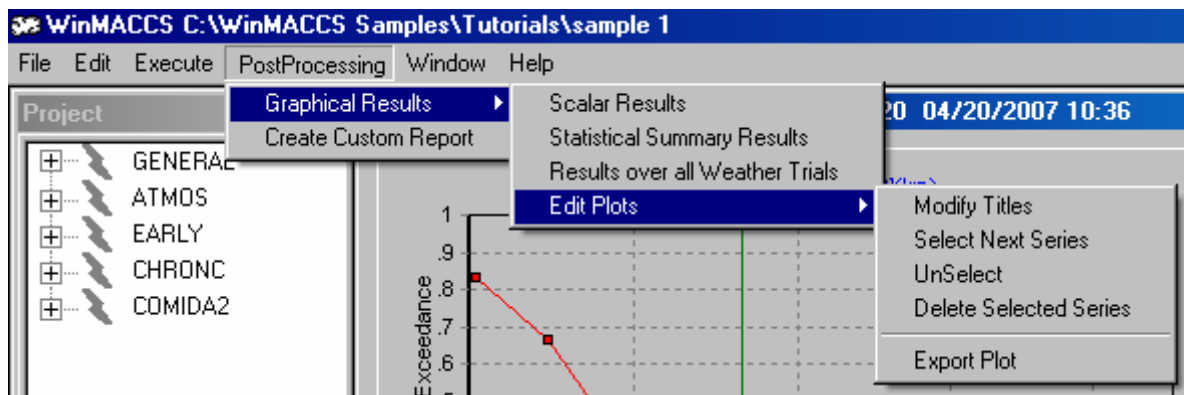


Figure 4-20 Graphical Results Menu

PostProcessing*→*Graphical Results*→*Scalar Results

This option is used to view results that are not dependent on weather sampling.

PostProcessing*→*Graphical Results*→*Statistical Summary Results

This option opens a graphics window to view statistical data MACCS2 has calculated over all simulations. The probability shown in the plot corresponds to the set of LHS trials, cyclical files, or a combination of both. The implicit assumption is that the variations represented by the cyclical files are equally probable.

PostProcessing*→*Graphical Results*→*Results over all Weather Trials

This option opens a graphical window to view the complementary cumulative distribution function reported on each individual execution. The probability shown in the plot corresponds to uncertainty in the weather at the time of the accident.

PostProcessing*→*Graphical Results*→*Edit Plots*→*Modify Titles

This option is used to change the plot, y-axis, or x-axis title.

PostProcessing*→*Graphical Results*→*Edit Plots*→*Select Next Series

This option is used to select the next series drawn on the plot. This performs the same function as the *Select* button on the *Plot* form.

PostProcessing*→*Graphical Results*→*Edit Plots* →*UnSelect

This option is used to remove the selection of a series on the plot.

PostProcessing*→*Graphical Results*→*Edit Plots* →*Delete Selected Series

This option is used to remove the selected series from the plot.

PostProcessing*→*Graphical Results*→*Edit Plots* → *Export Plot

This option is used to save the plot that the user has specified. A variety of formats, such as Excel (*.xls), Windows bitmap (*.bmp), Text (*.txt), JPEG (*.jpg), XML (*.xml), and HTML (*.html) are available.

PostProcessing*→*Create Custom Report

This option is used to create a custom report based on probabilities entered by the user in the *General*→*Reporting Options* form and the selected output requests. Output requests are made on forms in the *Atmos*→*Output Control*, *Early*→*Output Control* and *Chronc*→*Output Control* forms. All output is available even if the reporting option values on the *Output Control* forms are set to NONE or CCDF.

4.2.5 The Window Menu

By selecting items on the *Window* menu, it is possible to:

- Cascade the parameter modification forms and the plot form windows by selecting the *Cascade* function.
- Change the focus to another window by selecting that window from the list shown under the *Cascade* function.

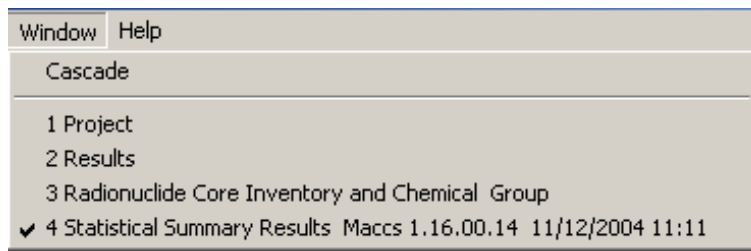


Figure 4-21 The Window Menu

4.2.6 The Help Menu

By selecting items on the *Help* menu, it is possible to:

- Access WinMACCS documentation by selecting either *Contents* or *Search For Help On...*
- Determine the version of WinMACCS by selecting *About*.

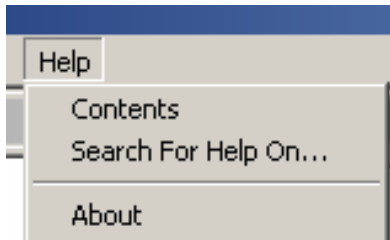


Figure 4-22 Help Menu

4.3 Selecting Models on Properties Form





The *Properties* form can be opened by selecting *Edit*→*Project Properties* from the main menu or by double-clicking on *General/Properties* from the *Parameters* tab in the *Project* window.

Basic model selections are made from the *Properties* form. By selecting models using the *Properties* form, other variable values relevant to model selection that are used by MACCS2 are initialized (e.g., METCOD). The variables affected by the *Properties* form can be viewed, but not modified, by opening the forms *ATMOS/Property Form Parameters*, *EARLY/Property Form Parameter* and *CHRONC/Property Form Parameters*.

The *Properties* form is automatically opened when a new project is created.

The decisions the user makes at this point determine which parameter forms are required. For example, if the *Late Consequences* module is not selected on the *Scope* tab, then variables in the *CHRONC* category are not required. Consequently, all *CHRONC* variables in the *Project* window *Parameters* tab have gray icons associated with them. Additionally, all tabs related to the *Late Consequences* module in the *Properties* form also have gray icons associated with them.


Each tab on the *Properties* form has at least one basic model associated with it. There is an icon next to the tab name. The meanings of the icons are as follows:

-  A red octagon means that the user must fill in this tab and click *OK* before proceeding with a calculation.
-  A green check mark means that the user has already completed this tab. If any modifications are made to this form, the user must click *OK* to save them.
-  A gray check mark means that the user has completed this tab, but the information is not used in a MACCS2 calculation given the basic modeling options the user has chosen. Depending on the selections made, other tabs may or may not be required.
-  A gray octagon means that the user has not completed this tab, but doesn't need to because the information is not relevant given the options that have been selected.

Save Changes

To save the changes, click *OK*.

Cancel Changes

To ignore the changes, click *Cancel* or close the window by clicking the  in the upper right corner.

Show Required Forms Given State of Tab

Click the *Show Required Forms* button to show which forms in the *Project* window are required if the models shown in the current tab were selected. Clicking this button also applies the selected options to other tabs in the Properties form. This does not save the current selection, but is a visual tool to help the user understand what input would be required if the selected options were saved.

In Figure 4-23, the *Power Law Functions* radio button was selected and *Show Required Forms* was clicked. When this was done, the *Dispersion Function* form name on the left changed from a gray octagon to a red octagon. This indicates that additional information is required on the *Dispersion Function* form if *OK* is clicked and this dispersion model option is saved.

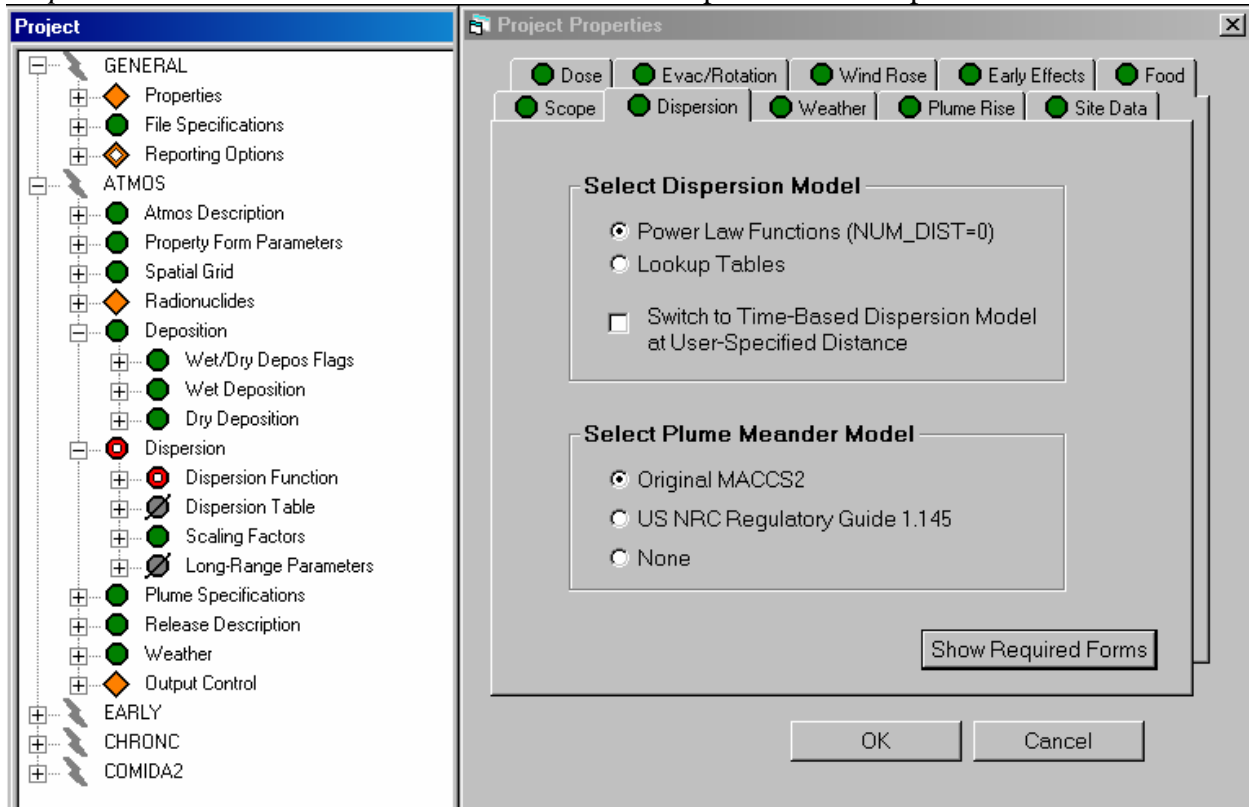


Figure 4-23 Relating Model Selection to Forms

4.3.1 Scope Tab

Each entry in the *Scope* tab of the *Properties* form corresponds to a set of variables that are required.

MACCS2 uses variables ENDAT1 and ENDAT2 to determine if the simulation should run the models ATMOS, ATMOS and EARLY or ATMOS, EARLY and CHRONC. The *Scope* tab

determines the value of these variables. ENDAT1 is set to False if the EARLY model is to be run. ENDAT2 is set to False if the CHRONC model is to be run.

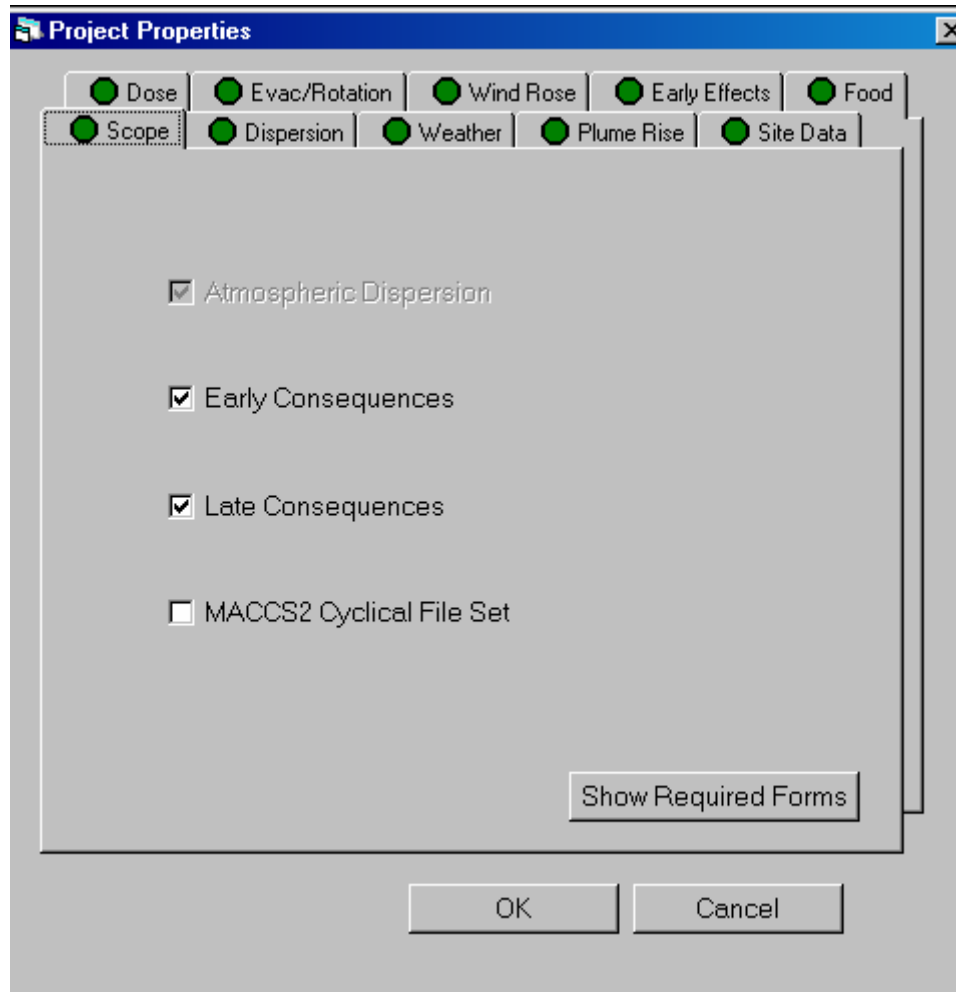


Figure 4-24 Scope of Calculation

The *Atmospheric Dispersion* (ATMOS) box is always checked.

Checking the *Early Consequences* Module (EARLY) box means:

- A dose conversion factor file needs to be assigned under the *File Specifications* category on *Parameters* tab of the *Project* window.
- Entries on other tabs, namely *Site Data*, *Dose*, *Evac/Rotation*, *Wind Rose*, and *Early Effects* determine the other required EARLY input variables.

Checking the *Late Consequences* module (CHRONC) means:

- *Early Consequences* are automatically checked. The CHRONC module cannot be run without the EARLY module.
- Entries on the *Food* tab determine the other required CHRONC input variables.

Checking the MACCS2 Cyclical File Set means:

- A cyclical file set needs to be assigned under the *File Specifications* category on the *Parameters* tab of the *Project* window.

Click *OK* to save the changes. Click *Show Required Forms* to see how this change affects the form states in the *Parameters* tab window and the tab states in the *Properties* form without saving the changes. Click *Cancel* to close this form without saving any changes.

4.3.2 Dispersion Tab

Select the *Dispersion* tab and select either *Power Law Functions* or *Lookup Tables*.

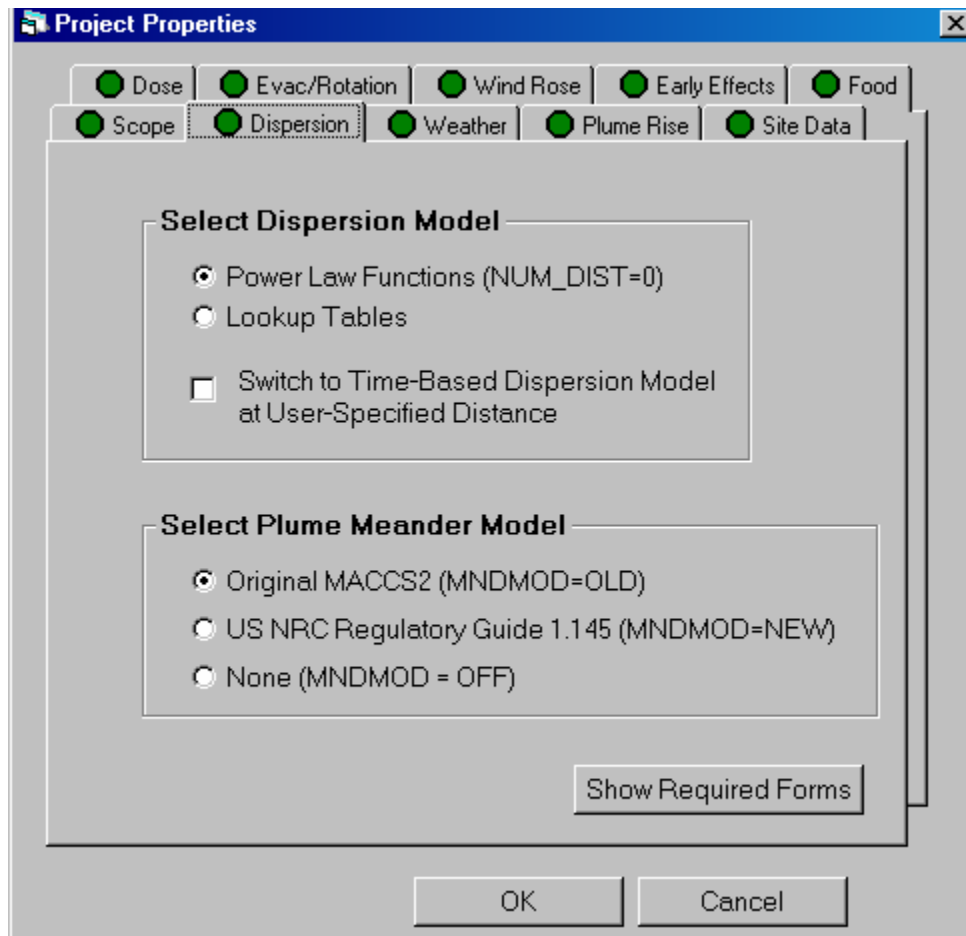


Figure 4-25 Dispersion Tab

Selecting the *Power Law Function* radio button means:

- Power law function parameters are required. These must be defined in the *Dispersion Function* form found in the *ATMOS/Dispersion* category in the *Parameters* tab. WinMACCS forces a value of zero to be used for NUM_DIST when building input images for MACCS2.

Selecting the *Lookup Tables* radio button means:

- Lookup table parameters are required. These must be defined in the *Dispersion Table* form found in the *ATMOS/Dispersion* category in the *Parameters* tab. WinMACCS uses the variable NUM_DIST as defined in the *Dispersion Table* form when building input images for MACCS2.

The check box labeled *Switch to Time-Based Dispersion Model at User-Specified Distance* means:

- If this box is checked, then WinMACCS sets the variable DISPMD to the value LRTIME. Parameters in the *Long-Range Time Based Parameters* form found in the *ATMOS/Dispersion* category in the *Parameters* tab are required.
- If not checked, then DISPMD is set to the value LRDIST. The value LRDIST causes MACCS2 to use the model used in MACCS2 1.12.

There are three choices for the plume meander model. MACCS2 uses a variable, MNDMOD, to determine which plume meander model to use. The corresponding value of MNDMOD is shown in to the right of each entry.

Selecting the *Original MACCS2* radio button means:

- Model used and required input parameters are consistent with MACCS2 1.12. The parameters on the form *ATMOS/Plume Specifications/Original Meander* are required. WinMACCS sets the variable MNDMOD to the value OLD.

Selecting the *US NRC Regulatory Guide 1.145* radio button means:

- Parameters on the form *ATMOS/Plume Specifications/US NRC Reg. Guide 1.145 Meander* are required. WinMACCS sets the variable MNDMOD to the value NEW.

Selecting the *None* radio button means:

- There are no required parameters. The plume meander model is turned off. WinMACCS sets the variable MNDMOD to the value OFF.

Click *OK* to save the changes. Click *Show Required Forms* to see how this change affects the form states in the *Parameters* tab window and the tab states in the *Properties* form without saving the changes. Click *Cancel* to close this form without saving any changes.

4.3.3 Weather Tab

Select the *Weather* tab.

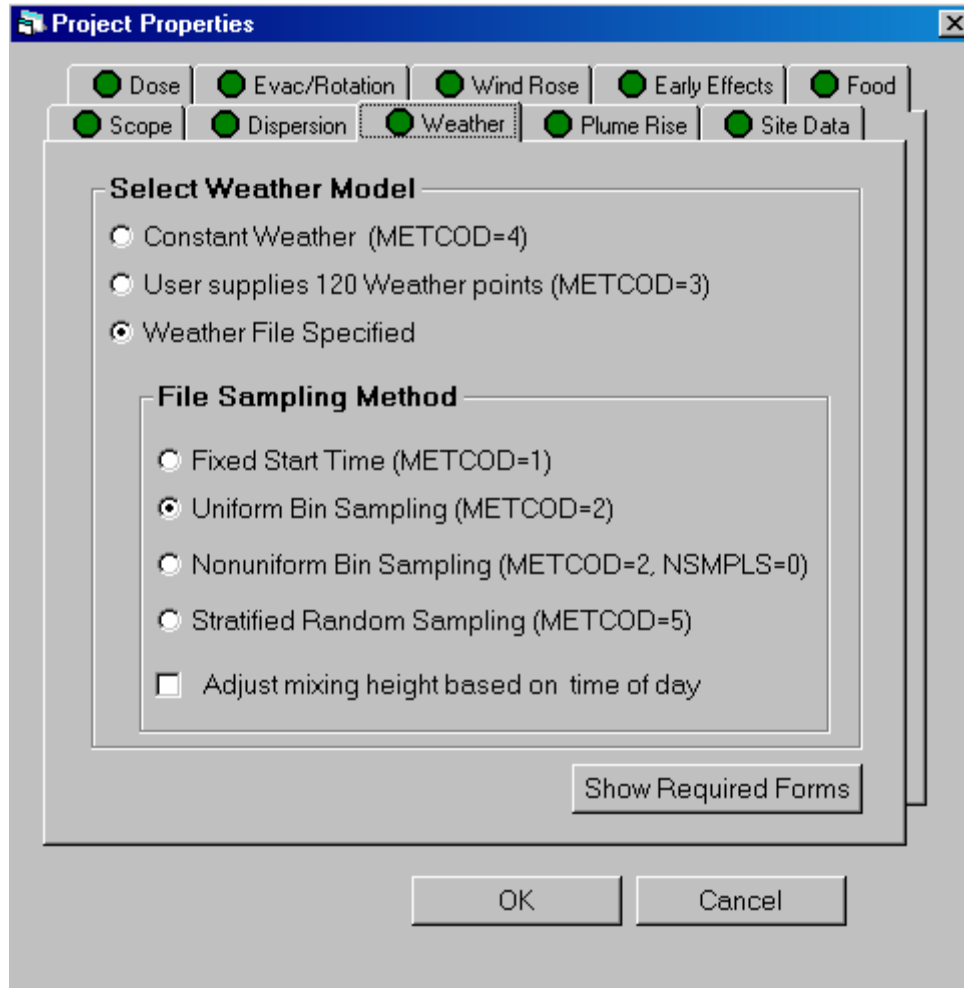


Figure 4-26 Weather Tab

MACCS2 uses a variable, METCOD, to determine which weather model to use. The corresponding value of METCOD is shown on the right of each entry.

Selecting the *Constant Weather* radio button means:

- The following forms found in the *ATMOS/Weather* category in the *Parameters* tab are required:
 - *Constant or Boundary Conditions*
 - *Fixed Start Time Data*

Selecting the *User supplies 120 Weather points* radio button means:

- The following forms found in the *ATMOS/Weather* category in the *Parameters* tab are required:
 - *Constant or Boundary Conditions*
 - *Fixed Start Time Data*

- *User-Supplied Weather*
- *Boundary Limit*

The other weather sampling options require specifying a meteorological file. The format of this file is described in Appendix A of the MACCS2 Users Guide. The meteorological file has been generalized to also support data for fifteen-minute and thirty-minute intervals. See Appendix A of this guide for more information. However, this finer time resolution for weather data is not supported with the *User Supplies 120 Weather points (METCOD=3)* option.

If the *Weather File Specified* radio button is selected, then a meteorological file is required and needs to be assigned under the *File Specifications* category on the *Parameters* tab. Also, a sampling method must be chosen. These are as follows:

Selecting the *Fixed Start Time* radio button means that the following forms found in the *ATMOS/Weather* category in the *Parameters* tab are required:

- *Constant or Boundary Conditions*
- *Fixed Start Time Data*
- *Boundary Limit*

Selecting *Uniform Bin Sampling* means that the following forms found in the *ATMOS/Weather* category in the *Parameters* tab are required:

- *Constant or Boundary Conditions*
- *Samples per Bin*
- *Seed*
- *Boundary Limit*
- *Rain Data Distance*
- *Rain Data Intensities*

Selecting *Nonuniform Bin Sampling* means that the following forms found in the *ATMOS/Weather* category in the *Parameters* tab are required:

- *Constant or Boundary Conditions*
- *Seed*
- *Boundary Limit*
- *Bins*
- *Rain Distances*
- *Rain Intensities*

Selecting *Stratified Random Sampling* means that the following forms found in the *ATMOS/Weather* category in the *Parameters* tab are required:

- *Constant or Boundary Conditions*

- *Samples per Day*
- *Seed*
- *Boundary Limit*

If the *Weather File Specified* radio button is selected then an optional mixing height model can be used. MACCS2 uses a variable, MAXHGT, to determine which mixing height model to use.

The check box labeled *Adjust mixing height based on time of day* means:

- If this box is checked, then WinMACCS sets the variable MAXHGT to the value DAY_AND_NIGHT. Parameters in the *Site Location* form found in the *ATMOS/Weather* category in the *Parameters* tab are required.
- If not checked, then MAXHGT is set to the value DAY_ONLY. This causes MACCS2 to use the model used in MACCS2 1.12.

Click *OK* to save the changes. Click *Show Required Forms* to see how this change affects the form states in the *Parameters* tab window and the tab states in the *Properties* form without saving the changes. Click *Cancel* to close this form without saving any changes.

4.3.4 Plume Rise Tab

Select the *Plume Rise* tab.

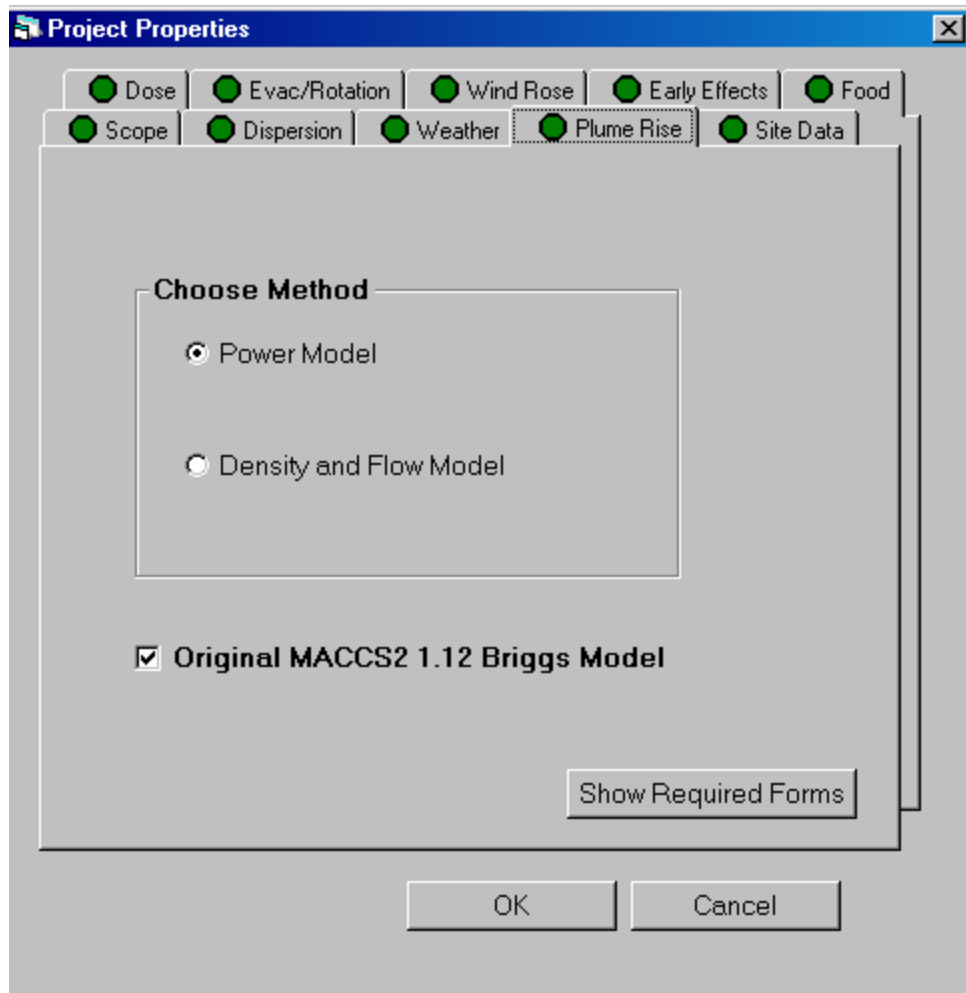


Figure 4-27 Plume Rise Tab

Selecting the *Power Model* radio button means:

- The original MACCS2 heat model is used. Heat rate input is required for each plume, which is found in the *ATMOS/Release Description/Heat* form on the *Parameters* tab.

Selecting the *Density and Flow Model* radio button means:

- Average mass flow rate and mass density are required parameters for each plume. These are defined in the *ATMOS/Release Description/Density and Flow* form found on the *Parameters* tab.

The check box labeled *Original MACCS2 1.12 Briggs Model* means:

- If this box is checked, then WinMACCS sets the variable BRGSMD to the value ORIGINAL. The original Briggs model is used to simulate plume rise. The default and recommended model is the improved one.
- If not checked, then BRGSMD is set to the value IMPROVED. This causes MACCS2 to use the improved plume rise model.

Click *OK* to save the changes. Click *Show Required Forms* to see how this change affects the form states in the *Parameters* tab window and the tab states in the *Properties* form without saving the changes. Click *Cancel* to close this form without saving any changes.

4.3.5 Site Data Tab

Select the *Site Data* tab.

It is necessary to fill out this tab if the *Early Consequences* module was selected.

MACCS2 uses a variable, POPFLG, to determine the site data source.

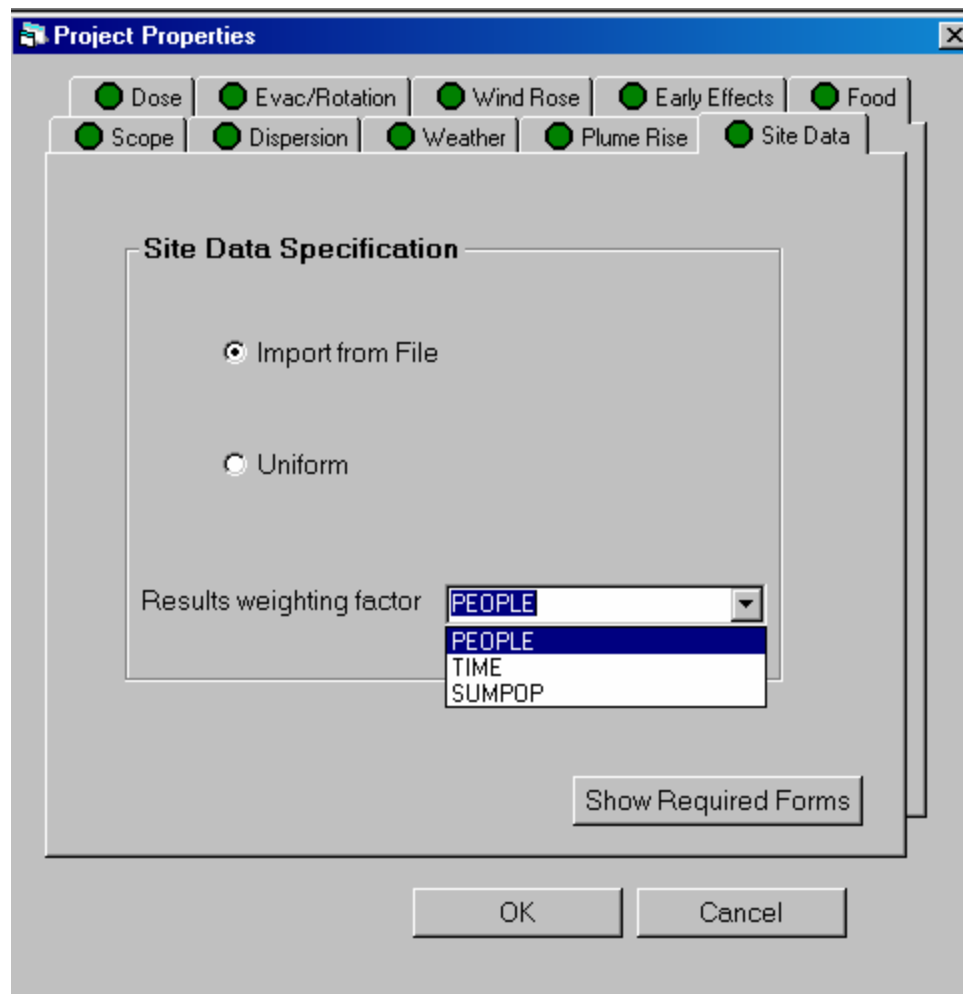


Figure 4-28 Site Data Tab

Selecting the *Import from File* radio button means:

- A site file is required and needs to be chosen under the *File Specifications* category on the *Parameters* tab on the *Project* window. This file can be created by a preprocessor, e.g., SECPOP2000, to generate the census and economic data relevant to the chosen site. A sample site file, Sursit.inp, is included with the WinMACCS CD. A preprocessor, PopMod, is included with WinMACCS. This is used to increase the angular resolution of a site file, and has been integrated into the site file specification form. See Appendix A of this document for more details.
- WinMACCS sets the variable POPFLG to the value FILE.

Selecting the *Uniform* radio button means:

- The population density data are required and are specified on the *Population Data* form found in the *EARLY/Model Basis* category on the *Parameters* tab.
- WinMACCS sets the variable POPFLG to the value UNIFORM.
- *SUMPOP* is not available as a value for the *Results weighting factor*.

The *Results weighting factor* value determines the way multiple-evacuation-scenario results are combined. The actual weight used for each of the scenarios (cohorts) is stored in variable WTRAC found in the *EARLY/Emergency Scenario N/Basic Parameters* forms, where *N* is the scenario number.

- If *SUMPOP* is selected, then the results are computed by a simple summation. The site file must include a separate population distribution for each evacuation scenario.
- If *TIME* is selected, then the weight fraction in the *Evacuation* tab refers to fraction of time.
- If *PEOPLE* is selected, then the weight fraction in the *Evacuation* tab refers to fraction of people.

MACCS2 uses a variable, WTNAME, to determine the result weighting method. This is set to SUMPOP, TIME, or PEOPLE, depending on the choice on this form.

Click *OK* to save the changes. Click *Show Required Forms* to see how these changes affect the form states in the *Parameters* tab window and the tab states in the *Properties* form without saving the changes. Click *Cancel* to close this form without saving any changes.

4.3.6 Dose Tab

Choices under the *Dose* tab must be made if the *Early Consequences* module was selected.

WinMACCS supports FGR (Federal Guidance Reports 11 and 12) dose conversion files created with FGRDCF, files created from Federal Guidance Report 13, and dose conversion files created by DOSFAC2. DOSFAC2 bases its dose conversion factors on DOE/EH-0070 (1988).

Changing the dose conversion factor file has the consequences of changing the possible values for organs in many of the forms. When this file type has been changed, the user may be required to modify other forms. The required forms display empty red octagons to show that they need attention after the user clicks OK on the *Properties* form. Optional forms that are incorrect are not clearly indicated in the interface, but are opened to be repaired when the user tries to run a simulation.

Selecting the *Federal Guidance Report (FGR-11 and -12) Dose Conversion Factor File (FGRDCF)* radio button means:

- Early injuries and early fatality calculation options are not available. These selections, *Early Fatality Effects* and *Early Injury Effects* are grayed out on the *Early Effects* tab in the *Properties* form.
- Data on the related forms *Early Fatality Parameters* and *Early Injury Parameters* are not used.
- Data defined on the *Early Fatality Radius* form in the *Early/Output Control* category are not used.
- The *Annual Threshold* and *Piecewise Linear* dose models are not available on the *Dose* tab. Only the *Linear No Threshold* model is available to the user.

Selecting the *File Created by DOSFAC2* radio button means:

- If the *Late Consequences* module is selected, then the *Annual Threshold* and *Piecewise Linear* dose models are available for selection.
- The form *Organs of Risk DOSFAC2* is required.

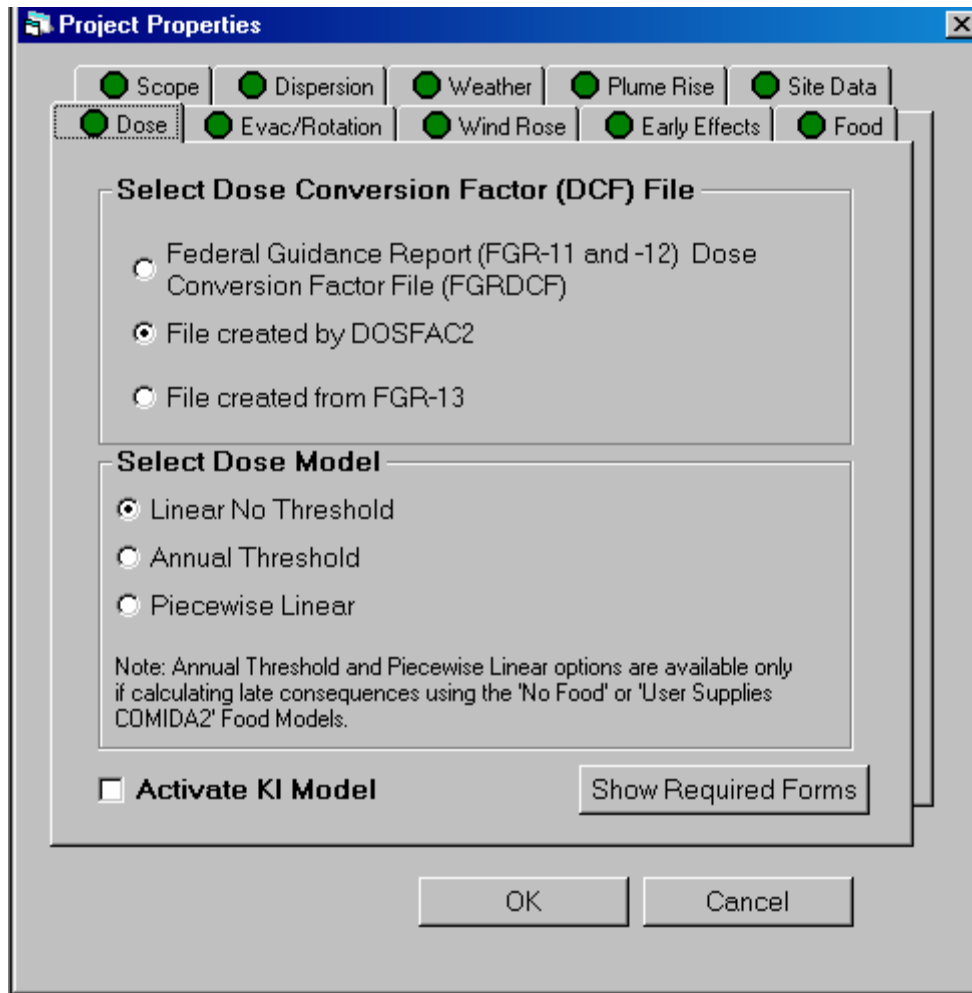


Figure 4-29 Dose Model Tab

Selecting the *File Created from FGR-13* radio button means:

- If the *Late Consequences* module is selected, then the *Annual Threshold* and *Piecewise Linear* dose models are available for selection.
- The form *Organs of Risk FGR-13* is required.

The user has three dose models to choose from. MACCS2 uses a variable, DOSMOD, to determine the dose model chosen.

Selecting the *Linear No Threshold* dose model radio button means:

The linear no-threshold (used in earlier versions of MACCS2) dose model is used to calculate doses. DOSMOD is set to LNT

Selecting the *Annual Threshold* dose model radio button means:

- The EARLY/Dose Model/Annual Threshold form must be completed.
- The EARLY/Dose Model/Lifetime Threshold form can be optionally completed.
- DOSMOD is set to AT.

Selecting the *Piecewise Linear* dose model radio button means:

- The EARLY/Dose Model/Piecewise Linear form must be completed.
- DOSMOD is set to PL.

Selecting either the *Annual Threshold* or *Piecewise Linear* models means:

- If the *Activate KI Model* check box is checked, the *EARLY/Dose Model/KI Ingestion* form must be filled out instead of the *EARLY/Emergency Scenario One/KI Ingestion* form. In this case, only the values 0 or 1 are valid for POPFRAC on the KI Ingestion form.
- On the *Food* tab the options *User supplies COMIDA2 file* or *No Food Model* must be chosen.
- Files must be specified under the GENERAL/File Specifications/Annual Differential DCF Files and GENERAL/File Specifications/Annual Differential COMIDA2 Files forms.

MACCS2 uses a variable, KIMODL, to determine if the KI model is to be used. If the check box *Activate KI Model* is checked, then this variable is set to *KI*. Otherwise, this variable is set to *NOKI*.

Click *OK* to save the changes. Click *Show Required Forms* to see how this change affects the form states in the *Parameters* tab window and the tab states in the *Properties* form without saving the changes. Click *Cancel* to close this form without saving any changes.

4.3.7 Evac/Rotation Tab

It is necessary to fill out this tab if the *Early Consequences* module was selected.

Choose the number of evacuation scenarios. WinMACCS supports up to 20 scenarios. (Scenarios two through twenty correspond to EARLY change sets in the MACCS2 input files.) Evacuation scenarios are called cohorts in the MACCS2 Users Manual.

MACCS2 uses a variable, EVATYP, to determine the evacuation model chosen for scenario one. This is set to RADIAL, NETWORK, or NONE, depending on the choice on this form.

The image shows a software interface for the Evac/Rotation tab. It features a row of radio buttons for selecting different modules: Scope, Dispersion, Weather, Plume Rise, Site Data, Dose, Evac/Rotation (which is currently selected and highlighted with a dashed border), Wind Rose, Early Effects, and Food. Below this row is a section labeled 'Number of Scenarios' with a dropdown menu showing the number '2'.

Figure 4-30 Number of Evacuation Scenarios

Choosing the *Number of Scenarios* greater than one means:

- Other evacuation scenarios use the same data as the previous scenario.
- Variable WTRAC is used to weigh the significance of the evacuation scenarios. For example, if 95% of the population evacuates as part of scenario one, and 5% evacuates as part of scenario two, then under the *EARLY* category *Emergency Scenario One* on the *Basic Parameters* form, WTRAC must be set to .95; similarly, WTRAC must be set to .05 under *Emergency Scenario Two*. In this example, *PEOPLE* should be selected on the *Site Data* tab in the *Properties* form.

Choosing the *Number of Scenarios* equal to one means that the value of WTRAC in the *Basic Parameters* form under the *Emergency Scenario One* category must be set to one.

Choose the evacuation model for scenario one.

The image shows a dialog box titled "Choose Evacuation Model for Scenario One". It contains two radio buttons: "No Evacuation (LASMOV=0)" and "Evacuation". The "Evacuation" radio button is selected. Below the "Evacuation" radio button is a dropdown menu with "Radial" selected. A red arrow points to the dropdown menu with the label "Evacuation Type Field".

Figure 4-31 Evacuation Type

Selecting the *No Evacuation* option means:

- The only option for the evacuation type field for subsequent evacuation scenarios (if applicable) is *None*.

Selecting the *Evacuation* option and *Radial* from the drop down menu means:

- The options for the evacuation type for subsequent evacuation scenarios (if applicable) are *None* and *Radial*.

Choosing the *Evacuation* option and *Network* from the drop down menu means:

- The options for the evacuation *Type* field for subsequent evacuation scenarios (if applicable) are *None* and *Network*.
- The field *Wind Shift and Rotation* must be set to *Wind Shift without Rotation*.

Choose the calculation method used to apply nuclide dispersion to the population.

MACCS2 uses a variable, IPLUME, to determine which wind direction model to use. The corresponding value of IPLUME is shown on the right of each entry.

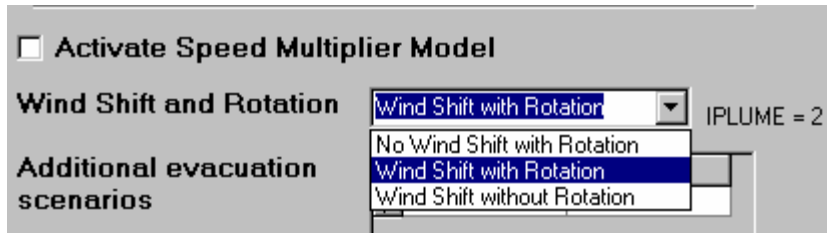


Figure 4-32 Wind Shift and Rotation

Choosing *No Wind Shift with Rotation* means:

- All subsequent plume segments move in the same direction as the initial plume segment.
- All plume segments are rotated around the compass, creating a result for each angle, and for each weather trial, if weather bin sampling is selected. There are typically sixteen angles per 360 degrees. The results are weighted using the wind rose for the weather bin or the user defined values for the wind rose (see below).
- IPLUME is set to one.

Choosing *Wind Shift with Rotation* means:

- Plume segments move in the direction that the wind is blowing at the time of their initial release.
- All plume segments are rotated around the compass, creating a result for each angle, and for each weather trial, if weather bin sampling is selected. The results are weighted using the wind rose for the weather bin or the user defined values for the wind rose (see below).
- IPLUME is set to two.

Choosing *Wind Shift without Rotation* means:

- Plume segments move in the direction that the wind is blowing at the time of their initial release.
- Only the wind direction indicated in the meteorological file or input is used for the plume segments. Thus, only a single result is generated per weather trial.
- IPLUME is set to three.

Enter the evacuation *Type* for the other scenarios by filling in the grid.

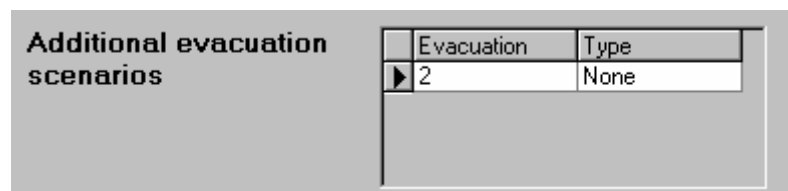


Figure 4-33 Additional Evacuation Data

Click *OK* to save the changes. Click *Show Required Forms* to see how this change affects the form states in the *Parameters* tab window and the tab states in the *Properties* form without saving the changes. Click *Cancel* to close this form without saving any changes.

4.3.8 Wind Rose Tab

It is necessary to fill out this tab if the *Early Consequences* module was selected.

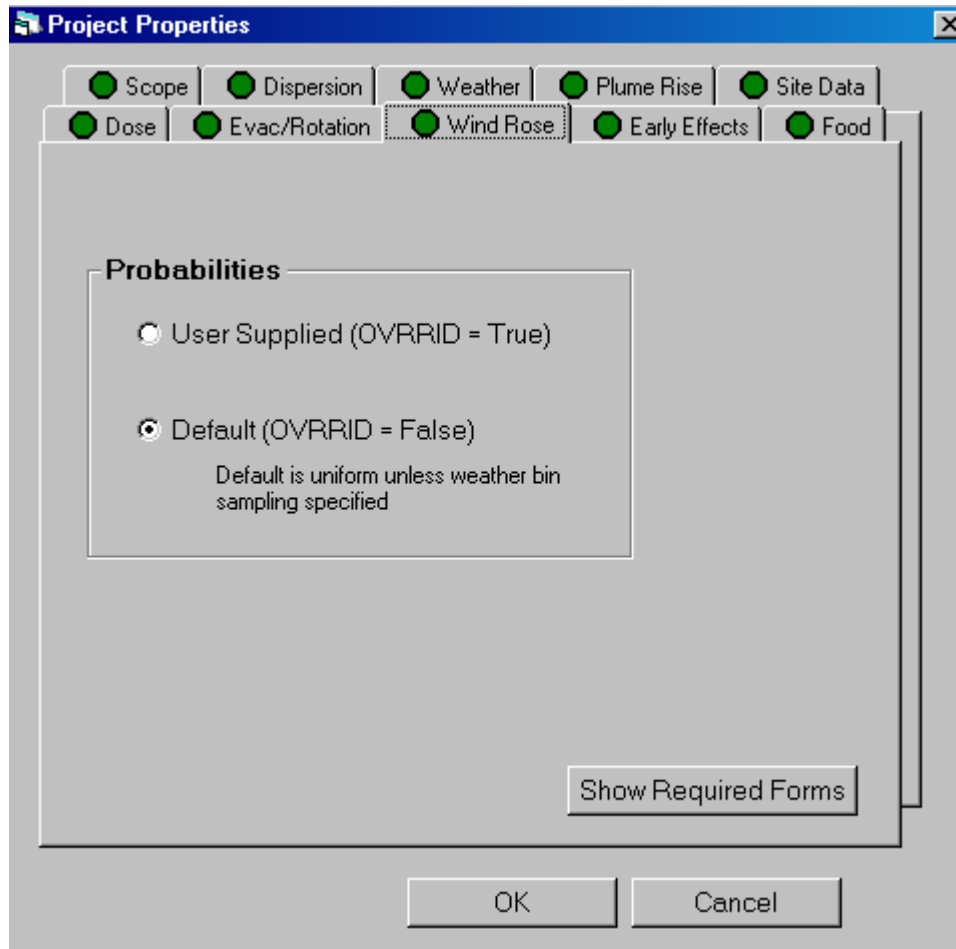


Figure 4-34 Wind Rose Tab

The corresponding value of the MACCS2 variable OVERRIDE is shown to the right of each entry.

Selecting the *User Supplied* radio button means:

- Wind rose probability parameters are required. These are defined in the *Wind Rose Probabilities* form found in the *EARLY/Model Basis* in the *Parameters* tab.

Selecting the *Default* radio button means:

- Wind rose probabilities for each weather sampling bin are used. If no wind rose is available, a uniform wind rose is used (i.e., the probability is 0.0625 in each direction if the compass is divided into sixteen equal angles).

Click *OK* to save the changes. Click *Show Required Forms* to see how this change affects the form states in the *Parameters* tab window and the tab states in the *Properties* form without saving the changes. Click *Cancel* to close this form without saving any changes.

4.3.9 Early Effects Tab

It is necessary to fill out this tab if the *Early Consequences* module was selected.

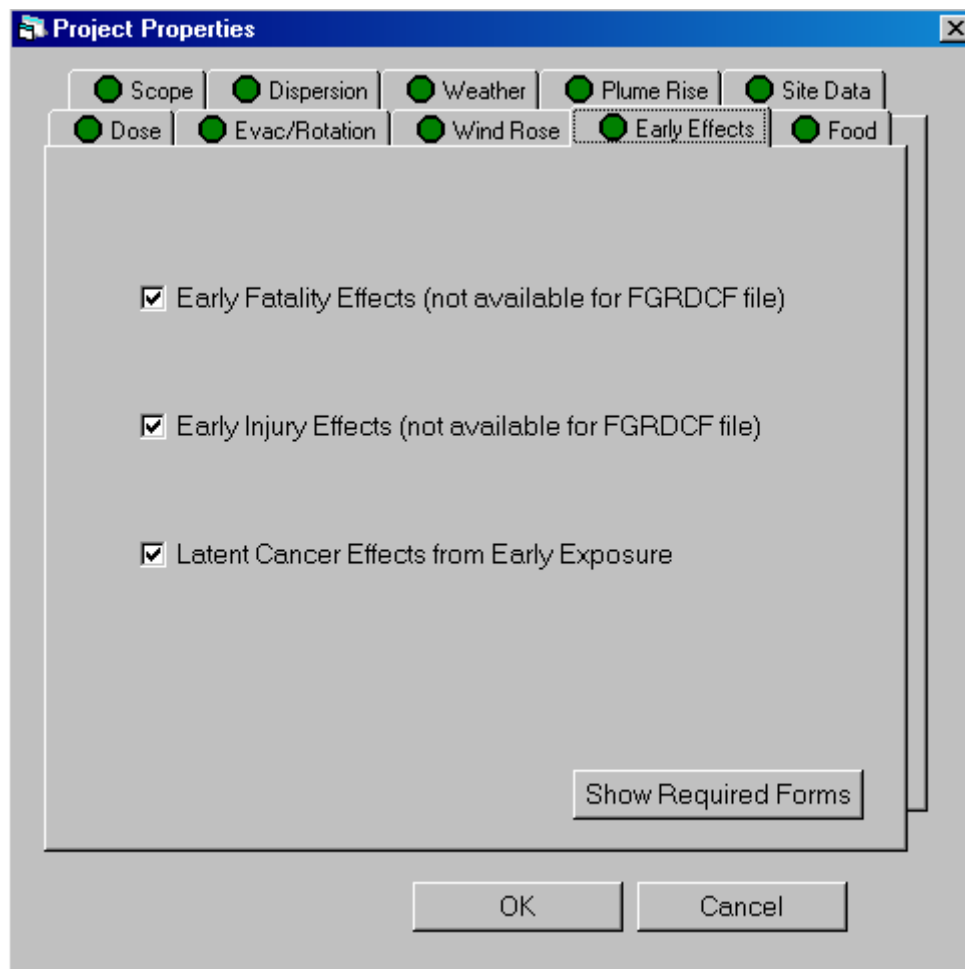


Figure 4-35 Early Effects Calculations

Select the desired early effects calculations.

If an FGRDCF dose conversion factor file was specified, early fatality and injury results are not available.

Selecting the *Early Fatality Effects* check box means:

- Early fatality parameters must be defined on the *Early Fatality Parameters* form.
- The fatalities defined can then be included in the output requests on the *Health-Effect Cases* form (type 1), *Average Individual Risk* form (type 4), *Centerline Risk* form (type 7) and *Population-Weighted Risk* form (type 8).

Selecting the *Early Injury Effects* check box means:

- Early injury parameters must be defined on the *Early Injury Parameters* form.
- The injuries defined can then be included in the output requests on the *Health-Effect Cases* form (type 1), *Average Individual Risk* form (type 4), *Centerline Risk* form (type 7) and *Population-Weighted Risk* form (type 8).

Note: If the *Early Injury Effects* check box is not selected, then early injury output requests are not calculated by MACCS2. Requests for early injury results must be removed from the *Health-Effect Cases* form (type 1), *Average Individual Risk* form (type 4), *Centerline Risk* form (type 7), or the *Population-Weighted Risk* form (type 8).

Selecting the *Latent Cancer Effects from Early Exposure* check box means:

- Latent cancer parameters must be defined on the forms found under the *Latent Cancer Parameters* category, namely *Latent Cancer Parameters* and *Latent Cancer Thresholds*.
- The latent cancer results can then be included in the output requests on the *Health-Effect Cases* form (type 1), *Average Individual Risk* form (type 4), *Centerline Risk* form (type 7) and *Population-Weighted Risk* form (type 8).

Note: If the *Latent Cancer Effects from Early Exposure* check box is not selected, output requests on the *Health-Effect Cases* form (type 1), *Average Individual Risk* form (type 4), *Centerline Risk* form (type 7), and *Population-Weighted Risk* form (type 8) may no longer be valid if they reference latent cancers that are no longer defined.

Click *OK* to save the changes. Click *Show Required Forms* to see how this change affects the form states in the *Parameters* tab window and the tab states in the *Properties* form without saving the changes. Click *Cancel* to close this form without saving any changes.

4.3.10 Food Tab

It is necessary to fill out this tab if *Long-Term Consequences* was selected.

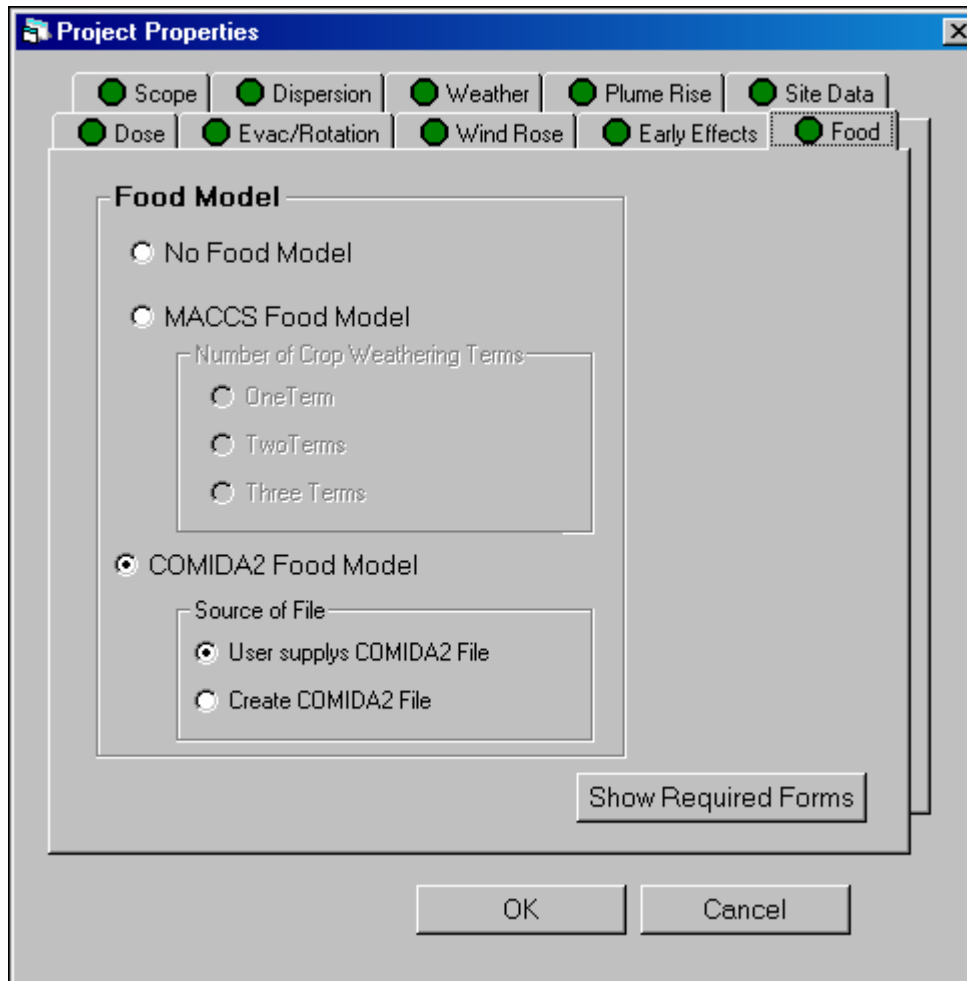


Figure 4-36 Food Chain Model

MACCS2 uses a variable FDPATH to determine which food model to use.

Selecting the *No Food Model* radio button means:

- The *Annual Threshold* and *Piecewise Linear* dose models are available. If one of these models is chosen, a set of fifty-one dose conversion factor files is required.
- FDPATH is set to OFF

Selecting the *MACCS Food Model* radio button means:

- The older MACCS food-chain model is used instead of the COMIDA2 model.
- The Annual Threshold and Piecewise Linear dose models are not available.
- FDPATH is set to OLD.
- MACCS2 uses variable NTTRM to indicate the number of crop weathering terms used if the MACCS2 food model is used. NTTRM is set to the value indicated on this tab.

Selecting the *User Supplies COMIDA2 File* radio button means:

- The *Annual Threshold* and *Piecewise Linear* dose models are available. If one of these models is chosen, a set of binary COMIDA2 and the corresponding dose conversion factor files used to create those binary COMIDA2 files are required.
- If the Linear (LNT) dose model is chosen, a single COMIDA2 file must be selected by the user. The dose conversion factor file must be the same one used to create the binary COMIDA2 file.
- FDPATH is set to NEW.

Selecting *Create COMIDA2 File* radio button means:

- The *Annual Threshold* and *Piecewise Linear* dose models are not available.
- The COMIDA2 binary file is created when the simulation is run. Uncertain values in the COMIDA2 input are supported.

Click *OK* to save the changes. Click *Show Required Forms* to see how this change affects the form states in the *Parameters* tab window and the tab states in the *Properties* form without saving the changes. Click *Cancel* to close this form without saving any changes.

4.4 Modifying Parameters

A parameter modification form can be opened in one of two ways

- Double-click on the variable name or the form containing the variable found on the *Parameters* tab in the *Project* window.
- Select the parameter name in the *Open Parameter Form* and click *OK*.

To open the *Open Parameter Form*, select *Edit*→*Find Parameter Window...* from the main menu.

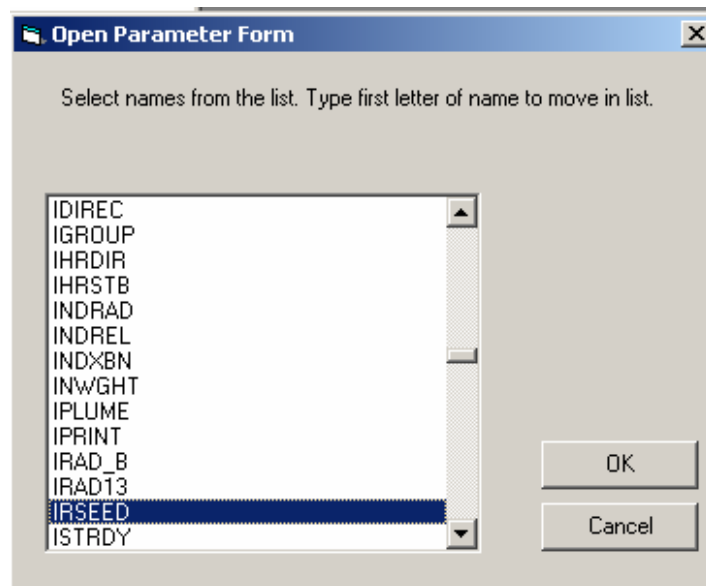


Figure 4-37 Open Parameter Form

The list of variables can be navigated by using:

- The up and down arrow keys on the keyboard.
- Typing a letter to position the list to parameters starting with that letter. For example, typing the letter *m* positions the list to the parameters starting with the letter *M*. Subsequent typing of that same letter moves the list position to the next variable starting with that letter.
- The scroll bar on the form.

Multiple variables can be selected in the list by:

- Clicking more than one of the variable names on the list.
- Navigate through the list using the arrow keys. The hit the space bar on the keyboard when the variable name has focus in the combo box. Focus is indicated by a dotted rectangle boxing the variable name.


The windows associated with the selected variables can be opened by:

- Clicking *OK*.
- Typing the Enter key on the keyboard.

In some cases, more than one form contains the same variable name. Sometimes the variables are separate entities, for example *ORGNAM* has a different usage on the *Early Fatality Effects* form and *Off Centerline Dose* form. All of the forms that contain the selected variable are opened.

4.4.1 Parameter Modification Forms

The following are the main components of a parameter modification form:

- *Enter Comments*: Optional comments are entered in this field. The expected usage is to enter comments related to the justification or derivation of parameter values.
-  *Eraser Button*: Clicking this button clears the values from all non read-only variables.
- *Data entry area*: The type of the variable that has focus is displayed in blue letters below the data entry area along with the variables acceptable bounds and units, if applicable.
- *Type and Bounds description area*: are shown in blue letters. This displays the type and bounds of the variable that has focus.

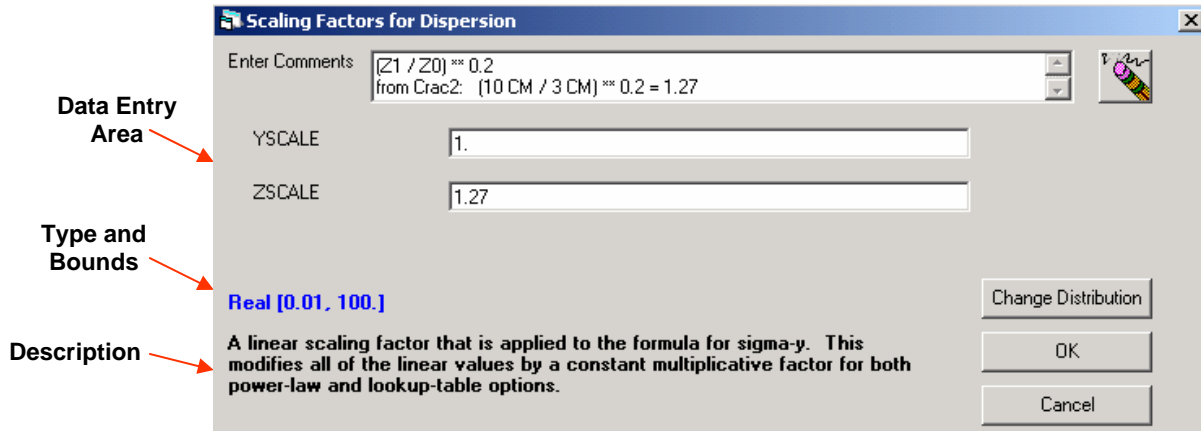




Figure 4-38 Parameter Modification Form

- Description area: Contains a brief description of the variable that has focus.
 - *Change Distribution* button: Most real-valued variables can be specified as uncertain. Uncertain variables have a probability distribution associated with them. To change the value of a variable to uncertain, either double-click on the text box or cell, or click on the *Change Distribution* button. This can also be used to change a variable from uncertain back to a constant.
- Note:** Not all variables are allowed to be uncertain. If a variable has focus and the *Change Distribution* button is enabled, then this variable can be uncertain.
- *OK* button: To save and apply these changes, click *OK*.
- Note:** All of the data on the form must be entered before the user can save any of the data on the form. If a box is left blank, and *OK* is clicked, an error message pops up. This serves as a reminder to complete the form before clicking *OK* to save the data.
-  *Cancel* button: To ignore the changes, click *Cancel* or close the window by clicking on the  in the upper righthand corner.

4.4.1.1 Modifying a Data Grid

Arrays and vectors are displayed in data grids. Data grids have the following characteristics:

- To select a row, click on the small box on the row preceding the data.
- To delete a row press the *Delete* key on the keyboard after selecting the row.

If typing in values for a row, press the *ESC* key on the keyboard to undo your typing. As long as the pencil icon is shown on the left margin of a row, it is possible to click in a cell on that row and press the *ESC* key to undo changes.

- Clipboard functionality is provided. To use the copy feature in the grid, select the desired data from the grid with a mouse down, drag, mouse up motion. Figure 4-39 illustrates a selected area in the grid. To copy the data in this selected area to the Windows clipboard, select the *Edit→Grid→Copy to Clipboard* function. Similarly, the *Edit-Grid→Paste from Clipboard* function can be used to replace a selected area in the grid with data on the Windows clipboard. This function can be used to transfer data from an Excel spreadsheet into WinMACCS.

		PLHITE (m)	REFTIM	PLUDUR (s)
1	▶	0.	0.00	1800.
2		0.	0.50	22000.
	*			

Figure 4-39 Selecting Grid Data for Copy and Paste

When modifying a grid on a parameter form, it may be necessary to insert rows or columns.

To insert a row or column:

- Click on the arrow symbol next to the first column on a row to highlight the row or click on the column header to highlight the column.
- Select *Edit→Grid→Insert Columns* or *Edit→Grid→Insert Rows* from the main menu.
Note: these operations may not be available for some vectors or arrays of fixed size.

After the *Grid Insert Form* opens:

- Choose to insert the rows/columns either before or after the selection.
- Enter the number of rows or columns to insert in the grid.
- Click *OK* to insert, or *Cancel* to cancel the operation.

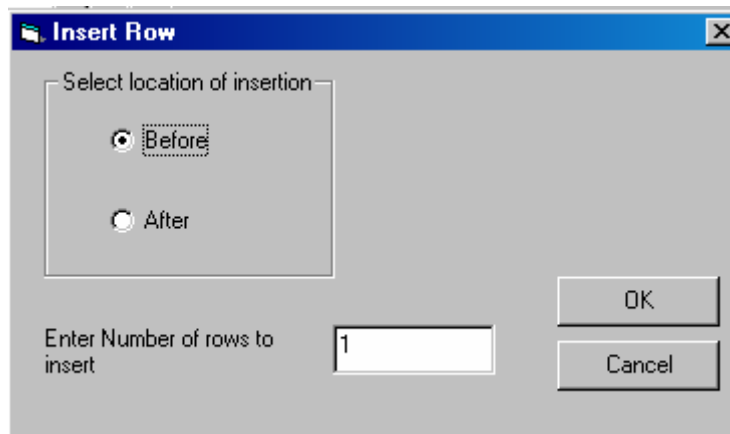


Figure 4-40 Inserting Rows in a Grid

The menu option to insert rows is not available when

- The number of rows on a form is fixed (e.g., the *ATMOS/Dispersion/Dispersion Function* form).

The menu option to insert columns is not available when:

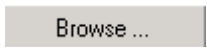
- Each column on a form represents a vector (e.g., the *ATMOS/Dispersion/Dispersion Table* form).

4.4.1.2 Supported Data Types

The following data structures are supported:

1. Scalar data: These are single values that are associated with variables. A scalar has various types, as listed below.
2. Vector data: These are singly subscripted variables. Multiple vectors can be displayed on the same grid; however, each of these vectors must have the same number of rows.
3. Array data: These are multiply subscripted variables (i.e., arrays). A single array can be displayed on a grid.

The following types are supported:

1. Integer: A number with no decimal point. An integer can be positive, negative, or zero.
2. Real: A number that has a decimal point.
3. Logical: Represented by a pull down menu. Value is either True or False.
4. Characters: A character string. Size requirements are shown in blue letters below the data entry area.
5. Drop-Down Menu: Possible values are displayed as a pull down menu. Only a portion of the name needs to be typed. For example, on the *ATMOS/Output Control/Spatial Intervals for Output* form, typing a *c* for CCDF or an *n* for NONE and advancing to another field completes the data entry for the CCDF enumerated field.
6. File: The name of a file is specified by clicking the browse button  on the parameter modification form. The selected file is copied to the project\data\ directory.
7. Linked Variables: The values of some variables are array sizes calculated by WinMACCS. For example, NUM_DIST is the size of the vectors DISTANCE, SIGMA_Y_A, etc. This variable is known in the interface as a 'linked variable.' It cannot be directly modified by the user. It is not in a box, which is intended to imply that the user cannot edit it. However, if the user clicks on the value, information regarding the linked variable is displayed at the bottom of the form. The value of the variable is updated as the number of grid rows increase or decrease. Linked variables are of type Integer, but can only take on positive values.

Chemical Group Names

Enter Comments

MAXGRP 9

	GRP NAM
1	Xe/Kr
2	I
3	Cs
4	Te
5	Sr
6	Ru
7	La
8	Ce
9	Ba
	*

Integer [1, 20]

Number of chemical groups defined in the model. Each radionuclide is assigned to a chemical group, e.g., noble gases may be assigned to the Xe group. The wet and dry deposition characteristics of a radionuclide, as well as its release fraction, are specified for each chemical group (IGROUP).

Make Uncertain

OK

Cancel

Figure 4-41 Example of a linked variable, MAXGRP

Note: A gray background in an input area indicates that the variable is read-only. In other words, the user cannot change the value of this variable on this form.

Supported data types that may be described in the Type and Bounds description area (see Figure 4-38) are described in the following examples:

1. Real [.01, 100.]: A number between 0.01 and 100., inclusive, must be entered in the text field.
2. Integer [1, NUMREL], NUMREL=2: A 1 or a 2 must be entered in the text field. If the value of NUMREL, the number of plume segments, is modified and saved on another form, then the bounds are changed to reflect the new value of NUMREL.
3. 1 to 16 Characters: A character string that is at least one character and not more than 16 characters must be entered in the field.
4. Row Bounds: [1, 10]: The grid with focus must have at least one row and not more than 10 rows.

5. $Nrows = MAXGRP$ ($MAXGRP=9$): The grid with focus must have exactly 9 rows. If the value of $MAXGRP$ is modified and saved on another form, then the number of required rows is changed to reflect the new value of $MAXGRP$.

4.4.2 Making a Parameter Value Uncertain

WinMACCS allows input parameters values to be made uncertain and enables sampling of the uncertain variables. The sampling is done using a stratified Monte Carlo method known as Latin Hypercube Sampling (LHS). The sampling allows the effect of an uncertain input value on predicted results to be explored. Uncertain variables must be assigned a distribution function from which samples are selected. The distribution function usually represents degree of belief over a range of values that are considered credible for that parameter. There are a number of methods for establishing degree of belief, one of which is to perform an expert elicitation.

To make a parameter value uncertain, open the window associated with that parameter. This can be done by double-clicking on the variable name in the *Parameters* tab in the *Project* window or by using *Edit*→*Find Parameter Window* to locate the form.

On the form, double-click on the parameter value or click on the parameter value and then on the *Change Distribution* button.

A form opens with the parameter name in the form title (or caption).

Use this form to:

- Change parameters from constants to uncertain values described by probability distributions.
- Change parameters from distributions to constants.
- Change the probability distribution associated with the variable.

Notice that the variable name is shown in the title area of the form. If an array or vector element is associated with a distribution, then the index is also part of the name shown in the title bar. In Figure 4-42, $REFTIM(2)$ in the caption portion of the form indicates that the second value of vector $REFTIM$ is being considered for modification.

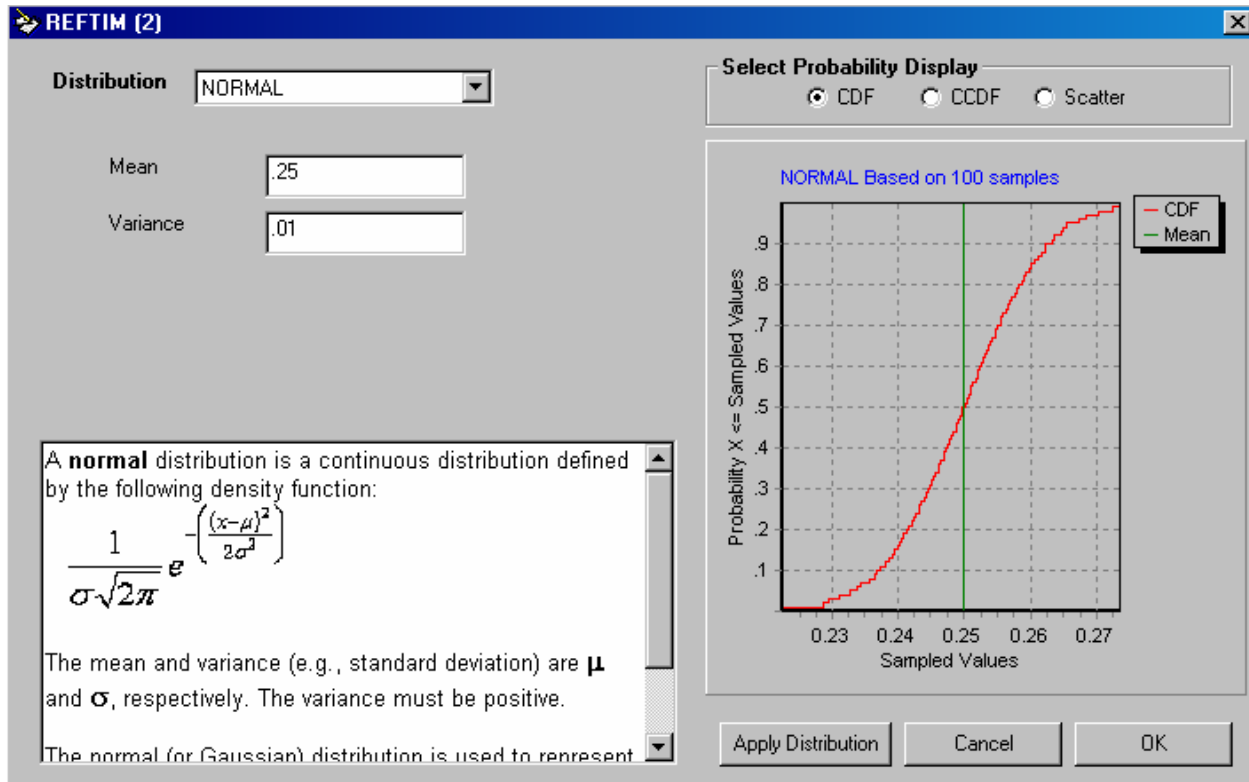


Figure 4-42 Assigning a Probability Distribution to a Parameter

Modify the value of the uncertain parameter as follows:

- Select the type of distribution from the *Distribution* pull down list.

If the parameter is to be changed from a distribution to a constant (deterministic) value, set the distribution to *CONSTANT*.

WinMACCS supports a wide range of distribution types, and each distribution type can accept a wide range of values for its parameters. It is possible to specify values for the distribution parameters that lead to invalid distributions, causing the LHS sampling to fail. The distribution parameter values entered should represent a reasonable distribution for the parameter. Furthermore, it is possible to define distributions that lead to illegal values (e.g., a negative value for a MACCS2 parameter that must be greater than zero).

- Enter the values that define the distribution in the edit boxes or tables. The type of distribution determines the amount and type of information needed to define the value.

These values either consist of a list of (x, y) pairs (known as tabulated data), or a list of parameters (such as the mean and standard deviation of the normal distribution).

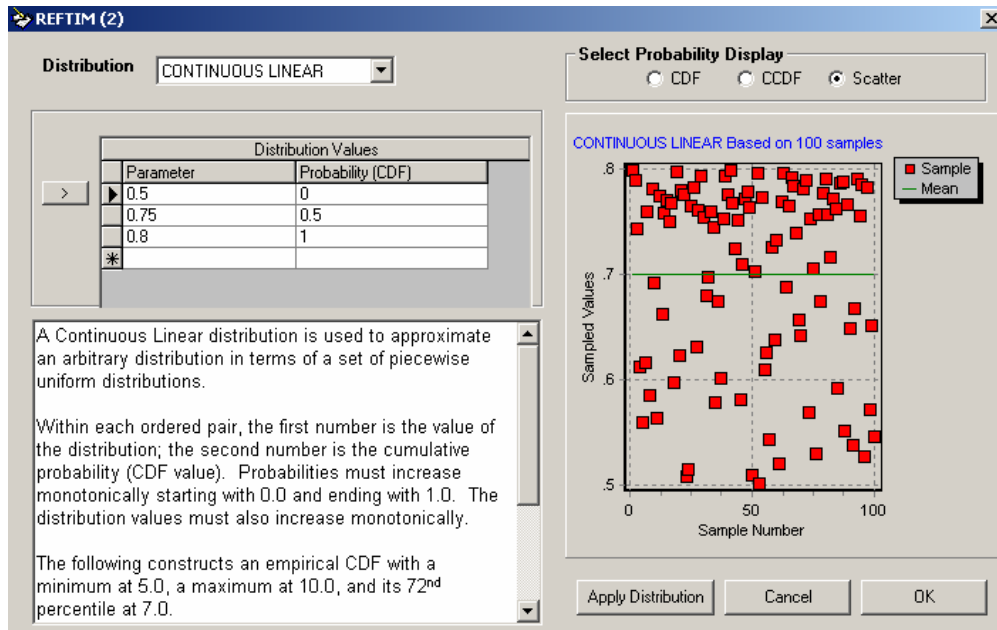



Figure 4-43 Tabulated Uncertain Parameters

- To delete a row of tabulated data, select the row by clicking on the left margin of the row. Press the Delete key on the keyboard. Press the ESC key on the keyboard to undo typing. As long as the pencil icon is shown on the left margin of a row, it is possible to click in a cell on that row and press the ESC key to undo changes.
- To insert a row of data, select an existing row. Click the row insert button () . A new row is inserted before the selected row.
- Use the left or right arrow key on the keyboard to go to an adjacent cell. The Enter key advances the cursor to the next cell.
- To save changes, click the *OK* button. This closes the window and saves any changes made to the parameter value. The value of the parameter in the parameter modification form is set to the character string "Uncertain" and has a different colored background than constant values on the form.

	PLHITE (m)	REFTIM	PLUDUR (s)
	0.	0.00	1800.
▶	0.	UNCERTAIN	22000.
*			

Figure 4-44 Uncertain Variable in a Parameter Modification Form

- To discard any changes, click the *Cancel* button.
- To view the current distribution entered, click the *Apply Distribution* button. LHS starts, and one hundred samples are returned and displayed. The data can be viewed as a *CDF*, *CCDF*, or a *Scatter* plot. The mean of the distribution is shown in each view. The sampled values used when running the model may differ from those shown on this graph because the input to LHS may not be the same.

To know what values have been set to uncertain after a simulation, open the file LHS.inp, which is one of the input files created by WinMACCS. This file can be opened by clicking the *Files* tab within the project, opening the *Input* category and then double-clicking on the file name LHS.inp. The raw data used in the MACCS2 simulation can be viewed by double-clicking on the file name LHS.out.

4.4.3 Correlate Uncertain Parameters

In many cases, sets of uncertain input variables are correlated to some extent. For example, atmospheric dispersion is often considered to have a large degree of uncertainty. In MACCS2, crosswind and vertical dispersion are treated independently in terms of the coefficients that control them. However, the two are related in the sense that both are governed by the degree of turbulence in the atmosphere. Thus, when crosswind dispersion tends to be large, vertical dispersion tends to be large as well. If the input parameters for dispersion are treated as uncertain, then it makes sense to correlate the values that control crosswind dispersion with those that control vertical dispersion so that either both are either large or both are small. It does not make physical sense for one to be small while the other is large, but this could be the case if the two sets of parameters were sampled and assumed to be uncorrelated.

WinMACCS allows two methods for correlating uncertain input variables. The first uses rank correlation coefficients and is described in this subsection; the second method performs a direct rank reordering of one variable and is described in the following subsection.

To correlate variables that have been chosen to be uncertain, select *Edit*→*Correlate Uncertain Variables*→*Linear Coefficients* from the main menu. This opens the *Correlate Uncertain Variables* table, which lists each rank correlation that is currently defined and allows ones to be defined.

It is possible to specify combinations of rank correlations that are not mutually consistent. Such inconsistencies are generally in the form of circular correlations. For example, two parameters "A" and "B" can be assigned a correlation of 0.99, parameters "B" and "C" can also be given a correlation of 0.99, but parameters "A" and "C" can be assigned a correlation of -0.99. Each correlation is valid by itself, but the three are logically incompatible. The parameter sampling may fail if any circular correlations are inconsistently defined.

A correlation can be added in the table's insertion row (indicated by "*") by doing the following:

1. Click in the "Parameter One" cell and select one of the uncertain parameters from the list-box.
2. Click in the "Parameter Two" cell and select the second parameter from the list-box.

3. Enter the desired rank correlation coefficient between the two selected parameters in the column labeled "Correlation Coefficient."

Because this is a rank correlation, the correlations apply to the ranks of the parameter values rather than to the values themselves. Correlations coefficients must be greater than -1 and less than 1. These limits are enforced by WinMACCS.

If any two parameters are uncorrelated, they have an implied correlation coefficient of zero, which is the default. Implied correlation coefficients are not listed in the table. Correlations can be removed (i.e., set to zero) by selecting the grid row and pressing the delete key on the keyboard.

Use the arrow keys to move from cell to cell in the grid.

Click *OK* to preserve changes. Click *Cancel* to discard changes made to the correlations.

WinMACCS creates a report titled SampleRank.out in the project Input/ directory that summarizes the correlations and the order and values of the uncertain variables used in the MACCS2 simulations.

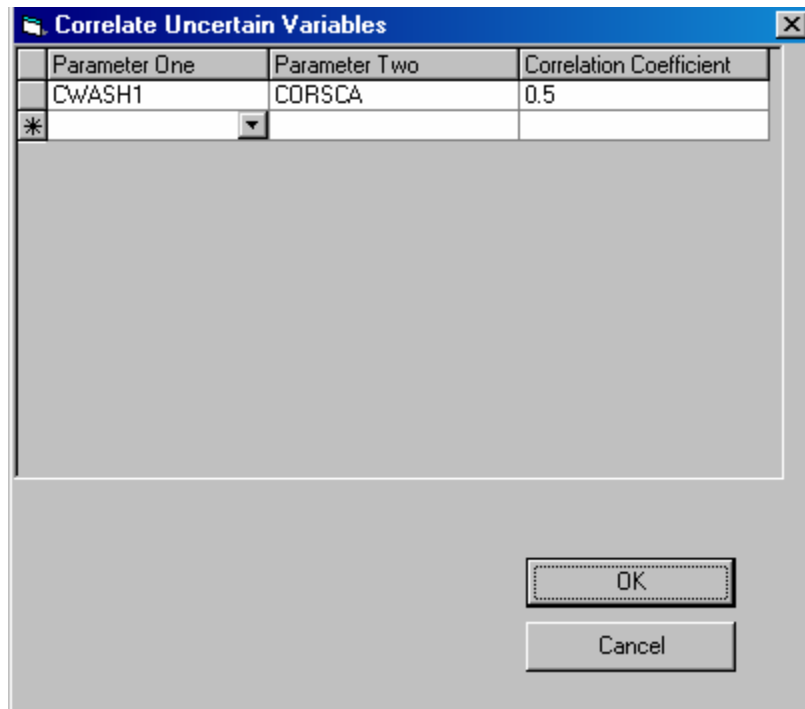


Figure 4-45 Correlate Uncertain Variables

4.4.4 Enforce Rank Order

After LHS has run and imposed correlations specified by the user, WinMACCS can reorder some of the variables to be consistent with the rank order of other variables. This is a desirable feature when there is a need to impose a perfect correlation of 1 or -1 between two sets of variables, which LHS does not support.

There are some restrictions on the correlations that WinMACCS allows. For example, it doesn't make sense to rank correlate two variables, A and B with some coefficient, and then impose a rank order of B with respect to the order of A. WinMACCS does not allow the same pair of variables to be rank correlated (as described in the preceding subsection) and also to be reordered (as described in this subsection).

To specify a rank order:

1. Open *Parameter Modification* forms and set variables to be ranked to probability distributions by clicking on the *Make Uncertain* button. Close the forms, saving the values.
2. Open the *Enforce Rank Order of Uncertain Variables* form by selecting *Edit*→*Correlate Uncertain Variables*→*Enforce Rank Order*.
3. In the column labeled *Reorder Basis* select the uncertain variable from the pull down menu whose rank order is used to order the variable specified in the column labeled *Reorder Parameter*. The order of the *Reorder Basis* variable is not changed from the order of values returned from LHS.
4. In the column labeled *Reorder Parameter*, select the uncertain variable whose order is to be changed.
5. In the column labeled *Rank Order* select either *Inverse Order* to order the variable in the opposite order as the basis parameter, *Reorder Basis*, or *Same Order* to order the variable in the same relative order as the basis parameter.
6. Add as many entries as needed in the table.
7. Click OK to preserve changes. Click *Cancel* to discard changes.

Rows can be deleted by selecting the grid row and pressing the delete key on the keyboard. Use the arrow keys to move from cell to cell in the table.

WinMACCS creates a report titled *SampleRank.out* in the project *Input/* directory that summarizes the correlations and the order and values of the uncertain variables used in the MACCS2 simulations.

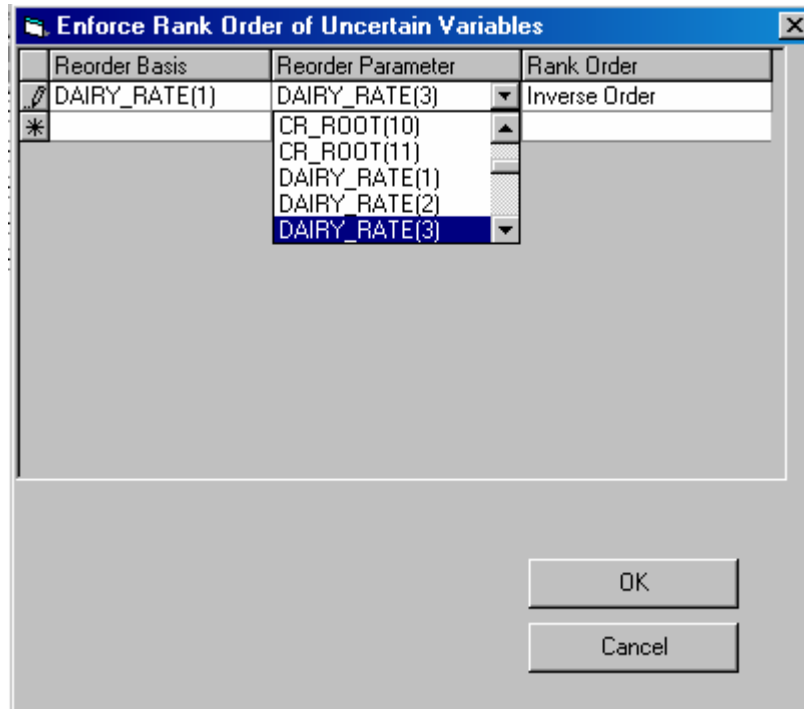


Figure 46 Enforce Rank Order Form

In the following example, a perfect positive correlation is imposed between ATMOS variables BUILDH(1) and SIGZINIT(1), and a perfect negative correlation is imposed between COMIDA2 variables DAIRY_RATE(1) and DAIRY_RATE(3).

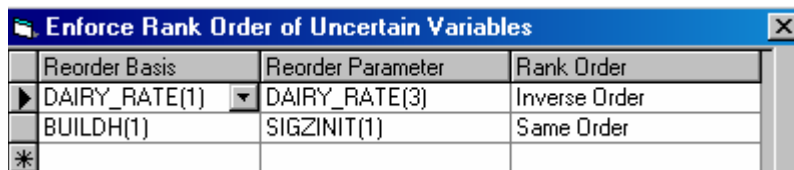


Figure 47 Enforce Rank Order Example

This ordering request causes the values of DAIRY_RATE(3) and SIGZINIT(1) to be changed from the order returned by LHS. After execution, LHS.out can be opened by double clicking the entry LHS.out found on the Files Tab in the Input/ category. As an example, suppose LHS.out contains the following information:

Trial	BUILDH(1)	DAIRY_RATE(1)	SIGZINIT(1)	DAIRY_RATE(3)
1	249.675	5.81245	295.12	9.16814
2	123.061	10.1165	281.956	10.3411
3	180.287	15.7363	338.324	12.1482
4	214.842	21.8037	267.811	13.5931
5	188.622	19.2878	312.628	5.65193

The actual order used in the sequence of MACCS2 simulations can be viewed in the file SampleRank.out, found in the project Input directory. In this example, the reported order is as follows:

Sample Trial	Value	Rank	Value	Rank	Value	Rank	Value	Rank
	BUILDH(1)		DAIRY_RATE(1)		SIGZINIT(1)		DAIRY_RATE(3)	
1	249.675	5	5.81245	1	338.324	5	13.5931	5
2	123.061	1	10.1165	2	267.811	1	12.1482	4
3	180.287	2	15.7363	3	281.956	2	10.3411	3
4	214.842	4	21.8037	5	312.628	4	5.65193	1
5	188.622	3	19.2878	4	295.12	3	9.16814	2

This table tells us which values are used in each MACCS2 simulation. For example, for trial number 3 (corresponding to the output file Model3.out), BUILDH(1) is set to 180.287 and SIGZINIT(1) is set to 281.956.

Notice that values of BUILDH(1) and DAIRY_RATE(1) are preserved from the order listed in the LHS output. However, values for SIGZINIT(1) and DAIRY_RATE(3) have been reordered so that the rank order for SIGZINIT(1) is the same as that of BUILDH(1), and the rank order of DAIRY_RATE(3) is the opposite of that for DAIRY_RATE(1).

4.5 Special WinMACCS Variables

4.5.1 Chemical Group Identifiers, GRPNAM

The chemical group names used in WinMACCS do not have a counterpart in MACCS2. This variable is entered on form *ATMOS/Radionuclides/Chemical Names*. In WinMACCS, GRPNAM is a required variable used for labeling on the following forms:

- ATMOS/Release Description/Particle Size Distribution.
- ATMOS/Release Description/Plume Segment Release Fraction.
- ATMOS/Deposition/Wet/Dry Depos Flags.

MACCS2 input images often list the chemical group names as a comment as shown in the following example taken from input file in1a.inp.

```
*           XE/KR  I    CS  TE  SR  RU  LA  CE  BA
*
RDRELFRC001  1.0E+0  6.8E-1 6.4E-1 1.7E-1 4.2E-3 2.3E-3 1.6E-4 4.0E-4 6.3E-3
```

This input was translated into a new variable, GRPNAM, as shown in Figure 4-48.

Chemical Group Names

Enter Comments

MAXGRP 9

	GRPNAM
1	Xe/Kr
2	I
3	Cs
4	Te
5	Sr
6	Ru
7	La
8	Ce
9	Ba
	*

1 to 15 Characters ; Row bounds: [1, 20]

The name of each chemical group. This is a new variable introduced with WinMACCS. It is used to label columns in other forms. This is not used by MACCS2. The values are not used in any calculation.

Make Uncertain
OK
Cancel

Figure 4-48 Chemical Group Names, GRPNAM

Figure 4-49 shows how GRPNAM is used as a label in the *ATMOS/Release Description/Particle Size Distribution* form.

Enter Comments

PSDIST		
GRPNAM	VDEPOS = .03 m/sec	VDEPOS = .01 m/sec
Xe/Kr	.75	.25
I	.75	.25
Cs	.75	.25
Te	.75	.25
Sr	.75	.25
Ru	.75	.25
La	.75	.25
Ce	.75	.25
Ba	.75	.25
	*	

Figure 4-49 GRPNAM Used in Form Labeling

Chemical group names are written to MELCOR plot files. MELMACCS, a software product used to interface the output from MELCOR to the input required by WinMACCS, reads the chemical group names from the MELCOR plot file. These names are translated into input images read by WinMACCS. This interface file can then either be imported into WinMACCS using the main menu option *File*→*Import MACCS2 Input File* or can be specified as a file in the MACCS2 cyclical file set in the *General/File Specifications/Cyclical File Set* form.

MELMACCS writes the chemical name information in a MACCS2 input file as images that are recognized by WinMACCS, but not by MACCS2. The image prefix used is ISGRPNAM, as shown in the following example:

```
ISGRPNAM001 Xe/Kr
ISGRPNAM002 I
ISGRPNAM003 Cs
ISGRPNAM004 Te
ISGRPNAM005 Sr
ISGRPNAM006 Ru
ISGRPNAM007 La
ISGRPNAM008 Ce
ISGRPNAM009 Ba
```

4.6 Annual Differential Threshold Dose Conversion Factor and COMIDA2 Files

If the *Annual Threshold* or *Piecewise Linear* dose models are chosen on the *Dose* tab of the *Project Properties* form, then a set of fifty-one dose conversion factor files are needed by MACCS2. Additionally, if the *COMIDA2 Food Model* is chosen on the *Food* tab of the *Project Properties* form, then a set of fifty-one COMIDA2 files are needed by MACCS2, each COMIDA2 file having been created with its associated DOSFAC2 file.

WinMACCS is distributed with files sets to be used with the annual threshold or piecewise linear dose models. The first set is based on DOE/EH-0070 (1988); the second is based on *EPA (2002) Federal Guidance Report No.13*.

The base DCF file is one that contains the conversion factors for a fifty year commitment period. The base Comida2 file is created using the base DCF file.

The annual, differential DCF files contain the dose conversion factors for each year of the 50-year commitment period. These file names are sequenced to enable the identification of the year number. For example, FGR13DCF03.inp corresponds to the dose conversion factors used to calculate the dose in year three for an exposure that occurred in year one. The annual COMIDA2 files are created using the corresponding annual DCF files.

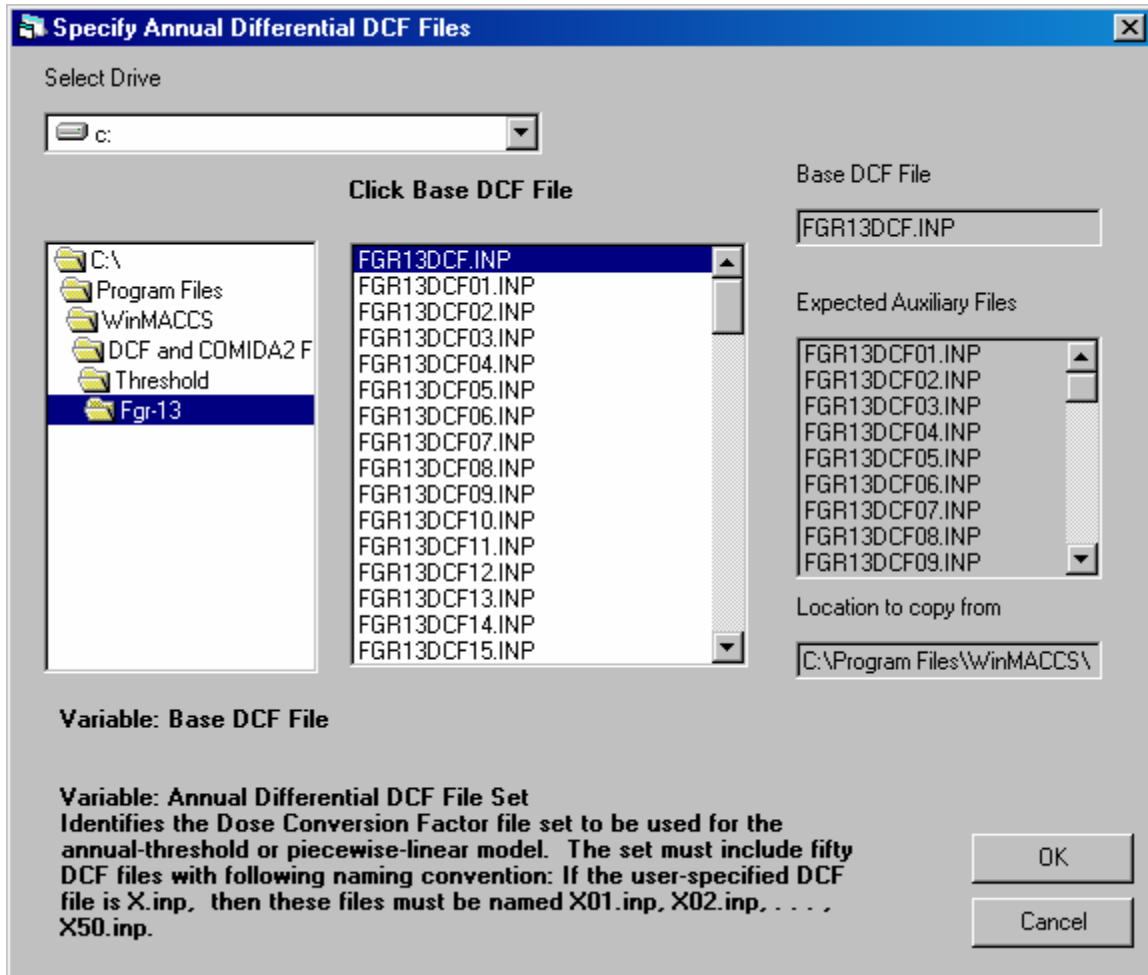


Figure 50 Threshold DCF Files

To specify an annual differential DCF and COMIDA2 file set:

1. Open the *File Specifications/Annual Differential DCF Files* form.
2. Open the folder where the DCF are files are located. Select the correct hard drive in the *Select Drive* pull down menu and locate the folder on the form. When WinMACCS is installed, a copy of the DCF and COMIDA2 files are put in the Program Files\WinMACCS folder. Additional copies can be found on the installation CD.
3. Select the base DCF file in the box directly under the title *Click Base DCF File*. In the example shown in Figure 50, the name of the file is FGR13DCF.inp. The base file name is copied in the box labeled *Base DCF File*. Other file names are generated given this base file following the algorithm of appending the year number to the file name. WinMACCS expects these additional files to be present in the current directory.
4. Click *OK* to save changes. WinMACCS copies the base DCF file and the fifty auxiliary files to the project directory. Click *Cancel* to close this form without saving any changes.
5. Repeat this process to define the COMIDA2 file set if the COMIDA2 model is run. The forms share a code base, and function the same. In this case, open the *File Specifications/Annual Differential COMIDA2 Files* form.

4.7 Cyclical MACCS2 Files

MACCS2 input can be changed using successive input files as follows:

- In the *Properties* form on the *Scope* tab, click on the checkbox *MACCS2 Cyclical File Set*. Click *OK*.
- Specify the cyclical file set by double-clicking on the *File Specifications/Cyclical File Set* form on the *Parameters* tab of the *Project* window.
- Complete this form as described in the next subsection.

The cyclical files must be formatted consistently as MACCS2 input files. However, the ATMOS, EARLY, CHRONC, and COMIDA2 input for a single simulation can be combined into a single file.

The parameter values specified in each of the cyclical files are used for a simulation. If a required parameter is not specified, the value of that parameter shown in WinMACCS (viewed from the *Parameter Modification* form) is used.

Before executing a set of cyclical files, a complete problem description must be entered into WinMACCS. Parameter values in the cyclical files override the parameters in WinMACCS. Thus, the cyclical files do not need to contain a complete MACCS2 problem description, but only the set of parameters that are to be modified.

4.7.1 Specifying Cyclical MACCS2 Files

To specify MACCS2 cyclical input files:

1. Open the *File Specifications/Cyclical File Set* form.
2. Navigate to the location of the MACCS2 cyclical files.
3. Double-click on the MACCS2 cyclical file names to add them to the list on the right side of the window.
4. Click *OK* to save the file selection. The files are copied to the projects *Data* directory. Click *Cancel* to close the window without copying any files to the *Data* directory.

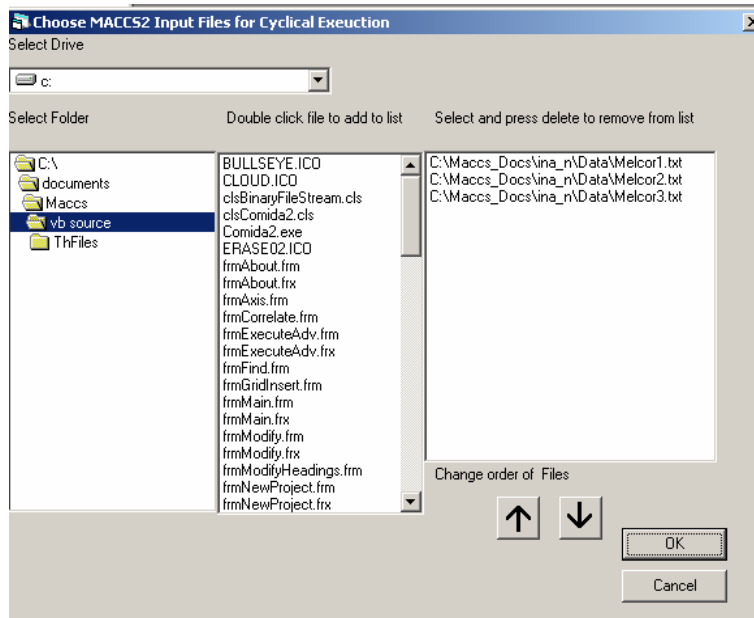


Figure 4-51 Choose Input Files for Cyclical Execution

To remove a file from the cyclical set:

- Select the file in the list on the right side of the form, as shown in Figure 4-51, and press the Delete key.

To change the order of processing the files by WinMACCS:

- Use the up and down arrow. This changes the order in which the selected file is listed. When MACCS2 executes, the files are used in the order they appear on this form.

An interface tool named MELMACCS can be used to create MACCS2-formatted files that contain source term information extracted from a MELCOR plot file. They can be specified as cyclical files. In this way, a set of source terms for a plant can be run sequentially.

4.7.2 Cyclical Execution with Uncertain Parameters

It is possible to perform calculations with a cyclical file set and to sample uncertain variables using LHS simultaneously. A simple example demonstrates the way MACCS2 input files are created.

Step One: Linking the MACCS2 Cyclical Files

After running three MELCOR simulations, three MELCOR/MACCS2 interface files (Melcor1.txt, Melcor2.txt, and Melcor3.txt) were created using the interface software MELMACCS. These files contain legal MACCS2 input cards belonging to the *ATMOS* module. They contain the results of MELCOR simulations that are to be imported into WinMACCS.

The *MACCS2 Cyclical File Set* option is activated on the properties form. The *Specify Cyclical MACCS2 Files* form is opened, and the files Melcor1.txt, Melcor2.txt, and Melcor3.txt are chosen as the cyclical file set, as illustrated in Figure 4-51.

Each of these files contains a different value for the dry deposition velocity associated with particle size group number one.

Melcor1.txt contains the following MACCS2 input line:

DDVDEPOS001 0.01

Melcor2.txt contains the following MACCS2 input line:

DDVDEPOS001 0.015

Melcor3.txt contains the following MACCS2 input line:

DDVDEPOS001 0.018

Step Two: Setting a Variable to an Uncertain Value

Additionally, the variable XPFAC1 is set to an uncertain value as follows:

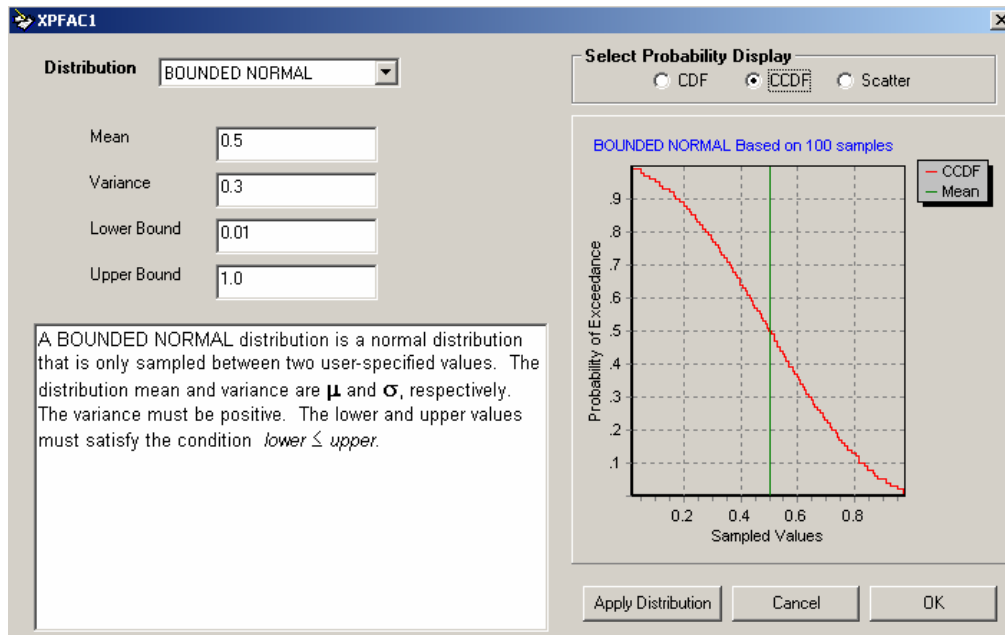


Figure 4-52 Assigning an Uncertain Value to a Variable

Step Three: Running the Simulation

The number of simulations is set to six from the *Advanced Execution Parameters* form. This form opens when the user clicks the button labeled *Advanced ...* on the *Run Models* form. The simulations are started when the user clicks the *Run Simulation* button on the *Run Models* form. The following steps are then performed by WinMACCS:

- The template files are created as follows:
atmosTemplateMelcor1.txt
earlyTemplateMelcor1.txt

chroncTemplateMelcor1.txt
 atmosTemplateMelcor2.txt
 earlyTemplateMelcor2.txt
 chroncTemplateMelcor2.txt
 atmosTemplateMelcor3.txt
 earlyTemplateMelcor3.txt
 chroncTemplateMelcor3.txt.

Because there were no EARLY or CHRONC input cards in the files Melcor1.txt, Melcor2.txt and Melcor3.txt, the EARLY and CHRONC template files are identical.

The template files contain the values read from the cyclical input files. A placeholder is inserted into these files for the uncertain values.

For example, atmosTemplateMelcor1.txt contains:

DDVDEPOS001 0.01

File atmosTemplateMelcor2.txt contains:

DDVDEPOS001 0.015

File atmosTemplateMelcor3.txt contains:

DDVDEPOS001 0.018

Each of the ATMOS template files contain the same placeholder, §3829§, for the uncertain value, XPFAC1. The placeholder value, 3829, is an internally generated key used by WinMACCS specific to this example. Each of the ATMOS template files contain:

PMXPFAC1001 §3829§

- LHS is invoked, and creates six sample values for the variable XPFAC1. These values are in the file LHS.out file. In this example, they are calculated as follows:

Table 4-4. Example Showing LHS Sample Values

Sample	Value of XPFAC1
1	0.391692
2	0.809949
3	0.352528
4	0.641766
5	0.510719
6	0.111567

- The template files are then used to create the ATMOS, EARLY and CHRONC input files for each of the six MACCS2 simulations.

Table 4-5. Example Showing Template Files Created by WinMACCS

Set 1	atmosTemplateMelcor1.txt earlyTemplateMelcor1.txt chroncTemplateMelcor1.txt
Set 2	atmosTemplateMelcor2.txt earlyTemplateMelcor2.txt chroncTemplateMelcor2.txt
Set 3	atmosTemplateMelcor3.txt earlyTemplateMelcor3.txt chroncTemplateMelcor3.txt.

Table 4-6. Example Showing Relationship of LHS Samples to Template Files

Simulation Number	Template set used	Value of VDEPOS	Value of XPFAC1
1	1	0.01	0.391692
2	2	0.015	0.809949
3	3	0.018	0.352528
4	1	0.01	0.641766
5	2	0.015	0.510719
6	3	0.018	0.111567

4.8 Specifying Evacuation Directions and Speeds

Evacuation directions are required if the network evacuation is enabled. If the speed multiplier option has been activated on the Properties Form, speed multipliers per grid element (i.e., for each direction and spatial distance) must be specified for either the radial or network evacuation models, depending on which option is selected.

4.8.1 Enabling the Evacuation and Speed Multiplier Model Settings

Evacuation and speed multiplier models are enabled as follows:

- Open the *Project Properties* form by selecting *Edit*→*Project Properties* from the main menu.
- Click on the *Evac/Rotation* tab.
- Select the evacuation model.
- Select the evacuation model for each of the scenarios.
- If speeds vary within the evacuation grid elements for either the network or the radial evacuation models, then check the box *Activate Speed Multiplier Model*.
- Click *OK*

If the *Network* evacuation is selected for scenario one, then the *Network Evacuation Direction* form is required for scenario one. A scenario specific *Network Evacuation Direction* form is optional for all additional scenarios where the evacuation model for that scenario is set to *Network*.

If the *Activate Speed Multiplier Model* is checked the *Evacuation Speed* form is required for scenario one. This information is optional for additional evacuation scenarios when either the network or radial evacuation model is selected on the *Evac/Rotation* tab.

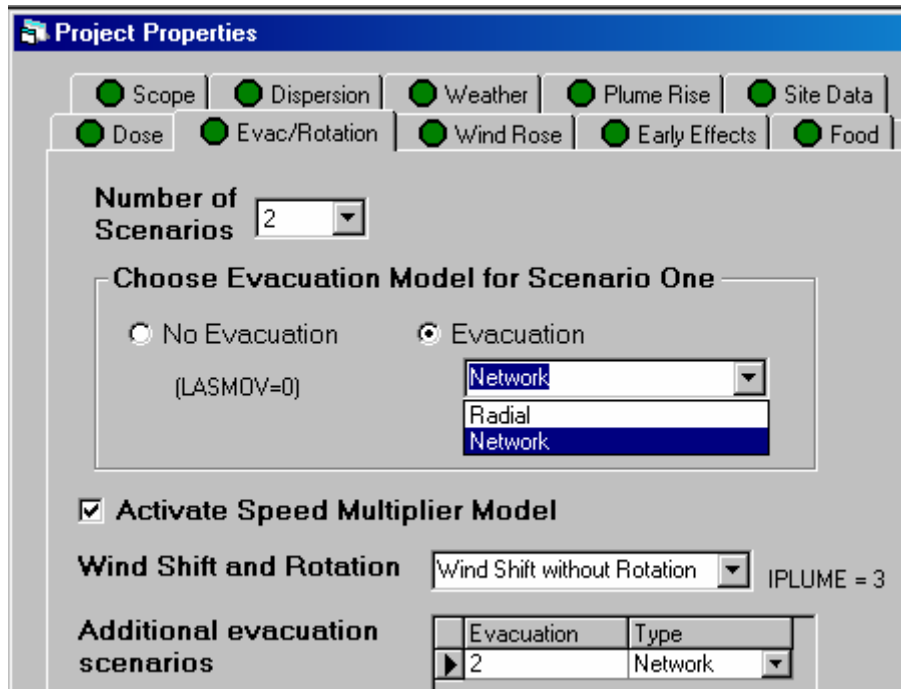


Figure 4-50 Activate Speed Multiplier Model

The variables SPAEND and LASMOV must be defined before the *Network Evacuation Direction* forms or *Evacuation Speed* forms can be successfully opened. These two variables are needed to define the evacuation grid. As a side effect, NUMEVA must also be defined because it is on the same form as LASMOV.

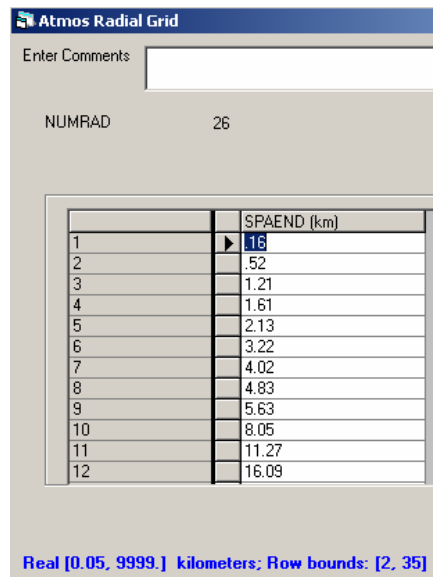


Figure 4-53 ATMOS Radial Grid, SPAEND

Figure 4-54 Evacuation Boundary, LASMOV

The *Network Evacuation Direction* forms for each additional network evacuation scenario are optionally available. For example, the form *EARLY/Additional Emergency Scenarios/Emergency Scenario Two/Network Evacuation Direction* is shown as optional if the network evacuation model is chosen for scenario two in the *Project Properties* form. Similarly, the *Evacuation Speed* forms are optionally available in each additional evacuation scenario. However, for both of these forms, LASMOV (and as a side effect, NUMEVA) must be defined for each additional scenario.

The *Network Evacuation Direction* form and the *Evacuation Speed* form share the same source code base. This means that the navigation of the forms is the same; however, the navigation of the forms with respect to specifying the direction or speed variables is different.

4.8.2 Creating Road Maps to Aid in Evacuation Modeling

Radial distances vary from zero to the upper bound of SPAEND. Grid elements are numbered with 1 for north, 5 for east, etc., when the grid is divided into sixteen equal angles. Each value of SPAEND is represented as a concentric circle.

When a new project is created, neither the *Network Evacuation Direction* forms nor the *Evacuation Speed* forms show a road map behind the polar grid. Evacuation directions are initially set to be radially outward, as shown in Figure 4-52, and the speed multiplier is set to one.

The number or letter drawn at the center of each of the grid elements indicates the associated speed multiplier rank. This is different than the value of the speed multiplier. If, for example, the speed multipliers are either .5 or 1.5, then there would be two possibilities for the multiplier rank, namely 1 corresponding to a speed multiplier of .5 and 2 corresponding to a speed multiplier of 1.5.

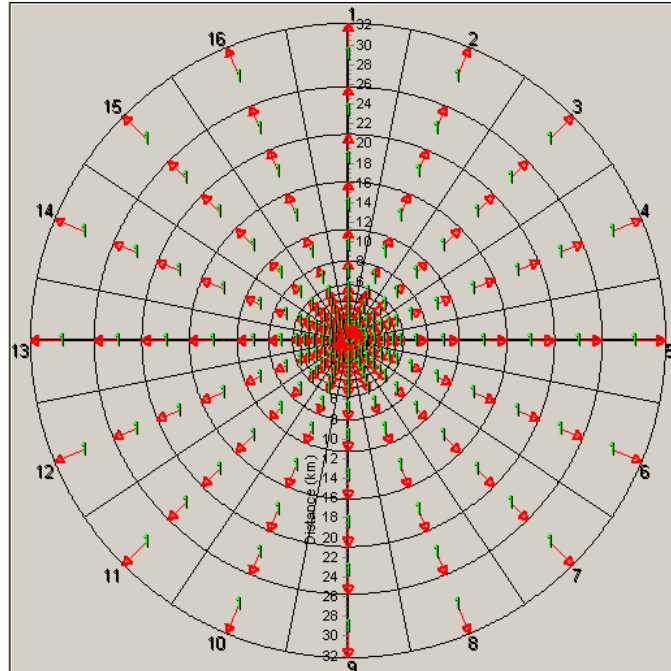


Figure 4-55 Initial State of Evacuation Grid

If MapGen, a custom software product created specifically for use with WinMACCS, has been installed, road maps can be easily created to display behind the grid by clicking on the button labeled *Create Map File* in any of the *Network Evacuation Direction* forms or the *Evacuation Speed* forms. When this is done, a file named *MapSummary.txt* is created and placed in the project *Input* directory.

The file, *MapSummary.txt* is subsequently imported into a separate software package, MapGen, to create the road maps. MapGen is implemented as a separate application because of licensing issues. No license outside of the NRC licensing requirements is required for WinMACCS or MACCS2. However, the map interface program, MapGen, requires that the Microsoft Map Point 2006 libraries be installed. Thus, to enable the use of maps in the WinMACCS, Microsoft Map Point 2006 must be purchased and installed.

WARNING: If the Spatial Grid is modified, a consistent set of road maps must be regenerated.

Step One: Enter a latitude and longitude

Within the Parameters Tab in the Project window, open the form *ATMOS/Weather/Site Location* by double-clicking on this entry. Enter the Latitude and Longitude in the form and click *OK*. This form may not be flagged as a required data entry form for the MACCS2 models selected (i.e., the icon may have a slash through it), but to generate a set of road maps, it is necessary to enter the latitude and longitude of the site.

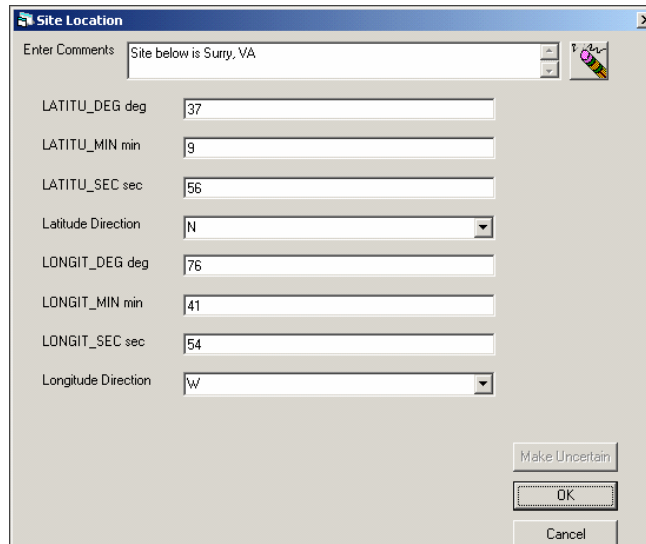


Figure 4-56 Enter Latitude and Longitude

Step Two: Create Map Summary.txt file

In any form that shows the polar evacuation grid, click the button titled *Create Map File*. A file titled MapSummary.txt is created and placed into the WinMACCS project Input directory.

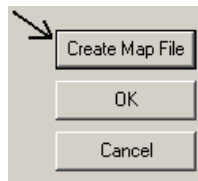


Figure 4-57 Create Map File

Within the Files Tab in the Project window, this file can be optionally viewed by double-clicking on the entry *Input/MapSummary.txt*.

A sample map interface file is as follows:

```

* File created using WinMaccs Version 3.1.11 12/7/2006 12:58:24 PM
* Latitude and Longitude as a decimal
/LAT    42.10056
/LON    -91.77722
* File Name to create, Distance in km from lat, long to edge of square map
/DAT    Map_0.16.gif  0.1733333
/DAT    Map_0.52.gif  0.5633333
/DAT    Map_1.21.gif  1.310833
/DAT    Map_1.61.gif  1.744167
/DAT    Map_2.13.gif  2.3075
/DAT    Map_3.22.gif  3.488333

```

Notice each line of the file that starts with the character string “/DAT”. Each /DAT lines directs MapGen to create a gif file.

Example:

```
/DAT      Map_0.16.gif  0.1733333
```

Two parameters are shown per input line. The first is the name of the file that is created, e.g., Map_0.16.gif. The second parameter is the distance in km from the center of the map to the edge of the map as displayed in the WinMACCS interface.

WinMACCS creates a line in the file for each value of SPAEND, the spatial grid distance. The value of SPAEND is built into the name of the GIF file. This ensures that an incorrect map is not shown behind the evacuation grid if the spatial grid entries are modified (SPAEND is changed in WinMACCS). In the above example, the input line corresponds to the spatial grid element 0.16 km.

The second number is a measure in km from the center of the map to the outer edge. This is calculated in WinMACCS to allow the map to fit to the edge of the form.

This process assumes that all maps are square. The control dimensions are fixed; the user has no control over these dimensions.

Step Three: Generate road maps using MapGen

Start MapGen from the MapGen group found on the Windows Start Menu. Select *File/Generate Gif from File* from the main MapGen menu.



Figure 4-58 Generate Road Map Files

Locate and select the *MapSummary.txt* file created in the previous step. Click the *Open* button.

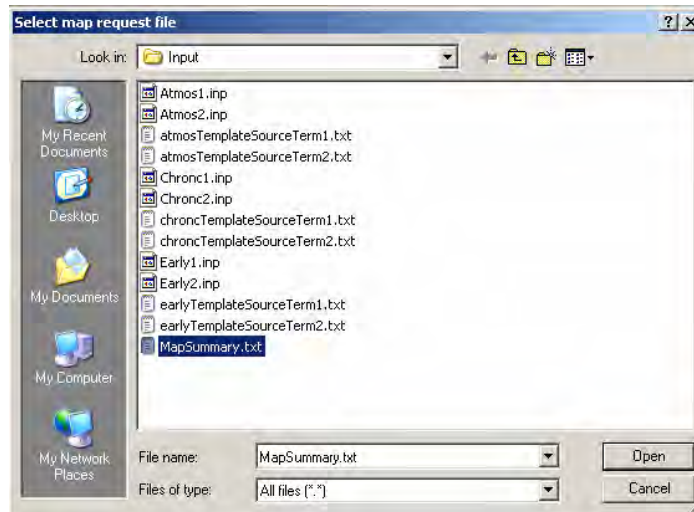


Figure 4-59 Open Map Summary.txt

Choose your Data folder under the project folder for the gif file destination. Click *OK*. The maps are automatically generated.

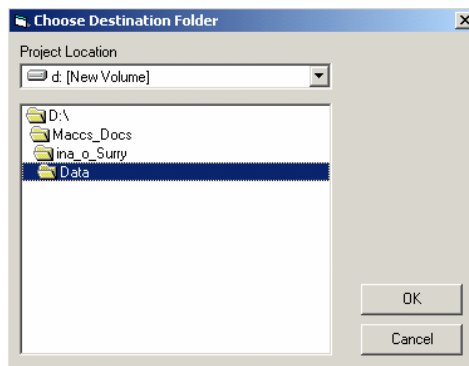


Figure 4-60 Complete Creation of Road Maps

Step Four: View maps in WinMACCS

Observe that when changing the *Outer Ring Shown* slider, the maps are displayed in the background. If the maps do not display, verify that the *Hide Map* check box is unchecked, that the map .gif files are in the project\Data directory, and that the spatial grid is in agreement with the names assigned to the map .gif files. For example, Map_1609.34.gif corresponds to 1609.34 km. This is the map that is displayed when the outer ring in the polar grid is at 1609.34 km. This corresponds to an entry in array SPAEND.

The *Outer Ring Shown* slider must be clicked to refresh the background the first time the maps are created.

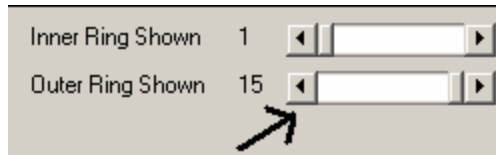


Figure 4-61 Show Maps in WinMACCS

4.8.3 Understanding the Polar Grid

Arrows drawn on the grid elements indicate the evacuation direction. There are four different directions supported by MACCS2. Outward, inward, counter clockwise and clockwise. Each of these directions is shown in a different color.

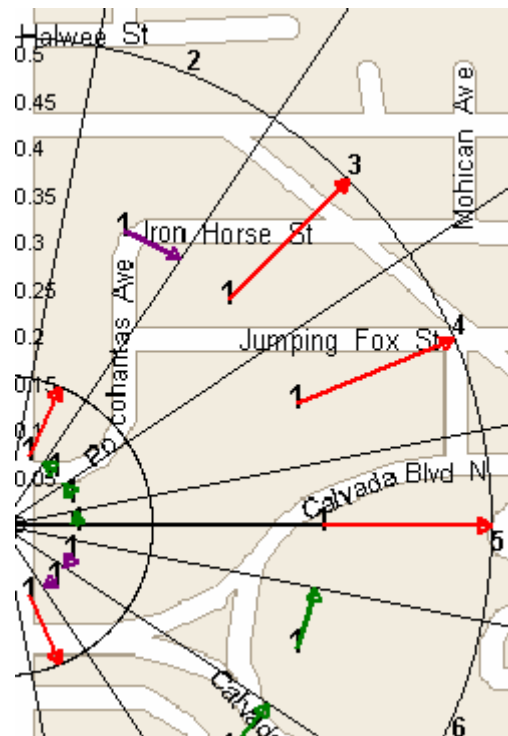


Figure 4-62 Evacuation Grid

The bottom of the screen shows the inner and outer ring displayed on the polar grid. The integer value shown to the right of the sliders labeled *Inner Ring Shown* and *Outer Ring Shown* correspond to the number in the column preceding the column labeled *Radius*. This number is the outer boundary of the grid element. In the example shown in this section, the *Inner Ring Shown* is set to 2, corresponding to a radius of 0.52. The *Outer Ring Shown* is set to 3, corresponding to a radius of 1.21. This can be observed by looking at the axis scale shown on the polar grid.

	Radius (km)	SectorRank	Speed Multiplier
1	0.16	1	0.5
2	0.52	2	1
3	1.21	3	1.2
4	1.61	4	
5	2.13	5	
6	3.22	6	
7	4.02	7	
8	4.83	8	
9	5.63	9	
10	8.05	10	
11	11.27	11	
12	16.09	12	
13	20.92	13	
14	25.75	14	
15	32.19	15	
		16	

Figure 4-63 Radius, Sector and Multiplier



Figure 4-64 Inner Ring and Outer Ring Sliders

The numbers, (or letters when more than nine ranks are defined), indicate the speed multiplier rank, which is different than the actual speed multiplier. In this example, the number 1 corresponds to a multiplier of 0.5, 2 to a multiplier of 1, and 3 to a multiplier of 1.2. By showing ranks, the speed multipliers can be adjusted without requiring the user to adjust the settings on the polar grid provided the relative order of speeds hasn't been modified.

When the grid is clicked, the radial distance from the center of the grid to the click is shown on the bottom left portion of the screen.

Distance from Center to Click 1.21

Figure 4-65 Radial Click Distance

This is useful for diagnostic reasons. Once a map is displayed behind the grid, the scale may be checked if there is a reason to believe that the polar scales and the map scales are inconsistent. The number shown in WinMACCS corresponds to the scale of the polar coordinate system. From the viewpoint of WinMACCS, the roadmap is simply a picture file.

The roadmap can be displayed in MapGen by entering the latitude and longitude in decimal form and the distance from the center to the left edge. These numbers can be read from the file MapSummary.txt in the lines labeled /LAT, /LON, and /DAT, as shown in the following example:

```
* Latitude and Longitude as a decimal
/LAT    36.19305
/LON    -115.9819
* File Name to create, Distance in km from lat,long to edge of square map
/DAT    Map_1.21.gif 1.289344
```

Enter these numbers and click the *Go* button in MapGen. The actual distance from the center to the edge can be verified by clicking the edge of the map in MapGen. This is the shortest distance from the center to the edge as calculated by MapPoint, the underlying Microsoft map engine.

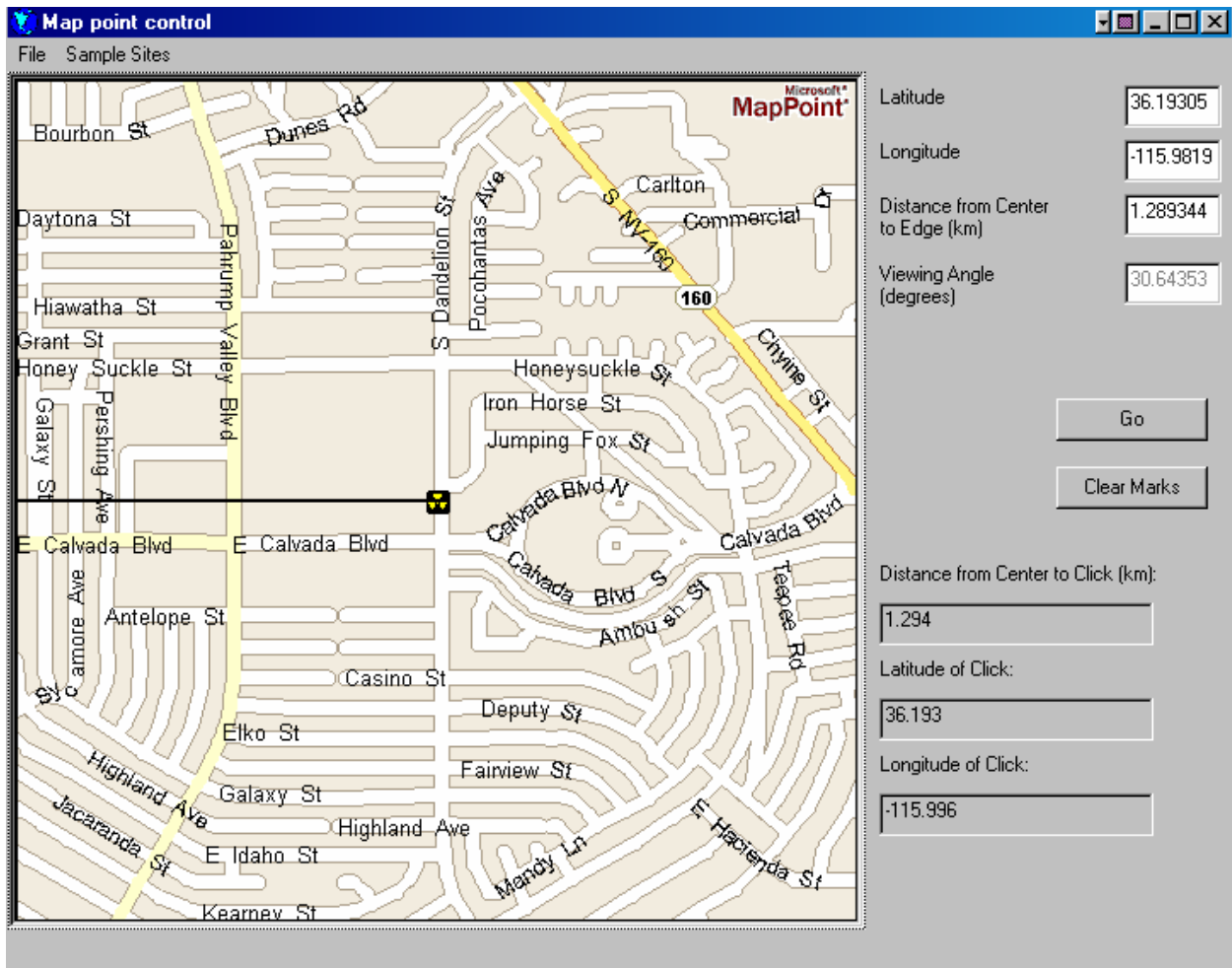


Figure 4-66 Distance of Line from Center to Edge

The MapPoint interface requires that a viewing altitude be specified. The developers determined that the viewing angle is 30.64353 degrees. This viewing angle does not hold at very high altitudes. However, this does not appear to be a problem at distances less than 2000 km.

MapGen is designed to be consistent with MapPoint 2006. Future versions of MapPoint could use a different algorithm or viewing altitude formula, and so could produce unexpected results if used with MapGen.

4.8.4 Modifying the Network Evacuation Direction

The evacuation direction can be modified in two ways.

The first method is to click the grid element. The direction changes for that grid element each time the area is clicked. The direction rotates ninety degrees clockwise each time the grid element is clicked.

When a grid element is clicked, the clicked element is selected in the Radius/Sector list. In the following example, the grid element between 3.22 km and 4.02 km and in the fourth sector is selected. Sector 4 corresponds to ENE in a grid that has been divided into 16 sectors.

	Radius (km)	Sector
1	0.16	1
2	0.52	2
3	1.21	3
4	1.61	4
5	2.13	5
6	3.22	6
7	4.02	7
8	4.83	8

Figure 4-67 Radius and Sector Selected

The second method is to use the *Change* button found on the right of the window.

Clicking the *UnSelect* button clears the selection of the radius and sector.

Selecting a radius from the list and clicking the *Change* button changes the direction for all grid elements at the selected radius by ninety degrees clockwise. Similarly, selecting a sector but no radius changes the direction for all grid elements in the selected sector by ninety degrees. Selecting a radius and a sector and clicking on the *Change* button changes the direction only within the selected grid element.

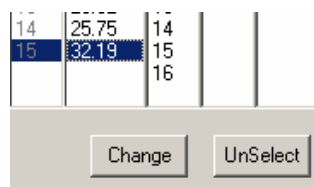


Figure 4-68 Select Radius only

4.8.5 Editing the Speed Multiplier List

A speed multiplier for each grid element is used by MACCS2 to adjust the speed multipliers assigned for each evacuation phase in variable ESPEED. A value of one for the multiplier indicates that the speed in that grid element is the same as ESPEED.

The default value for the speed rank is one and the speed multiplier has a default value of one. To add additional speed multipliers, click the *Modify Multipliers* button in the *Evacuation Speed* form. A dialog box like the one in Figure 4-66 opens.

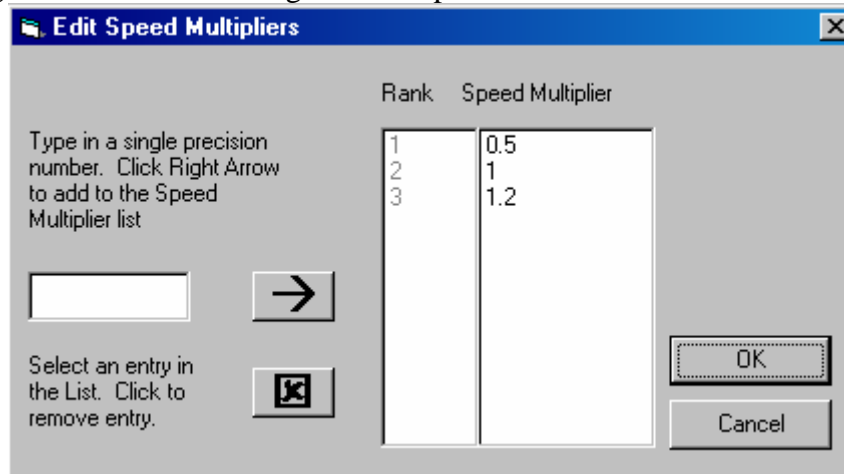


Figure 4-69 Edit Speed Multipliers

Speed multipliers can be added to the list by entering a number followed by Enter or clicking the button containing the right arrow symbol. Multipliers can be deleted by selecting a multiplier from the *Speed Multiplier* list and clicking the button containing the boxed cursive X symbol.

Multipliers are automatically sorted in ascending order. Multiple entries of the same number are not allowed.

Click *OK* or *Cancel* when finished. *OK* accepts the modifications; *Cancel* deletes them.

Ranks shown on the polar grid are modified when the multipliers are modified. For example, if before editing the multipliers, the rank of 1 corresponded to a speed multiplier of one and a multiplier of 0.5 was added in the *Edit Speed Multipliers* window, the rank of 1 now corresponds to a speed multiplier of 0.5. The polar grid continues to show the rank of 1 in the same locations as before.

At this time, uncertain speed multipliers are not supported in WinMACCS.

4.8.6 Modifying the Speed Multiplier ranks

The speed multiplier ranks can be modified in two ways.

The first method is to click the grid element. The rank is incremented by one each time that grid element is clicked. For example, clicking a grid element with an initial rank of four results in a rank of five if five ranks are defined; otherwise, the rank cycles to one.

When a grid element is clicked, the clicked element is selected in the Radius/Sector list.

The second method is to use the *Change* button shown on the right side of the form. The first step is to clear the radius, sector, and speed multiplier selected, if needed, by clicking the *UnSelect* button. Selecting a radius and a speed multiplier rank from the list and clicking the *Change* button changes the rank for all grid elements at the selected radius to the selected value. Similarly, selecting a sector but no radius changes the rank for all grid elements to the selected value. Selecting a radius, a sector, and a speed multiplier rank and clicking on the *Change* button only changes the rank of the selected grid element.

In the example, the speed multiplier rank for the grid element between 0.52 and 1.21 and sector two can be changed to 2, if the *Change* button is clicked, as illustrated below.

	Radius (km)	Sector	Rank	Speed Multiplier
1	0.16	1	1	0.5
2	0.52	2	2	0.7
3	1.21	3	3	2.3

Figure 4-70 Selecting a Speed Multiplier

4.9 Specifying a Site File

Files are generally specified in a general parameter modification form. However, the site file required a custom form because the preprocessor, PopMod.exe, has been integrated with this form.

In the past, the site file has been created using an external software source, such as SECPOP2000. This text file is required to be in a format as documented in Appendix A of the *Code Manual for MACCS2 User's Guide*. However, SECPOP2000 only supports 16 compass directions. PopMod was written to enable site files to be modified for 32, 48, and 64 compass directions. This software product reads a site file created by SECPOP2000 or some other source. The input consists of a total number of compass directions, which must be greater than the number of directions on the existing site file. PopMod creates a site file with data consistent with a higher angular resolution. No new site specific information from the census data source is inserted into the site file, but the file is created to be consistent with the existing file. See Appendix A for more information.

Figure 71 Specify Site Population File

The *Specify Site Population Data File* form has components identical to all other parameter modification forms. If a new site file is not needed, then click the *Browse...* button to define the desired site file containing sixteen compass sectors. The operation of this form is identical to any other parameter modification form.

Notice that MACCS2 variable values NUMCOR and Site File are shown on this form.

The *Create New* button is used to create a new site file with more angular resolution. A label titled *Angular Directions* shows the actual number of angular directions written to the file shown in the text box labeled *Site File*.

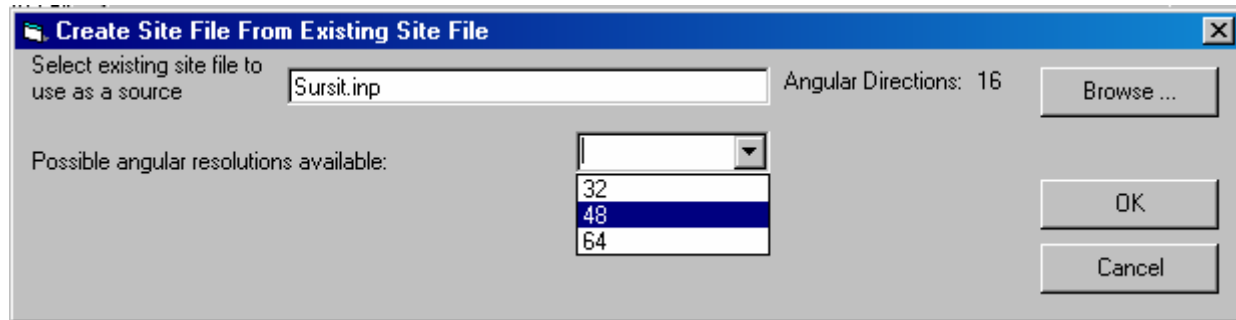


Figure 72 Create Site File From Existing Site File

To create a new site file with more angular directions from an existing site file:

1. Click the *Create New* button on the *Specify Site Population Data File* form. A new form titled *Create Site File From Existing Site File* opens.
2. Click on the *Browse* button on this form. Choose a site file that has a smaller angular resolution than the file you need to create. For the best results, choose a site file that has sixteen angular directions. The actual number of angular directions of the site file chosen is displayed on this form next to the label called *Angular Directions*.
3. Choose the angular resolution you need from the pull down menu.
4. Click *OK* to save the changes. Click *Cancel* to close this form without saving any changes.
5. The new file created has the number of new angles appended to the file name. In our example, the source file was *Sursit.inp*. Because 48 angles were selected, the new name is now *Sursit_48.inp*. Notice that the *Angular Directions* as read from the new site file has been updated to 48.
6. Click *OK* to save the changes. Click *Cancel* to close this form without saving any changes.

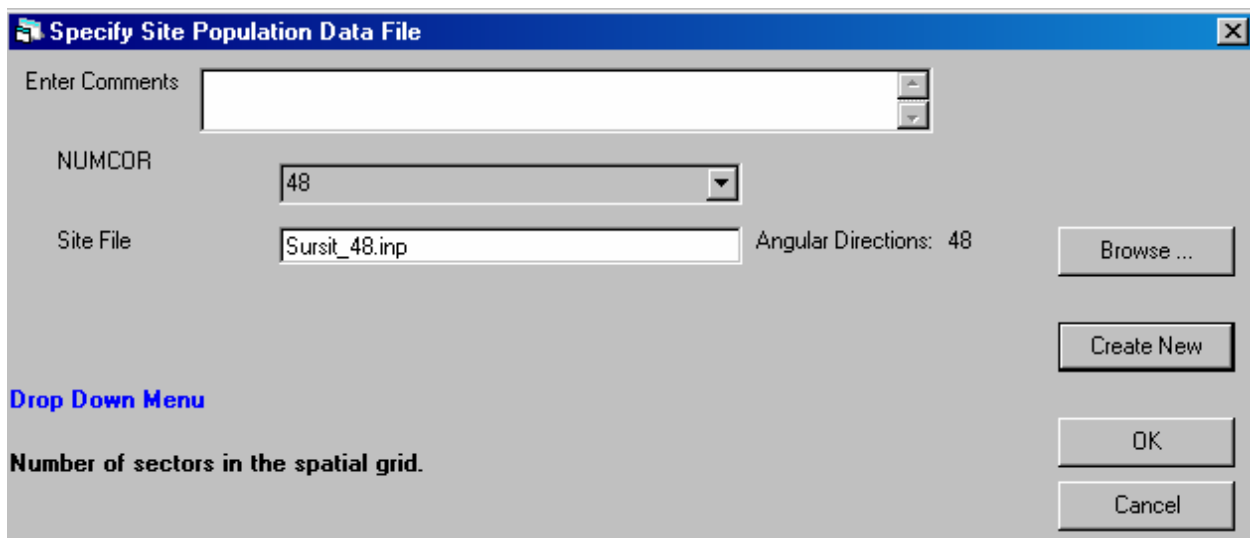


Figure 73 Newly Created Site File

4.10 Running Simulations

To initiate model execution:

- Open the *Run Models* form by selecting *Execute*→*Run Models...* from the main menu.
- Click on the *Run Simulation* button.

4.10.1 Run Models Form

The following are the main components of the *Run Models* form:

The MACCS2 modules to be used, namely *Atmospheric Dispersion*, *Early Consequences*, and *Late Consequences*, can be modified from the *Scope* tab of the *Properties* form. The *Create COMIDA2 File* setting can be modified from the *Food* tab of the *Properties* form. Scope choices cannot be modified on the *Run Models* form.

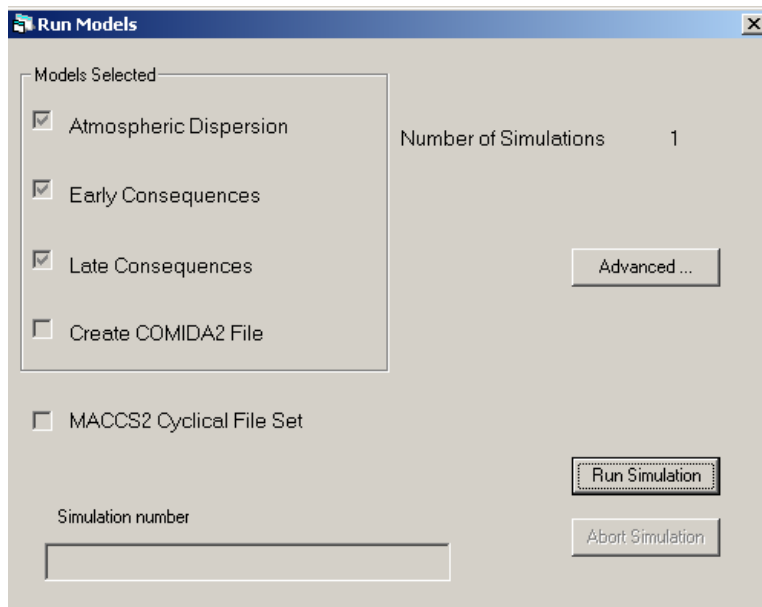


Figure 4-74 Run a Simulation

MACCS2 Cyclical File Set

The status of *MACCS2 Cyclical File Set* can be modified from the *Scope* tab of the *Properties* form. This cannot be modified on the *Run Models* form.

Number of Simulations

The *Number of Simulations* is the number of cyclical and/or LHS samples to be run. However, WinMACCS attempts to prevent redundant simulations. For example, if no cyclical files or uncertain parameters are specified within WinMACCS, only a single simulation is performed. Likewise, if a set of cyclical files are specified but there are no uncertain parameters, WinMACCS performs the same number of simulations as cyclical files.

To change the *Number of Simulations*, click the *Advanced...* button to open the *Advanced Execution Parameters* form. The user can also modify the seed used by the LHS random number generator with this form.

Run Simulation button

Click the *Run Simulation* button to initiate LHS, COMIDA2 and MACCS2 simulations. Progress is reported in the *Results* window.

The current simulation number (e.g., the MACCS2 run number) is displayed in the status bar found at the bottom of the *Run Models* form.

Abort Simulation

Click the *Abort Simulation* button to abort a MACCS2 run in progress.

4.10.2 Advanced Execution Parameters Form

To set advanced execution options, open the *Run Models* window by selecting *Execute*→*Run Models* from the main menu. Click on the *Advanced...* button.

The image shows a dialog box titled "Advanced Execution Parameters". It is divided into two main sections. The first section, "Execution Parameters", contains two text input fields: "Number of Simulations" with the value "1" and "Seed for Random Generation" with the value "8745237". The second section, "Disposition of MACCS2 Input and Output Files", contains three checkboxes: "Delete Atmos, Early, Chronc and COMIDA2 Input Files" (checked), "Delete MACCS2 and COMIDA2 Text Output Files" (unchecked), and "Delete MACCS2 and COMIDA2 Binary Result Files" (unchecked). At the bottom right of the dialog are "OK" and "Cancel" buttons.

Figure 4-75 Advanced Execution Parameters Form

The *Number of Simulations* text box sets the number of times MACCS2 runs.

- If there are uncertain parameters, set number of simulations to the number of LHS simulations that are to be used in the analysis. Changing this number changes the sampled values of the uncertain parameters used in the simulations.
- If MACCS2 cyclical files are used with or without LHS, enter the number of times you want MACCS2 to run. If LHS is not used, the *Number of Simulations* should be the same as the number of cyclical files; if LHS is used, the *Number of Simulations* should normally be an integer multiple of the number of cyclical files. Statistical results for the aggregated output assume that the conditions represented by the cyclical files are equally likely.

The value in the *Seed for Random Generation* text box is the random number seed used by LHS to create distribution samples of the variables the user has chosen to be represented by probability distributions. Changing this number changes the sampled values of the uncertain parameters used in the simulations. Powers of two should be avoided. The value of the seed must be between 1 and 2,147,483,647.

The section labeled *Disposition of MACCS2 Input and Output Files* gives the user the option of deleting various files that do not need to be referenced. These are useful options if there are many simulations. The files deleted are removed after MACCS2 has executed a single sample with the exception of the MACCS2 binary results files. The template files are always retained in the project Input directory.

If the *Delete Atmos, Early, Chronc and COMIDA2 Input Files* is checked, then the input files, *Atmosn.inp*, *Earlyn.inp*, *Chroncn.inp*, *Comidan.inp*, *Comidan.par*, *Comidan.var* and *LHS.inp* are deleted after the data have been read, where *n* is the simulation number. The template files (e.g., *Atmostemplate.txt*) are not deleted. These files are located in the project /Input directory.

If the *Delete MACCS2 and COMIDA2 Text Output Files* is checked, the MACCS2 output files *Modeln.out* and the COMIDA2 output files, *Comidan.cnc*, *Comidan.dmp* and *Comidan.lst*, are deleted. These files are located in the project /Output directory.

If the *Delete MACCS2 and COMIDA2 Binary Result Files* is checked, then the MACCS2 binary files are deleted after the requested summary reports are created. If no summary reports are requested, the MACCS2 binary results files are removed after MACCS2 has executed each sample.

If summary reports are requested by selecting reporting options in the output request windows (type0, type1, etc requests on forms such as *Heath Effects Cases* in the *Output Control* category shown in the *Properties* tab of WinMACCS), the binary information is imported into the database after all MACCS2 runs have been completed. The requested reports are created, and then all of the MACCS2 binary files are deleted. As a side-effect of this operation, data for plots and additional reports are available through the database, even after the binary files are removed.

If the user turns the *Execute/Auto Create Summary Report* toggle off (by default it is on each time WinMACCS opens) and has requested that the binary files are to be deleted on the Advanced Execution Parameter form, no reports and no plots are available after MACCS2 has

executed. WinMACCS is able to create user requested reports (type0, type1, etc requests). The user's request to delete the binary data takes precedence over the request for the creation of the reports when the *Execute/Auto Create Summary Report* toggle is off.

Click *OK* to save the changes. Click *Cancel* or close the window and discard the changes.

4.10.3 Template files

Template files are created by WinMACCS to facilitate the task of creating input files. These are named *atmosTemplate.txt*, *earlyTemplate.txt*, *chroncTemplate.txt* and *comidaTemplate.txt*. The positions where the values of uncertain variables are inserted are tagged within these files. The tags can be used to identify the uncertain variables. For example, notice the special characters around the number 309 in the following input line taken from a sample *atmosTemplate.txt* file.

WDCWASH1001 §309§

This line indicates that CWASH1 is uncertain. A sampled value from LHS is inserted into the space §309§ when the input file is created from the template file. The number 309 is an internal key used by WinMACCS to identify which variable to insert.

The *Atmos1.inp*, *Early1.inp*, *Chronc1.inp* and the three *Comida2* input files are recreated from the template files when the user clicks the *Run Simulation* button.

If the user desires to manually modify one or more input parameters within the MACCS2 template files, the user must first uncheck the main menu option *Execute→Refresh Template Input Files before Running*. Otherwise, the modified file is overwritten before MACCS2 executes and the modification is lost.

4.11 Creating Summary Reports

Summary reports are based on output requests made on the forms in the *ATMOS/Output Control*, *EARLY/Output Control* and *CHRONC/Output Control* categories, probabilities entered on the *GENERAL/Reporting Options* form and the binned CCDF data written to MACCS2 binary file.

If the requests are made on the *Output Control* forms, found on the *Parameters* tab of the *Project* window, then after the MACCS2 simulation has completed, the binary output files are imported into the database and the summary report, Summary.out, is automatically created.

Report requests can also be made after the simulations are completed by selecting *PostProcessing*→*Create Custom Report* to open the *Create Custom Report* form. Reports based on any of the output requested (even the value of NONE was associated with the Report Options variables) are available. Additionally, probability input to the custom report module can be modified both before and after MACCS2 has run using the *General/Reporting Options* form. These probabilities may be applied to the automatic reports (immediately after the MACCS2 simulation) and the custom reports.

4.11.1 Creating Automatic Reports

After MACCS2 simulations have been completed, automatic reports are created if both of the following conditions are true:

- Either *REPORT* or *CCDF & REPORT* has been requested in at least one of the WinMACCS output request form
- Execute→Auto Create Summary Report toggle is checked.

	NAME	DOSTH3 (Sv)	Report Options
1	A-RED MARR	1.5	REPORT
2	A-LUNGS	5.0	CCDF
3	L-EDEWBODY	0.05	NONE
	*		REPORT
			CCDF & REPORT

Figure 76 Automatic Report Request

To request an automatic report:

1. Open an output request form. This is a form that is in on the of the *Output Control* categories that show a linked variable with the name NUMn, where n is an integer or a letter. In the example shown in Figure 76 Automatic Report Request, the variable NUM3 indicates that the form corresponds to MACCS2 Type 3 output requests.

2. In the *Report Options* column, choose either *REPORT* or *CCDF & REPORT*. Both of these selections cause WinMACCS to create an automatic report after execution. If the *CCDF & REPORT* is chosen, then the additional binned data for each cohort is printed in each of the MACCS2 output files associated with the simulation.
3. Repeat this process for all output requests for which an automatic report is desired. Save all of the form changes.
4. Open the form *General/Reporting Options* from the *Parameters* tab.
5. Review the probabilities requested. By default, only the mean values of the requested output are reported. Additional information with respect to various interpolated points on the CCDF plot can be requested on this form.
6. Run the MACCS2 simulation.
7. After the simulation is completed, the binary result files, Modeln.bin, is imported into the database. The report, summary.out, is automatically created based on the user input, and placed in the project output directory. Double click on *Output/Summary.out* found on the *Files* tab of the *Project* window to open the report.

4.11.2 Creating Custom Reports

	Report Description	Report	MACCS2 Input Card
1	Population Exceeding Threshold	<input type="checkbox"/>	TYPE3OUT001 'A-RED MARR' 1.5 NONE
2	Population Exceeding Threshold	<input type="checkbox"/>	TYPE3OUT002 A-LUNGS5.0 NONE
3	Population Exceeding Threshold	<input type="checkbox"/>	TYPE3OUT003 L-EDEWBODY 0.05 NONE
1	Average Individual Risk	<input checked="" type="checkbox"/>	TYPE4OUT001 1 'ERL FAT/TOTAL' NONE
2	Average Individual Risk	<input checked="" type="checkbox"/>	TYPE4OUT002 2 'ERL FAT/TOTAL' NONE
3	Average Individual Risk	<input type="checkbox"/>	TYPE4OUT003 3 'ERL FAT/TOTAL' NONE
4	Average Individual Risk	<input type="checkbox"/>	TYPE4OUT004 4 'ERL FAT/TOTAL' NONE
5	Average Individual Risk	<input type="checkbox"/>	TYPE4OUT005 5 'ERL FAT/TOTAL' NONE
1	Population Dose	<input checked="" type="checkbox"/>	TYPE5OUT001 L-EDEWBODY 1 12 NONE
2	Population Dose	<input type="checkbox"/>	TYPE5OUT002 L-EDEWBODY 1 19 NONE
3	Population Dose	<input type="checkbox"/>	TYPE5OUT003 L-EDEWBODY 1 26 NONE
1	Population-Weighted Risk	<input checked="" type="checkbox"/>	TYPE8OUT001 'ERL FAT/TOTAL' 1 5 NONE
2	Population-Weighted Risk	<input type="checkbox"/>	TYPE8OUT002 'CAN FAT/TOTAL' 1 12 NONE
1	Peak Dose	<input type="checkbox"/>	TYPEAOUT001 L-EDEWBODY 1 26 NONE
1	Population Dose Results	<input type="checkbox"/>	TYPE9OUT001 L-EDEWBODY 1 26 NONE

Figure 77 Create a Custom Report

To request a custom report:

1. Select *PostProcessing*→*Create Custom Report* to open the *Create Custom Report* form after the MACCS2 simulation has been completed. If the form is not populated, you have to run the simulation before creating the report.
2. Each output request is listed on the *Create Custom Report* form. Check or uncheck data that you wish to include or now exclude in column three.
 - o The row number on the WinMACCS form is shown in the first column.

- The second column matches with the form name shown in the interface.
 - If an entry on the third column is checked, then the report contains data associated with that output request
 - The last column contains a copy of the MACCS2 image requesting the output. This matches data written to the binary file, and enables WinMACCS to locate the data on the binary file.
3. If desired, probabilities for the report may be modified by opening the form *General/Reporting Options* from the *Parameters* tab and saving the changes by clicking the *OK* button on the *Reporting Options* form. This can be done any time before creating the report.
 4. Click the *Create Report* button to create the report and keep the window open, or click the *OK* button to create the report, save the changes made to this form, and keep the window open, or click *Cancel* to close the form and not save the changes.
 5. Double click on *Output/Summary.out* found on the *Files* tab of the *Project* window to open the report.

4.11.3 Interpretation of Custom Reports

The report consists of the grand mean and an estimate for the probability of exceedence for the probabilities requested on the *General/Reporting Options* form based on the binned cumulative probability distributions calculated by MACCS2. The method of calculating these numbers from the CCDFs reported in described in the section Method Used to Estimate Probabilities.

If all of the values in the CCDF are identical, e.g., there is no variance in the parameter value, it is not possible to calculate a meaningful value for the probability of exceedence. In this case, the report contains the text “Unable to transform CCDF No differences in probability values in CCDF”.

In the following example, the report request was made under the form *Early/Output Control/Health-Effect Cases*. A section of the report relevant to this follows:

```

*****
Request 1 Health-Effect Cases
MACCS2 Image:TYPE1OUT007      'ERL INJ/SKIN ERYTHEMA' 1      26      CCDF
*****

Evacuation Evac # 1 ERL INJ/SKIN ERYTHEMA [0.E+00,1609.34](km)
      Probability of Exceedence
      "Grand Mean" 0.5      0.75      0.9      0.95
"Health-Effect Cases (none)" 2.417E+03 5.00E+02 2.00E+02 6.119E+01 2.766E-02

Evacuation Evac # 2 ERL INJ/SKIN ERYTHEMA [0.E+00,1609.34](km)
      Probability of Exceedence
      "Grand Mean" 0.5      0.75      0.9      0.95
"Health-Effect Cases (none)" 2.095E-01 5.857E-02 2.87E-02 1.871E-02 1.622E-02

```


Evacuation Overall ERL INJ/SKIN ERYTHEMA [0.E+00,1609.34](km)					
Probability of Exceedence					
"Grand Mean"	0.5	0.75	0.9	0.95	
"Health-Effect Cases (none)"	2.296E+03	5.00E+02	1.414E+02	6.119E+01	6.544E-02

Notice that the two evacuations plus the combined results are reported. All LHS trials have been combined. Interpreting the first line of results for evacuation scenario one, we can say that we are 90 percent certain that the number of skin erythema injury cases exceeds 61.19. The mean number of injuries over all LHS realizations is approximately 242 cases.

4.11.4 Method Used to Estimate Probabilities

Given a set of binned CCDF values read from the MACCS2 binary file, the first step is to map these values into a set of equally spaced probabilities. Probabilities are estimated over the range 0 to 1 in increments of .01.

The algorithm to do this is as follows:

- Take the natural log of x, the upper bound of the bin.
- Search for the first two probabilities that are different. In the example below, this corresponds to $\ln(x) = -20.0301$ and -19.6247 .

X	Prob >= X	ln (x)
1.00E-09	7.47E-02	-20.7233
2.00E-09	7.47E-02	-20.0301
3.00E-09	7.42E-02	-19.6247
5.00E-09	6.62E-02	-19.1138
7.00E-09	6.53E-02	-18.7774
1.00E-08	6.43E-02	-18.4207
2.00E-08	6.28E-02	-17.7275
3.00E-08	6.17E-02	-17.3221
5.00E-08	5.59E-02	-16.8112

- Calculate a new value of $\ln(x)$ for probabilities from .08 to 1.0 (first number greater than .0747 that is a multiple of .01) using the line defined by the points (7.42E-02, -19.6247) and (7.47E-02, -20.0301)
- For each value up to the last value, use linear interpolation to calculate the new value for $\ln(x)$. For values beyond the smallest probability value, in this case 0, .01, .02, .03, .04 and .05, use the line defined by the last two significant points, (6.17E-02, -17.3221) and (5.59E-02, -16.8112).
- In some cases, there are repeated values for the probability. When interpolating, looking from the first point on down, find the first data point that is less than the point of interest (say point idx). Use this point and the previous point for the interpolation. In the above example to interpolate to probability = .06, the first probability less than .06 is .0559. The points (6.17E-2, -17.3221) and (5.59E-2, -16.8112) are used to interpolate.
- In the case where the first point less than the point of interest corresponds to $idx = 1$, interpolate between $idx = 1$ and $idx = 2$. These are guaranteed to correspond to different probabilities.
- In some cases, the last two points have the same value of probability. In this case, look up the table (from the bottom up) for the first point with a different probability. Use this for the extrapolation.
- Take the antilog to complete the table. Result is a table of equally likely values of x .

Because of the logarithmic interpolation, the method requires only positive values for x . The algorithm fails to calculate quantiles if there are any zero or negative values of x .

To combine the CCDFs across various LHS runs, sort the arrays of all possible values of x in ascending order (using above increments of .01, this results is $101*N$ values where N is the number of LHS realizations).

To calculate the probability of exceedence, consider an array of sorted linearized CCDF values. For example, consider the following table of nine values:

Value	Probability of exceedance	f	Q(f)
5	1	1	5
8	7/8	.875	8
9	6/8	.75	9
9	5/8	.625	9
10	4/8	.5	10
12	3/8	.375	12
14	2/8	.25	14
30	1/8	.125	30
35	0	0	35

The first value, 5, is viewed as a lower bound and not a data point. Assigned CCDF column is the percentage of values that exceed or equal the given data point.

The function $Q(f)$ where $0 \leq f \leq 1$, is the distribution value such that the fraction, f , of all values exceeds or equals $Q(f)$.

For other values, linear interpolation is done. In the above example, $Q(.7) = 9$. $Q(.1)$ is between 30 and 35, and is linearly interpolated as 31.

The value, $Q(f)$, is precisely the value reported by WinMACCS, where f is the probability entered in form *General/Reporting Options*.

4.12 Viewing Graphical Results

Graphical output can be displayed after completing a MACCS2 run by selecting an entry from the main menu *Post Processing*→*Graphical Results*. The following results are available:

- Scalar results are displayed by selecting *PostProcessing*→*Graphical Results*→*Scalar Results* from the main menu.
- Statistical summary results are displayed by selecting *PostProcessing*→*Graphical Results*→*Statistical Summary Results* from the main menu.
- Probability distribution results representing weather uncertainty are displayed by selecting *Post Processing*→*Graphical Results*→*Results over all Weather Trials* from the main menu.

When a plot request is made after a simulation (i.e., one of the menu entries such as *PostProcessing*→*Graphics*→*Results over all Weather Trials*) is selected, the MACCS2 binary result files (e.g., Model1.bin) are imported into the project database if they were not already imported to support automatic or custom reports. This progress can be observed in the *Results* window as shown below.

```
Results
7/13/2007 5:47:58 PM : Start Time
7/13/2007 5:48:09 PM : Final Time
7/13/2007 5:48:14 PM : Start Time Import
Importing C:\WinMACCS Projects\Sample 1\Output\Model1.bin
Importing C:\WinMACCS Projects\Sample 1\Output\Model2.bin
Completed import of binary files into database
7/13/2007 5:48:16 PM : End Time Import
```

Figure 4-78 Results Window after Processing Binary Files

After the binary result files have been processed into the project database, the result information is available for quick access without repeating the import process.

4.12.1 Scalar Results

Graphical results can be displayed after completing a MACCS2 run by selecting an entry from the main menu item *PostProcessing*→*Graphical Results*→*Scalar Results*.

These results are associated with a single number as opposed to a probability distribution (e.g., the fractional release of Co-60 in plume number one). These results are displayed as cumulative distribution functions, or CCDFs. If the results are identical across LHS runs, they are displayed on the X-axis because the probability of exceedance is zero. The following is sample output from a result file, Model1.txt, which corresponds to scalar results for two plumes.

RELEASED INVENTORY OF ALL PLUMES		
Co-58	5.30E+13	1.08E+13
Co-60	4.05E+13	8.28E+12
Kr-85	1.77E+16	7.61E+13
Kr-85m	7.07E+17	1.45E+15
Kr-87	8.65E+17	2.71E+14
Kr-88	1.59E+18	2.12E+15
Rb-86	8.63E+14	3.21E+12
Sr-89	1.08E+16	1.74E+17

Figure 4-79 MACCS2 Plume Inventory

4.12.2 Results Displayed as a Complimentary Cumulative Distribution Function (CCDF)

Graphical results can be displayed after completing a MACCS2 run by selecting an entry from the main menu *PostProcessing*→*Graphical Results*→*Results over all Weather Trials* from the main menu.

Most MACCS2 results from a single execution are probability distributions representing uncertainty of the weather during a hypothetical accident. This window displays the CCDF distributions for each MACCS2 calculation. For example, if five MACCS2 simulations were run using LHS, there would be five CCDF curves for each result. The following is sample output from a result file that could be displayed as a single curve in this plot window.

RESULT NAME = Source Term 1: Plume 1, at 5.6-8.1 km		
Cs-137 Center Air Conc. (Bq-s/m ³)		
1.00E+04	1.00E+00	
2.00E+04	1.00E+00	
3.00E+04	1.00E+00	
5.00E+04	1.00E+00	
7.00E+04	1.00E+00	
1.00E+05	1.00E+00	
2.00E+05	1.00E+00	
3.00E+05	1.00E+00	
5.00E+05	1.00E+00	
7.00E+05	1.00E+00	
1.00E+06	1.00E+00	
2.00E+06	1.00E+00	
3.00E+06	1.00E+00	
5.00E+06	1.00E+00	
7.00E+06	1.00E+00	
1.00E+07	1.00E+00	
2.00E+07	1.00E+00	
3.00E+07	1.00E+00	
5.00E+07	1.00E+00	
7.00E+07	1.00E+00	
1.00E+08	1.00E+00	
2.00E+08	1.00E+00	
3.00E+08	9.99E-01	
5.00E+08	9.99E-01	
7.00E+08	9.99E-01	
1.00E+09	9.99E-01	
2.00E+09	9.99E-01	
3.00E+09	9.98E-01	
5.00E+09	9.71E-01	
7.00E+09	9.39E-01	
1.00E+10	8.50E-01	
2.00E+10	7.64E-01	
3.00E+10	7.17E-01	
5.00E+10	6.65E-01	
7.00E+10	6.37E-01	
1.00E+11	6.27E-01	
2.00E+11	4.52E-01	
3.00E+11	3.27E-01	
5.00E+11	2.02E-01	
7.00E+11	1.81E-01	
1.00E+12	7.04E-02	
1.53E+12	2.21E-02	

Figure 4-80 MACCS2 CCDF Results

The data correspond to the MACCS2 results reported when the CCDF flag is set on an output request line.

Even if not requested by the user, all CCDF results are written to the binary results files (e.g., Model1.bin). In the example shown in Figure 4-81, even though CCDF results for plume one at grid element nine are not reported in the Model1.txt results files, they are saved in the binary-result files.

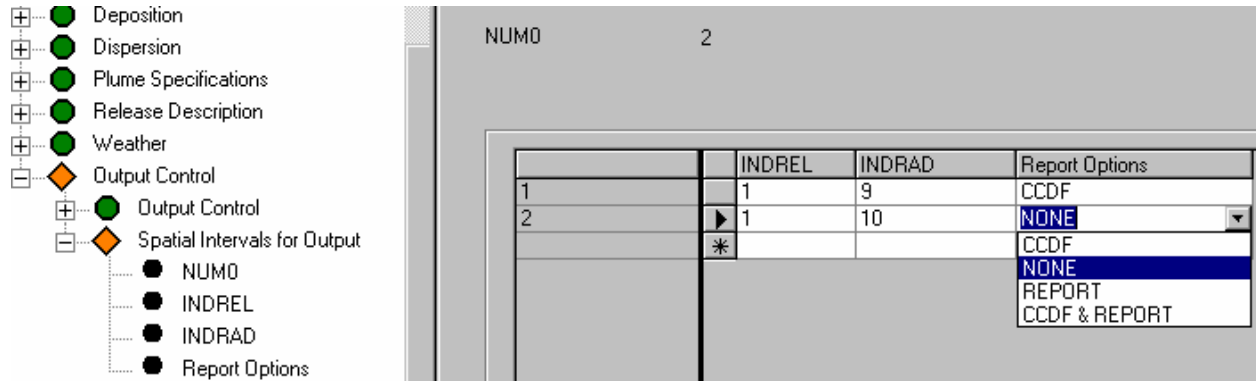


Figure 4-81 Requesting CCDF Results in WinMACCS

4.12.3 Statistical Summary Results

Graphical results can be displayed after completing a MACCS2 run by selecting an entry from the main menu *PostProcessing* → *Graphical Results* → *Statistical Summary Results* from the main menu.

Most MACCS2 results from a single simulation are probability distributions representing uncertain weather. For example, in Figure 4-82 the MACCS2 results for Center Air Concentration for Cs-137 for plume number one at 4.8 to 5.6 km is a probability distribution. MACCS2 reports statistics such as *Prob Non-Zero*, *Mean*, etc., calculated from this distribution. These statistics are listed as column headings below.

	PROB NON-ZERO	MEAN	50TH	QUANTILES				PEAK CONS	PEAK PROB	PEAK TRIAL
				90TH	95TH	99TH	99.5TH			
Source Term 1: Plume 1, at 4.8-5.6 km										
Cs-137 Center Air Conc. (Bq-s/m3)	1.0000	4.71E+11	2.87E+11	1.22E+12	1.58E+12	2.18E+12	2.31E+12	2.72E+12	7.71E-04	45
Cs-137 Ground Air Conc. (Bq-s/m3)	1.0000	4.20E+11	2.52E+11	1.08E+12	1.18E+12	1.45E+12	1.58E+12	1.99E+12	7.71E-04	45
Cs-137 Center Ground Conc. (Bq/m2)	0.9872	4.51E+09	2.73E+09	1.18E+10	1.39E+10	2.01E+10	2.14E+10	3.52E+10	1.14E-04	130
Total Center Ground Conc. (Bq/m2)	0.9872	4.27E+11	2.92E+11	1.08E+12	1.17E+12	1.39E+12	1.50E+12	3.36E+12	1.14E-04	130
Ground-Level Dilution, X/Q (s/m3)	1.0000	5.21E-06	3.06E-06	1.41E-05	1.99E-05	NOT-FOUND	NOT-FOUND	2.74E-05	2.21E-02	34
Cs-137 Adjusted Source, Q (Bq)	1.0000	9.21E+16	8.81E+16	1.03E+17	1.04E+17	1.07E+17	1.09E+17	1.11E+17	2.45E-03	75
Plume Sigma-y (m)	1.0000	4.27E+02	3.20E+02	7.27E+02	7.60E+02	8.43E+02	8.81E+02	8.98E+02	3.77E-03	110
Plume Sigma-z (m)	1.0000	2.66E+02	1.09E+02	7.33E+02	8.06E+02	NOT-FOUND	NOT-FOUND	2.40E+03	1.06E-02	28
Plume Height (m)	0.4148	1.24E+02	0.00E+00	7.06E+02	8.84E+02	1.02E+03	1.04E+03	1.11E+03	2.00E-04	21
Plume Arrival Time (s)	1.0000	6.86E+03	6.06E+03	9.90E+03	1.08E+04	1.30E+04	1.41E+04	1.42E+04	4.94E-03	36

Figure 4-82 MACCS2 Statistical Summary Results

The *Statistical Summary Results* form allows the user to display a CCDF for each of the entries in Figure 4-82 (e.g., the mean value of Center Air Concentration for Cs-137 for plume number one at 4.8 to 5.6 km). In other words, a plot created with this option displays a probability distribution (CCDF) of one of the statistics above over the set of LHS samples.

4.12.4 Navigation of the Plot window

Multiple plot windows can be opened. Notice that the caption of the plot window contains the MACCS2 version used in the simulation. The date and time correspond to a date/time stamp written on the binary output files (e.g., model1.bin).



Figure 4-83 Plot Window Caption

To add a plot to the graph:

1. Select the variable you want to plot from the *Select Variable* list.
2. Additionally, if a *Statistical Summary Results* form is being used, click on the desired statistic in the *Statistic* list.
3. Click on the *Add* button to add it to the existing graph.

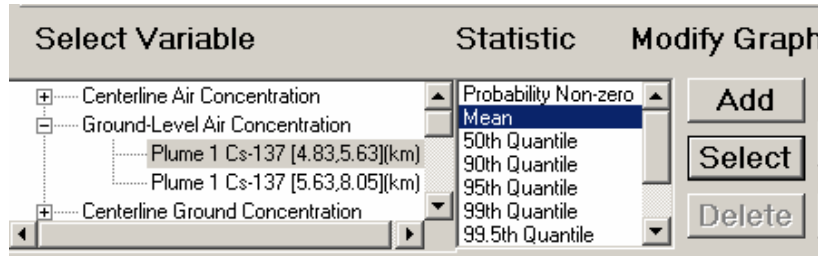


Figure 4-84 Add a Plot to a Graph

If the Mean is added, notice that the grand mean (average of all means over all simulations) is calculated and displayed on the graph as a vertical line.

To select a plot on the graph do one of the following:

- Click the *Select* button.
- Select Select Next Series from the PostProcessing→Graphical Results→Edit Plots menu.
- Click on the plot.

When a plot is selected:

- The individual points are marked.
- The details indicating the plot selected are shown in blue at the bottom of the window.
- The *Select Variable* list and the *Statistic* list, if applicable, indicate the selected plot.
- If a legend is applicable to the plot, the current selected plot is shown in the legend.
- If the bulls-eye toggle is pushed in, the data values are displayed on the plot.

Plots are selected in the order they were added. Only one plot can be selected at a time. If the last plot added is the selected plot and the *Select* button is clicked, then no plots are selected. This feature allows the user to cycle through all the plots, unselect all plots, and then start selection again with successive mouse clicks on the *Select* button.

In Figure 4-85, the Ground-Level Air Concentration for Plume 1, Cs-137 at a spatial distance of 4.83 to 5.63 km for the mean statistic is selected. Notice that this information is displayed in blue at the bottom of the window. Also notice that the *Grand Mean* is displayed on the plot as a vertical line. If the *Select* button is clicked when the *Mean* is selected, the *Grand Mean* would be selected. If it was clicked again, then no plots would be selected.

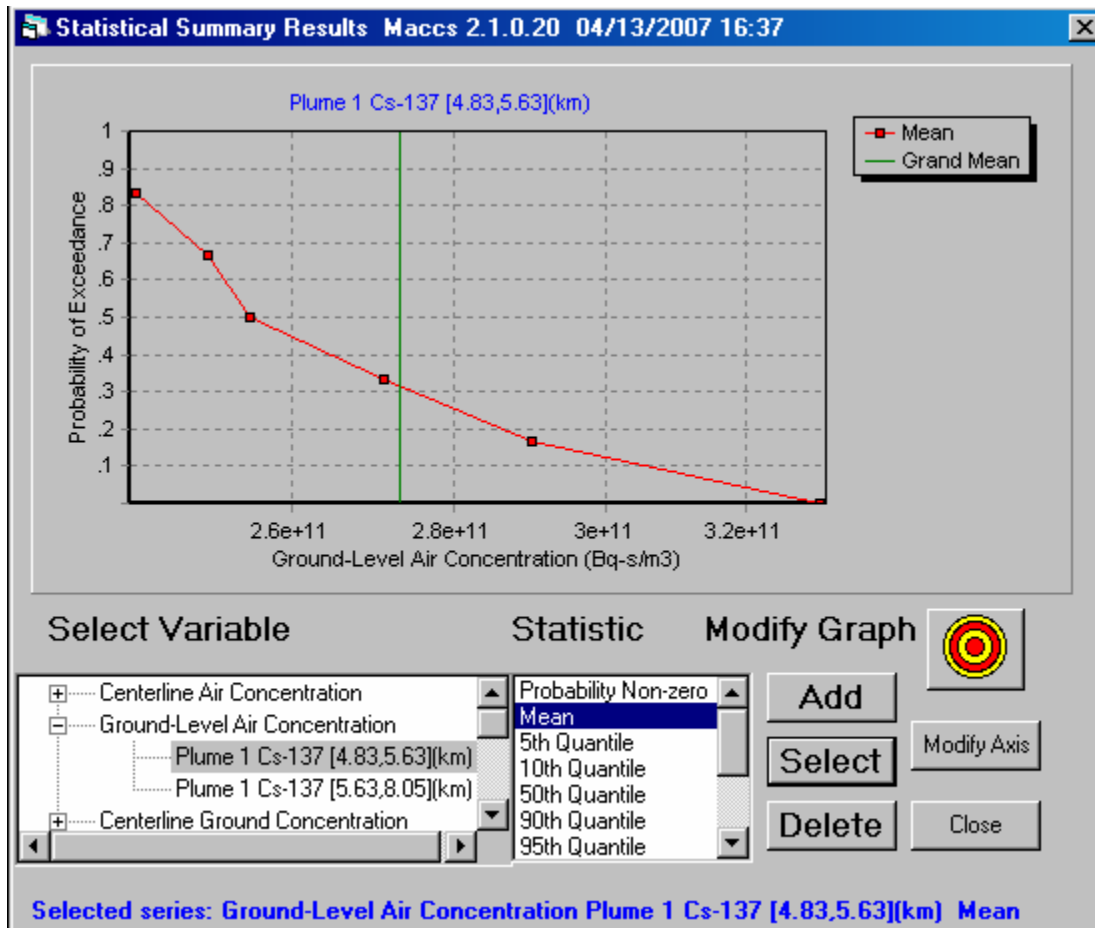


Figure 4-85 Plot Window

To place the graph in a state such that no plots are selected do one of the following:

- Click the *Select* button successively, cycling through each plot on the graph. When the last added plot is selected, clicking the *Select* button again puts the graph in a state such that no plots are selected.
- Select *Unselect* from the *PostProcessing*→*Graphical Results*→*Edit Plots* menu.

To delete a plot from a graph:

1. Select the plot to be deleted by clicking the *Select* button until the desired plot is selected.
2. Click the *Delete* button, or select *Delete Selected Series* from the *PostProcessing*→*Graphical Results*→*Edit Plots* menu.

To modify the axis labels or title of a graph:

1. Select *Modify Titles* from the *PostProcessing*→*Graphical Results*→*Edit Plots* menu. This causes the *Modify Titles* form to open, allowing the user to modify the plot and axis titles. Notice that by default the main plot title and the X axis title corresponds to the first plot placed on the graph.
2. Modify the plot title and axis labels.
3. Click on *OK* to save settings.

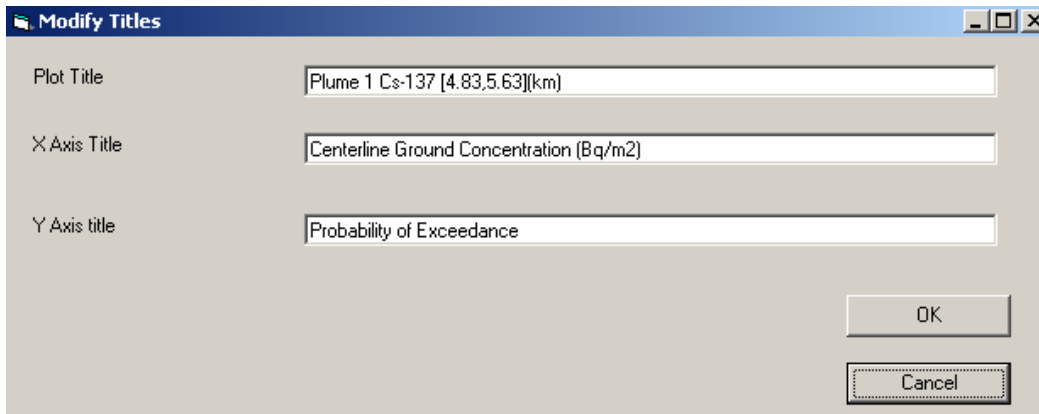


Figure 4-86 Modify Plot Titles

To zoom in the graphics window:

- Hold the left mouse button down in the top right corner of the desired area. Drag a rectangle by moving the mouse down and to the right. Release the mouse.

To unzoom, or restore the graphics window to its original scale:

- Hold the left mouse button down anywhere in the plot. Drag a rectangle by moving up and to the left. Release the mouse.

Note: Using the zoom or unzoom feature causes a selected series to be unselected and the bulls-eye toggle to be pushed out (i.e., shown in an off position).

To display plotted values:

- Click the bulls-eye toggle button. If this toggle is pushed in, as shown in Figure 4-87, the associated data points in the selected series are shown on the graphs as (x, y) coordinate pairs. To view some of the values, it may be necessary to use the zoom feature.

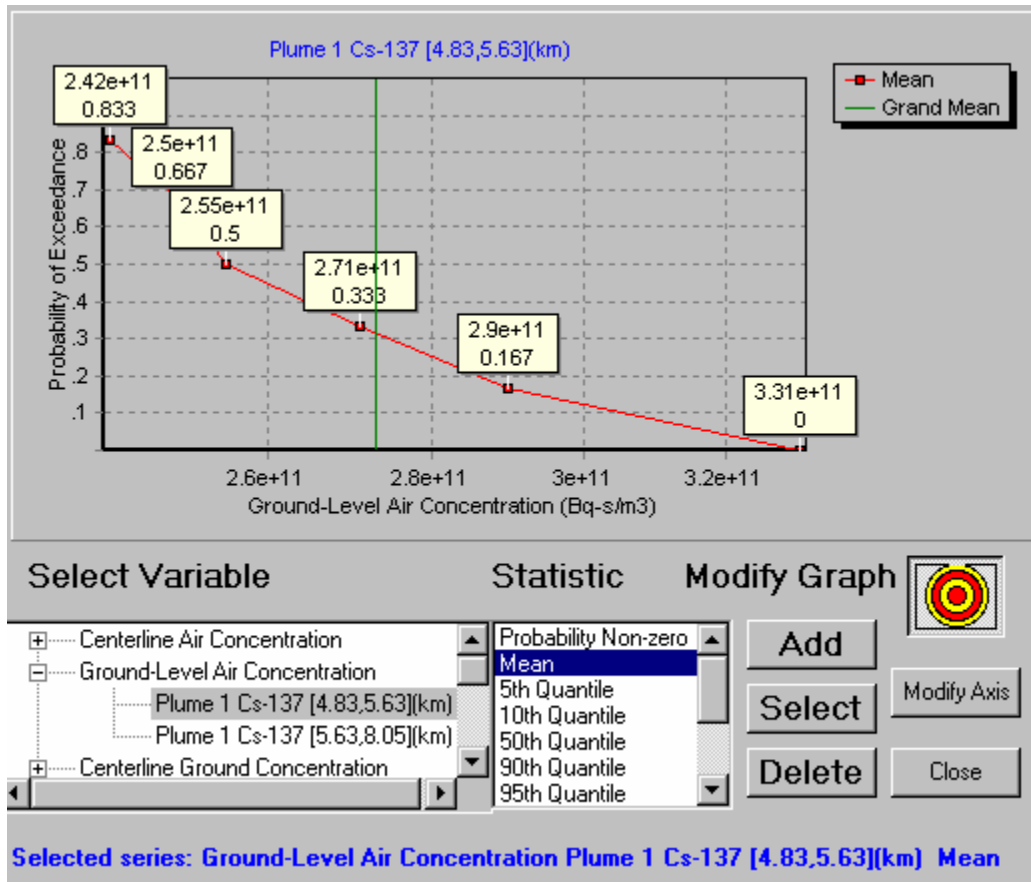


Figure 4-87 Data Values as Text Displayed in a Plot Window

To modify the plot axis:

- Click the *Modify Axis* button to open the *Modify Axis Bounds* form as shown in Figure 4-88. This allows the user to change the axis limits or switch to a log scale.

To rescale the X or Y axis:

1. Click the X or Y toggle buttons respectively. By default, the X axis is selected.
2. Select the scale of the toggled axis by clicking either the *Linear* or *Log* radio buttons.

3. Bounds can be set to *Automatic* or *Manual*.
 - a. To have the axis limits calculated by WinMACCS, select the radio button labeled *Automatic*.
 - b. To manually enter axis limits, select the radio button labeled *Manual*. Enter the axis limits in the text boxes labeled *Minimum* and *Maximum*.
4. To save and apply these changes click *OK*. To ignore the changes click *Cancel* or close the window.

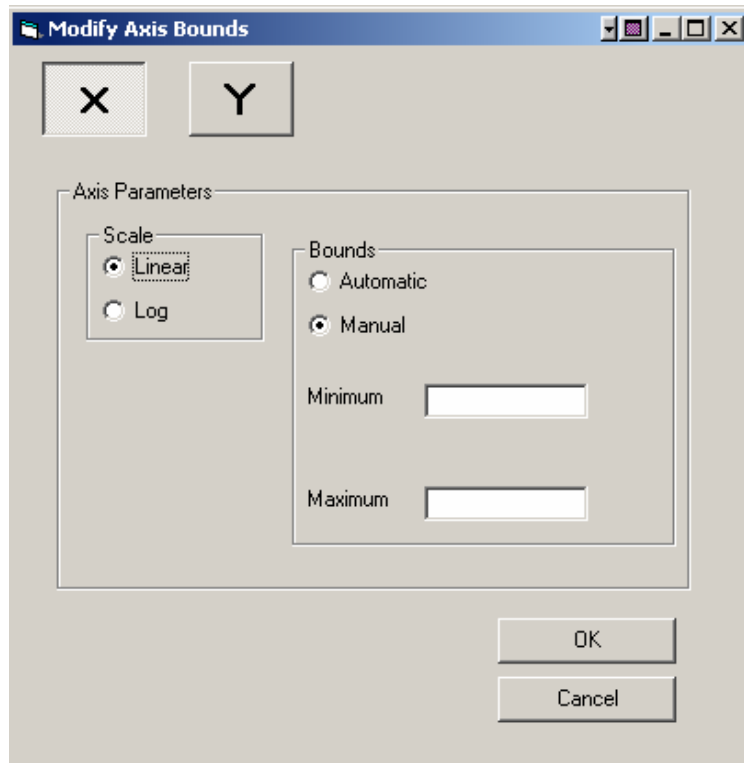


Figure 4-88 Modify Axis Bounds

To export the data, select *Export Plot* from the *PostProcessing*→*Graphical Results*→*Edit Plots* menu. The following file types are supported:

- Windows bit map (.bmp): A graphical format that integrates into other Microsoft documents such as Microsoft Word, Excel, or WordPad. Files can be edited in Microsoft Paint.
- Jpeg (.jpg): Viewable as a graphic in a web browser or photo editing software. Requires less memory than a .bmp file.
- Text files (.txt): ASCII text that is viewable in a text editor such as Notepad, WordPad, or Microsoft Word.
- XML and HTML: Viewable in a web browser such as Internet Explorer, Netscape or can be edited in Microsoft Word.
- Excel file (.xls): A document that can be opened with Microsoft Excel. Allows the user to do further data analysis in the graphical and functionally rich environment of Excel.

The result export file is saved in the Project Output directory unless the path is modified in the *Save As* form. Saved files are shown in the *Files* tab of the *Project* window as shown in Figure 4-89. Double-clicking on the exported file in the *Project* window causes the associated application to open that file for viewing.

Select *File*→*Refresh File View* from the main window to update the file names shown in the *Files* tab of the *Project* window.

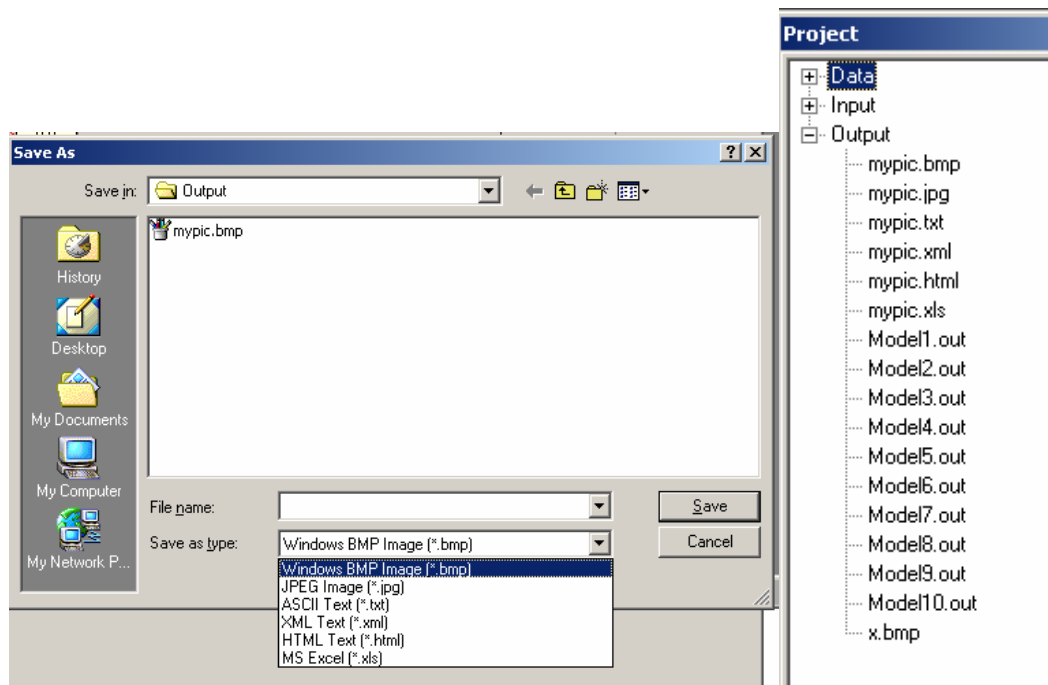


Figure 4-89 Exporting Graphics

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Appendix A: New MACCS2 Model Input Cards

INTRODUCTION

The following sections present modifications to the Code Manual for MACCS2 (NUREG/CR-6613, Vol. 1). Since the publication of that document, new MACCS2 models have been implemented and some variable bounds have been modified. Some entries that follow are corrections to the manual that fix typographical errors or improve clarity. A comprehensive review of the Code Manual for MACCS2 is expected in the future.

Page 4-1 Add a paragraph after heading “Running MACCS2” describing new command line parameters.

A MACCS2 run can be generated by using the older batch file method described in the MACCS2 1.12 documentation below, or by using command line parameters. The following parameters can be specified on the MACCS2.exe command line in any order.

-a ATMOS input file and path

-e EARLY input file and path

-c CHRONC input file and path

-m meteorological file and path

-s site file and path

-o output file and path. The prefix portion of the output file is used to name the binary output file. For example, if output file is named model.out, then binary file created by MACCS2 is named model.bin.

-i file containing names of MACCS2 input files. This is the path and name of a file containing the ATMOS, EARLY, CHRONC, meteorological, site and output files. If any of these files have been specified on the command line using the -a, -e, -c, -m, -s or -o parameter, this file is not used. If this -i option is not specified and the files have not been specified on the command line, the file names are expected to be in a file named Maccs2.tmp located in the Maccs2.exe directory. The file names in the -i file must be in order of ATMOS, EARLY, CHRONC, meteorological, site, and output, one file name and path per line. If the file is not relevant to the model, the line should contain a dummy file name or two double quotes to indicate no file specified.

The following example lists the contents of a Maccs2.tmp file. Only the ATMOS model is executed. The EARLY and CHRONC files are not specified. A meteorological file, Metsur.inp, has been specified. MACCS2 creates the results files Model1.out and Model1.bin.

```
C:\WinMACCSSamp\inb\Input\Atmos1.inp
```

```
""
```

```
""
```

```
C:\WinMACCSSamp\inb\Data\Metsur.inp
```

```
""
```

```
C:\WinMACCSSamp\inb\Output\Modell.out
```

-p is a prefix used in naming the status files. If this isn't specified, the status files are named MaxStat.log and FortErr.log. If it is specified, then the name of the two status files are prefixed with this parameter. For example, "maccs2.exe -p MyRun" would result in status files MyRunMaxStat.log and MyRunFortErr.log. These files are placed in the same directory as the output file directory specified in the -o parameter. If the -i parameter was used to specify the file names (instead of the -a, -e, -c, -m, -s and -o parameters), then the status files are placed in the same directory as the file specified after the -i flag. If neither of these conditions are met, then the status files are placed in the same directory as the Maccs2 executable file, MACCS2.exe.

The status file, MaxStat.log, contains a single line with the string 'OK' when the MACCS2 execution is successful. If the execution is not successful, the file contains a line with the string 'NO'. If MACCS2 detected the error and exited, the line containing the string 'NO' is followed by a MACCS2 generated error message.

The FORTRAN error file, FortErr.log, is created only if MACCS2 aborts abnormally. It contains trace back information and system level error messages. If this file exists when MACCS2 crashes, the error messages are appended to the end of the file, retaining previously generated error messages.

The -p parameter is independent of the input file specification, and is always optional.

If at least one of the command line parameters, -a, -e, -c, -m, -s, or -o, is present then the MACCS2.tmp file is not used to define the name and path of the required files. In this case all of the files used by MACCS2 must be specified on the command line.

Example usage where all files are specified from the command line:

```
C:\Program Files\WinMACCS> maccs2.exe -a C:\inb\Input\Atmos1.inp -m  
C:\inb\Data\Metsur.inp -o C:\inb\Output\Modell.out
```

Example usage where there is a file containing names of MACCS2 input files:

```
C:\Program Files\WinMACCS> maccs2.exe -i C:\inb\Maccs.tmp -p inb
```

In this example, MACCS2.tmp is renamed Maccs.tmp and the status files, MaxStat.log and FortErr.log, are renamed inbMaxStat.log and inbFortErr.log. These files are placed in the directory C:\inb\.

Page 4-1 Add a paragraph

Maccs2 version 1.12 stores intermediate values in temporary files. With the increase in size of memory in today's computers, it has become more efficient to use dynamic memory to store these intermediate results. By default, the current version of MACCS2 uses dynamic memory for the storage of these intermediate results, but the user has the option of reverting back to using temporary files to store these values. This is done by creating a file called maccs2.ini and placing the file in the same directory as the MACCS2 executable. If using WinMACCS, this directory is usually the following:

C:\ Program Files\WinMACCS

The user simply needs to add the line below to the file maccs2.ini and the MACCS2 program uses temporary files rather than trying to use dynamic memory.

FileTempMem = .TRUE.

Page 5-3 Add a variable to Geometry (GE) Data section.

Variable Name: NUMCOR
Variable Type: Integer, Vector
Allowed Values: 16, 32, 48, or 64
Purpose: Number of sectors in spatial grid, i.e., angular compass directions.

Example Usage:

* Number of angular compass directions
GENUMCOR001 16

Page 5-4 Add a sentence at the end of the purpose section of SPAEND.

Variable Name: SPAEND
The user must supply NUMRAD values in this data block.

Page 5-5 Update the range of MAXGRP.

Variable Name: MAXGRP
Allowed Range: $1 \leq \text{value} \leq 20$

Page 5-13 Correct a typographical error in the purpose section of variable DISTANCE.

Replace NUN_DIST with NUM_DIST.

Variable Name: DISTANCE

Purpose: ... The user must supply NUM_DIST values of DISTANCE.

Page 5-18 Add a new section.

5.7.4 Long-range, Lateral, Plume Spread Criteria

Hanna (2002) recommends that plume dispersion beyond 30 km be based on time, not on distance. This model allows the user to implement Hanna's recommendation. The basis for the recommended distance, 30 km, is that most measurements upon which dispersion tables are based have a limit of about 30 km. The time-based dispersion model is closer to those used in several Gaussian puff codes. In the MACCS2 implementation, the user must select the downwind distance at which the code switches from distance-based dispersion, described in Subsections 5.7.1 and 5.7.2, to time-based dispersion. The user must also select a linear coefficient for the time-based dispersion model. Hanna recommends a value of 0.5 m/s. The virtual source concept is used to ensure that there is no discontinuity in switching from distance-based to time-based dispersion. The following equation describes the new model:

$$\sigma_y = \begin{cases} a \left(\frac{x}{x_0} \right)^b & x < x_c \\ a_c t & x \geq x_c \end{cases} \quad 1$$

where

- σ_y = Value of crosswind dispersion (m)
- a = Linear coefficient for crosswind dispersion (m)
- x = Downwind distance (m)
- x_0 = Downwind distance scale, 1. m
- b = Exponential parameter for crosswind dispersion (dimensionless)
- x_c = Distance at which dispersion model switches from distance- to time-based
- a_c = Linear coefficient for time-based, crosswind dispersion (m/s)
- t = Time since the plume was released from the virtual source (s)

When DISTMD is set to LRTIME, time-based dispersion is implemented at distances greater or equal to the value of CYDIST. However, distance-based dispersion is always applied within the first ring, regardless of the value of CYDIST. Either the power-law function (Subsection 5.7.1) or lookup tables (Subsection 5.7.2) can be used to define the dependence of dispersion on downwind distance at distances less than CYDIST.

The following are ATMOS input cards to define the parameters for this model:

Variable Name: DISPMD
Variable Type: Character, Scalar
Allowed Value: LRTIME or LRDIST
Purpose: Crosswind dispersion model flag. Value set to 'LRTIME' for long-range, time-based model; value set to 'LRDIST' for long-range, distance-based model.

Variable Name: CYDIST
Variable Type: Real, Scalar
Allowed Range: $0.0 \leq \text{value} \leq 1.E+7$ m
Purpose: Distance for switching from distance-based to time-based, crosswind, dispersion model.

Variable Name: CYCOEF
Variable Type: Real, Vector
Allowed Range: $0.0 < \text{value} \leq 2.$ m/s
Purpose: Linear coefficient for time-based, crosswind, dispersion model.

Example Usage:

* New Model Dispersion parameters
DPDISPMD001 LRTIME
DPCYDIST001 30000.0
DPCYCOEF001 0.5

Page 5-19 Add a new section.

5.8.1 New Plume Meander Model based on Regulatory Guide 1.145

A new plume meander model has been added to MACCS2 based on Regulatory Guide 1.145 and supporting document NUREG/CR-2260. While this regulatory guide is used primarily for licensing activities, it has been deemed to be an appropriate alternative in MACCS2. The NRC considers this to be a better representation of plume meander than the original MACCS2 plume meander model.

The Regulatory Guide 1.145 plume meander model differs from the existing model in MACCS2 in that it accounts for the effects of wind speed and stability class. On the other hand, the existing plume meander model in MACCS2 accounts for the duration of the release (related to the length of the plume); the new model is calibrated for 1-hour release durations. The plume meander model described below would over predict doses for release durations longer than 1 hour; it should not be used for release durations that are significantly shorter than 1 hour since it would under predict doses.

The new plume meander model treats plume meander in a similar manner as an area source. The meander occurs in the first 800 m downwind, creating a broader plume at that distance. Beyond 800 m, the plume gradually approaches the size that it would have had if meander had not occurred, which is similar to the effect of an area source.

Model Description

The plume meander model described in Regulatory Guide 1.145 is defined as follows:

$$\sigma_{ym}(x) = f_m \cdot \sigma_y(x) \quad (1)$$

where

σ_y = lateral plume size not accounting for plume meander (m)

- f_m = meander factor (dimensionless)
- σ_{ym} = lateral plume size accounting for plume meander (m)
- x = downwind distance measured from the source (m)

Lateral plume size, σ_y , can be defined in terms of a power-law equation or as a look-up table. The meander factor is defined as follows:

$$f_m = m \cdot f(u) \tag{2}$$

where

- m = 1 for stability classes A through C
- 2 for stability class D
- 3 for stability class E
- 4 for stability class F

$f(u)$ = a function of wind speed and is defined in Equation (3) below

u = wind speed (m/s)

$$\begin{aligned}
 f(u) &= 1 & u \leq 2 \\
 f(u) &= 1 - (u - 2) / 4 \cdot (m - 1) / m & \text{when } 2 < u < 6 \\
 f(u) &= 1 / m & u \geq 6
 \end{aligned}
 \tag{3}$$

The above equations are valid for distances within 800 m of the source. Beyond 800 m downwind, Equation (1) is modified as follows:

$$\sigma_{ym}(x) = (f_m - 1) \cdot \sigma_{ym}(800) + \sigma_y(x) \tag{4}$$

The MACCS2 model is similar to the model described above. The difference is that the model is integrated with the MACCS2 treatment of a virtual source and generalized in terms of the model parameters. The basic equation for $x < X$ is similar to Equation (1) but uses a virtual source location to correct for the size of the area source.

$$\begin{aligned}
 \sigma_{ymv}(x) &= f_m \cdot \sigma_y(x + x_{yv}) \\
 f_m &= \text{MNDFAC}(i) * f(u)
 \end{aligned}
 \tag{5}$$

The variables are defined as follows:

x_{yv} = the location of the virtual source (m)

MNDFAC(i) = the value of m for stability class i

WINSP1 and WINSP2 = the wind speed values used in the following way to determine the value of $f(u)$ (m/s)

$$\begin{aligned} f(u) &= 1 && \text{if } u \leq \text{WINSP1} \\ f(u) &= 1 - (u - \text{WINSP1})/(\text{WINSP2} - \text{WINSP1}) * (m - 1)/m && \text{if } \text{WINSP1} < u < \text{WINSP2} \\ f(u) &= 1/m && \text{if } u \geq \text{WINSP2} \end{aligned}$$

MNDIST is used as follows:

$$\sigma_{ymv}(x) = fm \cdot \sigma_y(x + x_{yv}) \quad x \leq \text{MNDIST}$$

$$\sigma_{ymv}(x) = \sigma_y(x + x_{yv}) \quad x > \text{MNDIST}$$

where

MNDIST = the transition distance where the effect of plume meander begins to diminish (m)

Note that the value of x_{yv} is different in the two equations above. In the first equation, x_{yv} is calculated to account for the area source for the initial release, usually representing the dimensions of a containment, auxiliary, or other building from which the source emits. The value of x_{yv} in the second equation is chosen to make σ_{ymv} continuous at MNDIST.

The following are ATMOS input cards for this model:

Variable Name: MNDMOD
Variable Type: Character, Scalar
Allowed Value: OLD, NEW, and OFF
Purpose: Plume Meander model flag. If the value is set to 'OLD' original MACCS2 1.12 model is used; if the value is set to 'NEW' the model based on NRC Regulatory Guide 1.145 is used; if the value is set to 'OFF' the plume meander factor is set to unity, i.e., no plume meander is treated.

Variable Name: MNDFAC
Variable Type: Real, Vector
Allowed Range: $1.0 \leq \text{value} \leq 10$
Purpose: Meander factor m based on Stability Class. The user must supply six values, one for each stability class.

Variable Name: WINSP1
Variable Type: Real, Scalar
Allowed Range: $0.0 \leq \text{value} \leq 20$. m/s

Purpose: Wind speed coefficient number one

Variable Name: WINS2

Variable Type: Real, Scalar

Allowed Range: $0.0 \leq \text{value} \leq 20$. m/s

Purpose: Wind speed coefficient number two

Variable Name: MNDIST

Variable Type: Real, Scalar

Allowed Range: $0.0 \leq \text{value} \leq 10000$. m

Purpose: Downwind distance where the effect of meander begins to diminish.
MNDIST is a breakpoint in the formula for calculating Sigma y.

Example Usage:

* New Plume Meander Model parameters

PMMNDMOD001 NEW

*

PMMNDFAC001 1.

PMMNDFAC002 1.

PMMNDFAC003 1.

PMMNDFAC004 2.

PMMNDFAC005 3.

PMMNDFAC006 4.

*

PMWINS2001 2.0

*

PMWINS2001 6.0

*

PMMNDIST001 800.

Page 5-21 Add a new section.

5.9.1 Mixing Height Option

An option is available to the user to use nighttime mixing height by season. This only applies when a meteorological file is being used (i.e. METCOD = 1, 2 or 5). The option allows for two mixing height models to be used:

First, the original "DAY_ONLY" model is as follows: the meteorological file contains 2 sets of 4 values of maximum mixing height at the end of the file. The first set is the morning mixing height values for each of the four seasons. The second set is afternoon mixing height values for

each of the four seasons. All eight values are read but only the second set of values is used. The mixing height is only dependent on the season. It does not change with time of day.

The new “DAY_AND_NIGHT” model uses both morning and afternoon values. If the start time of the weather trial is between sunset and sunrise, the morning value is used based on the season until the first hour after sunrise. At the first hour after sunrise and until the hour before sunset the mixing height is calculated by interpolating between the morning height value and the afternoon height value for that season. Once the first hour of sunset is reached, the afternoon mixing height value is used for the remainder of the simulation. If the start time of the weather trial is between the hour after sunrise and the hour of sunset, the mixing height is calculated by interpolating between the morning height value and the afternoon height value for that season. Again, once the first sunset of the simulation is reached, the mixing height remains the afternoon value. The mixing height is never reduced from the previous hour’s value. It is possible for the mixing height to increase if the season changes and the new afternoon mixing height is greater than that of the previous season.

Variable Name: MAXMIX
 Variable Type: Character, Scalar
 Allowed Range: DAY_ONLY, DAY_AND_NIGHT
 Purpose: Maximum Mixing Height model flag. Value set to ‘DAY_ONLY’ uses the original MACCS2 model; value set to ‘DAY_AND_NIGHT’ uses the new model that treats the dependence of time of day on mixing height.

Variable Name: LATITU
 Variable Type: Real, Vector
 Allowed Range: $-360.0 \leq \text{value} \leq 360.0$
 Purpose: Latitude of site location.

Variable Name: LONGIT
 Variable Type: Real, Vector
 Allowed Range: $-360.0 \leq \text{value} \leq 360.0$
 Purpose: Longitude of site location.

Example Usage:

```
* Maximum Mixing Height Model parameters
M1MAXHGT001    DAY_AND_NIGHT
*
               deg   min   sec
M1LATITU001    35.0  5.0   2.4
M1LONGIT001    106.0 51.0  0.0
```

Page 5-22 BUILDH and SIGYINIT are arrays, not scalars. Add a sentence to the purpose paragraphs.

Variable Name: BUILDH

Variable Type: Real, Array
Purpose: ... The user must supply NUMREL values for this variable on one or more cards.

Variable Name: SIGYINIT
Variable Type: Real, Array
Purpose: ... The user must supply NUMREL values for this variable on one or more cards.

Page 5-23 SIGZINIT is an array, not a scalar. Add a sentence to the purpose paragraph.

Variable Name: SIGZINIT
Variable Type: Real, Array
Purpose: ... The user must supply NUMREL values for this variable on one or more cards.

Page 5-24 Update the range of NUMREL.

Variable Name: NUMREL
Allowed Range: $1 \leq \text{value} \leq 200$

Page 5-26 Add additional data requirement at the end of the purpose paragraph for PDELAY.

Variable Name: PDELAY
Purpose: ... Numbers must be in ascending order.

Page 5-27 Add a sentence to the purpose paragraph for CORINV.

Variable Name: CORINV
Purpose: ... The user must supply NUMISO values for this variable in column two.

Page 5-28 Update the range of CORINV.

Variable Name: CORINV
Allowed Range: $2.7E-10 \leq \text{value} \leq 1.0E25$

5.11.1 Plume Rise Density and Flow Model

Two options are available to determine plume buoyancy. The original MACCS2 model uses the rate of release of sensible heat content in a plume. In some cases, it is easier for the user to estimate the rate of mass release and the density of a plume segment. The new option allows these values to be specified in place of the rate of release of sensible heat.

The following are ATMOS input cards for this model:

Variable Name: PLM_HEAT
Variable Type: Character, Scalar
Allowed Value: HEAT or DENSITY
Purpose: If this variable is set to HEAT, variable PLHEAT is used to calculate the plume buoyancy. If it is set to DENSITY, the variables PLMDEN and PLMFLA (density and flow rate) are used to calculate the plume buoyancy.

If this card is not present, the value of PLM_HEAT is assumed to be HEAT. This is to support backward compatibility with MACCS2 1.12 input files.

Example usage:

```
* PLM_HEAT, plume rise model based on heat content
RDPLMMOD001    HEAT
*
* PLHEAT, heat content of each plume segment (watts)
RDPLHEAT001    3.7E+6
RDPLHEAT002    1.7E5
```

If the value of PLM_HEAT is DENSITY, then the following input is required:

Variable Name: PLMFLA
Variable Type: Real, Vector
Allowed Range: $0.000001 \leq \text{value} \leq 1.0E+32$ kg/s
Purpose: Specifies the average mass flow rate over the duration of a plume segment.

Variable Name: PLMDEN

Variable Type: Real, Vector
Allowed Range: $.02 \leq \text{value} \leq 5.0 \text{ kg/m}^3$
Purpose: Specifies the plume gas density at source conditions.

Example usage:

```
* PLM_DEN, plume rise model based on density
RDPLMMOD001  DENSITY
*
* PLMFLO, mass flow rate of each plume segment
RDPLMFLA001  30.
RDPLMFLA002  5.
*
* PLMDEN, density of each plume segment
RDPLMDEN001  1.2
RDPLMDEN002  0.5
```

5.11.2 Improved Briggs, Plume-Rise Model

Two optional models for plume rise are supported in MACCS2. The original MACCS2 plume-rise model for neutrally stable and unstable conditions is based on work performed by Briggs in 1973. Since that time, an earlier plume rise model developed by Briggs (1971, 1972) has been recognized as better representing plume data (Hanna, 1982). The user can choose between these two models. This flag only affects plume rise for unstable and neutrally stable atmospheric conditions (stability classes A through D); predicted plume rise under stable conditions (stability classes E and F) is identical for these two options. Under most conditions, the improved model predicts less plume rise than the original model. The original model is retained so that previous results can be reproduced; the new model is recommended for all new applications.

Variable Name: BRGSMD
Variable Type: Character, Scalar
Allowed Value: ORIGINAL or IMPROVED
Purpose: If BRGSMD is set to 'ORIGINAL', then the original Briggs plume rise model from MACCS 1.12 is used. If the value is 'IMPROVED', then the improved Briggs plume rise model is used.

If this card is not present, the value of BRGSMD is assumed to be 'ORIGINAL'. This is to support backward compatibility with MACCS2 1.12 input files.

Example Usage:

```
* Improved Briggs model
RDBRGSMD IMPROVED
```

Page 5-29 Modify range of IDEBUG

Variable Name: IDEBUG
Allowed Range: $-1 \leq \text{value} \leq 8$

Page 5-31 Change “This item is only required if IDEBUG is greater than 0” to “This item is always required”

Variable Name: NUCOUT
Purpose: Specifies the radionuclide to appear on the dispersion listing if one is produced. The dispersion listing is produced if IDEBUG is greater than zero. The specified radionuclide name must appear on the previously defined list of radionuclides, NUCNAM, defined in Section 5.4. This item is always required.

Page 5-36 Top of page, first paragraph, upper bound of NSMPLS depends on other input parameters and does not have an upper limit of 10.

The user controls how many weather sequences are chosen by assigning a value for NSMPLS. There are three options in which NSMPLS can be used. If it is set to zero (0) and METCOD = 2, nonuniform bin sampling is used. In this case, the user must also select the number of samples from each weather bin by defining the vector variable INWGHT.

In the second option METCOD = 2 and NSMPLS is greater than zero (0), uniform bin sampling is used. In this case, NSMPLS samples are chosen from each weather bin.

The third option, METCOD = 5, is called random stratified sampling. In this case, NSMPLS samples are selected for each day of the year. The limits on NSMPLS and further description of these options are provided below.

Page 5-37 Variable type is Real, not integer

Variable Name: RNRATE
Variable Type: Real, Array

Page 5-37 NSMPLS bounds have been modified. Description was rewritten.

Variable Name: NSMPLS
Variable Type: Integer, Scalar
Allowed Range: $0 \leq \text{value} \leq K*8760$ if METCOD = 2
 $1 \leq \text{value} \leq K*24$ if METCOD = 5
Where K=1 if the meteorological file contains hourly data, 2 if the file contains data for each 30 minutes, and 4 if the file contains data for each 15 minutes.

When METCOD = 2, it is advisable to set a value of at least 4; the more samples that are taken, the more robust is the sampling. If the user supplies a value of 0 for NSMPLS, and METCOD=2, the variables NSBINS, INDXBN, and INWGHT allow the user to specify how many samples are to be chosen from each of the weather-category bins.

When METCOD=5, setting NSMPLS=24*K causes the code to sample every time period of the year, a capability that can provide insights into the adequacy of the operation of the weather binning algorithm. In using the METCOD=5 option, it is advisable to select values for NSMPLS that are divisors of 24*K because then each interval is composed of a whole number of time periods.

Page 5-38 Bounds have changed, and are dependant on meteorological file

Variable Name: INWGHT
Variable Type: Integer, Array
Allowed Range: $0 \leq \text{value} \leq K*8760$
Where K=1 if the meteorological file contains hourly data, 2 if the file contains data for each 30 minutes, and 4 if the file contains data for each 15 minutes.

Page 5-39 Variable ISTAB referenced. Should be HRMXHT and IHRSTB

Variable Name: HRMXHT
Purpose: These are the mixing layer heights in meters that are used for a single trial. The user must supply 120 values of HRMXHT in column 1 of the data block.

Variable Name: IHRSTB
Purpose: Defines the stability classes that are used for the single trial. The integers 1 through 6 represent the Pasquill-Gifford stability classes A through F,

respectively. The user must supply 120 values of IHRSTB in column 2 of the data block corresponding to each of the 120 hours in the weather sequence.

Page 5-40 Variable RHMM referenced. Should be HRRAIN.

Variable Name: HRRAIN
Purpose: Defines the rain rate that is used for a single weather trial. Values are in units of millimeters per hour. The user must supply 120 values of HRRAIN in column 3 of the data block.

Page 5-40 Units not millimeters/s, but m/s

Variable Name: HRWNDV
Allowed Range: $0.5 \leq \text{value} \leq 30.0$ (m/s)

Page 5-42 Number of variable entries was not noted. Add sentence to purpose.

Variable Name: INDREL
Purpose: ... The user must supply NUM0 values for this variable on one or more cards.

Variable Name: INDRAD
Purpose: ... The user must supply NUM0 values for this variable on one or more cards.

Page 6-5 Edit existing paragraph starting with "If the DCF file was generated by FGRDCF"

If the DCF file was generated by FGRDCF using the dose conversion factors from FGR-11 and FGR-12, the first ...

Page 6-5 Add section 6.2.1 description of FGR-13 format

If the DCF file was generated using the dose conversion factors from FGR-12 and FGR-13, the first of the two header records contains the letters FGR13DF. When COMIDA2 and MACCS2 determine that an FGR13DF file is being used, as specified by the first 7 characters in the file named by the DCF_FILE variable, the list of available organs is set to the following:

A-SKIN
 A-RED MAR
 A-LUNGS
 A-THYROID
 A-STOMACH
 A-LOWER LI
 L-ICRP60ED
 L-RED MARR
 L-BONE SUR
 L-BREAST
 L-LUNGS
 L-THYROID
 L-LOWER LI
 L-BLAD WAL
 L-LIVER

Page 6-10 Modify available List of organs for DOSFAC2

The list of organs for which dosimetry data are available using DOSFAC2 is presented below.

SKIN	Yes	No
LUNGS	Yes	Yes
RED MARR	Yes	Yes
LOWER LI	Yes	Yes
STOMACH	Yes	No
THYROID	No	Yes
THYROIDH	Yes	Yes
EDEWBODY	No	Yes
BONE SUR	No	Yes
BREAST	No	Yes
BLAD WAL	No	Yes
LIVER	No	Yes

Page 6-11 Add Description of FGR-13 organs

The list of organs for which dosimetry data are available when using the dose conversion factor data from FGR-12 and FGR-13 are the following:

Organ –Name _____ Acute _____ Lifetime _____

SKIN	YES	NO
RED MAR	YES	YES
LUNGS	YES	YES
THYROID	YES	YES
STOMACH	YES	NO
LOWER LI	YES	YES
ICRP60ED	NO	YES
BONE SUR	NO	YES
BREAST	NO	YES
BLAD WAL	NO	YES
LIVER	NO	YES

Example Usage:

*

MIORGDEF017 'L-ICRP60ED' 'TRUE'

Page 6-9 Add to section 6.2

Annual Differential DCF and Comida2 Binary Files

If variable DOSMOD is AT or PL, then the user needs to specify a set of dose conversion factor files and a corresponding set of Comida2 binary files.

The base DCF file is one that contains the conversion factors for the total commitment period, which is normally fifty years. The base Comida2 file is created using the base DCF file.

The annual, differential DCF files contain the dose conversion factors for one-year commitment periods. These file names are sequenced to enable the identification of the year number. For example, Fgr13dcf03.inp corresponds to the dose conversion factors used to calculate the dose in year three for an exposure that occurred in year one. The annual COMIDA2 files are created using the corresponding annual DCF files. Only the base DCF and COMIDA2 files need to be specified in the input cards.

MACCS2 requires a consistent set of base and annual differential DCF files. These files are supplied as part of the distribution.

The following file naming convention is used:

Annual, differential DCF and COMIDA2 data files consist of the base name minus the file extension (e.g., “.inp”) followed by a two-digit number identifying the year, followed by the file extension. For example, if Fgr13dcf.inp is the base DCF file and fgr13samp_a.bin is the base COMIDA2 file, the remaining files are named Fgr13dcf01.inp, fgr13samp_a01.bin, Fgr13dcf02.inp, fgr13samp_a02.bin, etc.

The DCF base name is supplied to MACCS2 using the EARLY variable DCF_FILE. The COMIDA2 base name is supplied to MACCS2 using the CHRONC variable BIN_FILE.

Example Usage:

*Card in the EARLY input file

DCF_FILE001 'C:\Program Files\WinMACCS\DCF and COMIDA2 Files\Threshold\Fgr-13\Fgr13dcf.inp'

* Card in the CHRONC input file

BIN_FILE001 'C:\Program Files\WinMACCS\DCF and COMIDA2 Files\Threshold\Fgr-13\fgr13samp_a.bin'

6.2.3.1 Dose Model Specification

Three optional models are available to calculate latent-cancer injuries and fatalities. The first uses the standard linear, no-threshold, hypothesis (LNTH). This is the only model available in earlier versions of MACCS2. In the linear, no-threshold model, the relationship between dose and health effect is linear, even for infinitesimal doses.

The second model is called the annual-threshold model. In this model, the user can specify a set of thresholds, one for each year of the calculation. The thresholds are specified in terms of total effective dose equivalent (TEDE). When the predicted TEDE falls below an annual threshold, there are no contributions to any long-term health effects; when the predicted TEDE exceeds the annual threshold, contributions to health consequences are calculated in the same way as with the LNTH model. An optional lifetime threshold, also in terms of TEDE, can be specified. If the lifetime threshold is exceeded, the health effects are identical to those calculated with the LNTH model.

The third option is called the piecewise-linear model. In this model, the user can construct a series of line segments that define the mapping between dose and health effects. The line segments form a continuous curve. This model can be used to approximate a dose threshold, to create a sublinear dose-response model, or to create a superlinear dose-response model.

These are EARLY input cards.

If a card is not present, the LNT model is assumed. No other dose-model input is required if the LNT model is chosen. However, if either the annual-threshold (AT) or piecewise-linear (PL) dose model is chosen, the following are required:

- A CHRONC calculation must be performed (ENDAT2 = .FALSE.).
- The COMIDA2 food chain model or the No Food model must be chosen.
- The KI population fraction (POPFRAC) must be 0 or 1 if the KI model is ON.
- Other input cards dependent on the value of DOSMOD are required, as described below.

Variable Name: DOSMOD
Variable Type: Character, Scalar
Allowed Value: AT, PL, or LNT
Purpose: AT – Annual-threshold model
PL – Piecewise-linear model
LNT – Linear, no-threshold model

Example Usage:

* Annual Threshold model
LCDOSMOD AT

6.2.3.2 Annual Threshold Model

If variable DOSMOD is AT, then the following two input cards described are required:

Variable Name: DTHNUM
Variable Type: Integer, Scalar
Allowed Range: $1 \leq \text{value} \leq 398$
Purpose: Number of annual dose threshold values.

Variable Name: DTHANN
Variable Type: Real, Vector
Allowed Range: $0. \leq \text{value} \leq 1.E30$ Sieverts/Year
Purpose: Dose threshold for health effect models for each year. If calculated annual L-ICRP60ED dose per person is below the specified threshold, all health consequences are zero for that year. Value specified for the last year is used for all remaining years in the calculation. First entry corresponds to year one, second to year two, etc. ...

The following variable can be optionally included.

Variable Name: DTHLIF
 Variable Type: Real, Scalar
 Allowed Range: $0. \leq \text{value} \leq 1.E30$ Sieverts
 Purpose: Lifetime dose threshold. If this dose is exceeded, then all previous and future doses are included in the calculation of health effects, regardless of annual threshold value. If EXPTIM is greater than 1.57788E9 sec (50 years), then MACCS2 automatically resets EXPTIM to 1.57788E9.

Example Usage:
 LCDTHNUM 5 (Number of years with defined threshold values)

* Threshold value for year one
 LCDTHANN001 0.05
 * Threshold value for years two, three and four
 LCDTHANN002 0.02
 LCDTHANN003 0.01
 LCDTHANN004 0.005
 * Threshold value for year 5 and all subsequent years
 LCDTHANN005 0.001

LCDTHLIF001 0.10

6.2.3.3 Piecewise Linear Model

If variable DOSMOD is PL, then the input cards described in this section are required.

Variable Name: PWLNUM
 Variable Type: Integer, Scalar
 Allowed Range: $2 \leq \text{value} \leq 99$
 Purpose: Number of piecewise dose, multiplier pairs entered by user.

Variable Name: PWLDOS
 Variable Type: Real, Vector
 Allowed Range: $1.E-10 \leq \text{value} \leq 1.E30$ Sieverts/Year
 Purpose: Dose associated with multiplier, PWLFAC. Effective doses are calculated as the product of the multiplicative factor and the corresponding dose for each ordered pair (PWLDOS(i),PWLFAC(i)). Linear interpolation is used to calculate an effective dose given an actual dose. Health consequences are calculated using the effective rather than the actual dose. PWLDOS must be specified in ascending order.

Variable Name: PWLFAC
 Variable Type: Real, Vector
 Allowed Range: $0.0 \leq \text{value} \leq 1.0E30$

Purpose: Multiplicative factor associated with dose, PWLDOS. Effective doses are calculated as the product of the multiplicative factor and the corresponding dose for each ordered pair (PWLDOS(i), PWLFAC(i)). Linear interpolation is used to calculate an effective dose given an actual dose. Health consequences are calculated using the effective rather than the actual dose. The last value in vector PWLFAC must be 1.

Example Usage:

```
*
LCPWLNUM 4      (Number of (dose, multiplier) pairs)
*
LCPWLDATE001   0.5   0.1   (dose, multiplier)
LCPWLDATE002   1.0   0.25  (dose, multiplier)
LCPWLDATE003   2.0   0.5   (dose, multiplier)
LCPWLDATE004   3.0   1.0   (dose, multiplier)
```

Page 6-12 add paragraph at end

CSFACT, PROTIN, BRRATE, SKPFAC and GSHFAC can be redefined for each EARLY evacuation scenario (cohort). In other words, these variables can be included in EARLY change card sets. However, neither RESCON nor RESHAF can be included in change card sets.

Page 6-22 Add to end of WTNAME Purpose

WTNAME should only occur once and should not be included in a change card set. If WTNAME = 'SUMPOP', then the WTRAC variable is not used.

Page 6-24 Top of page, sequence number missing from card example

Example Usage:

```
*
* EVACUATION TRAVEL SPEEDS FOR THREE EVACUATION PHASES
(METERS/SECOND)
*
EZSPEED001      Initial           Middle           Late
                 1.8              1.8              1.8
```

Page 6-24 New variable added. Description follows EZSPEED

Variable Name: ESPMUL

Variable Type: Real, Array
 Allowed Range: $0.0 \leq \text{value} \leq 1.0$
 Purpose: Defines a multiplier to be applied to the evacuation speed variable, ESPEED, during periods of precipitation.

If this variable is not included, MACCS2 assumes a value of one for each entry. For situations where evacuation starts before the release begins, the weather prior to release is assumed to be the same as at the beginning of release. Precipitation data is from HRRAIN, BNDRAIN, or the meteorological file, depending on the weather sampling method. All three values must be the same if TRAVELPOINT = 'BOUNDARY'.

The user must supply three values for this parameter.

Example Usage:

```
*
* EVACUATION TRAVEL MULTIPLIERS FOR THREE EVACUATION PHASES
*
*           Initial           Middle           Late
EZSPMUL001      0.8           0.5           0.4
```

Page 6-26 New variable added. Description follows IDIREC

Variable Name: ESPGRD
 Variable Type: Real, Array
 Allowed Range: $0.01 \leq \text{value} \leq 10$.
 Purpose: Defines a multiplier for each grid element to be applied to the evacuation speed variable, ESPEED, to account for differences in the road network.

If this variable is not included, MACCS2 assumes that the value for each entry is one. The value of evacuation speed in an element is calculated with the following formula:

Evacuation Speed = ESPEED * ESPMUL * ESPGRD if precipitation is occurring
 Evacuation Speed = ESPEED * ESPGRD if no precipitation is occurring

ESPEED and ESPMUL are defined for each of the three sub phases (initial, middle, and late) of the emergency phase, but are independent of grid element. ESPGRD is independent of the sub phase, but is defined for each grid element.

If this variable is included, an input data record must be supplied for every ring in the evacuation and sheltering region (i.e., for all intervals extending out to LASMOV). Each line of data contains values corresponding to each of the compass points.

Example Usage:

```
*
* DEFINE THE EVACUATION SPEED MULTIPLIER FOR EACH GRID ELEMENT
*           N           E           S           W
EZESPGRD001 0.5 0.5 1.0 1.0 1.5 1.5 1.5 2.0 2.0 2.0 1.5 1.5 1.0 1.0 0.5 0.5 (FIRST RING)
```


EZESPGRD002 0.5 0.5 1.0 1.0 1.5 1.5 1.5 2.0 2.0 2.0 1.5 1.5 1.0 1.0 0.5 0.5 (SECOND RING)
 EZESPGRD003 1.0 1.0 1.5 1.5 2.0 2.0 2.0 2.5 2.5 2.5 2.0 2.0 1.5 1.5 1.0 1.0 (THIRD RING)
 .
 .
 .

Page 6-29 Append to section 6.6.8

Variable Name: KIMODL
 Variable Type: Character, Scalar
 Allowed Value: KI or NOKI
 Purpose: If the value is 'KI' then the consequences calculation account for ingestion of KI. If the value is 'NOKI', then the KI model is not used.

The KI ingestion model treats the reduction of uptake of radioiodine by the thyroid gland. The ingested KI saturates the thyroid gland so that the effect of inhaling iodine from a plume is diminished. The KI ingestion model allows the user to specify a population fraction that ingests KI and an efficacy factor. The efficacy factor defines the fractional dose reduction to the thyroid gland from inhaled radioiodine.

If this card is not present, then the value of KIMODL is assumed to be 'NOKI'. This is to support backward compatibility with MACCS2 1.12.

Example Usage:

* KIMODL, KI model
 EZKIMODL001 NOKI

If variable KIMODL is set to 'NOKI', no further input is required. However, if the KI model is set to KI for any of the evacuation scenarios, then the POPFRAC and EFFACY variables must be present for scenario one.

If variable KIMODL is set to 'KI', the following input are required along with the following restrictions and enhancements:

- The value of POPFRAC must be either 0 or 1 if dose model, DOSMOD, equals AT or PL
- Variables EFFACY and POPFRAC are supported in the EARLY multiple evacuation (change card) methodology.

Variable Name: EFFACY
 Variable Type: Real, Scalar

Allowed Range: $0.0 \leq \text{value} \leq 1.0$
Purpose: Efficacy factor for KI model. Thyroid health consequences from inhalation of radioiodine are reduced by a factor of $(1 - \text{EFFAC})$.

Variable Name: POPFRAC
Variable Type: Real, Scalar
Allowed Range: $0.0 \leq \text{value} \leq 1.0$
Purpose: Fraction of the population that ingests KI.

Example Usage:

* KIMODL, KI model
EZKIMODL001 KI
* EFFACY, KI Ingestion
EZEFFACY001 0.7
* POPFRAC, KI Ingestion
EZPOPFRC001 0.25

Page 6-27-28 Variables need to be move to non charge card section on page 6-14.

TIMHOT
TIMNRM
DOSNRM
DOSHOT
ENDEMP

Page 6-51 Type 6 output is supported if there is no evacuation.

Variable Name: NUM6
Purpose: The number of results of this type to be calculated. This result is only available when straight-line plume dispersion (IPLUME=1) and radial evacuation (EVATYP='RADIAL') or no evacuation (LASMOV=0) are selected. If IPLUME>1 or EVATYP='NETWORK', an input error occurs and MACCS2 execution is terminated.

Page 6-57 In the paragraph above the description of variable NUMB, the record identifier is incorrect.

If the controlling card (record identifier TYPEBNUMBER) is omitted, the calculations proceed on the assumption that the Type B results are not being requested.

Page 6-58 New output types C and D are added

6.21 Land Area for which Dose is Exceeded

This optional output provides the land area (hectares) that exceeds a user-specified dose level. Optionally, the user can also request dose levels for every grid element in the MACCS2 grid.

These are the EARLY input cards related to this output type.

Variable Name: NUMC
 Variable Type: Integer, Scalar
 Allowed Range: $1 \leq \text{value} \leq 16$
 Purpose: Defines the number of results of this type being requested.

Variable Name: ORGNAM
 Variable Type: Character, Vector
 Allowed Values: Allowed values depend on the dose conversion factor file specified. These allowed values are listed below.

Table A-1. Organs supported by MACCS2

DCF based on FGR-13	DCF generated by DOSFAC2	DCF generated by FGRDCF
A-SKIN	A-SKIN	L-GONADS
A-RED MARR	A-RED MARR	L-BREAST
A-LUNGS	A-LUNGS	L-LUNGS
A-THYROID	A-THYROIDH	L-RED MARR
A-STOMACH	A-STOMACH	L-BONE SUR
A-LOWER LI	A-LOWER LI	L-THYROID
L-ICRP60ED	L-EDEWBODY	L-REMAINDER
L-RED MARR	L-RED MARR	L-EFFECTIVE
L-BONE SUR	L-BONE SUR	L-SKIN(FGR)
L-BREAST	L-BREAST	
L-LUNGS	L-LUNGS	
L-THYROID	L-THYROID	
L-LOWER LI	L-LOWER LI	
L-BLAD WAL	L-BLAD WAL	
L-LIVER	L-LIVER	
	L-THYROIDH	

Purpose: The land area (hectares) that exceeds a user-specified dose level (Sieverts) to a specified organ is reported. Optionally, dose values for all grid elements for the specified organ are displayed.

Variable Name: ELEVDOSE
 Variable Type: Real, Vector
 Allowed Range: $0.0 \leq \text{value} \leq 1.0E12$ (Sv)

Purpose: Threshold value for calculating land contamination areas. Land area that is contaminated above the threshold value is reported in the output.

Variable Name: PRINT_FLAG_C

Variable Type: Logical, Vector

Allowed Range: .TRUE. or .FALSE.

Purpose: If .TRUE., the output includes dose levels to the specified organ for each grid element. If .FALSE., only the land area is reported.

Example Usage:

*

* Land area for which dose is exceeded

TYPECNUMBER 1

*	ORGNAM	DOSE	PRINT_FLAG_C
TYPECOUT001	'L-EDEWBODY'	0.01	.FALSE.

6.22 Land Area for which Concentration is Exceeded

This optional output provides the land area (hectares) that exceeds a user-specified ground concentration level for a specified radionuclide. Optionally, the user can also request ground concentrations (Sv/m²) and ground-level airborne exposures (Sv-s/m³) for every grid element in the MACCS2 grid.

These are EARLY input cards.

Variable Name: NUMD

Variable Type: Integer, Scalar

Allowed Range: $1 \leq \text{value} \leq 40$

Purpose: Defines the number of results of this type being requested.

Variable Name: IIDISTD

Variable Type: Integer, Vector

Allowed Range: $1 \leq \text{value} \leq \text{NUMRAD}$

Purpose: Outer spatial interval bounding the region of interest. Area considered is from zero to the outer spatial interval.

Variable Name: NUCLIDED
 Variable Type: Character, Vector
 Allowed Values: Values must appear in vector NUCNAM, a vector of previously defined radionuclides.
 Purpose: The land area (hectares) that exceeds a user-specified ground-concentration level (Bq/m²) of a specified radionuclide is reported. Optionally, ground concentrations (Bq/m²) and ground-level airborne exposures (Bq s/m³) are reported for all grid elements.

Variable Name: ELEVCONC
 Variable Type: Real, Vector
 Allowed Range: $0.0 \leq \text{value} \leq 1.0E12$ (Bq/m²)
 Purpose: Threshold value for calculating land contamination areas. Land area (hectares) that is contaminated above the threshold value is reported in the output.

Variable Name: PRINT_FLAG_D
 Variable Type: Logical, Vector
 Allowed Range: .TRUE. or .FALSE.
 Purpose: If .TRUE., the output includes results for each grid element. If .FALSE., only the land area is reported.

Example Usage:

* Land Area where concentration is exceeded

TYPEDNUMBER	1			
*	I1DISTD	NUCLIDED	ELEVCONC	PRINT_FLAG_D
TYPEDOUT001	10	Cs-137	550.0	.FALSE.

Page 7-7 Allowed range documented is in error.

Variable Name: TMPACT
 Allowed Range: $0.0 \leq \text{value} \leq \text{EXPTIM}$

Page 7-11 Added data restriction, append to end of purpose

Variable Name: DSRFCT
 Purpose: ... A value must be supplied for each of the LVLDEC decontamination levels.

Page 7-18 Added caveat

Variable Name: VALWF
Purpose: Add the following caveat (the same as in the previous four variable descriptions).

Note: If a Site Data file is being used (POPFLG=FILE), the value of this input parameter is not used by the code; nevertheless a valid parameter value must be supplied.

Page 7-18 Added caveat

Variable Name: FRFIM
Purpose: Add the following caveat (the same as in the previous five variable descriptions).

Note: If a Site Data file is being used (POPFLG=FILE), the value of this input parameter is not used by the code; nevertheless a valid parameter value must be supplied.

Page 7-18 Added caveat

Variable Name: VALWNF
Purpose: Add the following caveat (the same as in the previous six variable descriptions).

Note: If a Site Data file is being used (POPFLG=FILE), the value of this input parameter is not used by the code; nevertheless a valid parameter value must be supplied.

Page 7-18 Added caveat

Variable Name: FRNFIM
Purpose: Add the following caveat (the same as in the previous seven variable descriptions).

Note: If a Site Data file is being used (POPFLG=FILE), the value of this input parameter is not used by the code; nevertheless a valid parameter value must be supplied.

Page 7-22 Add a new possible value for FDPATH

...

If the user wishes to turn off the Food and water dose calculations, this is accomplished by setting FDPATH = 'OFF'. When this is done, no food or water ingestion is treated. No Comida2 or MACCS2 food-model input parameters are required.

Variable Name: FDPATH
Variable Type: Character, Scalar
Allowed Range: 'OLD', 'NEW', or 'OFF'
Purpose: If the value is set to 'OFF', no food or water dose calculations are performed.

Page 7-9 Add a new section

7.4.1 Shielding and Exposure

The shielding and exposure values are those to be used during CHRONC calculations. In earlier versions of MACCS2, these were the values used in the last emergency response scenario (cohort) defined in the EARLY input. Values used in EARLY for normal activity are reasonable values to use for these CHRONC variables.

Variable Name: LPROTIN
Variable Type: Real, Scalar
Allowed Range: $0.0 \leq \text{value} \leq 1.0$
Purpose: Inhalation protection factor. A value of 0 indicates complete protection from inhalation of radioactive materials; a value of 1 indicates no protection.

Example Usage:

*

* Inhalation protection factor

CHLPROTIN01 .41

Variable Name: LBRRATE
Variable Type: Real, Scalar
Allowed Range: $0.0 \leq \text{value} \leq 1.0$ cubic meters/second
Purpose: Breathing rate.

Example Usage:

*

* LBRRATE - Breathing rate used in CHRONC

CHLBRRATE01 2.66E-04

Variable Name: LGSHFAC

Variable Type: Real, Scalar

Allowed Range: $0.0 \leq \text{value} \leq 1.0$

Purpose: Groundshine shielding factors. A value of 0 indicates complete protection from groundshine; a value of 0.5 indicates no protection from groundshine.

Example Usage:

*

* LGSHFAC - groundshine shielding factor used in CHRONC

CHLGSHFAC01 .33

Modify second sentence on pg A-1

... The file consists of up to ten years of either fifteen-minute, thirty-minute or hourly averages of the wind direction, wind speed, atmospheric stability, and precipitation rate.

Modify first sentence paragraph three on pg A-1

There are a total of 8763 records in a meteorological file that represents hourly averages of weather conditions.

Page A-1 Modification to paragraph three

...CRAC2 meteorological data files may be used with MACCS2.

An optional line has been added to the meteorological data file which, if present, appears as the 3rd line in the file. The optional line defines the PERIOD of the data in the file. The line has the following format:

/PERIOD 30

Where 30 is means that each line of data in the file is represents a 30-minute time period. The default value of 60 is assumed if the optional line does not appear in the file. This value is free formatted, meaning that the column where /PERIOD starts, and the column where 30 starts is not important provided there is at least one space separating the fields. Values supported are 15, 30, and 60.

Note: the total time the file covers does not change. In each case, 365 days of weather data must be in the file. Therefore if PERIOD is 60, there are 8760 lines of weather data in the file; if PERIOD is 30, there are 17520 lines of weather data in the file; if PERIOD is 15, there are 35040 lines of weather data in the file.

Records 3 (or 4 if the file contains a value of PERIOD) to the next to the last record contain meteorological observations. These data are input as integers. The format of the information is as follows:

Page A-1 Meteorological Data-File Format. Correct description of RNMM

The last columns 15-17 of data should be interpreted as a rain rate in millimeters per hour rather than in units of millimeters of rain during the time period. This does not change the interpretation of values in older meteorological files since the time interval is 1 hour.

Page A-1 Meteorological Data File Format. Edit first sentence in second to last paragraph to read:

The last record of the file (i.e. 8763, 17521, or 35041 etc.) contains a table ...

Page A-2 Modify Range of Height variables from 0 to 999 to 1 to 100

A.4 Preprocessor PopMod

PopMod was developed to support a finer polar using WinMACCS and MACCS2.

This software reads an ASCII population file, created by SECPOP2000, compatible with MACCS2 1.13.1 requirements, and creates a new population file containing more compass sectors. The work of PopMod is to interpolate the course-resolution data onto a finer-resolution grid. No higher-fidelity information is added to the new site data file.

SECPop2000 supports exactly 16 compass sectors, hence site file on a finer polar grid cannot be created with the current version of SECPOP2000. If SECPOP2000 supports a finer polar grid in the future, it would be preferable to create the site file directly with SECPOP2000.

An interface to PopMod exists in WinMACCS. This interface can be accessed through the *General/File Specification/Site File* form.

PopMod requires three arguments as follows:

- Argument One: Full path and name of original population file. Ideally, this should be a file created directly with SECPOP2000. Accuracy may be lost if this argument refers to a file created by a previous run of PopMod.exe.
- Argument Two: Full path and name of a new population file that is created from the population file specified in Argument One.
- Argument three: Number of compass sectors to be included in the file specified by Argument Two. Argument Three must be greater than or equal to the number of compass sectors used in the file specified in Argument One. WinMACCS only allows values of 32, 48, or 64; however, this is not a restriction if using PopMod in a command window.

Arguments are separated by a single space or tab. If an argument contains spaces, the argument needs to be enclosed in double quotes. Embedded quotes in arguments are not supported.

This preprocessor can also be executed directly using a command prompt window as demonstrated in the following example:

1. Select *Run* from the Windows start menu and type cmd.exe.
2. Change directories to the directory where PopMod.exe is located.
3. Type the command to run PopMod as shown in Figure 90. In this example, the number of compass sectors is increased from 16 to 48. Sursit.inp has 16 sectors, as indicated by a line in the Sursit.inp file: "16 WIND DIRECTIONS". A file with 48 sectors is created and named Sursit_48.inp.

```
D:\temp2\PopMod>PopMod.exe Sursit.inp Sursit_48.inp 48
D:\temp2\PopMod>dir
Volume in drive D is New Volume
Volume Serial Number is 68CB-5F70

Directory of D:\temp2\PopMod
06/14/2007  04:52 PM    <DIR>          .
06/14/2007  04:52 PM    <DIR>          ..
06/04/2007  04:46 PM             40,960 PopMod.exe
08/24/2006  01:11 PM             13,105 Sursit.inp
06/14/2007  04:52 PM             29,477 Sursit_48.inp
               3 File(s)              83,542 bytes
               2 Dir(s)  28,440,117,248 bytes free
```

Figure 90 Run PopMod.exe from Command Line

A.3.1 Description of algorithm to create a new population file:

The data in the site file is divided up into sections. The new file is identical to the old file, with the exception of the following sections:

COMMENT SECTION:

The first two lines of the population file contain comments. The previous format allowed only 80 characters per line. To adhere to good quality assurance, the first comment line has an additional comment appended to the last non blank character, causing this line to exceed 80 characters. Line one in the new file contains the name of the original population file argument one, the version of PopMod used, and the date and time the new file was created.

WIND DIRECTIONS:

This value is changed to the value specified in argument three, the number of compass sectors.

POPULATION:

The population is interpolated onto the new compass sectors. The software overlays the new grid onto the old one and assigns the population to the new grid sectors weighted by new area relative to the old area. The populations written to the new file are rounded to the nearest integral value. This is necessary to preserve the file format.

LAND FRACTION:

The value of land fraction is either the same as that of a course sector or the average of two course sector values when it overlaps the two.

REGION INDEX:

If the fine sector falls entirely within a single course sector, then the REGION INDEX of the fine sector is assigned the same value as the course sector. If the fine sector overlaps two course sectors, the REGION INDEX associated with the course sector to the left (counter clockwise) is used.

WATERSHED INDEX:

Values are assigned in the same manner as for the REGION INDEX.

Page D-2 Entry for DISTANCE references section 7.5.2. This should be section 5.7.2

Page Ref-1 New References added to list

Briggs, G. A., "Some recent analyses of plume rise observations", Proc. Second International Clean Air Congress, Academic Press, New York (1971).

Briggs, G. A., "Discussion: chimney plumes in neutral and stable surroundings," Atmos. Envir. 6:507-510 (1972).

Hanna, S. R., "Review of Atmospheric Diffusion Models for Regulatory Applications," Technical Note No. 177, World Meteorological Organization (1982).

Hanna, S. R. and R. E. Britter, Wind Flow and Vapor Cloud Dispersion at Industrial and Urban Sites, Center for Chemical Process Safety, New York (2002).

Appendix B: MACCS2 Binary Results File Format

B-1 BINARY FILE OVERVIEW

With the WinMACCS development, it became necessary to create a file for easy communication of results between the MACCS2 modeling engine and the WinMACCS interface. All that existed at the point of MACCS2 1.12 was an ASCII formatted output file. The information on this file did not have sufficient structure to serve as a generic output file. It was believed to be an unreasonable constraint to require the MACCS2 ASCII output file to always comply with a format that WinMACCS could automatically process. In a development environment, output files often change formats. It was decided that there would be a separate file created by MACCS2 that would provide a better interface between MACCS2 and WinMACCS with the following design criteria.

The format of the file was to be in binary rather than ASCII format. This reduced the size of the file to one quarter of its ASCII equivalent. Additionally, the real and integer representations of the results are on the binary file, reflecting the accuracy of the calculated results without the round off caused by FORTRAN formatted write statements.

If the MACCS2 developer adds new variables to the file in a later version of MACCS2, WinMACCS would not have to be modified to display the new data.

The binary file would need to support multivariate data. For example, a variable value may be tied to a plume number, a radionuclide and an evacuation scenario.

B-2 FILE STRUCTURE

The binary file is a sequence of records. Each record begins with a “BOR” (beginning of record) marker and ends with a “EOR” (end of record) marker.

This file is created by MACCS2 using the following FORTRAN statement

```
Open (UNIT=FileID, FILE=FileName, FORM='BINARY')
```

Note: If the FORTRAN compiler used is not Intel 7.0, there may be incompatibles in reading this file in WinMACCS. This is because the exact record contents of a binary file record varies between FORTRAN compilers.

B-2.1 Record Structure Overview

Data are written to the binary file using the following data types:

- Fixed strings. For example, the RecordBOR field is a fixed ASCII string. Each character in the four character marker (e.g., E, O, R, space) is written as a single byte in ASCII representation.
- Variable length strings. The length of the string (as a 4 byte integer) always precedes the character array representing the string on the binary file. For example, the string “HEADER” is encoded as:
 - Integer representation of 7 using 4 bytes
 - 7 byte ASCII string “HEADER”

- 4 byte integers.
- 4 byte real numbers.

Each record in the file adheres to the following standard:

Table B-1. Structure of a Record in the Binary File

Field	Description
RecordBOR	4 byte fixed ASCII string, begin of record marker (“BOR”)
RecordLab	Variable length ASCII string identifying the record type. This is descriptive.
RecordID	4 byte fixed ASCII string identifying the record type. These are always four digits.
RecordData	Determined by RecordID
RecordEOR	4 Byte ASCII end of record marker, “EOR”.

B-2.2 Record Types

The following record types are supported:

Table B-2. Record Types Written to the Binary File

RecordLab	RecordID	Description of RecordData
HEADER	0000	Record contains time stamp, versioning information and other miscellaneous information. Heading type record.
QUALIFIERS	0001	Record contains details regarding the multivariate data (qualifiers), such as labels and units. For example, (“Distance”, “km”). Heading type record.
VARIABLES	0002	Record contains details regarding the result variables such as labels and units. For example, (“Release”, “Sv”) and has qualifiers (“Plume”, “Nuclide”, “Left Distance”, “Right Distance”). Heading type record.
STATS	0003	Record contains details regarding statistical labels. Heading type record.
VECTOR_RESULTS	0004	Record contains result vectors or variables with a single value. Results type record.

RecordLab	RecordID	Description of RecordData
2-D_RESULTS	0005	Record contains (x,y) pairs of data results. Results type record.
STAT_RESULTS	0006	Record contains blocks of statistical results. Results type record.
CCDF_RESULTS	0007	Record contains cumulative probability distributions (CCDF) as (x,y) pairs of data. Results type record.

Heading type records occur only once, and precede all results type records. Results type records contain calculated MACCS2 results. There are multiple occurrences of these records.

WinMACCS version 3.0 graphics does not support 2-D_RESULTS. With respect to Vector_Results type records, WinMACCS version 3.0 supports only single values variables (vectors of length one).

These data types were included in the MACCS2 structure for future enhancements.

B-2.3 RecordData Fields

B-2.3.1 RecordData Field for the Header Record

The following variables are written to the RecordData field when RecordLab=HEADER:

1. *Date* is a variable length string containing date (e.g., 20010402 is April 2, 2001).
2. *Time Stamp* is a variable length string containing time. 10-byte character array, (e.g., 151141.589 is 15th hour, 11th minute and 41.589 sec).
3. *MACCS Version* is a variable length string containing version number (e.g., 1.13.0.6).
4. *Undefined_Int* is a 4-byte integer containing value of a 4-byte undefined integer.
5. *Undefined_Real* is a 4-byte real containing value of a 4-byte undefined real.

B-2.3.2 RecordData Field for the Qualifiers Record

MACCS2 data is multivariate data. An example of the multidimensionality of variables is a plume release. This variable is described by three qualifiers, the plume number, the nuclide released and the ATMOS source term set.

The QUALIFIERS RecordData field lists all of the qualifiers referenced in the results type records. The following variables are written to the RecordData field when RecordLab=QUALIFIERS:

NQual is a 4 byte integer containing the number of qualifiers defined in this block. This is followed by *NQual* sets of data. Each set of data describes a qualifier as follows:

- *QualID* is a 4 byte integer identifying the qualifier. This ID is referenced in the results records
- *QualName* is a variable length string containing the qualifier name (e.g., “Distance”)
- *Units* is a variable length string describing units (e.g., “km”)
- *Type* 4 byte integer identifying data type

1 – Character Data

2 – 4 byte Integer

3 – 4 Byte Real

4 – TypeNoKey, character data that is not used by WinMACCS to build a key for data lookup. The intension was to link a copy of the output request to the data.

Example: (2, “Distance”, “km”, “3”)

Note: For simplicity in viewing these files in an ASCII editor, the qualifier values in the results record are written as variable length strings. However, the *Type* variable aids the processing software (e.g., WinMACCS) in translating values.

The following values are used to build the qualifiers record in MACCS2 2.0. However, new qualifiers can be added without impacting the processing of this file in WinMACCS.

Table B-3. Record Qualifiers associated with Results

[QualID]	[QualName]	[Units]	[Type]	Example Value
1	Nuclide	none	Character	Co-60
2	Ldistance	km	Real	5.3
3	Rdistance	km	Real	6.5
4	Distance	km	Real	6.6
5	Plume	none	Integer	3
6	Evacuation	none	Integer	1
7	Health Effect	none	Character	ERL INJ/PRODRIMAL VOMIT
8	Exceeds Risk	km	Real	5.6
9	Organ	none	Character	A-LUNGS
10	Exceeds Dose	sV	Real	5.2
11	Source Term	none	Integer	1
12	Angle	none	Character	ENE
13	Pathway	None	Character	GRD
14	Elevation Dose	Sv	Real	10.
15	Elevation Concentrat	Bq/m2	Real	4.2
16	MACCS2_Input	None	TypeNoKey	TYPE1OUT001 'ERL FAT/TOTAL' 1 26 NONE

B-2.3.3 RecordData Field for the Variables Record

The VARIABLES RecordData field lists all of the variable labels and the variable's required qualifiers. The VarID is referenced in the results type records.

The following variable is written to the RecordData field when RecordLab=VARIABLES:

- *NVar* is a 4 byte integer defining the number of variables defined in this block.

This is followed by *NVar* sets of data. Each set of data describes a variable as follows:

1. *VarID* is a 4 byte integer identifying the variable.
2. *VarLab* is a variable length string describing the variable.
3. *NQual* is a 4 byte integer identifying the number of qualifiers associated with this variable.

This is followed by *NQual* 4 byte integers, *QualID*(), containing the qualifier IDs associated with this variable. Details regarding these qualifier IDs are in the Qualifiers Record.

6. *Units* is a variable length string describing the units associated with this variable.

Example: (0110, "Centerline Air Concentration", 5, 11, 5, 1, 2, 3, "Bq-s/m3"). In this example, the sequence 5, 11, 5, 1, 2, 3 means that there are five qualifiers associated with this variable with Qualifier ID's 11, 5, 1, 2, and 3 corresponding to Source Term, Plume, etc. (see the QUALIFIERS RecordData field description).

What follows is a description of the variables that are written to the MACCS2 Version 2.1 binary output file.

Table B-4. Results Written to the Binary File

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
ATMOS					
BIN_RELEASE	1	Release	This output is always included in the ATMOS output. There are entries for each isotope (1 to NUMISO), for each plume release, and for each ATMOS change set (or source term)	Source Term Plume Nuclide	Bq
BIN_CLINE_AIR_CON	2	Centerline Air Concentration	Type 0 output	Source Term Plume Nuclide Ldistance Rdistance MACCS2_Input	Bq-s/m ³
BIN_GROUND_AIR_CON	3	Ground-Level Air Concentration	Type 0 output	Source Term Plume Nuclide Ldistance Rdistance MACCS2_Input	Bq-s/m ³
BIN_CLINE_GROUND_CON	4	Centerline Ground Concentration	Type 0 output	Source Term Plume Nuclide Ldistance Rdistance MACCS2_Input	Bq/m ²

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_TOT_CLINE_GROUND_CON	5	Total Centerline Ground Concentration	Type 0 output	Source Term Plume Nuclide Ldistance Rdistance MACCS2_Input	Bq/m ²
BIN_GROUND_DISP	6	Ground-Level Dispersion	Type 0 output	Source Term Plume Nuclide Ldistance Rdistance MACCS2_Input	s/m ³
BIN_SOURCE_STREN	7	Source Strength	Type 0 output	Source Term Plume Nuclide Ldistance Rdistance MACCS2_Input	Bq
BIN_PLUME_CROSS_SZ	8	Plume Crosswind Size	Type 0 output	Source Term Plume Nuclide Ldistance Rdistance MACCS2_Input	m

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_VERT_SZ	9	Plume Vertical Size	Type 0 output	Source Term Plume Nuclide Ldistance Rdistance MACCS2_Input	m
BIN_PLUME_CLINE_HEIGHT	10	Plume Centerline Height	Type 0 output	Source Term Plume Nuclide Ldistance Rdistance MACCS2_Input	m
BIN_PLUME_TIME	11	Plume Arrival Time	Type 0 output	Source Term Plume Nuclide Ldistance Rdistance MACCS2_Input	s
EARLY					
BIN_NEARLY_HEALTH	12	Number Early Health Effects Cases	Type 1 output	Source Term Evacuation Health Effect Ldistance Rdistance MACCS2_Input	none

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_HEALTH_LNT_DOSE	81	Health Effects LNT Population Dose	Type 1 output Note: This output is only printed when the Threshold or Piecewise model is used	Source Term Evacuation Health Effect Ldistance Rdistance Organ MACCS2_Input	Sv
BIN_HEALTH_USED_DOSE	82	Health Effects Used Population Dose	Type 1 output Note: This output is only printed when the Threshold or Piecewise model is used	Source Term Evacuation Health Effect Ldistance Rdistance Organ MACCS2_Input	Sv
BIN_EARLY_FAT_RAD	13	Early Fatality Radius	Type 2 output	Source Term Evacuation Exceeds Risk MACCS2_Input	km
BIN_NEARLY_POP_X_DOSE	14	Number Early Population Exceeding Dose	Type 3 output	Source Term Evacuation Organ Exceeds Dose MACCS2_Input	none

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_EARLY_AVG_RISK	15	Early Average Individual Risk	Type 4 output	Source Term Evacuation Health Effect Ldistance Rdistance MACCS2_Input	none
BIN_LIFE_POP_DOSE	16	Lifetime Population Dose	Type 5 output	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	Sv
BIN_PATH_CLINE_DOSE	17	Pathway Specific Centerline Dose	Type 6 output	Source Term Evacuation Organ Pathway Ldistance Rdistance MACCS2_Input	Sv
BIN_CLINE_RISK	18	Centerline Risk	Type 7 output	Source Term Evacuation Health Effect Ldistance Rdistance MACCS2_Input	none

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_POP_RATED_RISK	19	Population Rated Risk	Type 8 output	Source Term Evacuation Health Effect Ldistance Rdistance MACCS2_Input	none
BIN_PEAK_DOSE	20	Peak dose	Type A output	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	Sv
BIN_PEAK_RAD_DOSE	21	Peak dose (radial)	Type B results	Source Term Evacuation Organ Ldistance Rdistance Angle MACCS2_Input	Sv
BIN_DOSE_ALL_LOC	22	Dose at all Locations	Type C results	Source Term Evacuation Organ Angle Ldistance Rdistance MACCS2_Input	Sv

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_DOSE_ALL_LOC_ELEV	79	Dose at all locations Area That Exceeds Threshold	Type C results	Source Term Evacuation Elevation Dose Organ Ldistance Rdistance MACCS2_Input	Ha
BIN_EARLY_GROUND_CON	23	Early Ground Concentration	Type D output	Source Term Evacuation Nuclide Angle Ldistance Rdistance MACCS2_Input	Bq/m ²
BIN_EARLY_GROUND_CON_ELEV	80	Early Ground Conc Area That Exceeds Threshold	Type D output	Source Term Evacuation Elevation Concentration Nuclide Ldistance Rdistance MACCS2_Input	Ha

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_EARLY_AIR_CON	24	Early Air Concentration	Type D output	Source Term Evacuation Nuclide Angle Ldistance Rdistance MACCS2_Input	Bq-s/m ³
CHRONC					
BIN_PATHWAY_DOSE	25	Tot Long-Term Pathways Dose	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_EXP_PATH	26	Tot Long-Term Direct Exposure Pathways	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_INGESTION_DOSE	27	Tot Ingestion Pathways Dose	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_GROUND_DOSE	28	Long-Term Groundshine Dose	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_RESUSP_DOSE	29	Long-Term Resuspension Dose	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_POP_DECON_DOSE	30	Population Dependent Decontamination Dose	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_FARM_DECON_DOSE	31	Farm Dependent Decontamination Dose	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_WATER_INGEST_DOSE	32	Water Ingestion Dose	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_MILK_DOSE	33	Milk Growing Season Dose	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_CROP_DOSE	34	Crop Growing Season Dose	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_LONG_MILK_DOSE	35	Milk Long-Term Dose	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_LONG_CROP_DOSE	36	Crop Long-Term Dose	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_INGEST_GRAINS	37	Ingestion of Grains	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_INGEST_LEAFY	38	Ingestion of Leafy Vegetables	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_INGEST_ROOT	39	Ingestion of Root Crops	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_INGEST_FRUIT	40	Ingestion of Fruits	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_INGEST_LEGU	41	Ingestion of Legumes	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_INGEST_BEEF	42	Ingestion of Beef	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_INGEST_MILK	43	Ingestion of Milk	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_INGEST_POULTRY	44	Ingestion of Poultry	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_INGEST_OTHER	45	Ingestion of Other Meat Crops	Type 9 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	person-Sv
BIN_TOT_ECO_COST	46	Total Economic Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$
BIN_POP_COST	47	Pop Dependent Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$
BIN_FARM_COST	48	Farm Dependent Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_POP_DECON_COST	49	Pop Dependent Decontamination Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$
BIN_FARM_DECON_COST	50	Farm Dependent Decontamination Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$
BIN_POP_INTERD_COST	51	Pop Dependent Interdiction Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$
BIN_FARM_INTERD_COST	52	Farm Dependent Interdiction Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$
BIN_POP_COND_COST	53	Pop Dependent Condemnation Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_FARM_COND_COST	54	Farm Dependent Condemnation Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$
BIN-EMERGENCY_COST	55	Emergency Phase Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$
BIN-INTERMEDIATE-COST	56	Intermediate Phase Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$
BIN_MILK_DISP_COST	57	Milk Disposal Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$
BIN_CROP_DISP_COST	58	Crop Disposal Costs	Type 10 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	\$

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_FARM_DECON_DIST	59	Farm Dependent Decontamination Distance	Type 11 results	Source Term Evacuation MACCS2_Input	km
BIN_POP_DECON_DIST	60	Pop Dependent Decontamination Distance	Type 11 results	Source Term Evacuation MACCS2_Input	km
BIN_FARM_INTERD_DIST	61	Farm Dependent Interdiction Distance	Type 11 results	Source Term Evacuation MACCS2_Input	km
BIN_POP_INTERD_DIST	62	Pop Dependent Interdiction Distance	Type 11 results	Source Term Evacuation MACCS2_Input	km
BIN_FARM_COND_DIST	63	Farm Dependent Condemnation Distance	Type 11 results	Source Term Evacuation MACCS2_Input	km
BIN_POP_COND_DIST	64	Pop Dependent Condemnation Distance	Type 11 results	Source Term Evacuation MACCS2_Input	km
BIN_MILK_DIST	65	Milk Disposal Distance	Type 11 results	Source Term Evacuation MACCS2_Input	km

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_CROP_DIST	66	Crop Disposal Distance	Type 11 results	Source Term Evacuation MACCS2_Input	km
BIN_FARM_DECON_AFF	67	Farm Decontamination	Type 12 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	ha
BIN_POP_DECON_AFF	68	Pop Decontamination	Type 12 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	individuals
BIN_POP_DECON_AREA	69	Pop Decontamination Area	Type 12 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	ha
BIN_FARM_INERD	70	Farm Interdiction	Type 12 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	ha

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_POP_INTERD	71	Pop Interdiction	Type 12 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	individuals
BIN_POP_INTERD_AREA	72	Pop Interdiction Area	Type 12 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	ha
BIN_FARM_COND	73	Farm Condemnation	Type 12 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	ha
BIN_POP_COND	74	Pop Condemnation	Type 12 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	individuals
BIN_POP_COND_AREA	75	Pop Condemnation Area	Type 12 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	ha

Maccs2 Variable Name containing value of VarID	VarID	VarLab	Comments	Qualifiers	Units
BIN_MILK_DISP_AREA	76	Milk Disposal Area	Type 12 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	ha
BIN_CROP_DISP_AREA	77	Crop Disposal Area	Type 12 results	Source Term Evacuation Ldistance Rdistance MACCS2_Input	ha
BIN_MAX_FOOD_DOSE	78	Maximum Annual Food Dose	Type 13 results	Source Term Evacuation Organ Ldistance Rdistance MACCS2_Input	Sv

B-2.3.4 Record Data Field for the Statistics Record

The following variable is written to the RecordData field when RecordLab=STATISTICS:

- *NStat* is a 4 byte integer containing the number of statistics defined in this block.

This is followed by *NStat* sets of data. Each set of data describes a statistic as follows:

- *StatID* is a 4byte integer identifying the variable
- *StatLab* is a variable length string describing the statistic

Example: (3,"50th Quantile")

Table B-5. Statistics Written to the Binary File

<i>StatID</i>	<i>StatLab</i>
1	Probability Non-zero
2	Mean
3	50th Quantile
4	90th Quantile
5	95th Quantile
6	99th Quantile
7	99.5th Quantile
8	Peak Concentration
9	Peak Probability
10	Peak Trial

B-2.3.5 RecordData Field for the Results Records

There are four different types of results supported, vectors, ordered pairs, statistical blocks and statistical ordered pairs representing a cumulative probability distribution (CCDF). Some of the MACCS results are single numbers (e.g., a radioactivity level). Other results are probability distributions, for example the distribution of a dose. Other results are summaries of probabilities, such as the mean or trial where the peak value occurs.

All results records must have information about the variable and qualifiers that are being reported.

The following format for the RecordData field is as follows when RecordLab=VECTOR_RESULTS, 2-D_RESULTS, STAT_RESULTS or CCDF_RESULTS.

Table B-6. Formatting Details of the Results Records

Field	Description	Example
VarID	4 byte integer identifying variable. This value refers to one of the reported values of <i>VarID</i> in the <i>RecordData</i> field of the <i>Variables</i> record.	4 Note: This represents Centerline Ground Concentration
“BQU ”	4 character fixed string indicating beginning of qualifier block	“BQU ”
QualID	Long integer identifying qualifier ID. This value refers to one of the reported values of <i>QualID</i> in the <i>RecordData</i> field of the <i>Qualifiers</i> record.	11 Note: This represents source term. This matches qualID as listed in record 0001
QualVal	Variable length string containing qualifier value.	“1” Note: This identifies the source term as the first
“EQU ”	4 character fixed string indicating end of qualifier block.	“EQU ”
Repeated Qualifier blocks, “BQU”, QualID, QualVal, “EQU”	Above fields are repeated until all qualifiers are defined.	11, “1”, 5, “2”, 1, “Co-60”, 2, “4.5”, 3, “8.2” Note: This represents source term 1, plume 2, Co-60 from 4.5 to 8.2 km on the radial grid. These values are grouped as follows: {11, “1”}, {5, “2”}, {1, “Co_60”}, {2, “4.5”}, {3, “8.2”} In this example, VarID=4. There are five sets of qualifiers. Set one corresponds to source term (QualID=11), set two to plume (QualID=5), set three to nuclide (QualID=1), set four to Ldistance (QualID=2) and set five to Rdistance (QualID=3)
Results	Results record, this format is determined by record type	

B-2.3.5.1 Results Field for the VECTOR_RESULTS Records

The format of the *Results* field is as follows:

1. *Length* is a 4 byte integer identifying number of real numbers that follow.
2. *Values* is a vector of 4 byte real numbers.

B-2.3.5.2 Results Field for the 2-D_RESULTS Records

The format of the *Results* field is as follows:

1. *Length* is a 4 byte integer identifying the number of (x,y) pairs that follow.
2. *Values* is an array of 4 byte real numbers of size 2 by *Length* containing (x,y) pairs of results written to the file in row major order.

B-2.3.5.3 Results Field for the STAT_RESULTS Records

The format of the *Results* field is as follows:

Values is a vector of 4 byte real numbers of size *NStat* (part of the Statistics record). The value of *NStat* for MACCS2 version 2.0 is ten. Data is in the same order as listed in the Statistics record.

B-2.3.5.4 Results Field for the CCDF_RESULTS Records

The format of the *Results* field is as follows:

1. *Length* is a 4 byte integer identifying the number of (x,y) pairs that follow.
2. *Values* is an array of 4 byte real numbers of size 2 by Length containing (x,y) pairs of results written to the file in row major order.

Appendix C: FGR-13 Dose Factor Files

C-1 Introduction

WinMACCS is supplied with a set of 51 “adult” dose factor files which are based on the CD supplement to Federal Guidance Report 13 (EPA 2002). Data for 825 isotopes is provided. This dose factor file set supports WinMACCS calculations using the linear no threshold, annual threshold, piecewise linear, and acute health risk models.

These dose factors utilize ICRP publication 60 (ICRP 1991) tissue weighting and the respiratory tract model defined in ICRP-publication 66 (ICRP 1994). Federal Guidance Report 13 dose factors are generally similar to those published in ICRP publication 72 (1996), but they incorporate modifications to ICRP publication 72 assumptions that were agreed to by the U. S. Environmental Protection Agency and the ORNL Center for Biokinetic and Dosimetric Research. Minor differences between Federal Guidance Report 13 and ICRP publication 72 dose coefficients are largely attributable to differences in:

- Assumptions of shared kinetics in some decay chains
- Systemic biokinetic models for some elements, and
- Gastrointestinal tract absorption-to-blood fractions, f_I .

C-2 Lung Clearance Behavior

With few exceptions, the absorption types are consistent with those used in the current dose factor files. The dose factor files do not show an absorption type for certain isotopes when either there was no choice of clearance type in Federal Guidance Report 13, or the choice was superfluous because the inhalation dose coefficients were zero.

C-3 Gastrointestinal Tract Uptake Fraction, F_I

Federal Guidance Report 13 assigned f_I values for uptake of elements from the digestive tract via the ingestion pathway based on the chemical form expected to be encountered in the environment, and these values were not necessarily consistent with the f_I values used in the computation of inhalation dose coefficients. There were choices of f_I to be made for only four elements, hydrogen, sulfur, mercury, and polonium. The ingestion dose coefficient for tritium was based on tritiated water (HTO). Sulfur, mercury, and polonium isotopes were assigned ingestion dose coefficient based on the form and f_I that gave the highest dose.

C-4 Particle Size Distribution

Inhalation dose coefficients for micron sized particles depend on the activity median aerodynamic diameter (AMAD). The Federal Guidance Report 13 inhalation dose factors are based on an AMAD of 1 μm .

C-5 Organs Included in Data Set

The following organs and tissues are included in the Federal Guidance Report 13 dose factor files.

Table C-1. Organs Included in Federal Guidance Report 13 Files.

Organs with Annual and 50-Year Equivalent Dose Commitment Coefficients	Organs with Acute Dose Commitment Coefficients
Adrenals	
Urinary Bladder Wall	
Bone Surface	
Brain	
Breasts	
Stomach Wall	Stomach Wall
Small Intestine Wall	Small Intestine Wall
Upper Lg Intestine Wall (ULI)	
Lower Large Intestine Wall (LLI)	Lower Large Intestine Wall
Kidneys	
Liver	
Esophagus	
Muscle	
Ovaries	
Pancreas	
Red Marrow	Red Marrow
Skin	
Spleen	
Testes	
Thymus	
Thyroid	Thyroid
Uterus	
Lungs	Lungs
Colon	
Gonads	
Remainder	
Effective	

C-6 Annual and 50-year Equivalent Dose Commitment Factors

The annual and 50-year dose commitment factors are intended for stochastic health effect (cancer and heritable effect) estimation, so they include a radiation weighting factor of 20 for the high linear energy transfer (LET) contributions to these dose coefficients.

C-7 Calculating annual and 50-year dose commitment factors for “composite organs”

Dose factors for composite organs were calculated from dose factors for the underlying tissues or organs as follows:

- The **esophagus** was assigned the corresponding inhalation dose coefficients and ingestion dose coefficients of the **thymus**.
- Inhalation and ingestion dose coefficients for the **colon** were calculated as a weighted sum of the dose coefficients for upper large intestine (57%) and lower large intestine (43%)
- The inhalation and ingestion dose coefficients for the **lung** (thoracic portion of respiratory tract) and **ET_{Reg}** (the extra-thoracic region of the respiratory tract) were calculated using equations on page 35 of ICRP publication 66. The lung coefficient is the weighted sum of the coefficients for the several respiratory tract tissues.
- The dose coefficients for **remainder** were calculated using equations on ICRP publication 71 (ICRP 1995) page 27.
- The dose coefficients for **gonads** were the larger of the dose coefficients for testes and ovaries.
- The dose coefficients for **effective** were computed from the individual organ dose coefficients using the ICRP 60 tissue weighting method.

C-8 Acute Inhalation Dose Factors

Reliable data on relative biological effectiveness, **RBE**, of high LET radiation at causing acute health effects were not available; so the acute inhalation dose factors were based on an RBE of 10 for consistency with DOSFAC2 dose factor files.

Next, the resulting acute dose coefficients **DCF[i, at, org, cp]** were weighted by acute dose protraction factors, **WTFRAC[cp,org]**, and then summed to obtain adjusted acute dose coefficients, **DCF[i, at, org]**. The values of **WTFRAC[cp, org]** that were used are given in the DOSFAC2 Users Manual (Young and Chanin, 1997).

C-9 Designating Pseudo-Stable Isotopes When Using Federal Guidance Report 13 Dose Factor Files

In contrast to DOSFAC2 and FGRDCF dose factor files, Federal Guidance Report 13 dose factors make no assumptions about the degree of equilibrium within decay chains for radioactive materials in the environment or for intakes of radioactive materials from the environment. Consequently, one must be mindful about specifying both parent and the corresponding progeny

that are released or form as decay products in the environment via the WinMACCS “Radionuclide Core Inventory and Chemical Group” window. For long decay chains, such as uranium-238, the sixth member of the chain (thorium-230 for example) must be identified as pseudo-stable. If the pseudo-stable isotope conventions commonly observed for DOSFAC2 or FGRDCF dose factor files are used with Federal Guidance Report 13 dose factor files, then doses and health effects may be significantly underestimated.

C-10 Known Issues

The FGR-13 dose factor files have inherited the following issues from the CD Supplement to FGR-13:

- The ingestion and inhalation dose coefficients for four alpha-emitting rare-earth isotopes (Sm-146, Sm-147, Gd-148, and Gd-152) are incorrect.
- The ingestion and inhalation dose coefficients for four isotopes having significant spontaneous fission decay modes (Cm-248, Cm-250, Cf-252, and Cf-254) are listed as zero.