VENTSAR XL USER'S MANUAL

A. A. Simpkins

Technical Reviewer

May 1996

SAFETY • RESPONSIBILITY • SECURITY

SRS

SAVANNAH RIVER SITE

MASTER

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This report has been reproduced directly from the best available copy.

Available to DOE and DOE contractors from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831; prices available from (615) 576-8401.

Available to the public from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161.

VENTSAR XL USER'S MANUAL

A. A. Simpkins

Issued: May 1996

ABSTRACT

This manual is designed as a tool for novice users of the VENTSAR XL calculational Microsoft Excel spreadsheet. VENTSAR XL predicts contaminant concentrations on or near buildings for a release at a nearby location. Plume rise also may be considered. This user's manual contains the operating instructions for VENTSAR XL.

TABLE OF CONTENTS

LIST OF FIGURES

VENTSAR XL User's Manual

By A. A. Simpkins

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

1.0 INTRODUCTION

VENTSAR XL is a Microsoft Excel calculational spreadsheet used to estimate concentrations on or near buildings from a release at a nearby location. The code will calculate the concentrations either for a given set of meteorological conditions or for a given probability that meteorological conditions are not exceeded. A single building can be modeled which lies in the path of the plume, and a penthouse may be added to the top of the building. Plume rise also may be considered. This report discusses the information needed to execute the program and interpret the results. For a detailed discussion on the mathematical models within VENTSAR XL refer to Simpkins (1996).

2.0 EXECUTING VENTSAR XL

VENTSAR XL is a calculational spreadsheet that was created using Microsoft Excel Version 4.0. Macros, the Excel programming language, is used. Later versions of Microsoft Excel will also support this program. The user simply changes the required inputs in the "VENTDATA" file and clicks a button (CALCULATE) to run the models. "VENTDATA" and "VENT MACRO" can only be opened as a read only file, so when the prompt asks, open as "Read Only." If a window comes up saying "Incorrect Password" press return. Once the calculations are complete, the user can use "Save As" to keep a copy of the results. Certain cells have been locked so inadvertent changes cannot be made by the user.

Figure 1 shows a sample page of input which corresponds to Test Case 1 of Environmental Dosimetry's routinely performed test cases. The CALCULATE button is contained in the upper left hand of the computer screen. Once a Macro has begun to execute, the user may work within applications other than Excel by clicking on the desktop. The user may stop execution by holding down the apple key (⌘) and the period key (.).

Input parameters are discussed and their ranges of validity are noted. Valid ranges of input are shown to the right of the parameter in the spreadsheet. If the user enters a value that is not valid, column E will show "INVALID." The spreadsheet will not execute if there is an "INVALID" anywhere in column E of the data spreadsheet.

Figure 1. Input Template for VENTSAR XL

VENTSAR XL

TITLE
Name and Phone Number

		Units	VALID RANGE	
Release Location	P			
(A,C,D, F, H, K, P, or O for other)				
Grid Coordinates Easting		ft	0	120000
Northing		ft		120000
Building Dimensions				
Building Height	10	m	0	1000
Building Width	20	m	0	1000
Building Length	30	m	0	1000
Penthouse Height	1	m	0	1000
Penthouse Width	2	m	0	1000
Penthouse Length	3	m	0	1000
Distance to Penthouse on Rooftop	5	m	0	1000
(Negative indicates on roof)				
Minimum Distance of Interest	10	m	10	99999
Maximum Distance of Interest	1010	m	10	100000
Number of Increments	10		1	200
Compass Sector of Building	16		1	16
(1-N, 2-NNE, ...)				
Distance of Vent from Roof Edge	-500		-1000	1000
(negative is upwind)				
Vent Height	50	m	0	500
Radioactive Calculations(Y or N)	N			
If yes Release Rate	1	Ci/min	1.00E-12	1.00E+12
If No Mole Fraction of Vent Gas	1.0E-06			
Vent Gas Flow Rate	500	m3/s	0	500
Averaging Option (Y or N)	Y			
If YES Specify Probability Level	0.005		0.001	0.5
If NO Wind speed at Vent Height	4.5	m/s	0.1	15
Stability Class(1-7 to A-G)	4		1	7
Plume Rise(Y or N)	y			
Vent Diameter	3	m	0.001	100
Gas Molecular Weight	210			
Vent Gas Temperature	20	C		
Ambient Air Temperature	15	C		

RELEASE LOCATION

Enter the location of release as either a specified meteorological tower or "O" for other location. If "O" is chosen, the exact location of the release must be specified using the next two input lines. Site coordinates must be used to input the grid location. This input is entered to determine which meteorological data set is used for the remainder of the calculations. See Parker (1992) and Weber (1993) for information on the meteorological data bases.

BUILDING DIMENSIONS

Enter the dimensions of the building and penthouse in meters. Figure 2 shows a three-dimensional view of the building dimensions with the wind direction toward the face of the building. XSTP is the distance to the penthouse from the edge of the building. The valid range for this parameter is such that the penthouse will still fit on top of the building. The assumed direction of the wind is important with respect to the building dimensions that are used. If no penthouse is included, set all of the penthouse parameters to zero. Calculations may also be done without a building by setting all of the parameters to zero.

DISTANCES FOR CALCULATIONS TO BE PERFORMED

Enter the minimum and maximum distances for which the calculations are to be performed. Valid range is from 10 to 100,000 m and the maximum must be greater than the minimum or an error will result. These two inputs set the bounds for the distances at which the calculations will be performed. The next input specifies the number of increments that the above bracketed distance will be divided into. Valid range is 1 to 200. This parameter will greatly affect the amount of time that it takes the Macro to execute, so choose the smallest number possible that will still give you the desired results. If building wake effects are to be considered, there should be several increments just beyond the building to ensure the proper fraction of the plume is entrained.

SECTOR DESIGNATION

Enter the sector that corresponds to the direction in which the building lies with respect to the release location. Sector selection is important if meteorological exceedance probability is specified because meteorological frequency data will be chosen based on this input. Figure 3 shows a pictorial view of the sector notation for a sample release from H Area. The dotted lines represent the center of the sector. If a given wind speed and stability class is used, sector designation is unimportant since no meteorological data files are accessed.
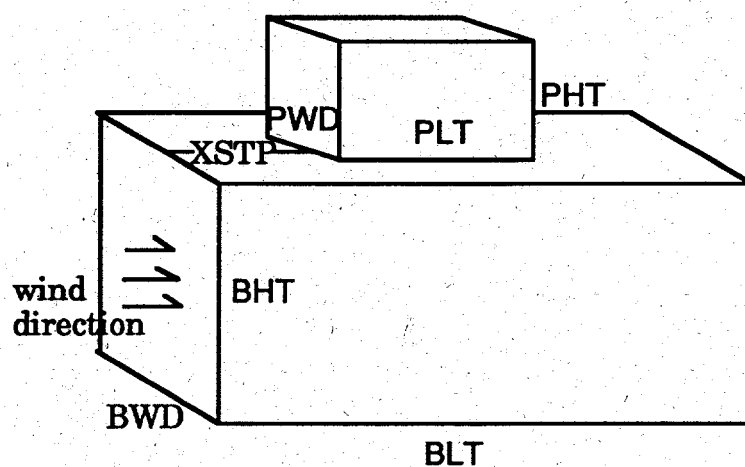
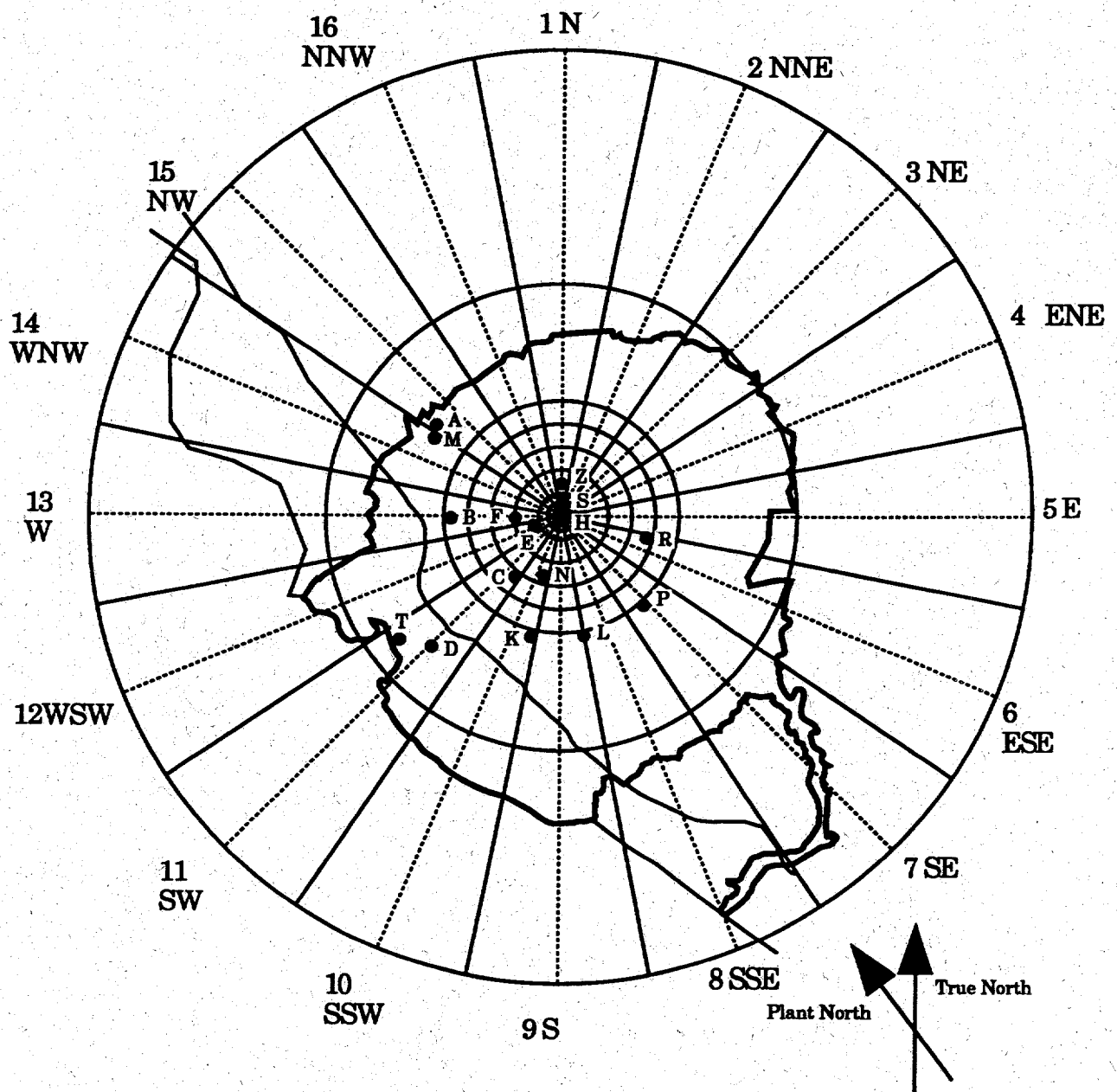Figure 2. Building Dimensions for VENTSAR XL Input

Figure 3. Sector Notation (Sector represents direction wind moves towards.)

DISTANCE TO ROOF EDGE

The distance from the roof edge to the vent or release location is entered here. A negative number indicates that the vent is upwind of the building while a positive number indicates the vent is located on the roof. Figure 4 shows a simple representation of the side view of a building with two positions noted. For a release location in position A, an input of "-10.0" would be used whereas for position B, "5.0" would be entered. Valid range is -1000.0 to 1000.0 meters.
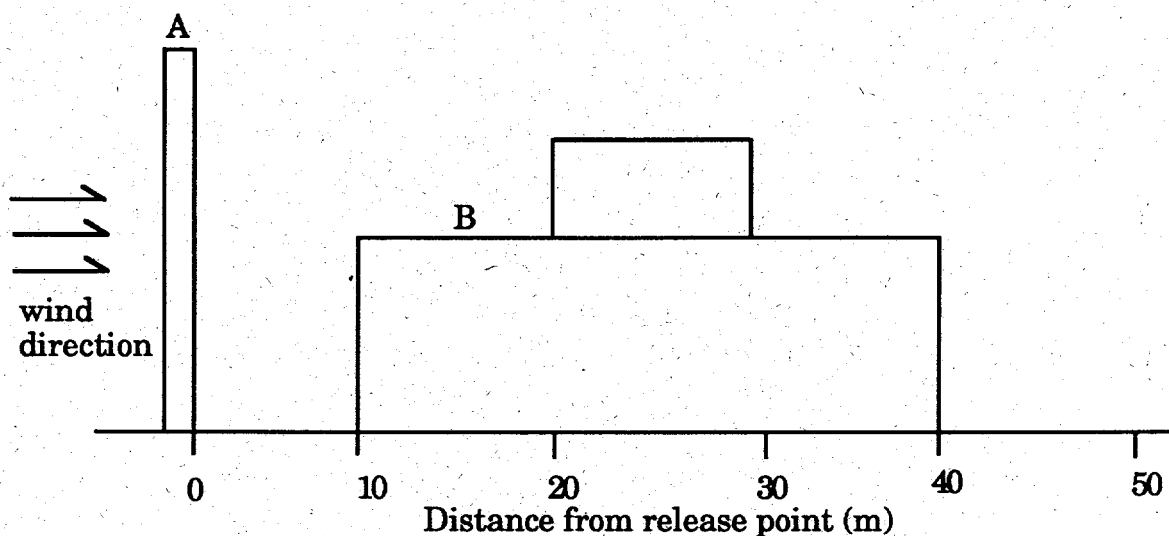

Figure 4. Release Location Explanation for Input

RELEASE HEIGHT

Enter the height of the release. Valid range is 0.0 to 500 m.

RADIOACTIVE CALCULATION

Enter "Y" if the calculation is for radioactive emissions and "N" if it is not. Depending on the answer to the above question, enter the release quantities (release rate (Ci/min) or component mole fraction) in the spaces provided.

VENT GAS FLOW RATE

Enter the rate at which the gas is exiting the stack or vent in m^3/s. Valid range is from 0 to 1000 m^3/s.

AVERAGING OPTION

Enter "Y" for a meteorological exceedance probability to be specified. For meteorological conditions not exceeded 99.5% of the time, "0.005" would be entered. If "N" is entered, the wind speed and stability class must be specified in the following two lines. Enter the wind speed and a number that corresponds to the stability class (A - G corresponds to 1 - 7). These two statements may be left blank if the averaging option is selected.

PLUME RISE

Enter "Y" for yes and "N" for no. If yes is entered and plume rise is considered, the following four lines must have input. If no is entered, plume rise will not be considered, however the next line (diameter) must be completed. If plume rise is considered, enter the molecular weight of the gas. The molecular weight of the air and gas mixture will be calculated and used for the remaining calculations. Enter the temperature of the vent gas and the ambient air in degrees Celsius.

VENT HEIGHT INCREMENT

This option was removed for the spreadsheet version, however the user can reproduce any previous runs by executing separate input templates for each of the release heights.

3.0 VENTSAR XL OUTPUT

Sample portions of the output are displayed and discussed. A copy can be generated using the input parameters shown in Figure 1. A printout of the output can be made by clicking on the "PRINT" button at the top of the "VENTDATA" file.

Output headings will vary depending on whether the release is chemical or radioactive. Figure 5 shows part of the results for a radioactive release. The titles above each of the columns are self explanatory. If a specific wind speed and stability class is selected instead of the probability level the annual average χ/Q will not be calculated. Simpkins (1996) discusses how each of these parameters are determined.

Figure 5. Sample Output for VENTSAR XL

Distance(m)	99.50% x/Q s/m^3	Pollutant Concentration (pCi/cc)	Annual Average s/m^3
10.0	0.00E+00	0.00E+00	0.00E+00
110.0	2.42E-45	1.19E-42	3.53E-24
210.0	1.63E-18	7.99E-16	9.52E-15
310.0	3.69E-15	1.82E-12	1.69E-12
410.0	6.83E-12	3.35E-09	1.87E-11
510.0	3.67E-10	1.80E-07	6.33E-11
610.0	2.21E-09	1.09E-06	1.27E-10
710.0	8.03E-09	3.95E-06	2.15E-10
810.0	2.66E-08	1.31E-05	4.10E-10
910.0	5.83E-08	2.87E-05	6.87E-10
1010.0	9.91E-08	4.87E-05	1.02E-09

4.0 CONCLUSIONS

A spreadsheet version of VENTSAR, entitled VENTSAR XL, was written and is available for execution using Microsoft Excel. One page of input is required and then calculations are automatically performed at user-selected distances.

5.0 REFERENCES

Parker, M.J., 1992, *The 1987-1991 Savannah River Site Meteorological Data Base(U)*, Westinghouse Savannah River Company Report, WSRC-RP-92-598, Savannah River Site, Aiken, SC.

Simpkins, A.A., 1996, *Verification of VENTSAR XL - A Spreadsheet Version of VENTSAR*, Westinghouse Savannah River Company Report, WSRC-RP-96-228, Savannah River Site, Aiken, SC.

Weber, A.H., 1993, *Comparison of Savannah River Site's Meteorological Databases(U)*, Westinghouse Savannah River Company Report, WSRC-RP-93-269, Savannah River Site, Aiken, SC.