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4.1.0 Supplement to MACCS User's Guide and Reference Manual

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Updates to WinMACCS Users Guide (Section 3.)

Introduction

With the introduction of WinMACCS 4.1.0, WinMACCS and MACCS have been modified in several very significant ways:

- Additional models were implemented to enhance MACCS capabilities for near-field analysis. These additional models include the Ramsdell and Fosmire plume meander model, and an updated version of the U.S. NRC Regulatory Guide 1.145 plume meander model.
- A new output option was added for projecting a peak dose over a moving time window.
- Other improvements are more evolutionary in nature, including extension of key bounds for selected input parameters.

The following sections describe changes made to WinMACCS since version 4.0.0 to create WinMACCS 4.1.0. This document has been formatted to be consistent with the headings in the MACCS Users Guide for WinMACCS 4.0.0.

Modified Parameter Bounds (Various Sections Consolidated into a Table)

The following input variables have been updated with extended bounds:

Table 1. Modified Bounds in WinMACCS and MACCS

Variable Name	Description	Bounds for 3.10.0	Bounds for 4.1.0
BUILDH	Height of building	[0.1, 1000] m	[0, 1000] m
NUM_DIST	Number of distances in dispersion table	[3, 50]	[3, 99]

ATMOS Input and Model Description (Section 3.2)

Nearfield Enhancements

To enhance MACCS capabilities for nearfield modeling, two plume meander models were added: the Ramsdell and Fosmire plume meander model, and an updated version of the U.S. NRC Regulatory Guide 1.145 plume meander model for a point source. These models are selectable in Project Properties on the *Transport* tab.

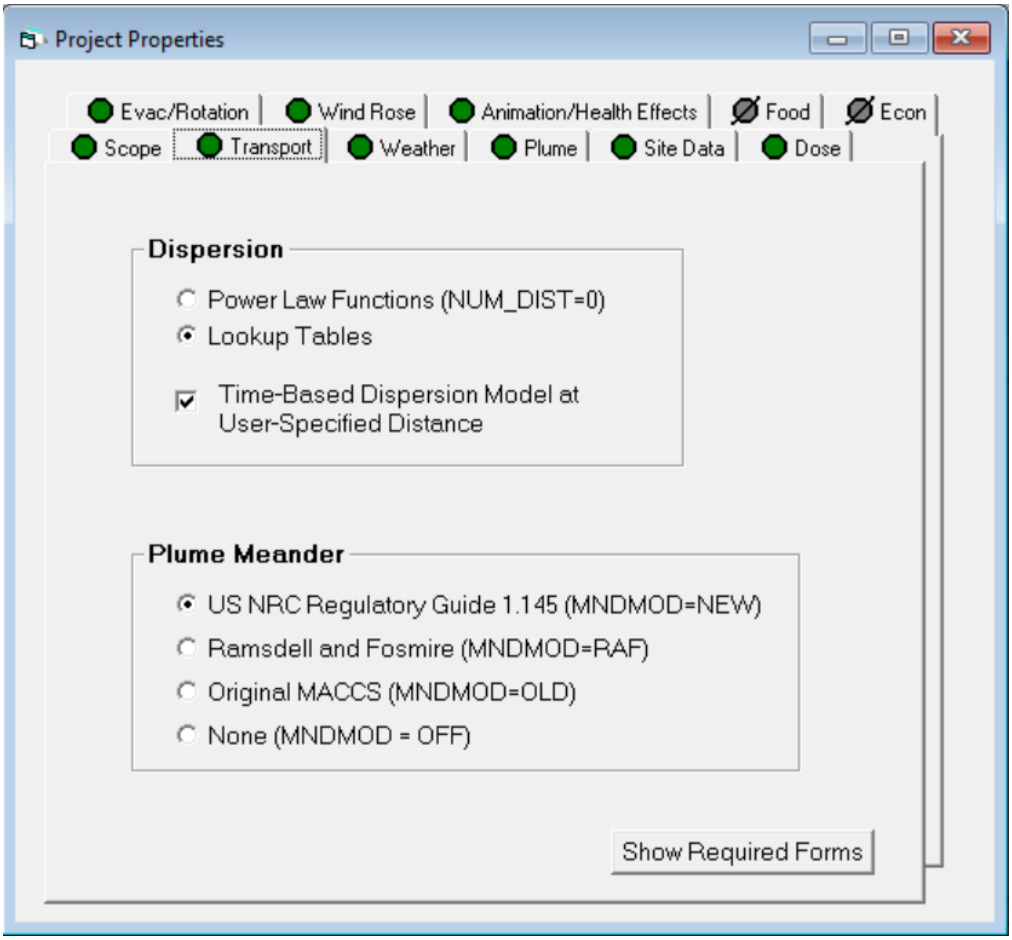

Figure 1. Plume Meander Selection

Options were added to the Project Properties *Plume* tab to allow selection of a point source, area source, or automatic area source calculation to enhance transparency in the source type being modeled. Furthermore, options were also added for Plume Trapping/Downwash where users can now select Briggs (building parameters) or Briggs (buoyancy flux), with the additional option to automatically calculate the trapped plume release height.

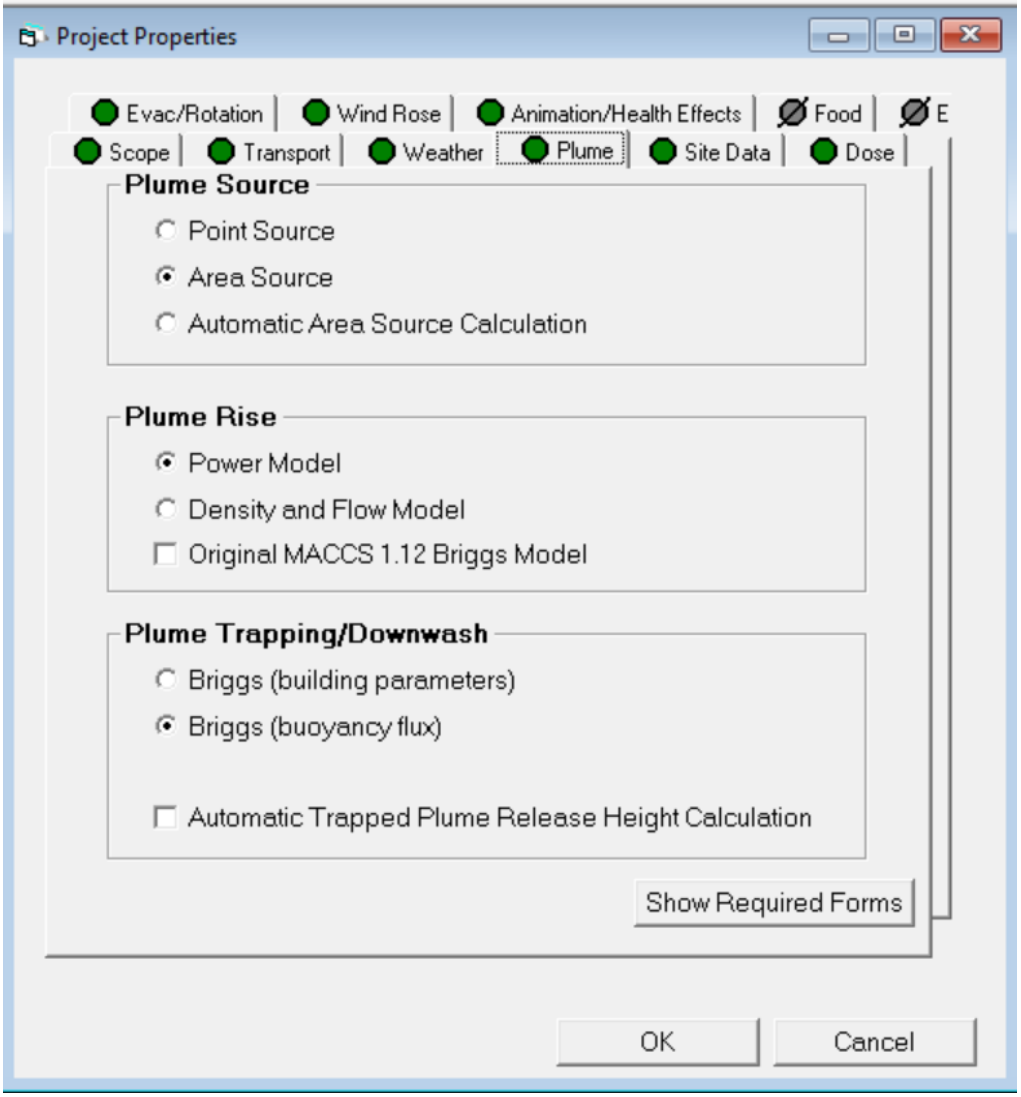

Figure 2. Project Properties Plume Tab

Depending on which plume meander model, plume source model and plume trapping/downwash model is selected additional parameters may be required to define the dimensions of the building, which are defined in the Additional Building Data form.

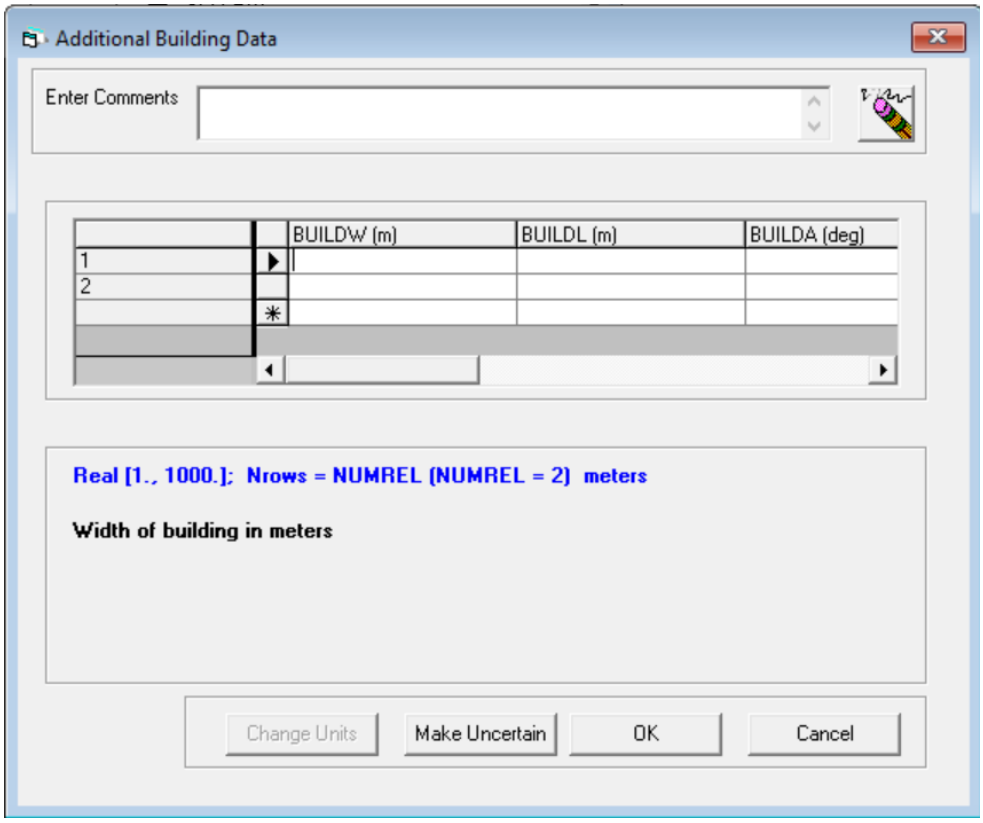

Figure 3. Additional Building Data Form

BUILDW is the width of the building in meters.

BUILDL is the length of the building in meters.

BUILDA is the angle from north in degrees for width dimensions.

Table 2. Additional Building Data Input

Variable Name	Definable	Type	Dimensions	Allowed Values
BUILDW	Yes	Real	NUMREL	1 to 1000 m
BUILDL	Yes	Real	NUMREL	1 to 1000 m
BUILDA	Yes	Real	NUMREL	-180 to 180 deg

When either the Briggs building parameters or Briggs buoyancy flux trapping and downwash model are selected and the trapped plume release height is not automatically calculated, the user must define the trapped plume release height. This is specified in the Trapped/Downwashed Plume Release Height form.

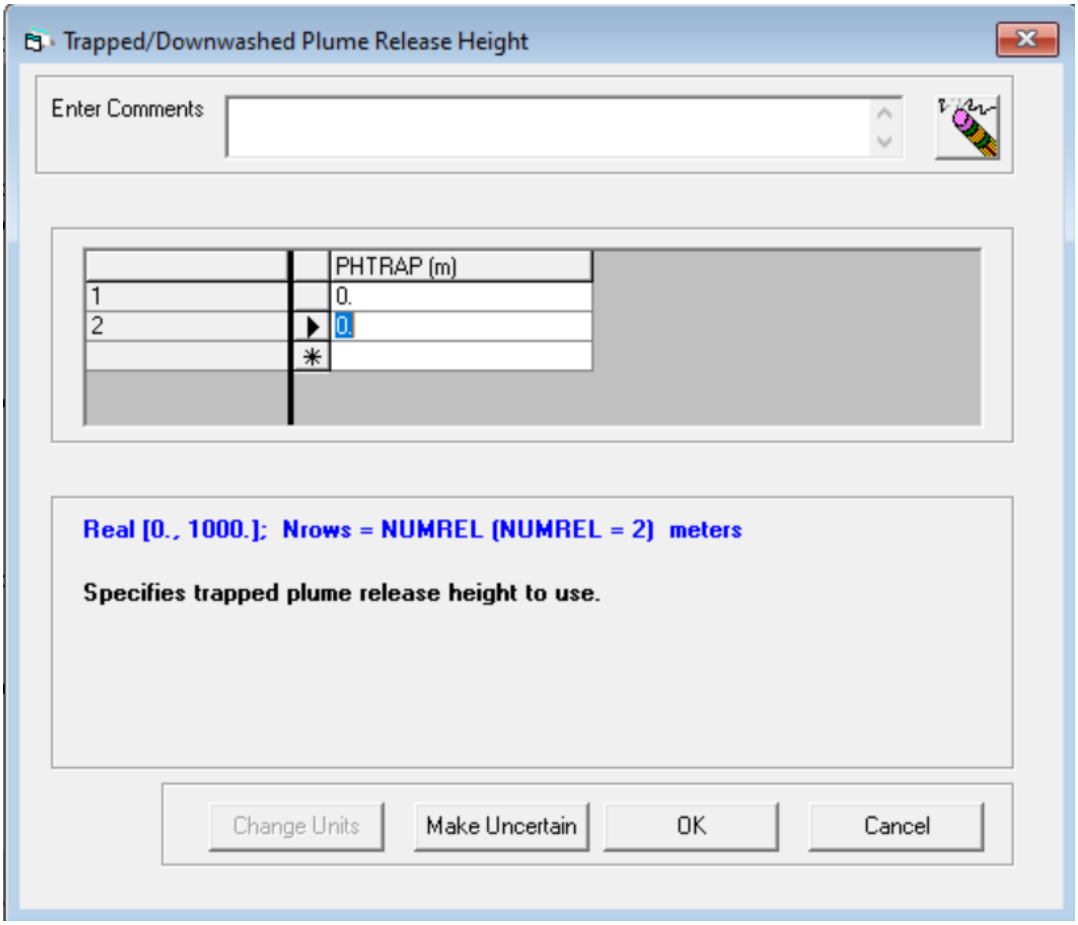

Figure 4. Trapped/Downwashed Plume Release Height Form

PHTRAP specifies the trapped plume release height for each plume segment.

Table 3. Trapped/Downwashed Plume Release Height Input

Variable Name	Definable	Type	Dimensions	Allowed Values
PHTRAP	Yes	Real	NUMREL	1 to 1000 m

Plume Specifications (Section 3.2.8)

US NRC Regulatory Guide 1.145 Point Source

The US NRC Regulatory Guide 1.145 Point Source plume meander model implementation in MACCS is covered in detail in the *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*, which is included with MACCS 4.1. Parameters required to be specified in MACCS to use the US NRC Regulatory Guide 1.1.45 Point Source plume meander model are specified in the form below:

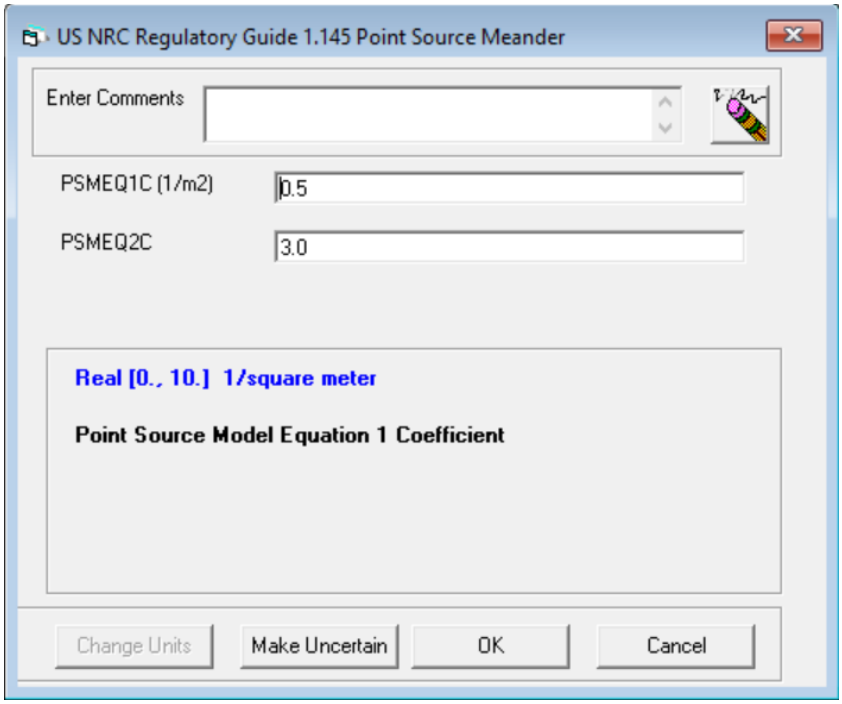

Figure 5. US NRC Regulatory Guide 1.145 Point Source Plume Meander Form

PSMEQ1C is the point source model equation 1 coefficient, which is recommended to have a value of 0.5 m^{-2} in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

PSMEQ2C is the point source model equation 2 coefficient, which is recommended to have a value of 3.0 in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

Table 4. US NRC Regulatory Guide 1.145 Point Source Plume Meander Input

Variable Name	Definable	Type	Dimensions	Allowed Values
PSMEQ1C	Yes	Real	None	0 to 10 m^{-2}
PSMEQ2C	Yes	Real	None	1 to 10

Ramsdell and Fosmire Model

The Ramsdell and Fosmire plume meander model implementation in MACCS is covered in detail in the *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*, which is included with MACCS 4.1

A new form was created under Plume Specifications for input of parameters for the Ramsdell and Fosmire plume meander model.

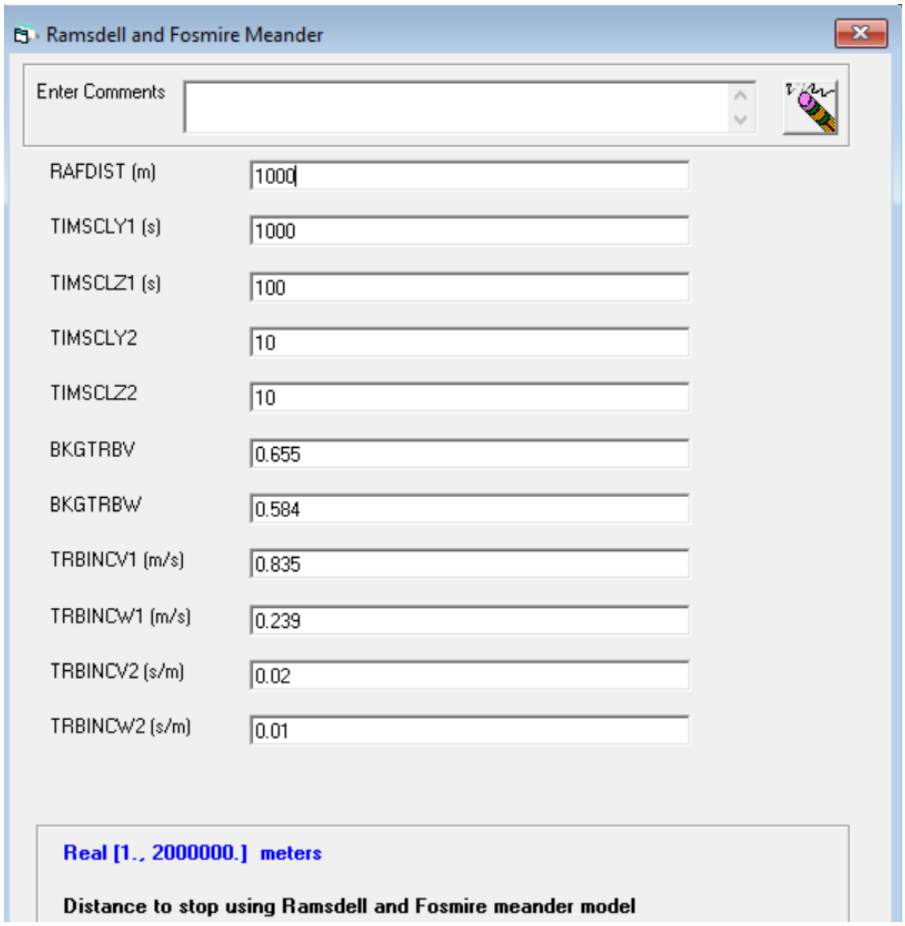

Figure 6. Ramsdell and Fosmire Form

RAFDIST is the distance to stop using the Ramsdell and Fosmire meander, which is recommended to have a value of 1000 m in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

TIMSCLY1 is the Ramsdell and Fosmire meander model low speed y timescale parameter, which is recommended to have a value of 1000 s in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

TIMSCLZ1 is the Ramsdell and Fosmire meander model low speed z timescale parameter, which is recommended to have a value of 100 s in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

TIMSCLY2 is the Ramsdell and Fosmire meander model high speed y timescale coefficient, which is recommended to have a value of 10 in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

TIMSCLZ2 is the Ramsdell and Fosmire meander model high speed z timescale coefficient, which is recommended to have a value of 10 in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

BKGTRBV is the Ramsdell and Fosmire meander model background v turbulence, which is recommended to have a value of 0.655 in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

BKGTRBV is the Ramsdell and Fosmire meander model background w turbulence, which is recommended to have a value of 0.584 in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

TRBINCV1 is the Ramsdell and Fosmire meander model low speed v turbulent increment, which is recommended to have a value of 0.835 m/s in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

TRBINCW1 is the Ramsdell and Fosmire meander model low speed w turbulent increment, which is recommended to have a value of 0.239 m/s in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

TRBINCV2 is the Ramsdell and Fosmire meander model high speed v turbulent increment, which is recommended to have a value of 0.02 s/m in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

TRBINCV1 is the Ramsdell and Fosmire meander model high speed w turbulent increment, which is recommended to have a value of 0.01 s/m in *Implementation of Additional Models into the MACCS Code for Nearfield Consequence Analysis*.

Table 5. Ramsdell and Fosmire Meander Model Inputs

Variable Name	Definable	Type	Dimensions	Allowed Values
RAFDIST	Yes	Real	None	1 to $2x10^6$ m
TIMSCLY1	Yes	Real	None	1 to $1x10^4$ s
TIMSCLZ1	Yes	Real	None	1 to $1x10^4$ s
TIMSCLY2	Yes	Real	None	1 to $1x10^4$
TIMSCLZ2	Yes	Real	None	1 to $1x10^4$
BKGTRBV	Yes	Real	None	0.001 to 10
BKGTRBW	Yes	Real	None	0.001 to 10
TRBINCV1	Yes	Real	None	0.001 to 10 m/s

TRBINCW1	Yes	Real	None	0.001 to 10 m/s
TRBINCV2	Yes	Real	None	0.001 to 10 s/m
TRBINCW2	Yes	Real	None	0.001 to 10 s/m

EARLY Input and Model Description (Section 3.3)

Output Control

Projective Peak Dose

A new output control form was created called Projective Peak Dose in order to project a peak dose over a fixed exposure window. This may be of interest in order to project doses for comparison to emergency response guidelines for evacuation. Each dose will be calculated running from the time a plume arrives at a grid element to the end of the given time period. Then the maximum of the sum of the different plume releases will be set as the peak dose.

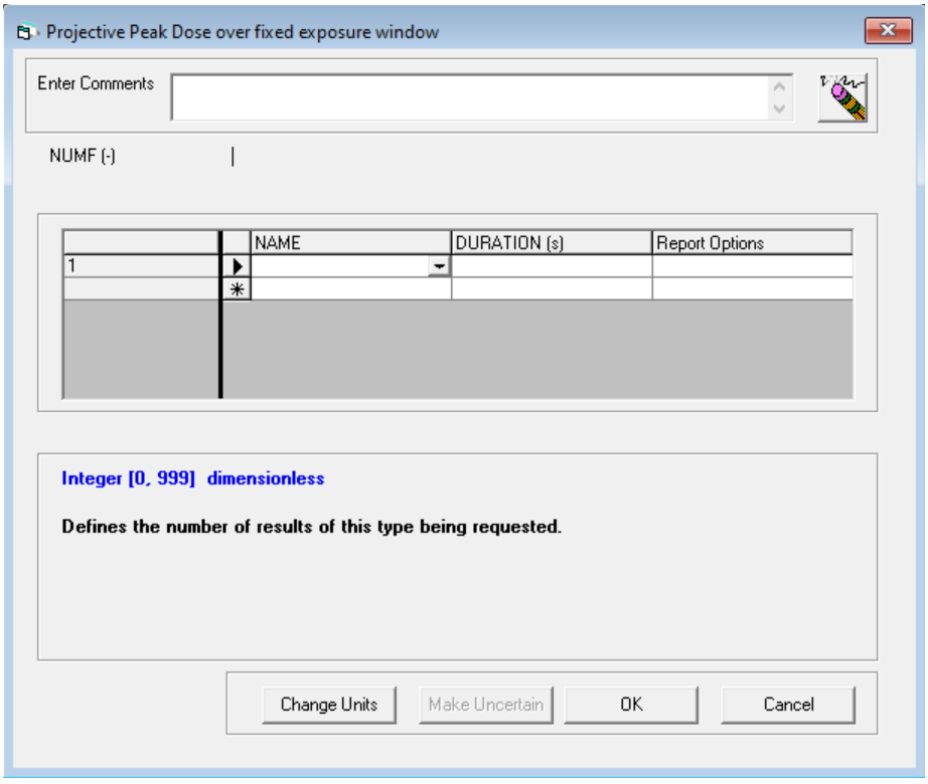

Figure 7. Projective Peak Dose Form

NUMF defines the number of results of this type being requested.

NAME defines the name of the organ for the dose measure.

DURATION defines the time duration for the moving projective peak dose time window.

Report Options indicated which outputs will be displayed: NONE, CCDF, REPORT, CCDF & REPORT

Table 6. Projective Peak Dose Input

Variable Name	Definable	Type	Dimensions	Allowed Values
NUMF	No	Integer	None	0 to 999
NAME	Yes	Logical	None	Based on DCF
DURATION	Yes	Real	None	0 to $1x10^{10}$ s
Report Options	Yes	Logical	None	NONE, CCDF, REPORT, CCDF & REPORT

Conclusions

WinMACCS and MACCS continue to be developed and improved to support consequence analysis of atmospheric radioactive releases. WinMACCS 4.1.0 is a major step forward in the improvement of consequence modeling capabilities. It includes added capabilities for near-field modeling, a new output option for a projective peak dose over a moving window, and extension of several key input parameter limits.