

## **Beta Release of AERSCREEN User's Guide**

**August 16, 2010**

This document describes the beta Release version of AERSCREEN, including a brief overview of the AERSCREEN package, a more detailed description of the main components of AERSCREEN and how to apply them.

### **1. Overview of AERSCREEN**

AERSCREEN is a screening-level air quality model based on AERMOD(U.S. EPA, 2004a) that is being developed jointly by U.S. Environmental Protection Agency (US EPA) and State modelers with contractor support. The AERSCREEN model, which is currently in draft form and is being released at this time for Beta Testing, consists of two main components: 1) the MAKEMET program which generates a site-specific matrix of meteorological conditions for input to the AERMOD model; and 2) the AERSCREEN command-prompt interface program (formerly called ASCREEN) developed by James Haywood of the Michigan Department of Environmental Quality (DEQ). AERSCREEN interfaces with MAKEMET for generating the meteorological matrix, but also interfaces with AERMAP (U.S. EPA, 2004b) and BPIPFRM (Schulman et al. 2000; U.S. EPA, 2004b) to automate the processing of terrain and building information respectively, and interfaces with the AERMOD model utilizing the SCREEN option to perform the modeling runs. AERSCREEN interfaces with the 09292 version of AERMOD and will not work with earlier versions of AERMOD. The AERSCREEN program also includes averaging time factors for worst-case 3-hr, 8-hr, 24-hr and annual averages. Both of these components are written in the FORTRAN programming language.

The screening mode of the current version of AERMOD, which is controlled by the SCREEN option on the CO MODELOPT card, forces the model calculations to represent values for the plume centerline, regardless of the source-receptor-wind direction orientation. This option is included in AERMOD to facilitate the use of the model in a screening mode to estimate worst-case impacts. Since the screening option in AERMOD is designed to be used with a non-sequential meteorological data file representing a matrix of conditions, currently generated by the MAKEMET program, the SCREEN option also forces the use of the NOCHKD option even if NOCHKD is not included on the MODELOPT card. The NOCHKD option suspends the checks made within AERMOD for proper date sequences in the surface and profile meteorological input data files. The SCREEN option also restricts the averaging period options to 1-hour averages only on the CO AVERTIME card.

Given these two basic components of AERSCREEN, the AERMOD model can be run in a screening mode by either: 1) using the AERSCREEN command-prompt interface; or 2) using the stand-alone MAKEMET program to generate the matrix of meteorological conditions and running AERMOD directly with the SCREEN option. The first approach automates much of the processing for the user, including building and terrain processing, while the second approach gives the user more flexibility for defining the receptor network to be used in the screening analysis and may be more appropriate in certain situations, especially in very complex terrain settings. These two options for running AERMOD in a screening mode will not necessarily

produce the same results. This is because the results for the stand-alone application of AERMOD with MAKEMET-generated meteorology will be determined by the user-specified receptor network, whereas the AERSCREEN program performs a more precise search to isolate the receptor distance with the highest impact, similar to the automated distance option in SCREEN3 (U.S. EPA, 1995). In general, the AERSCREEN program should produce slightly more conservative results than stand-alone AERMOD with MAKEMET data, depending on the receptor resolution used for the latter.

Before running AERSCREEN, users should consult and become familiar the following:

- AERMOD User's Guide and addenda (U.S. EPA, 2004a)
- AERMAP User's Guide and addenda (U.S. EPA, 2004b)
- AERMET User's Guide [for surface characteristics tables] (U.S. EPA, 2004c)
- BPIPPRM User's Guide (U.S. EPA, 2004d)
- *Guideline on Air Quality Models (Appendix W)* (U.S. EPA, 2005)
- AERSURFACE User's Guide (U.S. EPA, 2008)
- AERMOD Implementation Guide (U.S., EPA, 2009)

The above documents and other support documents can be found at the AERMOD modeling page of the Support Center for Regulatory Atmospheric Modeling (SCRAM) page at: [http://www.epa.gov/scram001/dispersion\\_prefrec.htm#aermod](http://www.epa.gov/scram001/dispersion_prefrec.htm#aermod) and the *Guideline on Air Quality Models* (hereafter referred to as Appendix W) can be found at: [http://www.epa.gov/scram001/guidance/guide/appw\\_05.pdf](http://www.epa.gov/scram001/guidance/guide/appw_05.pdf)

## **1.1 Description of AERSCREEN**

As stated above, AERSCREEN is an interactive command-prompt application that interfaces with MAKEMET for generating the meteorological matrix, but also interfaces with AERMAP and BPIPPRM to automate the processing of terrain and building information, and interfaces with the AERMOD model utilizing the SCREEN option to perform the modeling runs. The AERSCREEN program also includes averaging time factors for worst-case 3-hr, 8-hr, 24-hr and annual averages. The AERSCREEN program is currently limited to modeling a single point, capped stack, horizontal stack, rectangular area, circular area, flare, or volume source.

Inputs or options to AERSCREEN are:

- Source parameters for point, rectangular area, circular area, volume, capped stack, horizontal stack or flare sources
- Building downwash information for point, capped stack, horizontal stack, and flare sources
- Ability to use terrain heights for source and receptors via AERMAP
- Specify minimum and maximum temperatures for MAKEMET
- Specify minimum wind speed and anemometer height for MAKEMET
- Specify surface characteristics for input to MAKEMET by the following methods:
  - user-defined single values for albedo, Bowen ratio, and surface roughness (no temporal or spatial variation in surface characteristics)
  - AERMET seasonal tables

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- Values listed in an external file, either an AERSURFACE (U.S. EPA, 2008) output file or surface characteristics listed in an AERMET stage 3 input file
- Probe distance (maximum downwind distance) of receptors
- Use of flagpole receptors and define flagpole height
- Urban or rural source and urban population if urban source
- Fence line distance for ambient air receptors
- Performs error checks on AERSCREEN inputs, AERMOD output and/or AERMAP output
- Calculate maximum concentration by distance
- Search routine to find overall worst case scenario (maximum concentration)

AERSCREEN automatically provides impacts for other averaging periods using scaling ratios. The averaging period ratios currently implemented in AERSCREEN are as follows (*SCREEN3 factors are shown for comparison*):

- 3-hour      fixed ratio of 1.00    *0.90*
- 8-hour      fixed ratio of 0.90    *0.70*
- 24-hour     fixed ratio of 0.60    *0.40*
- Annual      fixed ratio of 0.10    *0.08*

For area sources (rectangular and circular), the averaging factors are based on guidance in Section 4.5.4 of the EPA screening guidance document (U.S. EPA, 1992). For area sources, the 3, 8, and 24-hour average concentrations are equal to the 1-hour average calculated by AERMOD in screening mode. No annual average concentration is calculated.

## **1.2 Description of MAKEMET**

The MAKEMET program generates a matrix of meteorological conditions, in the form of AERMET-ready surface (AERSCREEN.sfc) and profile (AERSCREEN.pfl) files, based on user-specified surface characteristics and ambient temperatures. See the AERMET User's Guide (U.S. EPA, 2004c) for file formats. The current version of MAKEMET also allows the user to specify the minimum wind speed to include in the matrix and the anemometer height as well. These options have been included to facilitate comparisons of AERSCREEN estimates to estimates from AERMOD in a refined mode to eliminate differences that may be due to either the minimum wind speed in the refined data or the anemometer height. The suggested default values for routine application of MAKEMET are 0.5 m/s for the minimum wind speed and 10 meters for the anemometer height.

MAKEMET allows the user to specify more than one set of surface characteristics and ambient temperatures, such as for seasonal or monthly variations, and will concatenate the resulting meteorological matrices into single surface and profile files. For AERSCREEN, this option is not used and separate files are created for seasonal or monthly variations in surface characteristics. No variation in minimum and maximum temperature is done in MAKEMET. MAKEMET also allows the user to specify a single wind direction or a range of wind directions for the meteorological matrix. This option may be useful for applications involving building downwash to ensure that building dimensions for all sectors are included in the screening analysis (the treatment of building downwash in the AERSCREEN program is described below). However, in AERSCREEN processing, the wind direction is set to a single direction of 270 degrees.

MAKEMET can be run from the command-prompt, with the prompts in Figure 1 for user input.

```
1. ' ENTER SFC MET FILE NAME '
2. ' ENTER PFL MET FILE NAME '
3. ' ENTER MIN. WS (M/S) '
4. ' ENTER ANEM HT (M) '
5. ' ENTER NUMBER OF WIND DIRECTIONS '
   if (one Wind Direction) then
6a. ' ENTER WIND DIRECTION '
   else
6b. ' ENTER STARTING WIND DIRECTION '
6c. ' ENTER CLOCKWISE WIND DIRECTION INCREMENT '
   endif
7. ' ENTER MIN AND MAX AMBIENT TEMPS IN KELVIN '
8. ' ENTER ALBEDO '
9. ' ENTER BOWEN RATIO '
10. ' ENTER SURFACE ROUGHNESS LENGTH IN METERS '

' DO YOU WANT TO GENERATE ANOTHER MET SET THAT WILL BE',
' APPENDED TO CURRENT FILE?',
' [TYPE EITHER "Y" OR "y" FOR YES; OR HIT "ENTER" TO EXIT] '

IF ("Y" or "y") then the program loops through prompts 7 through 10
   for each additional data set (e.g. seasonal).
```

**Figure 1. User prompts for MAKEMET.**

The MAKEMET program has a long complex history, dating back over 10 years. Suffice it to say that the version of MAKEMET being submitted for Beta testing operates in the following manner. As mentioned earlier, MAKEMET generates a matrix of meteorological conditions for application of AERMOD in a screening mode and output the results in the form of AERMOD-ready surface and profile meteorological data files. The matrix is generated based on looping through a range of wind speeds, cloud covers, ambient temperatures, solar elevation angles, and convective velocity scales ( $w^*$  for convective conditions only) for user-specified surface characteristics ( $Z_o$ ,  $B_o$ ,  $r$ ). For stable cases, the mechanical mixing height ( $Z_{im}$ ) is calculated based on the friction velocity,  $u^*$ . A loop through  $Z_{im}$  factors (multiplied times the initial value calculated from  $u^*$ ) is also included to account for smoothing of  $Z_{im}$  that occurs with refined AERMET data. Stable transition cases with solar angle greater than zero but less than the critical solar angle (ACRIT) are also included in the matrix.

The program calculates  $u^*$ , Monin-Obukhov length ( $L$ ), and  $Z_{im}$  for each combination in the matrix, and also calculates the convective mixing height ( $Z_{ic}$ ) based on  $w^*$  for convective cases. The program uses subroutines from AERMET (U.S. EPA, 2004c) to calculate boundary layer parameters for each combination in the matrix. The program generates a log file, called MAKEMET.LOG, which summarizes the inputs selected for that run, and the number of “hours” in the final screening matrix for each set of surface characteristics. An effort has been made to optimize the MAKEMET program for AERMOD screening applications by eliminating combinations that are unnecessary in terms of identifying worst-case impacts, based on a wide range of tests comparing screening to refined AERMOD estimates (which are briefly summarized below). The number of “hours” per set of surface characteristics will typically be around 300-400, but will vary depending on the user inputs. The number will tend to be larger

for applications with lower surface roughness due to the internal checks made to eliminate unnecessary combinations.

MAKEMET uses the following scheme to assign dates for each of the “hours” in the meteorological matrix. The default starting year for the data is 10, and the year is incremented by 10 for each additional data set generated. Thus, for seasonal data files, the first season date will start with a '1', second season will start with a '2', etc. The hour is used to distinguish between stable and convective conditions, with hours 01 through 11 indicating stable hours, and hours 12 through 24 indicating convective hours. Note that for monthly data sets and/or for large numbers of wind directions (greater than 36), duplicate dates may be generated. A warning message is written to the log file in these cases. AERMOD will still run since the NOCHKD option is invoked, but determining which conditions produced the worst-case results could become problematic. In addition to the required variables for input to AERMOD, the surface file generated by MAKEMET also includes five columns of integer variables that provide the loop indices for each of the loops in the met matrix corresponding to each "hour" of screening meteorology. These indices can be used to analyze the frequency of occurrence for various combinations within the meteorological matrix resulting in the controlling (highest) concentration.

AERSCREEN provides three options for surface characteristics inputs for generating the screening meteorology. One option allows for user-specified surface characteristics – albedo, Bowen ratio, and surface roughness (no spatial or temporal variation), the second option is to use seasonally varying surface characteristics for generic land use classifications based on Tables 4-1, 4-2, and 4-3 of the AERMET User’s Guide (U.S. EPA 2004c). The third option is to input the name of an AERSURFACE (U.S. EPA, 2008) output file or AERMET stage 3 input file that contains surface characteristics. Monthly, seasonal, and annual output for one sector or multiple sectors is allowed with the third option. AERSCREEN will setup and run the MAKEMET program to generate the screening meteorological data for input to AERMOD. AERSCREEN will run MAKEMET for each combination of temporal period and spatial sector of the surface characteristics. AERSCREEN does not call AERSURFACE, so the user must run AERSURFACE prior to running AERSCREEN if AERSURFACE surface characteristics are to be used.

### **1.3 Differences with SCREEN3**

The three areas where AERSCREEN deviates significantly from SCREEN3 and will, thus, be the most difficult for first time users are:

- 1) **Building wake effects** – AERSCREEN utilizes all the advantages of PRIME (Schulman et al., 2000) including stacks detached from the building. This requires three additional pieces of information from the user beyond the normal building height and dimensions. The additional information is orientation of the maximum dimension relative to north, angle relative to north of the stack and, distance between the stack and building center. AERSCREEN will use this information to setup and run the BPIPPRM program and extract the information needed for the AERMOD model. More downwash details can be found in Section 2.2.

- 2) **Meteorology** – AERSCREEN provides three options for generating the screening meteorology. One option allows for user-specified surface characteristics – albedo, Bowen ratio, and surface roughness (no temporal or spatial variation) – the second option is to use seasonally varying surface characteristics for generic land use classifications based on Tables 4-1, 4-2, and 4-3 of the AERMET User’s Guide. The third option is to use surface characteristics listed in an external file such as an AERSURFACE output file or AERMET stage 3 input file. The user enters the name of the file. The user also specifies the overall minimum and maximum ambient temperatures. AERSCREEN will setup and run the MAKEMET program to generate the screening meteorological data for input to AERMOD. More details about meteorology can be found in Section 2.3.
  
- 3) **Terrain** – AERSCREEN provides the option for incorporating terrain impacts on the screening analysis. The user must create a file called demlist.txt. The first line of this file describes the type of terrain file being used. The file type must be DEM or NED. DEM refers to any DEM file type and NED refers to National Elevation Dataset. The third line of the file lists the location of the NAD conversion files and the fourth line begins the list of terrain files with each file on a separate line. When AERSCREEN is run, the user will be prompted to provide the source coordinates and associated NAD. AERSCREEN will then setup the necessary input file for AERMAP, run AERMAP, and extract the information needed for the AERMOD model. More terrain processing details can be found in Section 2.4

Given the use of surface characteristics and terrain, it is important that the user know the exact coordinates of the source, i.e., stack or center location of volume or area source.

## **2 AERSCREEN features**

As noted in Section 1.1, AERSCREEN has many features and options available to the user. In this section, the features and inputs to the restart file, AERSCREEN.INP, are described. The prompts used to enter the data interactively are described in each relevant section as well. Prompts are not necessarily shown in the order in which they appear but in the order for the parameters shown in AERSCREEN.INP for each data section. The prompts described are based on metric units. When processing data from the input file, all units are assumed to be metric. Some variables listed below are not requested when using the prompts to enter data, but are automatically defaulted, such as when processing a rectangular area source, volume source, or circular area source. In the case of a rectangular area source, terrain use and downwash are automatically set to “no” and the user is not prompted for the choice of terrain processing and source coordinates. For all three source types, downwash is automatically set to “no” and downwash information is not requested.

### **2.1 Source inputs**

AERSCREEN can be used for a single point, flare, capped stack, horizontal stack, volume, rectangular area source, or circular area source. Below are listed the source types with required input variables and example values from the first line of the AERSCREEN.INP file. Building downwash is allowed for the point, capped stack, horizontal stack, and flare sources but not for volume or area (rectangular or circular) sources. Terrain processing is allowed for all sources except rectangular area sources. For all source types, emission rates are in g/s or lb/hr. For area source types, AERSCREEN calculates the emission rate per unit area, the required input for AERMOD.

#### *2.1.1 Point, capped stacks and horizontal stack sources*

Stack parameters for point (vertical stacks with no caps), capped stacks, and horizontal stacks are the same. Point sources are denoted by the term “\*\* STACK DATA” in the input file in the line above the source parameters. Capped stacks are denoted by the term “\*\* POINTCAP DATA” in the input file and horizontal stacks are denoted by the term “\*\* POINTHOR DATA” in the input file. Source inputs for these three source types are, with English and metric units in parentheses:

- emission rate (lb/hr or g/s)
- stack height (feet or meters)
- stack diameter (inches or meters)
- stack temperature (degrees Fahrenheit or Kelvin)
- and stack velocity (ft/s or m/s) or flow rate (ACFM)

Note that stack velocity can be input as ft/s or m/s, regardless of using English or metric units for other parameters. AERSCREEN.INP and prompt inputs (shown in italics) are shown in Figures 2 through 4 for point, capped stack and horizontal stacks, respectively. If a stack temperature of zero (Fahrenheit or Kelvin) is entered, the ambient air temperature will be used as the stack temperature. For capped and horizontal stacks, AERMOD uses the BETA option on the MODELOPT keyword in the AERMOD runstream file, AERMOD.INP, to invoke the algorithms for those source types.

<b>AERSCREEN.INP point source inputs</b>							
** STACK DATA	Rate	Height	Temp.	Velocity	Diam.	Flow	
**	0.1896E+01	5.0902	353.7056	13.2662	0.6096	8204.	□
<b>Point source prompts inputs</b>							
If the user enters “P” or “p” for point source:							
<i>Enter Emission Rate (g/s):</i>							
<i>Enter Stack Height (meters):</i>							
<i>Enter Stack Diameter (meters):</i>							
<i>Enter Stack Temperature (K)</i>							
<i>Enter 0 for ambient temperature:</i>							
<hr/>							
<i>Option (1) - Exit Velocity (m/s)</i>							
<i>Option (2) - Exit Velocity (ft/s)</i>							
<i>Option (3) - Flow Rate (ACFM)</i>							
<hr/>							
<i>Enter Option for Flow Rate or Exit Velocity:</i>							
If the user chooses option 1, the prompt is:							
<i>Enter Exit Velocity (m/s):</i>							
If the user chooses option 2, the prompt is:							
<i>Enter Exit Velocity (ft/s):</i>							
If the user chooses option 3, the prompt is:							
<i>Enter Flow Rate (ACFM):</i>							

**Figure 2. AERSCREEN.INP and prompts inputs for point sources.**

<b>AERSCREEN.INP capped stack source inputs</b>						
** POINTCAP DATA	Rate	Height	Temp.	Velocity	Diam.	Flow
**	0.1896E+01	5.0902	353.7056	13.2662	0.6096	8204.□
<b>Capped stack source prompts inputs</b>						
If the user enters “S” or “s” for capped stack source:						
<i>Enter Emission Rate (g/s):</i>						
<i>Enter Stack Height (meters):</i>						
<i>Enter Stack Diameter (meters):</i>						
<i>Enter Stack Temperature (K)</i>						
<i>Enter 0 for ambient temperature:</i>						
<hr/>						
<i>Option (1) - Exit Velocity (m/s)</i>						
<i>Option (2) - Exit Velocity (ft/s)</i>						
<i>Option (3) - Flow Rate (ACFM)</i>						
<hr/>						
<i>Enter Option for Flow Rate or Exit Velocity:</i>						
If the user chooses option 1, the prompt is:						
<i>Enter Exit Velocity (m/s):</i>						
If the user chooses option 2, the prompt is:						
<i>Enter Exit Velocity (ft/s):</i>						
If the user chooses option 3, the prompt is:						
<i>Enter Flow Rate (ACFM):</i>						

**Figure 3. AERSCREEN.INP and prompts inputs for capped stack sources.**

<b>AERSCREEN.INP horizontal stack source inputs</b>							
** POINTHOR DATA	Rate	Height	Temp.	Velocity	Diam.	Flow	
**	0.1896E+01	5.0902	353.7056	13.2662	0.6096	8204.	□
<b>Horizontal stack source prompts inputs</b>							
If the user enters “H” or “h” for horizontal stack source:							
<i>Enter Emission Rate (g/s):</i>							
<i>Enter Stack Height (meters):</i>							
<i>Enter Stack Diameter (meters):</i>							
<i>Enter Stack Temperature (K)</i>							
<i>Enter 0 for ambient temperature:</i>							
<hr/>							
<i>Option (1) - Exit Velocity (m/s)</i>							
<i>Option (2) - Exit Velocity (ft/s)</i>							
<i>Option (3) - Flow Rate (ACFM)</i>							
<hr/>							
<i>Enter Option for Flow Rate or Exit Velocity:</i>							
If the user chooses option 1, the prompt is:							
<i>Enter Exit Velocity (m/s):</i>							
If the user chooses option 2, the prompt is:							
<i>Enter Exit Velocity (ft/s):</i>							
If the user chooses option 3, the prompt is:							
<i>Enter Flow Rate (ACFM):</i>							

**Figure 4. AERSCREEN.INP and prompts inputs for horizontal stack sources.**

### 2.1.2 Flares

Flare sources are denoted by the term “\*\* FLARE DATA” in the input file in the line above the source parameters. Flare source inputs are, with English and metric units:

- emission rate (lb/hr or g/s)
- stack height (feet or meters)
- total heat release rate (cal/sec)
- radiative heat loss fraction

The heat loss fraction can be user selected or the SCREEN3 default value of 0.55. AERSCREEN will process the flare in AERMOD as a POINT source type. For the exit velocity and exit temperature, AERSCREEN defaults these values to 20 m/s and 1,273 K, respectively as done in SCREEN3 (U.S. EPA, 1995). The stack diameter and effective stack height used in AERMOD are calculated from the inputs as:

$$D = 9.88 \times 10^{-4} \times \sqrt{HR \times (1 - HL)} \quad (1)$$

$$H_{eff} = H_s + 4.56 \times 10^{-3} \times HR^{0.478} \quad (2)$$

Where D is effective stack diameter, HR is the heat release rate, HL is the heat loss fraction,  $H_{eff}$  is effective stack height and  $H_s$  is the stack height entered by the user.

AERSCREEN.INP and prompt inputs (in italics) are shown in Figure 5.

<b>AERSCREEN.INP flare source inputs</b>				
** FLARE DATA	Rate	Height	Heat	HeatLoss
**	0.1000E+03	35.0000	0.1000E+08	0.550
<b>Flare source prompts inputs</b>				
If the user enters "F" or "P" for flare source:				
<i>Enter Emission Rate (g/s):</i>				
<i>Enter Flare Stack Height (meters):</i>				
<i>Enter Total Heat Release Rate (cal/sec):</i>				
<i>Enter Radiative Heat Loss Fraction –</i> <i>&lt;Enter&gt; for default value of 0.55:</i>				

**Figure 5. AERSCREEN.INP and prompts inputs for flare sources.**

### 2.1.3 Volume sources

Volume sources are denoted by the term “\*\* VOLUME DATA” in the input file in the line above the source parameters. Volume source inputs are, with English and metric units:

- emission rate (lb/hr or g/s)
- release height, i.e. center of volume (feet or meters)
- initial lateral dimension of the volume (feet or meters)
- initial vertical dimension of the volume (feet or meters)

AERSCREEN.INP and prompt inputs (in italics) are shown in Figure 6.

<b>AERSCREEN.INP volume source inputs</b>				
** VOLUME DATA	Rate	Height	Syinit	Szinit
**	0.1000E+03	2.0000	1.5000	3.0000
<b>Volume source prompts inputs</b>				
If the user enters “V” or “v” for volume source:				
<i>Enter Emission Rate (g/s):</i>				
<i>Enter Center of Volume Height (meters):</i>				
<i>Enter Initial Lateral Dimension (meters):</i>				
<i>Enter initial Vertical Dimension (meters):</i>				

**Figure 6. AERSCREEN.INP and prompts inputs for volume sources.**

### 2.1.4 Rectangular area sources

Rectangular area sources are denoted by the term “\*\* AREA DATA” in the input file in the line above the source parameters. Rectangular area source inputs are, with English and metric units:

- emission rate (lb/hr or g/s)
- release height above ground (feet or meters)
- long and short dimensions of area (feet or meters)
- initial vertical dimension of plume (feet or meters)

As previously noted, the emission rate is in g/s or lb/hour, not emission rate per unit area as entered in AERMOD input files. AERSCREEN automatically calculates the emission rate per unit area to input into AERMOD. The angle of the source relative to north is automatically set to 0 degrees. Note that the long dimension of the area source is in the x-direction and short dimension in the y-direction. AERSCREEN.INP and prompt inputs (in italics) are shown in Figure 7. For rectangular area sources, AERMOD uses the FASTAREA keyword on the MODELOPT keyword in the CO pathway of the AERMOD.INP file.

<b>AERSCREEN.INP rectangular area inputs</b>							
** AREA DATA	Rate	Height	Length	Width	Angle	Szinit	
**	0.1000E+03	2.0000	500.0000	200.0000	0.0	1.50	
<b>Rectangular area source prompts inputs</b>							
If the user enters “A” or “a” for rectangular area source:							
<i>Enter Emission Rate (g/s):</i>							
<i>Enter Release Height Above Ground (meters):</i>							
<i>Enter Long Side of Area Source (meters):</i>							
<i>Enter Short Side of Area Source (meters):</i>							
<i>Enter Initial Vertical Dimension (meters):</i>							

**Figure 7. AERSCREEN.INP and prompts inputs for rectangular area sources.**

### 2.1.5 Circular area sources

Circular area sources are denoted by the term “\*\* AREACIRC DATA” in the input file in the line above the source parameters. Circular area source inputs are, with English and metric units:

- emission rate (lb/hr or g/s)
- release height above ground (feet or meters)
- radius of circle (feet or meters)
- initial vertical dimension of plume (feet or meters)

As with rectangular area sources, the emission rate is in g/s or lb/hour, not emission rate per unit area. AERSCREEN.INP and prompt inputs (in italics) are shown in Figure 8. For circular area sources, AERMOD uses the FASTAREA keyword on the MODELOPT keyword in the CO pathway of the AERMOD.INP file.

<b>AERSCREEN.INP circular area source inputs</b>						
** AREACIRC DATA	Rate	Height	Radius	NVerts	Szinit	
**	0.1000E+03	2.0000	250.0000	20	1.50	
<b>Circular area source prompts inputs</b>						
If the user enters “C” or “c” for circular area source:						
<i>Enter Emission Rate (g/s):</i>						
<i>Enter Release Height Above Ground (meters):</i>						
<i>Enter Radius of AREACIRC Source (meters):</i>						
<i>Enter Initial Vertical Dimension (meters):</i>						

**Figure 8. AERSCREEN.INP and prompts inputs for circular area sources.**

### 2.1.6 Other inputs

Other inputs in the source input prompts are urban/rural classification and fence line distance. These are discussed in more detail in Section 2.5.

## 2.2 Downwash

Several parameters are needed by AERSCREEN for input into BIPPRIME. These are:

- Include downwash (Y=use building downwash, N=no downwash)
- Building height
- Maximum building horizontal dimension
- Minimum building horizontal dimension
- Degrees from north of maximum building horizontal dimension
- Angle from north of stack location relative to building center
- Distance between stack and building center

Building parameter data are denoted by the term “\*\* BUILDING DATA” in the input file in the line above the building dimensions. These inputs are listed in the second block of data of AERSCREEN.INP (Figure 9). The order of variables is as listed above. Prompts for building downwash are also shown in Figure 9. When entering data via the prompts, building prompts will only appear when processing point or flare sources. Building dimensions are in feet or meters. Angles are in degrees relative to North (0 to 360 degrees). An example building/stack configuration is shown in Figure 10. When entering building parameters, either through the building data line or prompts shown in Figure 9, the parameters are for a single tier rectangular or square shaped building. If the user wishes to use downwash for multiple buildings, tiers, or more complicated geometries, the user can enter a BPIPPRIME input filename at the prompts (“Use pre-existing BPIP input file”) or in the CO pathway of the AERSCREEN input file using the TITLETWO keyword. If a BPIP input filename is entered, AERSCREEN will use the parameters from the file but will not overwrite parameters from the building data block. If a pre-existing BPIP input file is used, the process, line 2 of the BPIP input file, must be set to ‘P’ or ‘p’ for PRIME downwash or AERSCREEN will abort.

<b>AERSCREEN.INP building inputs on BUILDING DATA line</b>								
**	BUILDING DATA	BPIP	Height	Max dim.	Min dim.	Orient.	Direct.	Offset
**		Y	34.0000	120.0000	60.0000	90.0000	26.6000	45.0000
<b>AERSCREEN.INP building BPIP input filename line</b>								
CO STARTING								
TITLEONE flare								
TITLETWO BUILDING.INP								
**	REFINE STAGE 3							
MODELOPT CONC SCREEN								
AVERTIME 1								
POLLUTID OTHER								
RUNORNOT RUN								
CO FINISHED								
<b>Building prompts inputs</b>								
<i>Include Building Downwash? (y/N):</i>								
If user enters “y” or “Y”:								
<i>Use pre-existing BPIP input file? (y/N):</i>								
If user enters “y” or “Y” for pre-existing BPIP input file:								
<i>Enter user created BPIP input file:</i>								
If user enters “n” or “N” for pre-existing BPIP input file:								
<i>Enter Building Height (meters):</i>								
<i>Enter Maximum Horizontal Building Dimension (meters):</i>								
<i>Enter Minimum Horizontal Building Dimension (meters):</i>								
<i>Enter Maximum Building Dimension Angle to True North (0 - 179 degees):</i>								
<i>Enter Direction of Stack from Building Center (0 - 360 degrees):</i>								
<i>Enter Distance Between Stack and Building Center (feet):</i>								
If user enters “n” or “N” for building downwash use then no prompts are processed.								

**Figure 9. AERSCREEN.INP and prompts inputs for building inputs.**

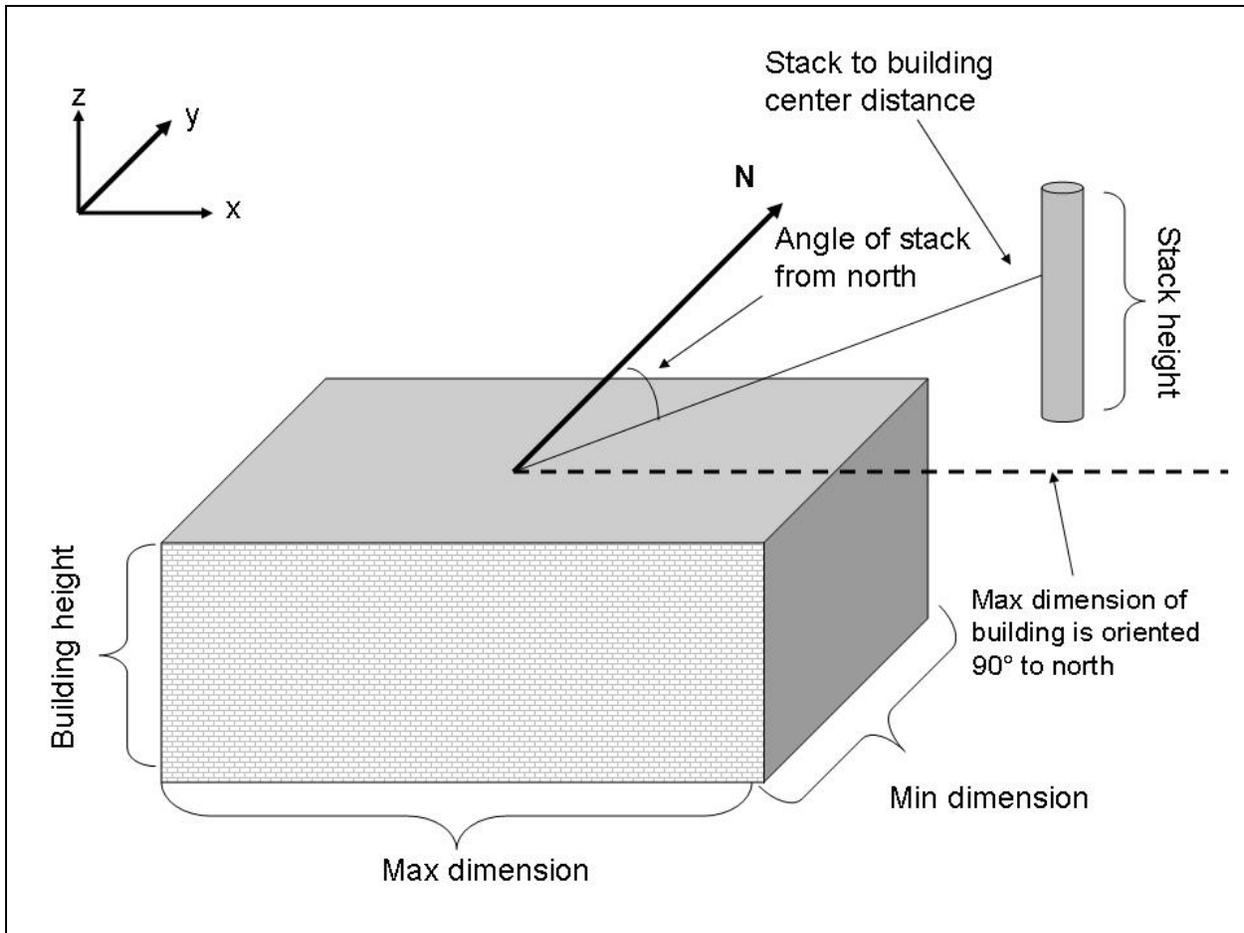


Figure 10. Stack and building orientation for a building oriented 90 degrees to north and stack oriented 45 degrees to north.

### 2.3 Meteorology and surface characteristics

For inputs to MAKEMET, the user enters the following:

- Minimum and maximum ambient air temperatures (Fahrenheit or Kelvin)
- Minimum wind speed (m/s)
- Anemometer height (m)
- Surface characteristics type (user-entered, AERMET tables, or surface characteristics listed in an external file)

When entering data via the prompts, the user can choose to enter default values for temperatures, wind speed, and anemometer height (see Figure 11). If using non-default values for temperatures, the record minimum and maximum temperatures for the area containing the source should be entered. If using a non-default value for the minimum wind speed, a wind speed less than 0.5 m/s is allowed. When entering surface characteristics, if the user chooses to utilize user-entered single value surface characteristics, the user will be prompted for those values. If the user chooses to use AERMET seasonal tables, the user will be prompted for land use type and

surface moisture (average, dry, or wet). If the user chooses to use an external file, i.e. AERSURFACE output or AERMET stage 3 input file, the user will be prompted to enter the name of the file. If the filename contains spaces or the pathname contains spaces, the filename should be entered in quotations. If the surface characteristics are in a file that is not an AERSURFACE file or AERMET stage 3 input file, the format should follow that as outlined in the AERMET User's Guide, Section 4.7.7 (U.S. EPA, 2004c). After entering the filename, AERSCREEN will check for its existence and if it does not exist, the user will be re-prompted for the surface characteristics type (user, AERMET tables, or external file). If the user uses the AERSCREEN input file to enter the meteorological parameters, the inputs are as follows in the third block of data of the input file and the data section is denoted by "\*\*\* MAKEMET DATA" in the input file. In the AERSCREEN.INP file, temperatures are in degrees Kelvin. For prompts based input, temperatures are in degrees Fahrenheit or Kelvin. Regardless of the units convention, wind speeds are in m/s and anemometer height is in meters. The AERSCREEN.INP and prompts inputs are shown in Figure 11.

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<b>AERSCREEN.INP meteorological inputs</b>										
** MAKEMET DATA	MinT	MaxT	Speed	AnemHt	Surf	Clim	Albedo	Bowen	Length	SC FILE
**	250.00	310.00	0.5	10.000	0	0	0.1600	0.8700	0.0440	"aersurface 12.out"
<b>Prompts inputs</b>										
<p><i>Enter Min &amp; Max Ambient Temperatures (K) or &lt;Enter&gt; to default to 250 310 K...</i></p> <p><i>Enter Minimum Temperature (K):</i></p> <p>If user enters a number for minimum temperature:</p> <p><i>Enter Maximum Temperature (K):</i></p> <p><i>Enter Minimum Wind Speed or &lt;Enter&gt; to default to 0.5 m/s...</i></p> <p><i>Enter Anemometer Height or &lt;Enter&gt; to default to 10.0 meters...</i></p> <p>-----</p> <p><i>1) Single user specified values</i>  <i>2) AERMET seasonal tables</i>  <i>3) External file</i></p> <p>-----</p> <p><i>Enter surface characteristics option:</i></p> <p>If the user enters 1</p> <p><i>Enter Albedo:</i></p> <p><i>Enter Bowen Ratio:</i></p> <p><i>Enter Surface Roughness Length (m):</i></p> <p>If the user enters 2</p> <p><i>1) Water</i>  <i>2) Deciduous Forest</i>  <i>3) Coniferous Forest</i>  <i>4) Swamp</i>  <i>5) Cultivated Land</i>  <i>6) Grassland</i>  <i>7) Urban</i>  <i>8) Desert Shrubland</i></p> <p><i>Enter Dominant Surface Profile:</i></p> <p><i>1) Average Moisture</i>  <i>2) Wet Conditions</i>  <i>3) Dry Conditions</i></p> <p><i>Enter Dominant Climate Profile:</i></p> <p>If user enters "A" or "a":</p> <p><i>Enter filename containing surface characteristics.</i>  <i>Enclose filename with quotes if path or filename includes spaces...</i></p>										

**Figure 11. AERSCREEN.INP and prompts inputs for meteorological and surface characteristics data.**

The parameters in the input file are:

- Minimum temperature
- Maximum temperature
- Minimum wind speed
- Anemometer height
- Land use type for surface characteristics
  - 0 = user-entered surface characteristics
  - 1 = water
  - 2 = deciduous forest
  - 3 = coniferous forest
  - 4 = swamp
  - 5 = cultivated land
  - 6 = grassland
  - 7 = urban
  - 8 = desert shrub land
  - 9 = use AERSURFACE calculated values
- Climatology type ( for land use of 1 through 8)
  - 1 = average moisture
  - 2 = wet conditions
  - 3 = dry conditions
- User defined albedo (not used/requested if land use type is 1 through 9)
- User defined Bowen ratio (not used/requested if land use type is 1 through 9)
- User defined surface roughness (not used/requested if land use type is 1 through 9)
- External surface characteristics filename (not used/requested if land use type is 0 through 8 )

When determining surface characteristics, the user should consider the location of the source (stack or center of volume or area source). Often in emission inventories, the location given for a source is not the actual location of the source, but an average of sources in a facility or location of an address. The user should verify coordinates of a stack, volume, or area source. The exact location of the source is important in determining surface characteristics, especially when using a tool such as AERSURFACE. Inaccurate source locations can lead to inaccurate surface characteristics estimations, especially surface roughness. When determining surface characteristics for the source, regardless of method (user-entered, AERMET tables, or AERSURFACE), the user is highly encouraged to review Section 3.1 of the AERMOD Implementation Guide (U.S. EPA, 2009) and if using AERSURFACE to review the AERSURFACE User's Guide (U.S. EPA, 2008).

## 2.4 Terrain

For terrain processing in AERMAP, the user enters the following:

- Include terrain processing (yes=include terrain, no=do not include terrain effects)
- Probe distance (km)
- Flagpole receptors (discussed in Section 2.5)
- Source elevation or use AERMAP to determine source elevation
- Source coordinates (geographic or UTM)
- NAD datum (NAD 27 or 83)
- UTM zone (if UTM coordinates entered)

If the user is processing a rectangular area source, the only inputs the user enters via the prompts are probe distance, flagpole receptors, and source elevation. The user will not have the choice of using AERMAP for source elevation. When entering data via the prompts, the user has the choice of inputting geographic coordinates (latitude and longitude) or UTM coordinates, as well as the NAD datum of the coordinates, North American Datum of 1927 (NAD 27) or North American Datum of 1983 (NAD 83). If the user enters geographic or UTM coordinates with NAD 27 datum, AERSCREEN converts the coordinates to UTM coordinates with NAD 83 datum. If the user enters geographic coordinates with NAD 83, AERSCREEN converts the coordinates to UTM coordinates with NAD 83 datum and writes those to the AERSCREEN.INP file. If the terrain files read in AERMAP are NAD datum 27 and not datum 83, AERMAP will do the necessary conversions to NAD 27 for terrain processing in AERMAP. For more information about the NAD conversion process see the AERMAP User's Guide (U.S. EPA, 2004b).

If geographic to UTM conversion is performed, AERSCREEN will write the converted NAD 83 UTM coordinates to the new AERSCREEN.INP file with a message that the latitude and longitude coordinates were converted to UTM coordinates. AERSCREEN will also write a message to the input file if coordinates were switched from NAD 1927 to NAD 1983. When entering data using the AERSCREEN.INP file, coordinates must be in UTM coordinates. If the coordinates are indicated to be in NAD 1927, AERSCREEN will convert to NAD 1983 UTM coordinates and notify the user. Coordinates should only be in NAD 1927 if the user manually changed the coordinates and NAD in AERSCREEN.INP. The variables are as follows in the fourth line of the AERSCREEN input file (Figure 12). Terrain data is denoted by the term “\*\* TERRAIN DATA” in the input file. Prompts are also shown in Figure 12.

<b>AERSCREEN.INP inputs</b>									
** TERRAIN DATA	Terrain	UTM East	UTM North	Zone	Nada	Probe	PROFBASE	Use AERMAP	elev
**	N	406672.0	3698970.8	12	1	5.0	18.30		N
<b>Prompts inputs</b>									
<i>Include Terrain Heights? (y/N):</i>									
If user enters “y” or “Y”:									
<i>Enter Maximum Distance (km) to probe</i>									
<i>&lt;Enter&gt; for default (10 km):</i>									
If user enters “n” or “N”:									
<i>Enter Maximum Distance (km) to probe</i>									
<i>&lt;Enter&gt; for default (5 km):</i>									
<i>Enter stack elevation (m) or</i>									
<i>&lt;Enter&gt; for AERMAP derived elevation:</i>									
If the user enters “n” or “N” for terrain or source is a rectangular area source:									
<i>Enter source elevation (m) or</i>									
<i>&lt;Enter&gt; for default 0 m:</i>									
If user enters “y” or “Y” for terrain:									
<i>Enter coordinate type:</i>									
<i>LATLON for latitude &amp; longitude or</i>									
<i>UTM for UTM coordinates</i>									
If the user enters LATLON:									
<i>Enter Source Latitude (North positive) (xx.xxxx):</i>									
<i>Enter Source Longitude (West negative) (xxx.xxxx):</i>									
If the user enters UTM:									
<i>Enter Source UTM Easting (xxxxxx.x):</i>									
<i>Enter Source UTM Northing (xxxxxx.x):</i>									
The following prompt is shown for UTM coordinates:									
<i>Enter Source UTM Zone (xx):</i>									
-----									
<i>Option (1) - North American Datum of 1927</i>									
<i>Option (4) - North American Datum of 1983</i>									
-----									
<i>Enter Option for Applicable UTM Nada:</i>									

**Figure 12. AERSCREEN.INP and prompts inputs for terrain data.**

Input parameters in AERSCREEN.INP are:

- Terrain flag (Y=use terrain, N=do not use terrain)
- UTM X coordinate
- UTM Y coordinate
- UTM zone
- NAD datum of source location
- Probe distance in kilometers
- Source elevation (feet or meters)
- Override source elevation with AERMAP value (Y=yes, N=no)

If the user enters the source coordinates as latitude and longitude, the UTM zone will not be requested and is determined by AERSCREEN. If not processing terrain, the user can enter the actual elevation for the source or choose a default of zero. The user will not be prompted for AERMAP override of user-entered source elevation.

When entering data via the prompts, the prompt for terrain processing and overriding of source elevation with AERMAP will appear for all source types except rectangular area sources. The other prompts will appear for all sources.

The name(s) of the terrain input file(s) that AERMAP reads are input into AERSCREEN by a file called demlist.txt, which is to be located in the same directory as the AERSCREEN executable or local folder in which the user is working. The demlist.txt file is not created by AERSCREEN but the user must create the file prior to running AERSCREEN. The general format of the file and three examples are shown in Figure 13. The general format is that the first line contains either “NED” or “DEM” (the case can be lower or upper case) as the first three characters to denote the file type. The rest of the line is for informational purposes and not read by AERSCREEN. The second line is a delineator between the file type and the file list, usually a series of dashes. The third line is to specify the location of the grid files (conus.las, conus.los, etc.) that will be used for NAD conversion (from 27 to 83 or vice versa). The location is specified by starting the line with “NADGRIDS” followed by the pathname of the files. If the pathname contains spaces, the entire pathname should be enclosed in quotations. The pathname must also contain the “\” character at the end of the pathname. If the files are in the current working directory<sup>1</sup>, the rest of the line after “NADGRIDS” can be the full path of the current working directory, blank, or “.”, without the quotation marks. However, if the files are not in the working directory, AERSCREEN will abort. Regardless of the NAD datum of the coordinates, the field will be read by AERSCREEN and input into AERMAP. If the line beginning with NADGRIDS is not in the demlist.txt file, AERSCREEN will abort and notify the user.

Finally beginning with the fourth line, is the list of the files to be read into AERMAP, each file on a separate line. If the filename or pathname of the file contains spaces, the filename or

---

<sup>1</sup> Current working directory refers to the directory or folder that a DOS prompt is working in when using a DOS window or to the folder that the AERSCREEN executable is in when double clicking the AERSCREEN executable icon.

pathname must be enclosed in quotations. For NED files only, the units of the terrain data can be included. The units are:

- FEET for units of feet
- DECI-FEET or DECIFEET for units of decifeet
- DECA-FEET or DECAFEET for units of decafeet
- METERS for meters
- DECI-METERS or DECIMETERS for units of decimeters
- DECA-METERS or DECAMETERS for units of decameters

Note that the units are not case sensitive, so lower-case text is allowed. If no units are entered, i.e. blank after the filename, the units are understood to be meters and AERMAP will give a non-fatal warning to the user when AERMAP is executed. If units are included, when AERSCREEN creates the AERMAP.INP file, the TIFFDEBUG keyword will be added to the DATAFILE line in the AERMAP.INP file.

In Figure 13a, a single National Elevation Data (NED) file called `ned_file.tif` is to be read into AERMAP with units of meters by default. Also, the NADGRIDS files are located in a folder with spaces in the pathname so the filename is in quotations. Figure 13b gives an example of a NED file whose pathname contains spaces, so the name is enclosed in quotations. The units of the terrain are specified to be meters. Figure 13b also shows that the location of the grid files used for NAD conversion. Figure 13c shows a list of DEM files that will be processed in AERMAP with NAD grid files located in the current working directory. Note that units cannot be included with DEM files.

<p>NED : Must be either DEM or NED</p> <p>-----</p> <p>NADGRIDS "c:\grid files\ ned_file.tif</p>	<p>a</p>
<p>NED : Must be either DEM or NED</p> <p>-----</p> <p>NADGRIDS c:\aermap\grids "test dir\ned_file.tif" meters</p>	<p>b</p>
<p>DEM : Must be either DEM or NED</p> <p>-----</p> <p>NADGRIDS test01.dem test02.dem test03.dem</p>	<p>c</p>

**Figure 13. Format of demlist.txt for a) NADGRIDS file with spaces in directory path and a single NED file with units defaulted to meters, b) a NED file with spaces in the pathname and user-specified units of meters along with the location of the NAD grid files, and c) list of DEM files with NAD grid files in current working directory.**

If terrain is to be included, users should consult the AERMOD Implementation Guide, specifically sections 4.3, 4.4, and 4.5 (U.S. EPA, 2009) as well as the AERMAP User’s Guide and addendum (U.S. EPA, 2004b).

## 2.5 Other inputs

Other inputs or options used by AERSCREEN are:

- units of inputs (metric or English),
- urban/rural classification
- urban population if urban
- fence line distance (feet or meters)
- use of flagpole receptors
- flagpole receptor height (feet or meters)

These variables in the fifth line of the AERSCREEN input file are shown in Figure 14 and are denoted by the term “\*\* UNITS/POPULATION.” While entering data via prompts, the English or metrics unit prompt is before any other prompts, while the urban/rural and fence line prompts occur during the source input processing. The flagpole receptor prompts occur in the terrain inputs processing.

<b>AERSCREEN.INP inputs</b>						
** UNITS/POPULATION	Units	R/U	Population	Amb. dist.	Flagpole	Flagpole height
**	M	R	0.	50.000	N	0.00
<b>Prompts inputs</b>						
<i>English or Metric Units? (E or M):</i>						
<i>Rural or Urban? (R or U):</i>						
<i>Enter Population of Urban Area:</i>						
<i>Enter Minimum Distance (meters) to Ambient Air – &lt;Enter&gt; for default (1 m):</i>						
<i>Use Flagpole receptors? (y or n):</i>						
<i>If user enters “y” or “Y”:</i>						
<i>Enter Flagpole receptor height (meters)</i>						

**Figure 14. AERSCREEN.INP and prompts inputs for other inputs.**

Inputs in AERSCREEN.INP are:

- Units of data (m=metric, E=English)
- Urban/rural flag (U=urban, R=Rural)
- Population for urban source
- Fence line distance
- Use Flagpole receptors
- Flagpole receptor height (ignored if flagpole receptors = no)

If the units flag in AERSCREEN.INP is set to “E” AERSCREEN will stop processing and notify the user that the flag is not set to “M.” for metric. The user can enter the data in English units when entering data from the prompts but AERSCREEN will change the units flag to metric and convert the variables from English to metric units during processing. When AERSCREEN creates the AERSCREEN.INP file from prompt-entered data, there will be a comment in the new input file that units were converted from English to metric.

For fence line distances, when entering data with English units, the default value listed will be 3.3 feet, or 1 meter. For volume sources, the fence line distance must be greater than 2.15 times the initial lateral dimension,  $2.15\sigma_y$  plus one meter. In AERMOD, receptors with source-receptor distances less than  $2.15\sigma_y$  plus one meter are not included in concentration calculations. When entering data via the prompts, the default value that is listed will be  $2.15\sigma_y$  plus 1 m (or 3.3 feet). If the user chooses the default value by hitting <Enter>, that will be the fence line distance. If the user enters a different value from the listed default value, it must be greater than

or equal to the default value listed. Otherwise, the user will receive a message that it is not and must enter another value. When obtaining the fence line distance from AERSCREEN.INP, AERSCREEN will compare that value against  $2.15\sigma_y$  plus 1 m and if the entered value is less than  $2.15\sigma_y$  plus 1 meter, it is reset to  $2.15\sigma_y$  plus 1 m. If the user does not wish to use the reset value, it change be changed at the validation page but must be greater than  $2.15\sigma_y$  plus 1m.

## **2.6 Error checking**

When entering data via the AERSCREEN.INP file or via prompts, AERSCREEN will check for invalid responses for flags (use downwash, terrain, urban/rural, etc.) or values for numeric values (stack height, building height, etc.). When processing input from the AERSCREEN.INP file, any flags or parameters found to be invalid or outside a realistic data range (minimum ambient temperature is greater than maximum ambient temperature), AERSCREEN lists error messages for the parameters to the AERSCREEN.LOG file and stops AERSCREEN processing to allow the user to correct the values in the AERSCREEN.INP file. Examples would be a character other than “Y”, “y”, “N”, or “n” for the building downwash flag or a negative building height for downwash. If processing input data from the prompts, AERSCREEN will re-prompt the user for a valid response. For the two examples listed above, AERSCREEN would re-prompt the user for responses. Tables A-1 through A-4 in Appendix A list the input parameters, reasons for invalid values, and actions taken by AERSCREEN.

AERSCREEN also checks for the presence of demlist.txt in the current working directory, if terrain is processed and a BPIPPRM input file if the user has specified an input file. If these files are not found, AERSCREEN issues a message and aborts.

In addition to checking for negative building dimensions, AERSCREEN also checks that the maximum horizontal building dimension is greater than or equal to the minimum horizontal building dimension. If the maximum horizontal dimension is less than the minimum horizontal dimension, AERSCREEN will issue an error when reading from the AERSCREEN.INP file or re-prompt the user for both values when processing from the prompts.

AERSCREEN also checks to makes the minimum ambient temperature is less than the maximum ambient temperature. As with the building dimensions, an error is generated if the maximum temperature is less than the minimum temperature when reading from AERSCREEN.INP, or the user is re-prompted when processing from the prompts.

AERSCREEN also checks for the presence of the AERMOD and MAKEMET executables in the current working folder. If one of those executables is not present, AERSCREEN issues an error and aborts. If processing downwash, AERSCREEN will check for the presence of the BPIPPRM executable and the AERMAP executable if processing terrain. If those are not present, AERSCREEN will issue an error and abort.

### 3. AERSCREEN Program Execution

The AERSCREEN program can be run from the command-prompt or by double-clicking on the AERSCREEN\_BETA1.EXE from Windows Explorer. The user should make sure that demlist.txt, the AERMOD, MAKEMET, and if necessary the AERMAP and BPIPFRM executables are in the current working directory. General AERSCREEN processing is shown in Figure 15. If a restart file generated from a previous run (called 'AERSCREEN.inp') is present in the folder, then the user will be asked to continue with the restart file or enter data via the prompts (Figure 16). If there is no restart file, the prompts will begin automatically.

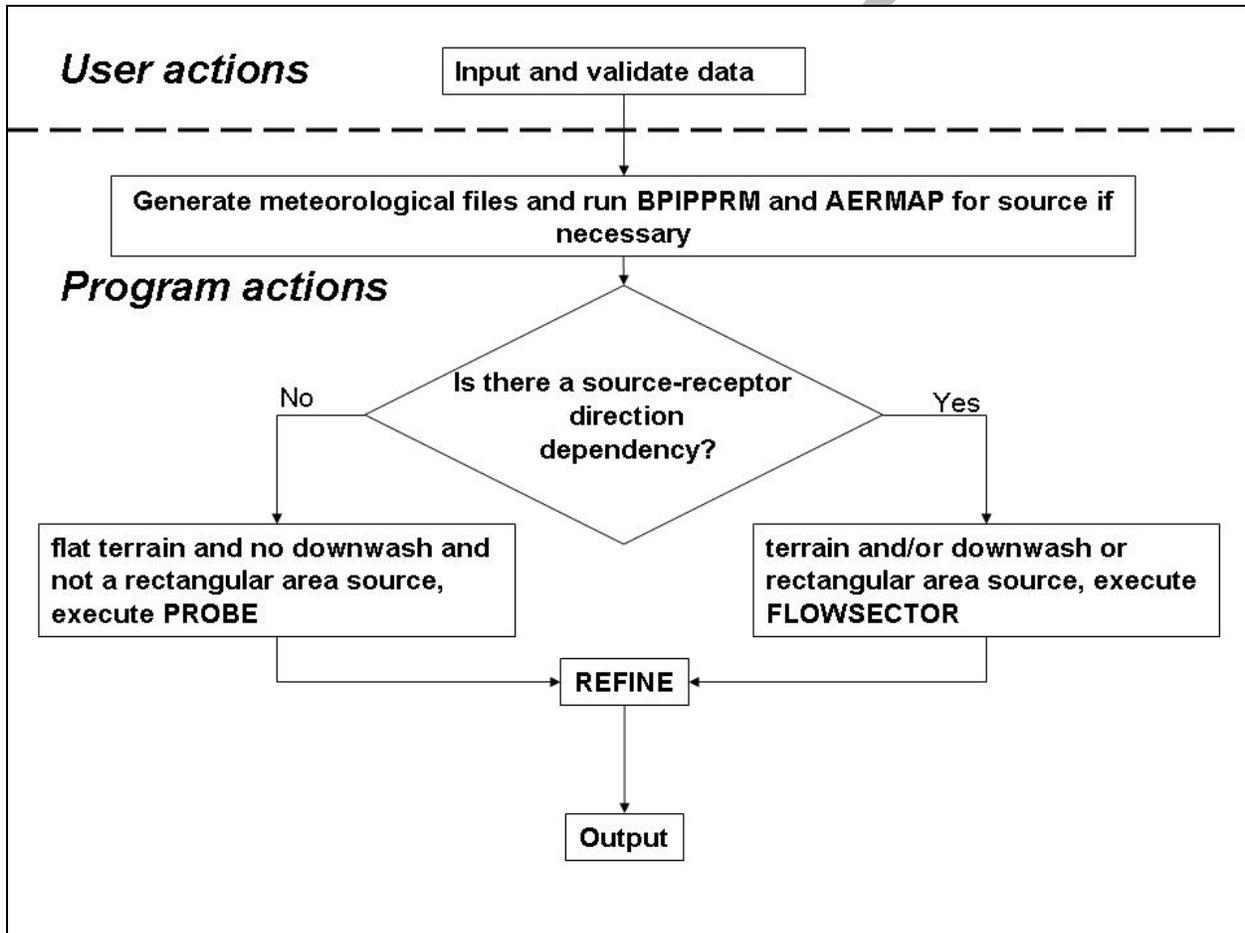
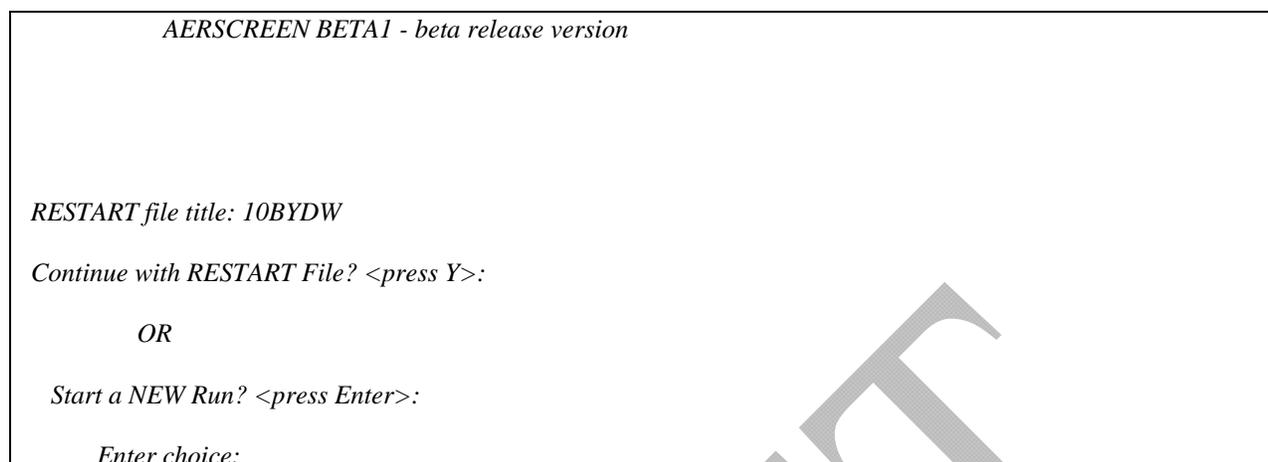


Figure 15. AERSCREEN processing and stages.



**Figure 16. AERSCREEN start screen.**

If the user chooses the restart file, AERSCREEN goes directly into the user validation page. The user should carefully review the data to ensure accurate inputs. If processing terrain, particular attention should be paid to the coordinates to ensure that any NAD conversions were successful. Also on the validation page, the user will have the option of rerunning the same inputs or selectively modifying specific components, such as building or terrain information (Figure 17). For example, if changes are to be made to building parameters, the user chooses option 2 and a list of further options will appear (Figure 19). The user can change individual parameters without having to re-enter all the parameters. The option to re-enter all parameters is a choice as well. Changes to individual parameters are available for source, meteorological, and terrain parameters as well. Some options cannot be changed without changing another parameter first. These include changing urban population for a rural source or surface characteristics (i.e. user defined values when AERMET tables are chosen). Figure 18 shows the list of choices for various source types, Figure 19 shows the choices for building parameters, Figure 20 lists the choices for terrain processing, and Figure 21 lists the choices for meteorological processing. For each submenu, once the desired changes are made, the user can hit <Enter> to return to the validation page. Some changes will automatically return the user to the validation page, such as choosing option 1 in Figure 19a for building downwash or option 1 in Figure 20a.

Note, that if the user chooses to change source data, the source type cannot be changed; only parameters for the source type from the AERSCREEN.INP file. For example, the user cannot change the source from point to rectangular area. For building data, if the user is running AERSCREEN for an area source, rectangular or circular, or a volume source (which do not use building downwash) and chooses option 2 from the validation page, AERSCREEN will give the message that building parameters cannot be changed due to source type and return to the validation page. The same is true for changing terrain data when running a rectangular area source.

The user may also change parameters in the AERSCREEN.INP file before running AERSCREEN, instead of modifying the data using the prompts.

**Beta Release DRAFT**

```
AERSCREEN BETA1 - beta release version

----- DATA ENTRY VALIDATION -----
      METRIC      ENGLISH
** STACKDATA ** -----
Emission Rate:   1.0000 g/s      7.937 lb/hr
Stack Height:    10.00 meters    32.81 feet
Stack Diameter:  1.000 meters    39.37 inches
Stack Temperature: 450.0 K      350.3 Deg F
Exit Velocity:   1.000 m/s      3.28 ft/s
Stack Flow Rate: 1664 ACFM
Model Mode:      RURAL
Dist to Ambient Air: 30.0 meters  98. feet

** BUILDING DATA **
Building Height: 7.0 meters      23.0 feet
Max Building Dimension: 30.0 meters  98.4 feet
Min Building Dimension: 10.0 meters  32.8 feet
Building Orientation: 90.0 degrees
Stack Direction: 0.0 degrees
Stack Distance:  8.0 meters      26.2 feet

** TERRAIN DATA **
Input coordinates are UTM
Source Longitude: -114.17867 deg  718346. Easting
Source Latitude:  46.02880 deg   5101118. Northing
UTM Zone:         11      Reference Datum: 4 (NAD 83)
Source Base Elevation: 1185.0 meters  3887.8 feet

Probe distance: 2000. meters      6562. feet
No flagpole receptors
** METEOROLOGY DATA **
Min/Max Temperature: 250.0 / 310.0 K  -9.7 / 98.3 Deg F

Minimum Wind Speed: 0.5 m/s
Anemometer Height: 10.000 meters

Dominant Surface Profile: Cultivated Land
Dominant Climate Type: Average Moisture

*** AERSCREEN Run is Ready to Begin - Choose Option to Proceed ***

      1 - Change Source Data;
      2 - Change Building Data;
      3 - Change Terrain Data;
      4 - Change Meteorology Data;
      5 - Stop AERSCREEN;
      - or -
      Hit <Enter> to Start Run
```

**Figure 17. AERSCREEN validation page.**

<p>-----                  Enter number of parameter to change or                  &lt;Enter&gt; to return to validation page      <b>a</b>                  -----                  Point Source                  1) Emission rate                  2) Stack height                  3) Stack diameter                  4) Stack temperature                  5) Exit velocity                  6) Urban/Rural                  7) Urban population                  8) Distance to ambient air                  9) Update all parameters                  -----</p>	<p>-----                  Enter number of parameter to change or                  &lt;Enter&gt; to return to validation page      <b>b</b>                  -----                  Volume Source                  1) Emission rate                  2) Center of volume height                  3) Initial lateral dimension                  4) Initial vertical dimension                  5) Urban/Rural                  6) Urban population                  7) Distance to ambient air                  8) Update all parameters                  -----</p>	<p>-----                  Enter number of parameter to change or                  &lt;Enter&gt; to return to validation page      <b>c</b>                  -----                  Rectangular area source                  1) Emission rate                  2) Release height                  3) Long side dimension                  4) Short side dimension                  5) Initial vertical dispersion parameter                  6) Urban/Rural                  7) Urban population                  8) Distance to ambient air                  9) Update all parameters                  -----</p>
<p>-----                  Enter number of parameter to change or                  &lt;Enter&gt; to return to validation page      <b>d</b>                  -----                  Circular area source                  1) Emission rate                  2) Release height                  3) Radius                  4) Initial vertical dispersion parameter                  5) Urban/Rural                  6) Urban population                  7) Distance to ambient air                  8) Update all parameters                  -----</p>	<p>-----                  Enter number of parameter to change or                  &lt;Enter&gt; to return to validation page      <b>e</b>                  -----                  Flare Source                  1) Emission rate                  2) Stack height                  3) Total heat release rate                  4) Heat loss fraction                  5) Urban/Rural                  6) Urban population                  7) Distance to ambient air                  8) Update all parameters                  -----</p>	

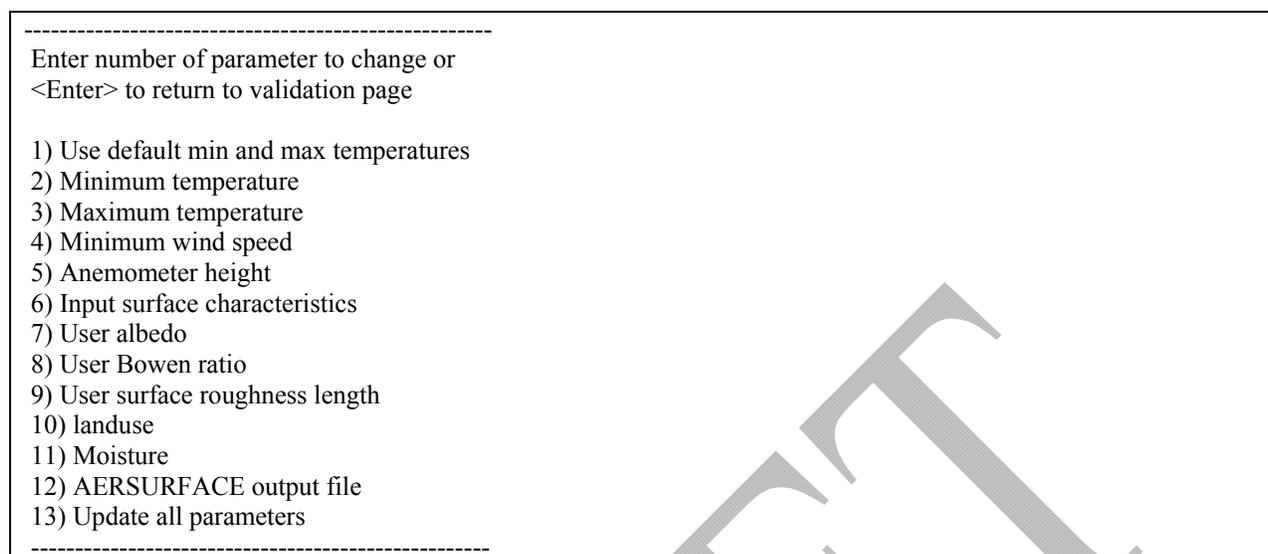
Figure 18. Submenus for changing source parameters for a) point, capped or horizontal stack, b) volume, c) rectangular area, d) circular area, and e) flare sources.

<p>-----                  Enter number of parameter to change or                  &lt;Enter&gt; to return to validation page      <b>a</b>                  -----                  Pre-existing BPIP input filename must be                  re-entered if it is to be used (Option 2)                  1) Do not include building downwash                  2) BIP input filename                  3) Building height                  4) Maximum horizontal dimension                  5) Minimum horizontal dimension                  6) Maximum building dimension angle to North                  7) Angle of stack from building center                  8) Distance between stack and building center                  9) Update all parameters                  -----</p>	<p>-----                  Enter number of parameter to change or                  &lt;Enter&gt; to return to validation page      <b>b</b>                  -----                  Pre-existing BPIP input filename must be                  re-entered if it is to be used (Option 2)                  1) Include building downwash                  2) BIP input filename                  3) Building height                  4) Maximum horizontal dimension                  5) Minimum horizontal dimension                  6) Maximum building dimension angle to North                  7) Angle of stack from building center                  8) Distance between stack and building center                  9) Include building downwash and update all parameters                  -----</p>
--	---

Figure 19. Building downwash submenus for a) building downwash included and b) building downwash not included.

----- Enter number of parameter to change or <Enter> to return to validation page  1) Do not include terrain heights 2) Probe distance 3) Use flagpole receptors 4) Flagpole receptor height 5) Source elevation input (user entered or AERMAP) 6) Input coordinate type and coordinates (LATLON or UTM), UTM zone, and NAD 7) Update all parameters -----	<b>a</b>
----- Enter number of parameter to change or <Enter> to return to validation page  1) Include terrain heights 2) Probe distance 3) Use flagpole receptors 4) Flagpole receptor height 5) Source elevation input (user entered or AERMAP) 6) Input coordinate type and coordinates (LATLON or UTM), UTM zone, and NAD 7) Include terrain heights and update all parameters -----	<b>b</b>
----- Enter number of parameter to change or <Enter> to return to validation page 1) Probe distance 2) Use flagpole receptors 3) Flagpole receptor height 4) Source elevation input (user entered or AERMAP) 5) Update all parameters -----	<b>c</b>

**Figure 20. Terrain submenus for a) terrain heights included, b) terrain heights not included and c) rectangular area sources.**



**Figure 21. Meteorological data submenu.**

If the user chooses to run from the restart file, while reading the file, AERSCREEN may automatically change some of the options in the file, depending on other options. If the source being modeled is a rectangular area source and the terrain flag is set to “y” or “Y” then the terrain flag is reset to “N” and the probe distance is unchanged. For rectangular area sources, circular area sources, or volume sources, if the BPIP flag is set to “Y” or “y” in the input file then the BPIP flag is set to “N” and no downwash is calculated.

If the user enters data using prompts instead of the AERSCREEN.INP file, the validation page will appear after all prompts have been processed for the source, building, terrain, and meteorological data.

After reading the input file or prompt inputs, and prompting the user for any changes, AERSCREEN processes the surface characteristics and runs MAKEMET to create the AERMOD meteorological input files (.sfc, and .pfl files). MAKEMET is run for each temporal period /spatial sector combination of surface characteristics. Depending on the temporal resolution and number of spatial sectors of the surface characteristics, one surface and one profile file (annual, 1 sector) to a maximum of 144 (monthly, 12 sector) surface files and 144 profile files are created, one for each temporal period/spatial sector combination (Figure 22). In the meteorological files naming convention, the first set of 2-digit numbers refers to the temporal period of the surface characteristics, which ranges from 1 to 12. If processing annual surface characteristics, the number would be “01” and if processing seasonal or monthly surface characteristics, the number would be range from “01” to “04” for seasonal output and “01” to “12” for monthly output. The second set of numbers in the filenames is the number of spatial sectors for surface roughness. This can range from “01” to “12” for one sector to 12 sectors. In Figure 22, aerscreen\_01\_01.sfc and aerscreen\_01\_01.pfl use surface characteristics for January, sector 1; aerscreen\_01\_02.sfc and aerscreen\_01\_02.pfl use surface characteristics for January, sector 2 and so on with aerscreen\_12\_12.sfc and aerscreen\_12\_12.pfl using surface characteristics for December, and sector 12.

```
Creating met files aerscreen_01_01.sfc & aerscreen_01_01.pfl
Creating met files aerscreen_01_02.sfc & aerscreen_01_02.pfl
Creating met files aerscreen_01_03.sfc & aerscreen_01_03.pfl
Creating met files aerscreen_01_04.sfc & aerscreen_01_04.pfl
Creating met files aerscreen_01_05.sfc & aerscreen_01_05.pfl
.
.
.
Creating met files aerscreen 12 12.sfc & aerscreen 12 12.pfl
```

**Figure 22. Meteorological file creation for monthly 12 sector AERSURFACE output.**

The input parameters to MAKEMET, which are normally entered using prompts, are written to a text file called prompts.inp by AERSCREEN and then “piped” to the MAKEMET call by AERSCREEN with the call system command, “makemet < prompts.inp.” Using the MAKEMET prompts shown in Figure 1 as a guide, AERSCREEN assigns the names for the surface and upper air meteorological files requested in prompts 1 and 2 shown in Figure 1 based on the file naming convention described above. The minimum wind speed (prompt 3) and anemometer height (prompt 4) are assigned the values entered by the user. The number of wind directions (prompt 5) is automatically set to 1 by AERSCREEN and the wind direction (prompt 6a) is set to 270 degrees. Prompts 6b and 6c are ignored. The minimum and maximum temperatures (prompt 7) are assigned the values entered by the user. The albedo (prompt 8), Bowen ratio (prompt 9) and surface roughness length (prompt 10) are assigned the values for the particular temporal/spatial combination being processed. The final prompt, “DO YOU WANT TO GENERATE ANOTHER MET SET THAT WILL BE APPENDED TO CURRENT FILE? [TYPE EITHER "Y" OR "y" FOR YES; OR HIT "ENTER" TO EXIT]” is set not to generate another file. An example for monthly, 12 sector AERSURFACE output is shown in Table 1.

**Table 1. MAKEMET prompts and example values for the first month and surface roughness sector and last month and surface roughness sector for monthly 12 sector AERSURFACE output.**

<b>MAKEMET prompt</b>	<b>Value (month 1, sector 1)</b>	<b>Value (month 12, sector 12)</b>
ENTER SFC MET FILE NAME	aerscreen_01_01.sfc	aerscreen_12_12.sfc
ENTER PFL MET FILE NAME	aerscreen_01_01.pfl	aerscreen_12_12.pfl
ENTER MIN. WS (M/S)	User input minimum wind speed	User input minimum wind speed
ENTER ANEM HT (M)	User input anemometer height	User input anemometer height
ENTER NUMBER OF WIND DIRECTIONS	1	1
ENTER WIND DIRECTION	270	270
ENTER MIN AND MAX AMBIENT TEMPS IN KELVIN	User entered temperatures	User entered temperatures
ENTER ALBEDO	Albedo for month 1, sector 1	Albedo for month 12, sector 12
ENTER BOWEN RATIO	Bowen ratio for month 1, sector 1	Bowen ratio for month 12, sector 12
ENTER SURFACE ROUGHNESS LENGTH IN METERS	Surface roughness for month 1, sector 1	Surface roughness for month 12, sector 12
DO YOU WANT TO GENERATE ANOTHER MET SET THAT WILL BE APPENDED TO CURRENT FILE? [TYPE EITHER "Y" OR "y" FOR YES; OR HIT "ENTER" EXIT]	N	N

If downwash is to be considered, BPIPPRIME inputs are calculated and written to a BIPPRIME input file or the user entered input file is used and BIPPRM is executed to create the projected building dimensions for input into AERMOD. If a user-entered file is used and the processing flag (line 2) of the BIPPRIME input file is not a “P” or “p” then BPIPPRIME will abort and notify the user.

If terrain is being used, AERSCREEN calls AERMAP to get the source location’s elevation. The source elevation, user-entered or AERMAP calculated, can be used as the source elevation in the SO pathway of the AERMOD runstream file, AERMOD.INP, and as the station elevation, keyword PROFBASE in the ME pathway of the AERMOD input file. If the user has chosen to replace the input source elevation, either from the restart file or via prompts, AERSCREEN will use the AERMAP elevation as the source location’s elevation. If the user chose to keep the input elevation, AERSCREEN will calculate a percent difference between the user-entered elevation and the AERMAP calculated elevation and write the difference to the AERSCREEN log file.

There are three main routines in AERSCREEN: PROBE, FLOWSECTOR and REFINE as shown in Figure 15. PROBE is executed when there is no source-receptor direction dependency (no terrain, no building downwash, and the source is not a rectangular area source). FLOWSECTOR is executed when there is a source-receptor direction dependency (terrain, building downwash, or source is a rectangular area source). REFINE is executed after PROBE or FLOWSECTOR. Details about each section and the final output of AERSCREEN are described in each of the following sections.

### 3.1 PROBE

For PROBE, the probe distance is set to the user-specified probe distance. Depending on the probe distance, there may be two receptor spacing values. For receptors placed out to 5 km, the receptor spacing is 25 m. For receptors placed outside 5 km, the receptor spacing is a multiple of 25 m or 50 m, depending on the final probe distance. Receptors located at distances less than the fence line distance are not included in the set of receptors. Receptor distances are relative to  $x=0$  and  $y=0$ . For point, capped stacks, horizontal stacks, and flare sources,  $x=0$  and  $y=0$  represent the stack or flare location. For volume and circular area sources,  $x=0$  and  $y=0$  represent the center of the source.

PROBE executes AERMOD for each combination of temporal periods and spatial sectors. For example, if user defined surface characteristics are used (annual, 1 spatial sector), AERMOD is executed once (Figure 23a). If monthly, 12 spatial sector AERSURFACE output is used, then AERMOD is executed 144 times, 12 months x 12 sectors, (Figure 23b).

Running probe for Annual	sector 1	<b>a</b>
Running probe for January	sector 1	<b>b</b>
Running probe for January	sector 2	
Running probe for January	sector 3	
Running probe for January	sector 4	
Running probe for January	sector 5	
Running probe for January	sector 6	
Running probe for January	sector 7	
Running probe for January	sector 8	
Running probe for January	sector 9	
Running probe for January	sector 10	
Running probe for January	sector 11	
Running probe for January	sector 12	
.	.	
Running probe for December	sector 1	
Running probe for December	sector 2	
Running probe for December	sector 3	
Running probe for December	sector 4	
Running probe for December	sector 5	
Running probe for December	sector 6	
Running probe for December	sector 7	
Running probe for December	sector 8	
Running probe for December	sector 9	
Running probe for December	sector 10	
Running probe for December	sector 11	
Running probe for December	sector 12	

**Figure 23. Sequence of AERMOD runs for a) annual, one sector surface characteristics, and b) monthly, 12 sector surface characteristics.**

AERSCREEN reads the output from AERMOD for each run and the highest concentration and its distance from the source are stored in arrays that will be used to find the highest overall

concentration in REFINE. AERSCREEN also retains the high first high (H1H) 1-hour concentration for each receptor. These concentrations are later used in determining the maximum concentration by downwind distance.

### **3.2 FLOWSECTOR**

FLOWSECTOR is executed when there is a source-receptor direction dependency (terrain and/or building downwash, or rectangular area source). As for PROBE, the probe distance is set by the user and the spacing determined as explained in Section 3.1. As with PROBE, receptors inside the fence line distance are not included.

If terrain is to be used, AERSCREEN checks for the presence of output from a previous AERMAP run. If there is output available, AERSCREEN checks the following against the same parameters in the current AERSCREEN run:

- source location
- probe distance
- fence line distance
- receptor spacings
- number of receptors
- NAD datum
- UTM zone
- Type (DEM or NED files), number and names of terrain input files
- If the above conditions are met, AERSCREEN then checks the receptor coordinates in the previous AERMAP run to ensure the distances and directions match the receptor spacings of the current run and that all 36 radial directions are included. This step is done in case the file was changed or corrupted without the user's knowledge.

If any of those differ, AERMAP will be executed to create new receptor elevations. If all parameters match, the user is prompted to decide to use the elevations from the previous output, or to run AERMAP to create new elevations. If the older AERMAP output is for a source type different than the one being processed in the current run, the user may want to consider re-running AERMAP. AERSCREEN sets the ANCHORXY,  $x=0$  and  $y=0$  to the source location and receptor locations are relative to this location. For volume and circular area sources, this represents the center of the source. For point and flare sources, this is the stack location.

After running AERMAP for the receptor elevations, AERSCREEN checks the AERMAP.OUT file for any warnings or errors. If any are found, they are written to the AERSCREEN log file. If any errors are found, AERSCREEN is stopped.

#### *3.2.1 Rectangular area sources*

For rectangular area sources, the angle of the diagonal is calculated from the center to the corner of the rectangle. Next, radials are calculated every five degrees, beginning with 0 up to the nearest 5 degrees past the diagonal. For example, if the diagonal of the source was found to be 26 degrees, radials are calculated for 0, 5, 10, 15, 20, 25, and 30 degrees, as shown in Figure 24.

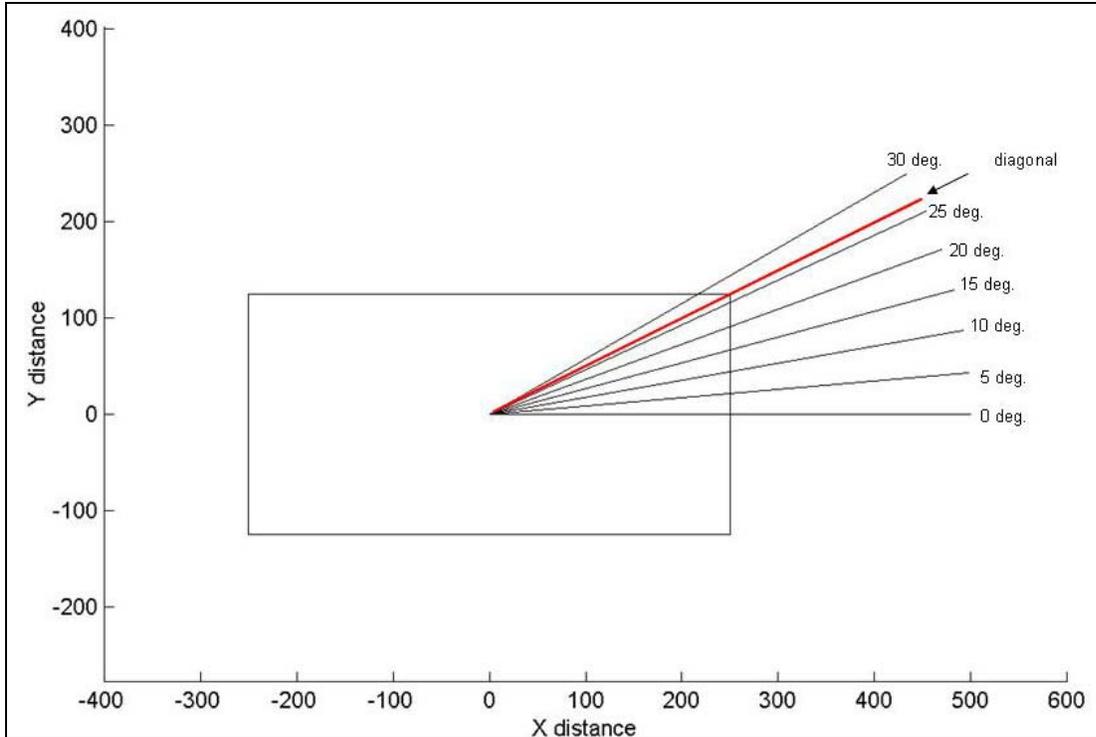


Figure 24. Receptor radials for rectangular area sources.

For each one of these radials, receptors are placed out to the probe distance at the calculated spacing. For each radial, the WDRotate keyword is used in the ME pathway of the AERMOD runstream input file with the value set to the angle of the radial (0, 5, 10, etc.). See Figure 25 for examples.

<pre>ME STARTING SURFFILE AERSCREEN.SFC FREE PROFFILE AERSCREEN.PFL FREE SURFDATA 11111 2010 SCREEN UAIRDATA 22222 2010 SCREEN PROFBASE 18.3 METERS ME WDRotate 0.0 ME FINISHED</pre>	<p><b>a</b></p> <pre>ME STARTING SURFFILE AERSCREEN.SFC FREE PROFFILE AERSCREEN.PFL FREE SURFDATA 11111 2010 SCREEN UAIRDATA 22222 2010 SCREEN PROFBASE 18.3 METERS ME WDRotate 5.0 ME FINISHED</pre> <p><b>b</b></p>
<pre>ME STARTING SURFFILE AERSCREEN.SFC FREE PROFFILE AERSCREEN.PFL FREE SURFDATA 11111 2010 SCREEN UAIRDATA 22222 2010 SCREEN PROFBASE 18.3 METERS ME WDRotate 10.0 ME FINISHED</pre>	<p><b>c</b></p> <pre>ME STARTING SURFFILE AERSCREEN.SFC FREE PROFFILE AERSCREEN.PFL FREE SURFDATA 11111 2010 SCREEN UAIRDATA 22222 2010 SCREEN PROFBASE 18.3 METERS ME WDRotate 15.0 ME FINISHED</pre> <p><b>d</b></p>

Figure 25. ME pathway in the AERMOD runstream with WDRotate keyword and values for angles of a) 0 , b) 5, c) 10, and d) 15 degrees.

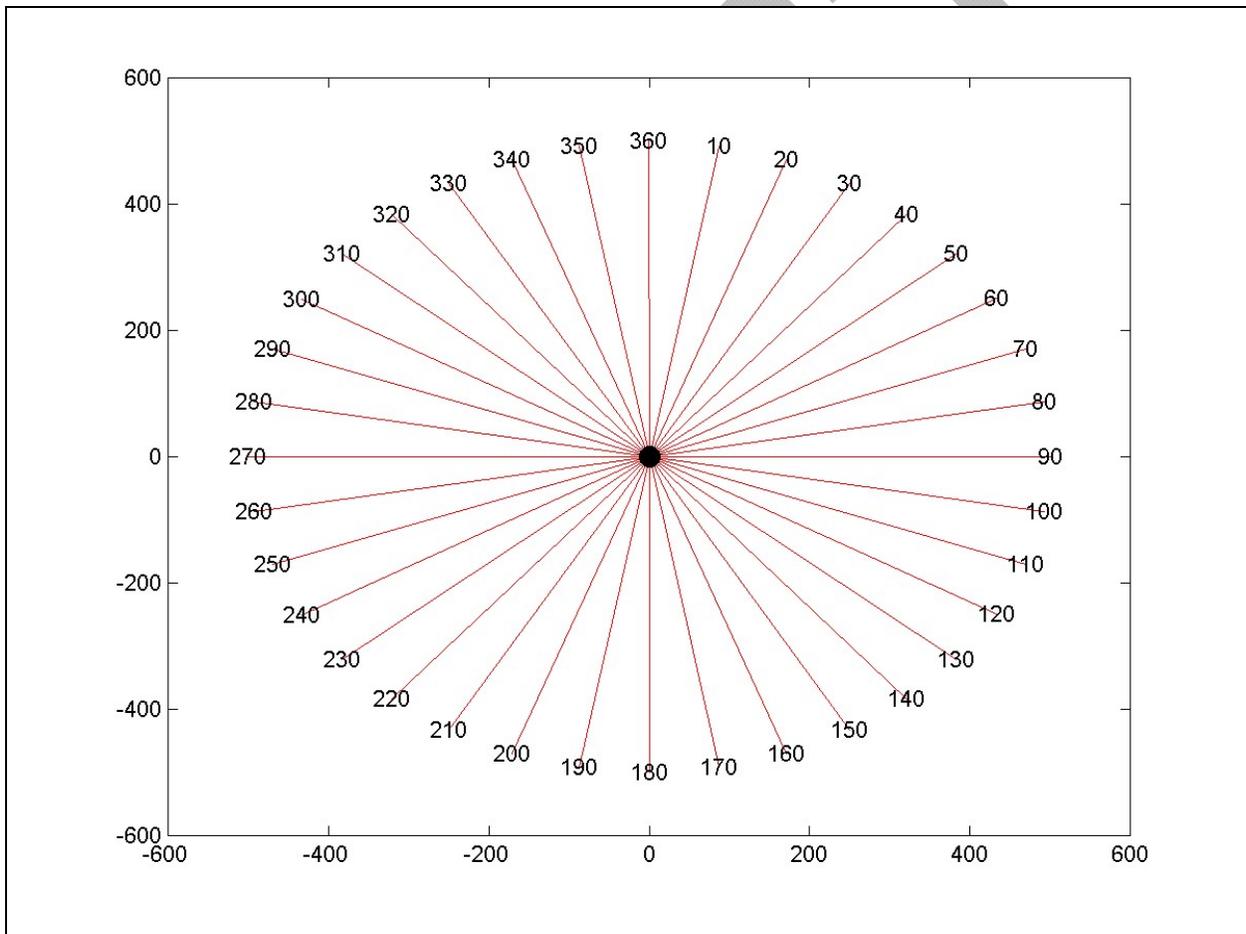
The WDROTATE keyword rotates the wind to be along the radial being processed in AERMOD because the wind direction in the meteorological files is 270 degrees. Receptor x and y coordinates are also calculated based on the angle of the radial, i.e. for the 10 degree radial at 50 m  $x=49.24$  m,  $y=8.68$  m. AERMOD is run for each of the radials for each surface characteristic temporal/spatial sector combination. In the example in Figure 24, for annual surface characteristics for the whole 360 degree sector, AERMOD is executed seven times, once for each radial. For seasonal surface characteristics for 2 spatial sectors, AERMOD is executed 56 times, once for each radial for each season and sector. For monthly surface characteristics with the maximum 12 sectors for surface roughness, AERMOD is executed 1,008 times, once for each sector, month, and surface roughness sector. Figure 26 shows sample AERMOD run sequences for seasonal, 12 sector surface characteristics for a rectangular area source with six radials. First, winter surface characteristics for sector 1 are used for each of the six radials. Next, winter surface characteristics for sector 2 are used for each of the six radials. This process is followed for each season and surface characteristic sector finishing with autumn sector 12 surface characteristics. For each temporal/sector combination, AERSCREEN then determines the worst case concentration and associated radial to be used later in the REFINE stage.

```
Processing Winter
Processing surface roughness sector 1
Processing wind flow sector 1
Processing wind flow sector 2
Processing wind flow sector 3
Processing wind flow sector 4
Processing wind flow sector 5
Processing wind flow sector 6
Processing surface roughness sector 2
Processing wind flow sector 1
Processing wind flow sector 2
Processing wind flow sector 3
Processing wind flow sector 4
Processing wind flow sector 5
Processing wind flow sector 6
.
.
Processing surface roughness sector 12
Processing wind flow sector 1
Processing wind flow sector 2
Processing wind flow sector 3
Processing wind flow sector 4
Processing wind flow sector 5
Processing wind flow sector 6
.
.
Processing Autumn
Processing surface roughness sector 12
Processing wind flow sector 1
Processing wind flow sector 2
Processing wind flow sector 3
Processing wind flow sector 4
Processing wind flow sector 5
Processing wind flow sector 6
```

**Figure 26. AERMOD run sequences for rectangular area source for seasonal 12 sector surface characteristics.**

*3.2.2 Non-rectangular area sources*

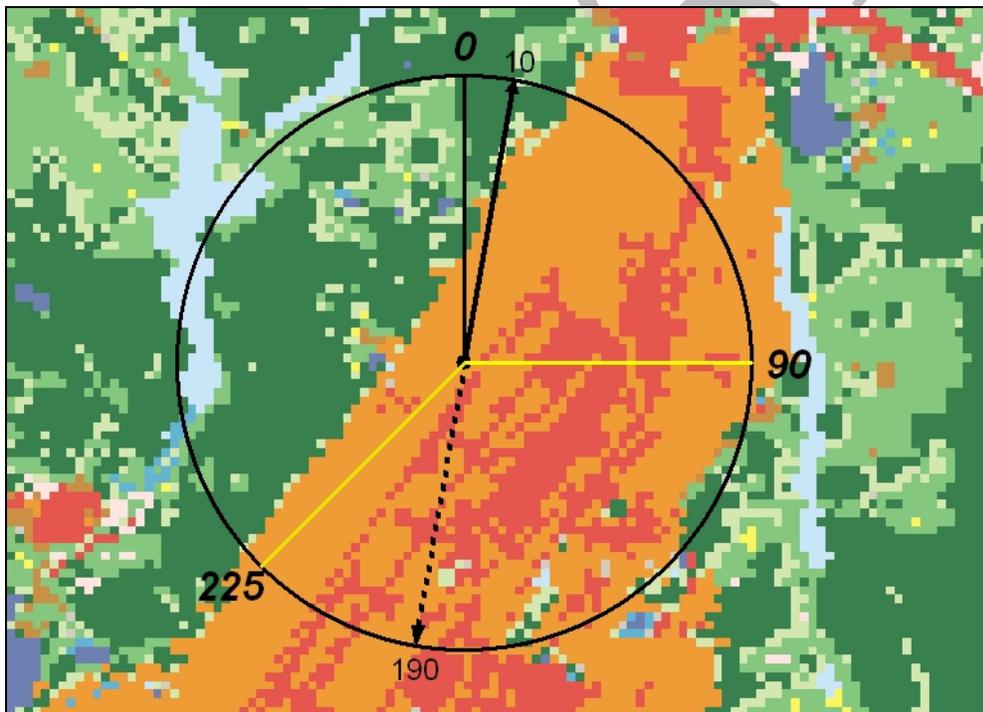
For non-rectangular area sources, FLOWSECTOR arranges receptors along 36 radials from the source, every 10 degrees, shown below in Figure 27. AERMOD is executed for each temporal period (annual, seasonal, or monthly) for the surface characteristics (Figure 28). However, it is not executed for each surface roughness sector. Instead, for each radial, AERSCREEN determines the upwind surface roughness sector of the radial being processed. That is, AERSCREEN determines the sector that contains the direction 180 degrees from the radial being processed. That is done because the radial is considered in the direction of the flow while surface characteristics are for the sector from which the wind is blowing, i.e. upwind. Figure 29 shows which sector is used for the 10 degree flow vector for three sectors from AERSURFACE output. In this case, the upwind direction of 10 degrees, 190 degrees, is contained in the 90 to 225 surface roughness sector.



**Figure 27. Receptor placement for point (including capped and horizontal stacks), flare, volume, or circular area sources in FLOWSECTOR.**

```
Processing Winter
Processing wind flow sector 10
Processing wind flow sector 20
Processing wind flow sector 30
Processing wind flow sector 40
.
.
Processing wind flow sector 360
.
.
Processing Spring
Processing wind flow sector 10
.
.
Processing Autumn
Processing wind flow sector 10
Processing wind flow sector 20
Processing wind flow sector 30
Processing wind flow sector 40
.
.
Processing wind flow sector 360
```

**Figure 28. AERMOD sequence for seasonal 12 sector surface characteristics when processing terrain and/or building downwash.**



**Figure 29. Flow vector (solid arrow) of 10 degrees and associated upwind surface roughness sector for three surface roughness sectors (0 to 90, 90 to 225, 225 to 0). The dashed arrow represents a direction of 190 degrees, the upwind vector of the 10 degree flow.**

If building downwash is considered, projected building dimensions calculated by BPIPPRIME for the flow direction being modeled are included in the AERMOD run. If terrain is processed, AERSCREEN will find the appropriate receptors (based on distance and direction) from the AERMAP output and include the appropriate terrain data in the AERMOD input file. AERSCREEN also checks to ensure the receptor coordinates match the specified distance and direction. If they do not, AERSCREEN will issue an error and abort. Since AERSCREEN generates the receptor elevations via AERMAP, this should not happen, unless the AERMAP output file became corrupted during processing. When extracting the appropriate receptors, if any receptors have a missing elevation, i.e. -9999.0, AERSCREEN will skip those receptors and they will not be included in the AERMOD run for that particular direction. AERSCREEN will notify the user of how many receptors were skipped for the particular AERMOD run (Figure 30a). If any receptors did have missing elevations, the warning messages for those receptors will appear in the AERSCREEN.LOG file for the AERMAP quality assurance check (Figure 30b). AERSCREEN will notify the user of the total number of receptors skipped for FLOWSECTOR at the end of the AERSCREEN run (Figure 30c). If the user finds that receptors have been skipped due to missing elevations, the user may want to check the input terrain files for gaps or other irregularities or reconsider the probe distance, as this can affect the final maximum 1-hour concentration from AERSCREEN.

<pre>Running AERMOD Processing Winter ***** Processing wind flow sector 10 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector 10   0 receptors skipped due to missing elevations . . . Processing wind flow sector 150 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector 150   8 receptors skipped due to missing elevations . . . Processing wind flow sector 160 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector 160   7 receptors skipped due to missing elevations</pre>	<b>a</b>
<pre>Running AERMAP for FLOWVECTOR *** AERMAP Finishes Successfully *** for stage 2 ***** WARNING MESSAGES ***** OU W400 7265 FIND4:Receptor Location Outside Range of Profiles, IREC= 2997 OU W410 7265 MAIN:Receptor Elevation is Missing (-9999.0), IREC= 2997 OU W400 7265 FIND4:Receptor Location Outside Range of Profiles, IREC= 2998 OU W410 7265 MAIN:Receptor Elevation is Missing (-9999.0), IREC= 2998 . . . OU W410 7265 MAIN:Receptor Elevation is Missing (-9999.0), IREC= 4210   51 receptors have missing elevations and will be skipped in AERMOD processing</pre>	<b>b</b>
<pre>***** AERSCREEN Finished Successfully But with Warnings   51 receptors skipped for FLOWVECTOR   0 receptors skipped for REFINE Check log file for details *****</pre>	<b>c</b>

**Figure 30. a) Receptor skipping notification during FLOWSECTOR run, b) notification of missing elevations in AERMAP, and c) total number of receptors skipped for FLOWSECTOR and REFINE.**

For each AERMOD run in FLOWSECTOR, the maximum concentration, downwind distance, and terrain (if applicable) are stored for later use in REFINE. The stored concentrations are concentrations for each radial and temporal period of the surface characteristics.

### 3.3 REFINE

REFINE finds the maximum concentration and associated distance and date output from PROBE or FLOWSECTOR. If output is from PROBE or a rectangular area source from FLOWSECTOR, REFINE uses the meteorological files for the temporal period and surface roughness sector of the maximum concentration. If output is from FLOWSECTOR for non-rectangular area sources, REFINE finds the upwind surface characteristic sector of the flow direction of maximum concentration as in Figure 29. REFINE then uses the meteorological files for the appropriate temporal and surface characteristics sector. Receptor spacing becomes one, two, or five meters, depending on maximum concentration distance, to refine the output. For rectangular area sources, the receptors are placed along the radial associated with the maximum

concentration. If building downwash is used, building dimensions based on the flow direction of maximum concentration are used. If terrain is used, REFINE will rerun AERMAP with the new receptors in the flow direction of the maximum concentration output from FLOWSECTOR. REFINE then runs AERMOD using the new receptors and appropriate meteorological, building and terrain data. As with FLOWSECTOR, if any receptors have a missing elevation, they will be skipped, and the user notified of how many were skipped (Figure 30c).

### **3.4 Output**

AERSCREEN creates the file AERSCREEN.OUT which contains source information, output from either PROBE or FLOWSECTOR, meteorology associated with the maximum concentration output from PROBE or FLOWSECTOR, maximum concentrations by distance, and REFINE output: final maximum concentration and maximum fence line concentration. See Section 4 for example output. AERSCREEN also outputs a file called max\_conc\_distance.txt that contains the highest concentration by distance, independent of worst case meteorology and flow direction, with associated meteorology for the concentrations. These concentrations were calculated in PROBE or FLOWSECTOR. Also included in the file is the overall maximum concentration output from REFINE. This concentration is denoted by an asterisk. The format of this file is shown in Table 1. AERSCREEN also copies the AERMOD.INP file from the REFINE AERMOD run to the file AERSCREEN.INP, containing the inputs to AERSCREEN entered via prompts or a previous AERSCREEN.INP file with any changes that were made during AERSCREEN processing.

**Table 2. Variables listed in max\_conc\_distance.txt.**

<b>Variable</b>	<b>Description</b>
Concentration	Maximum 1-hour screening concentration ( $\mu\text{g}/\text{m}^3$ ). A concentration with a preceding asterisk is the overall maximum concentration.
Distance	Distance (m) from source of maximum 1-hour concentration
Elevation	Elevation (m) of maximum 1-hour concentration
Flow	Flow vector (degrees) associated with maximum 1-hour concentration
Season/Month	Season/Month of maximum 1-hour concentration (can be annual, season, or month)
Zo sector	Surface roughness sector number of maximum 1-hour concentration
Date	Date of maximum 1-hour concentration
H0	Heat flux ( $\text{W}/\text{m}^2$ ) of hour of maximum 1-hour concentration
U*	Friction velocity (m/s) of hour of maximum 1-hour concentration
W*	Convective velocity (m/s) of hour of maximum 1-hour concentration
DT/DZ	Lapse rate (K/m) of hour of maximum 1-hour concentration
ZICNV	Convective mixing height (m) of hour of maximum 1-hour concentration
ZIMCH	Mechanical mixing height (m) of hour of maximum 1-hour concentration
M-O LEN	Monin-Obukhov length (m) of hour of maximum 1-hour concentration
Z0	Surface roughness length (m) of hour of maximum 1-hour concentration
Bowen	Bowen ratio of hour of maximum 1-hour concentration
Albedo	Albedo of hour of maximum 1-hour concentration
REF WS	Wind speed (m/s) of hour of maximum 1-hour concentration
HT	Anemometer height (m) of hour of maximum 1-hour concentration
REF TA	Temperature (K) of hour of maximum 1-hour concentration
HT	Height of Temperature (m) of hour of maximum 1-hour concentration

## 4. Example run

This section will show an example AERSCREEN run for a point source with building downwash and terrain. Table 3 gives a summary of the AERSCREEN inputs and Figure 31 shows the building/stack orientation. Table 4 lists the seasonal surface characteristics and Figure 32 shows the land use and terrain for the example. Figure 33 lists the inputs for demlist.txt.

**Table 3. Inputs for example AERSCREEN run.**

Parameters	Inputs	Input values
Source	Source type	POINT
	Stack height	10 m
	Emission rate	1 g/s
	Stack diameter	0.5 m
	Stack exit temperature	300 K
	Stack exit velocity	15 m/s
Building	Include building downwash	Yes
	Building height	34 m
	Maximum horizontal dimension	120 m
	Orientation of maximum building dimension to North	90°
	Minimum horizontal dimension	60 m
	Direction of stack from North	26.6°
	Distance from stack to building center	67 m
Meteorology	Minimum temperature	261.4
	Maximum temperature	313.1
	Minimum wind speed	1.5 m/s
	Anemometer height	10 m
	Source of surface characteristics	AERSURFACE (aersurface_12.out)
Terrain	Include terrain	Yes
	Coordinate type	Latitude and longitude (LATLON)
	Source latitude	35.891940° N
	Source longitude	78.781940° W
	NAD	83
	Probe distance	1 km
	Source elevation	126.8
	Override input elevation with AERMAP derived value	No
Other inputs	Input units	Metric
	Rural/urban	Urban
	Input population	2400000
	Fence line distance	30 m
	Use flagpole receptors	No

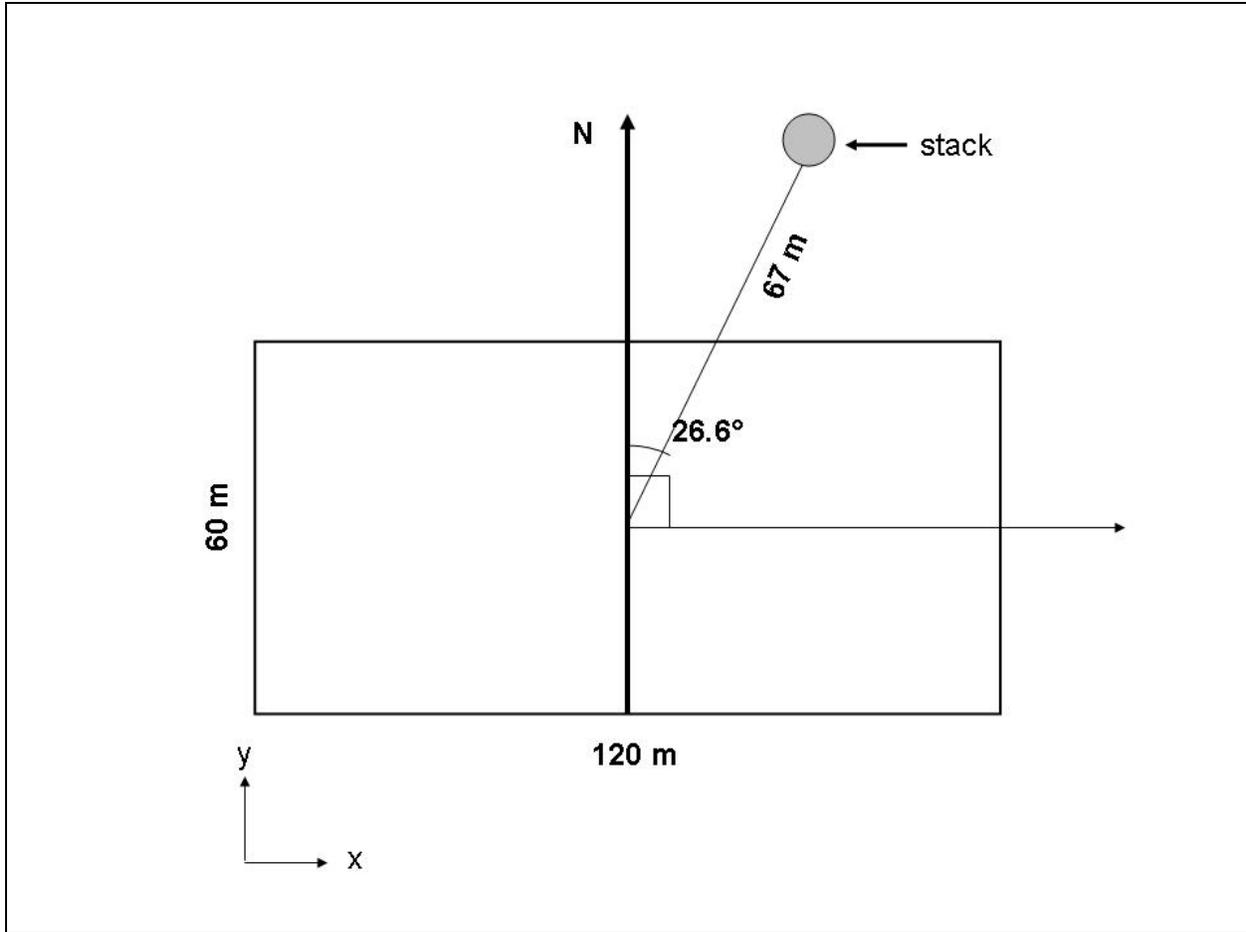
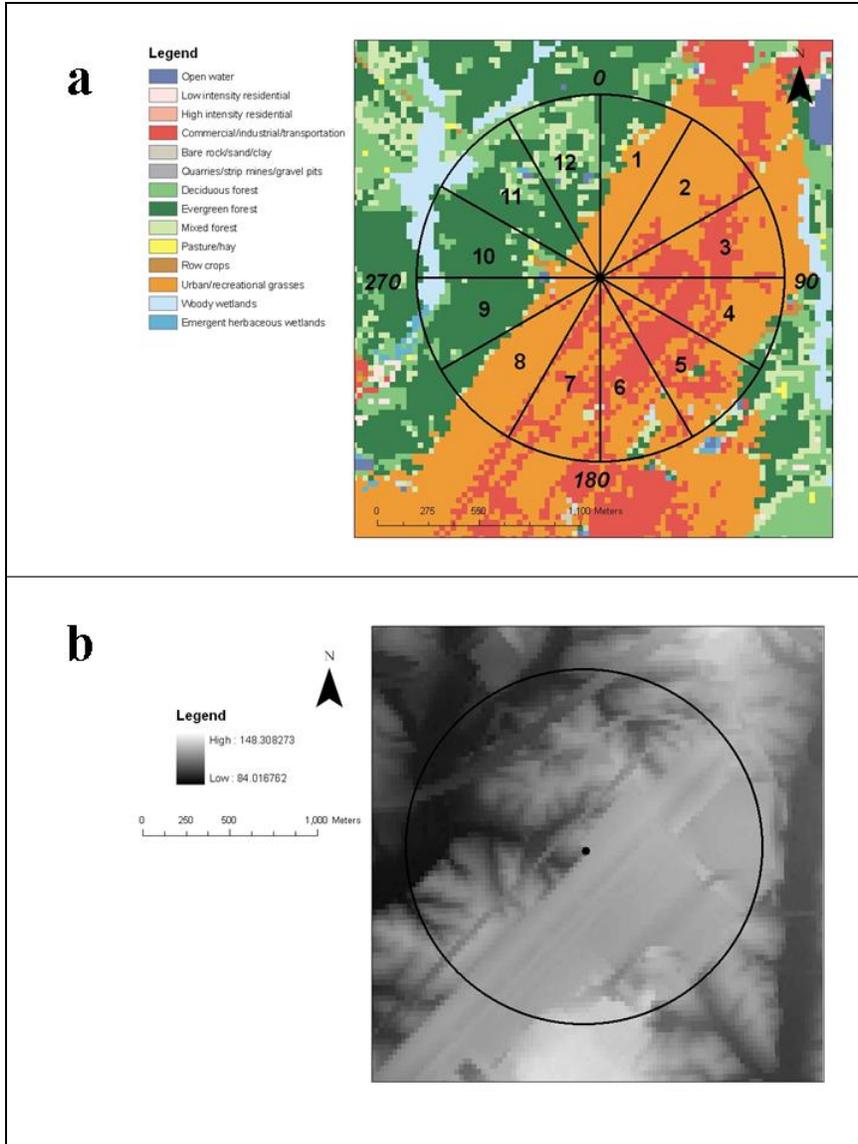


Figure 31. Plane view of building and stack orientation for example AERSCREEN run.

Table 4. Seasonal surface characteristics by sector.

Variable	Season	Sector												
		1	2	3	4	5	6	7	8	9	10	11	12	
Albedo	Winter	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Spring	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
	Summer	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Autumn	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Bowen ratio	Winter	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	Spring	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
	Summer	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
	Autumn	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Surface roughness	Winter	0.089	0.011	0.025	0.029	0.032	0.034	0.031	0.013	0.115	0.244	0.391	0.305	
	Spring	0.118	0.016	0.032	0.036	0.04	0.042	0.038	0.019	0.141	0.289	0.458	0.379	
	Summer	0.143	0.022	0.038	0.043	0.048	0.049	0.045	0.025	0.163	0.335	0.509	0.435	
	Autumn	0.123	0.016	0.032	0.036	0.041	0.042	0.038	0.019	0.142	0.311	0.478	0.405	



**Figure 32. a) landuse pattern and sectors used for surface characteristics and b) terrain. The circle represents the 1 km radius from the source.**

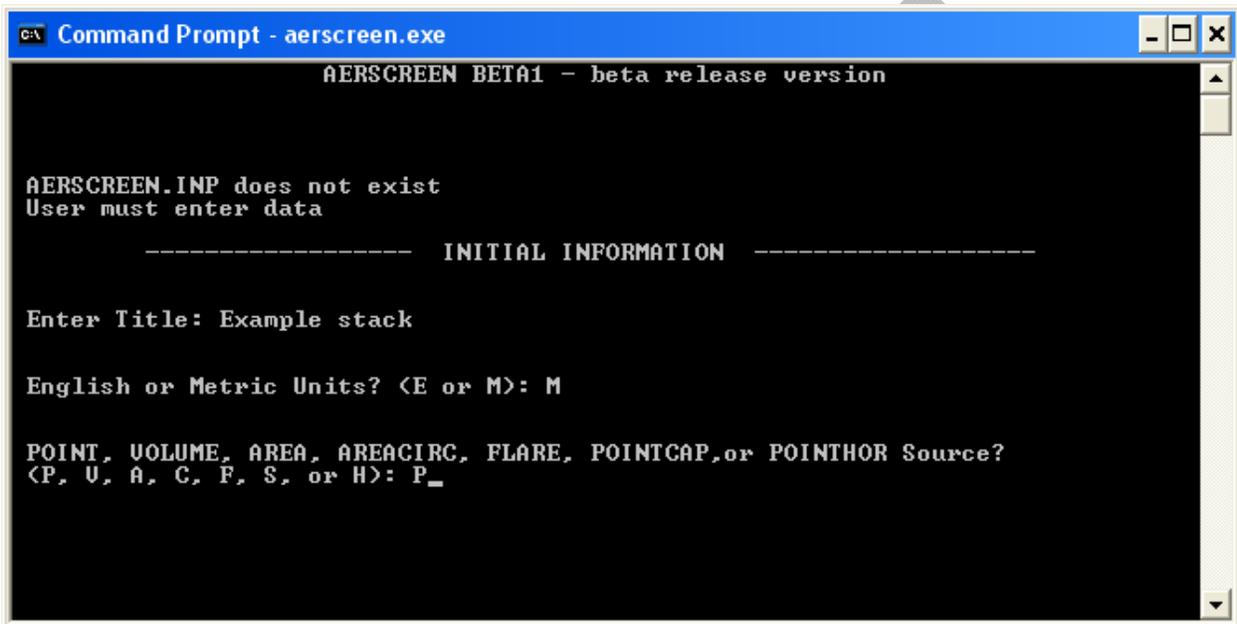
NED : Must be either 7.5 for 7.5' DEM or 1 for 1-deg DEM

NADGRIDS .\  
NED 22944813\NED 22944813.tif

**Figure 33. Contents of demlist.txt for terrain processing.**

#### 4.1 Processing and log file

Below in Figures 34 through 39 are the prompts (in italics) and inputs for the source, building information, meteorological data and terrain data. In Figure 34, the initial prompts are shown. Since there is no existing AERSCREEN.INP file, AERSCREEN alerts the user that AERSCREEN.INP does not exist and the user must enter the data. The user enters a title, whether the inputs are in English or metric units, and the source type (point, volume, etc.).



```
Command Prompt - aerscreen.exe
AERSCREEN BETA1 - beta release version

AERSCREEN.INP does not exist
User must enter data

----- INITIAL INFORMATION -----

Enter Title: Example stack

English or Metric Units? <E or M>: M

POINT, VOLUME, AREA, AREACIRC, FLARE, POINTCAP, or POINTHOR Source?
<P, U, A, C, F, S, or H>: P_
```

**Figure 34. Initial AERSCREEN title, units, and source type prompts.**

After the initial prompts, the user then enters source parameters (Figure 35). The stack parameters, stack height, inner stack diameter, stack exit temperature, stack velocity units, and stack velocity. The user also enters if the source is urban or rural, and the urban population if an urban source. The user then enters the minimum distance to ambient air, i.e. fenceline distance. Values entered are as described in Table 3.

```
CA: Command Prompt - aerscreen.exe
AERSCREEN BETA1 - beta release version
----- SOURCE INFORMATION -----

Enter Emission Rate (g/s): 1

Enter Stack Height (meters): 10

Enter Stack Diameter (meters): 0.5

Enter Stack Temperature (K)
Enter 0 for ambient temperature: 300

-----
Option (1) - Exit Velocity (m/s)
Option (2) - Exit Velocity (ft/s)
Option (3) - Flow Rate (ACFM)
-----

Enter Option for Flow Rate or Exit Velocity: 1
Enter Exit Velocity (m/s): 15

Rural or Urban? (R or U): U

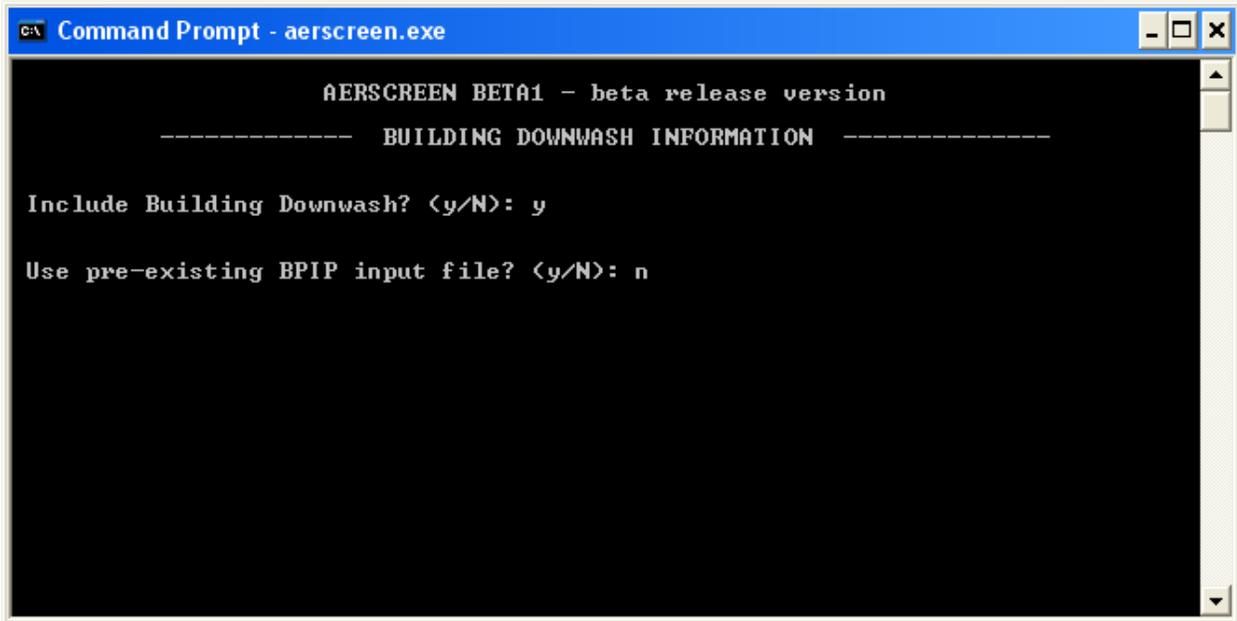
Enter Population of Urban Area: 2400000

Enter Minimum Distance (meters) to Ambient Air
<Enter> for default (1 m): 30_
```

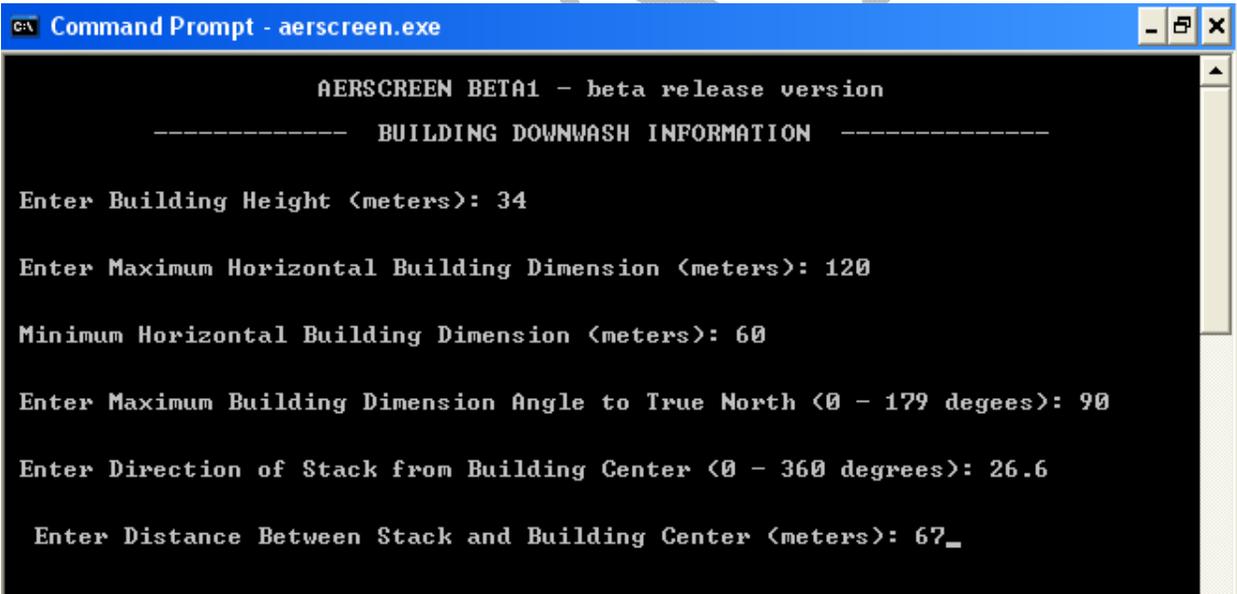
Figure 35. Source parameter inputs.

After source parameters have been entered, the user enters the building parameters for building downwash effects (Figures 36 and 37). In Figure 36, the initial prompts are shown. The user is prompted to include downwash if desired and if so, the user is prompted if an existing BPIP input file is to be used. If the answer is yes to downwash but no to an existing BPIP file, the user is then prompted for the building dimensions, building orientation, and stack orientation relative to the building (Figure 37). The inputs are building height, maximum horizontal dimension, minimum horizontal dimension, angle of maximum horizontal dimension to North, angle of

stack from North, and distance between stack and building center. Building dimensions are shown in Table 3 and Figure 31.



**Figure 36. Initial building downwash prompts.**



**Figure 37. Building parameter inputs.**

The next set of inputs is for terrain (Figure 38). The user is prompted if terrain is to be used. The user is then prompted for the probe distance with a default of 10 km available. Note, that the terrain input file or files (NED or DEM), must encompass the probe distance. Following the probe distance, the user is prompted for the use of flagpole receptors and if so, the flagpole height. After the flagpole information, the source elevation is input by the user. This can be an elevation or the user can hit <Enter> to use AERMAP to calculate elevation. In this case, the

user has entered 126.8 m. Note if terrain is not used, this is the last prompt in the terrain section of inputs. If terrain is to be used, the user enters the coordinate type and coordinates. The NAD datum is also entered by the user. If coordinates are UTM coordinates, the user will be prompted for the UTM zone. Since geographic coordinates are used in this example, the UTM zone is determined by AERMAP.

```
Command Prompt - aerscreen.exe
AERSCREEN BETA1 - beta release version
----- TERRAIN HEIGHT INFORMATION -----
Include Terrain Heights? <y/N>: y
Enter Maximum Distance <km> to probe
<Enter> for default <10 km>: 1
Use Flagpole receptors? <y or n>: n
Enter source elevation <m> or
<Enter> for AERMAP derived elevation: 126.8
Enter coordinate type:
LATLON for latitude & longitude or
UTM for UTM coordinates
latlon
Enter Source Latitude <North positive> <xx.xxxx>: 35.891940
Enter Source Longitude <West negative> <xx.xxxx>: -78.781940
-----
Option <1> - North American Datum of 1927
Option <4> - North American Datum of 1983
-----
Enter Option for Applicable UTM Nada: 4
```

**Figure 38. Terrain parameter prompts.**

The meteorological parameters are the next inputs by the user (Figure 39). The user enters the minimum and maximum air temperatures for the AERSCREEN run or accepts defaults of 250 and 310 K. The user then enters the minimum wind speed and anemometer height. For this example, a minimum of 1.5 m/s was selected for the wind speed and the default 10 m anemometer height was entered. After the anemometer height, the surface characteristics type, user-entered single values (option 1), AERMET seasonal tables (option 2), or use of an external file (option 3) is chosen. Option 3, an external file, is chosen by the user and the user then enters the filename. The file is in the same folder as the current working directory so no pathnames are necessary.

```
Command Prompt - aerscreen.exe
AERSCREEN BETA1 - beta release version
----- MAKEMET METEOROLOGY -----

Enter Min & Max Ambient Temperatures <K>
or <Enter> to default to 250 310 K...

Enter Minimum Temperature <K>: 261.4

Enter Maximum Temperature <K>: 313.1

Enter Minimum Wind Speed or <Enter> to default to 0.5 m/s... 1.5

Enter Anemometer Height or <Enter> to default to 10.0 meters...

-----
1) Single user specified values
2) AERMET seasonal tables
3) External file
-----

Enter surface characteristics option: 3

Enter filename containing surface characteristics
Enclose filename with quotes if path or filename includes spaces...

aersurface_12.out
```

Figure 39. Meteorological parameter prompts and inputs.

Finally after the meteorological inputs, the validation page is displayed to the user listing all input parameters for the source, building downwash, terrain, and meteorological data (Figure 40). The source and building parameters are listed in both metric and English units as well as the minimum and maximum temperatures, source elevation and probe distance. AERSCREEN also displays the UTM and geographic coordinates for the source with the message that coordinates were converted from geographic to UTM coordinates. Coordinates are displayed in NAD datum of 1983. If coordinates were initially entered in NAD 1927 datum, those coordinates would be listed as well with the message that coordinates were switched from NAD 27 to NAD 83 with the NAD 27 geographic and UTM coordinates listed as well. The options listed below the meteorological data can be used to change parameters for the source, building, terrain, or meteorological data. If options 1 through 4 are chosen, the user then sees a sub-menu of parameters to choose (See Section 3). If the user is ready to proceed, option 5 is chosen and AERSCREEN begins processing the data. After choosing option 5, the same data as seen on the validation page is written to the AERSCREEN.LOG file (Figure 41).

```

CA Command Prompt - aerscreen.exe
----- DATA ENTRY VALIDATION -----
              METRIC              ENGLISH
** STACKDATA **
Emission Rate:      1.0000 g/s          7.937 lb/hr
Stack Height:       10.00 meters        32.81 feet
Stack Diameter:     0.500 meters        19.69 inches
Stack Temperature:  300.0 K            80.3 Deg F
Exit Velocity:      15.000 m/s         49.21 ft/s
Stack Flow Rate:    6240 ACFM
Model Mode:         URBAN
Population:         2400000
Dist to Ambient Air: 30.0 meters        98. feet

** BUILDING DATA **
Building Height:    34.0 meters         111.5 feet
Max Building Dimension: 120.0 meters    393.7 feet
Min Building Dimension: 60.0 meters     196.9 feet
Building Orientation: 90.0 degrees
Stack Direction:   26.6 degrees
Stack Distance:    67.0 meters          219.8 feet

** TERRAIN DATA **
Input coordinates switched from geographic to UTM
Source Longitude:  -78.78194 deg        700197. Easting
Source Latitude:   35.89194 deg         3974236. Northing
UTM Zone:          17                   Reference Datum: 4 (NAD 83)
Source Base Elevation: 126.8 meters     416.0 feet

Probe distance:    1000. meters          3281. feet

No flagpole receptors

** METEOROLOGY DATA **
Min/Max Temperature: 261.4 / 313.1 K   10.9 / 103.9 Deg F
Minimum Wind Speed:  1.5 m/s
Anemometer Height:   10.000 meters

Using surface characteristics in file: aersurface_12.out

*** AERSCREEN Run is Ready to Begin - Choose Option to Proceed ***
      1 - Change Source Data;
      2 - Change Building Data;
      3 - Change Terrain Data;
      4 - Change Meteorology Data;
      5 - Change Title;
      - or -
Hit <Enter> to Start Run

```

Figure 40. Data validation page.

**Beta Release DRAFT**

```
Start date and time 07/21/10 11:34:35
                    AERSCREEN BETA1 - beta release version

Example stack

    Example stack

----- DATA ENTRY VALIDATION -----
              METRIC              ENGLISH
** STACKDATA ** -----
Emission Rate:      1.0000 g/s          7.937 lb/hr
Stack Height:       10.00 meters        32.81 feet
Stack Diameter:     0.500 meters        19.69 inches
Stack Temperature:  300.0 K            80.3 Deg F
Exit Velocity:      15.000 m/s         49.21 ft/s
Stack Flow Rate:    6240 ACFM
Model Mode:         URBAN
Population:         2400000
Dist to Ambient Air: 30.0 meters        98. feet

** BUILDING DATA **
Building Height:    34.0 meters         111.5 feet
Max Building Dimension: 120.0 meters    393.7 feet
Min Building Dimension: 60.0 meters     196.9 feet
Building Orientation: 90.0 degrees
Stack Direction:   26.6 degrees
Stack Distance:    67.0 meters         219.8 feet

** TERRAIN DATA **
Input coordinates switched from geographic to UTM
Source Longitude:  -78.78194 deg        700197. Easting
Source Latitude:   35.89194 deg        3974236. Northing
UTM Zone:          17 Reference Datum: 4 (NAD 83)
Source Base Elevation: 126.8 meters    416.0 feet

Probe distance:    1000. meters        3281. feet

No flagpole receptors

** METEOROLOGY DATA **
Min/Max Temperature: 261.4 / 313.1 K    10.9 / 103.9 Deg F
Minimum Wind Speed:  1.5 m/s
Anemometer Height:   10.000 meters

Using surface characteristics in file: aersurface_12.out

*** AERSCREEN Run is Ready to Begin

Terrain to be used,AERMAP will be run
*****
```

**Figure 41. Input data in AERSCREEN.LOG.**

After data validation, AERSCREEN reads the AERSURFACE output file and lists the surface characteristics (Figure 42).

```

SURFACE CHARACTERISTICS & MAKEMET
Obtaining surface characteristics...

Using seasonal surface characteristics for 12 spatial sector(s)
Sector   Start   End
  1         0     30
  2        30     60
  3        60     90
  4        90    120
  5       120    150
  6       150    180
  7       180    210
  8       210    240
  9       240    270
 10       270    300
 11       300    330
 12       330     0

Season   Sector   Albedo   Bo       zo
Winter   1         0.15    0.85    0.089
Winter   2         0.15    0.85    0.011
Winter   3         0.15    0.85    0.025
Winter   4         0.15    0.85    0.029
Winter   5         0.15    0.85    0.032
Winter   6         0.15    0.85    0.034
Winter   7         0.15    0.85    0.031
Winter   8         0.15    0.85    0.013
Winter   9         0.15    0.85    0.115
Winter  10        0.15    0.85    0.244
Winter  11        0.15    0.85    0.391
Winter  12        0.15    0.85    0.305
Spring   1         0.14    0.63    0.118
Spring   2         0.14    0.63    0.016
.
.
.
Autumn   11        0.15    0.84    0.478
Autumn   12        0.15    0.84    0.405

Creating met files aerscreen_01_01.sfc & aerscreen_01_01.pfl
Creating met files aerscreen_01_02.sfc & aerscreen_01_02.pfl
.
.
.
Creating met files aerscreen_04_11.sfc & aerscreen_04_11.pfl

Creating met files aerscreen_04_12.sfc & aerscreen_04_12.pfl
*****

```

**Figure 42. Surface characteristics processing and meteorological files creation.**

AERSCREEN then runs AERMAP for the source and determines the percent difference between the user-entered source elevation and the AERMAP derived elevation (Figure 43). The AERMAP elevation will not be used by AERSCREEN. AERSCREEN also lists any fatal error or warning messages from AERMAP. In this case warning messages about the use of default elevation units of meters for the NED file are displayed. For the example case, the difference between the AERMAP elevation, 118.28 m, and the user-entered elevation, 126.8 m, differ by 6.72%.

```
Running AERMAP for stage 0
*** AERMAP Finishes Successfully ***   for source
***** WARNING MESSAGES *****
OU W473   26 NEDCHK:Default elevation units of METERS used; NED file:      1
AERMAP elevation, 118.28 differs from user entered elevation, 126.80 by 6.72%
```

**Figure 43. AERMAP processing and elevation of source.**

Once AERMAP has been run for the source, AERSCREEN then begins the FLOWSECTOR stage and executes AERMAP for the receptors (Figure 44). While processing the receptors, AERMAP writes the processing status to the screen (Figure 45). Once AERMAP is completed for all receptors for all thirty-six directions, AERSCREEN checks the AERMAP.OUT file for any warnings or errors (Figure 46).

```
Buildings and/or terrain present or rectangular area source, skipping probe
FLOWSECTOR started 07/21/10 11:39:34
*****
Running AERMAP for FLOWVECTOR
```

**Figure 44. AERSCREEN.LOG records for AERMAP processing for FLOWSECTOR.**

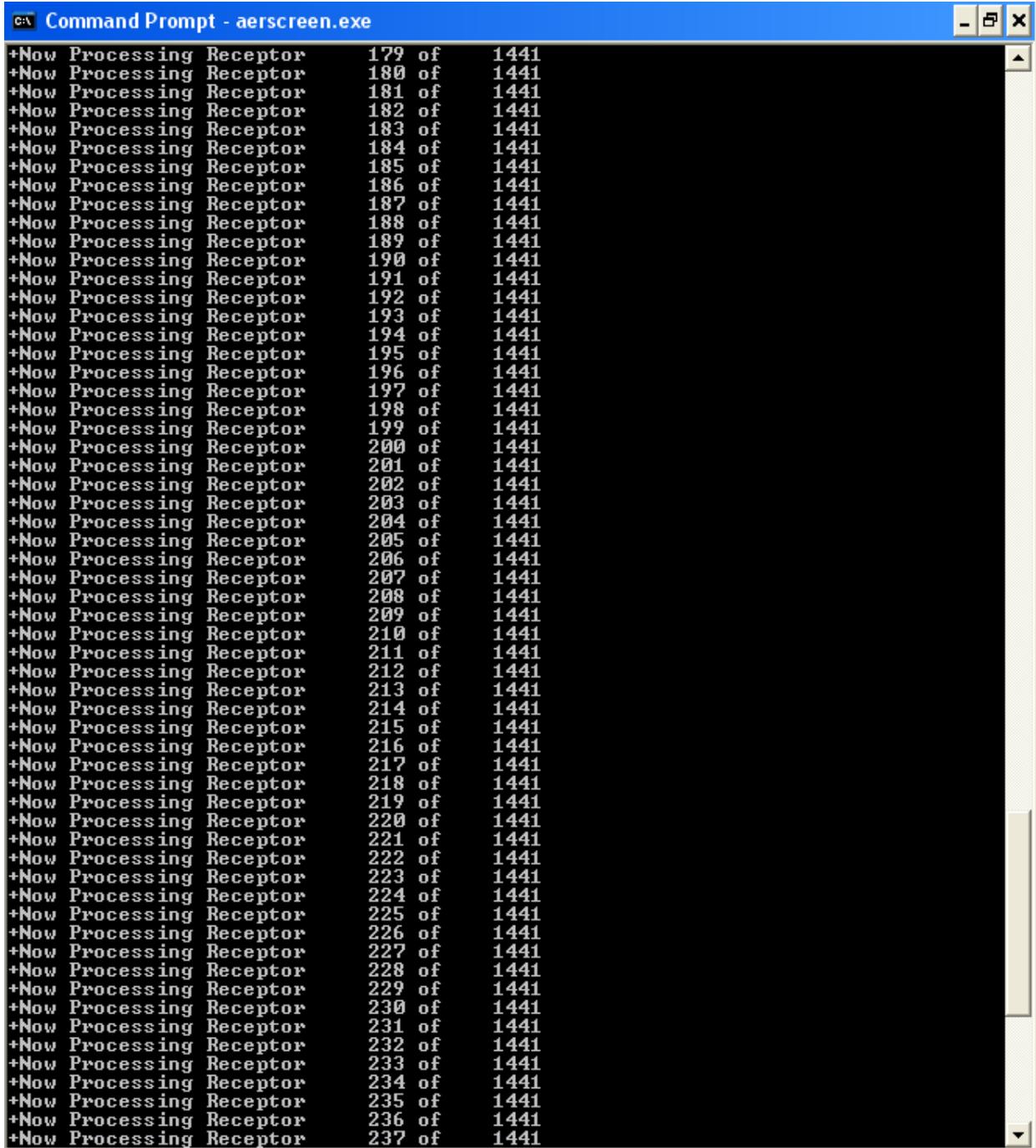


Figure 45. Status of AERMAP processing for FLOWSECTOR.

```

*** AERMAP Finishes Successfully *** for FLOWVECTOR
***** WARNING MESSAGES *****
OU W473 1461 NEDCHK:Default elevation units of METERS used; NED file:
1
*****
    
```

Figure 46. AERCREEN.LOG summary of AERMAP.OUT warning and error messages.

Figure 47 shows partial AERMAP output for FLOWSECTOR. It is from this output that AERSCREEN will extract the receptor elevations for AERMOD processing in FLOWVECTOR. Receptor spacing for this example was 25 m since the probe distance was less than 5 km. Summing across all 36 radials, excluding receptors less than the fence line distance, including the fence line distance, and the source location, results in 1,441 total receptors. Also listed in the output is information that will be used for later AERSCREEN runs to determine if AERMAP needs to be rerun for FLOWVECTOR. This includes the UTM coordinates, probe distance (meters), receptor spacing, UTM zone, NAD datum, number of NED files and number of receptors.

```

** AERMAP - VERSION 09040
**
** Example stack
** 700197.0 3974235.5 1000.0 25.0 25.0 17 4
** A total of 1 NED files were used
** A total of 1441 receptors were processed
** No user-specified DOMAIN; all available data used
** ANCHORXY 0.0 0.0 700197.0 3974235.5 17 4
** Terrain heights were extracted by default

RE ELEVUNIT METERS
DISCCART 0.00 0.00 118.28 120.84
DISCCART 5.20 29.50 120.37 120.37
DISCCART 8.70 49.20 120.61 120.61
DISCCART 13.00 73.90 120.49 120.49
DISCCART 17.40 98.50 119.30 119.30
DISCCART 21.70 123.10 117.83 120.36
DISCCART 26.00 147.70 116.67 120.49
DISCCART 30.40 172.30 117.09 117.61
DISCCART 34.70 197.00 112.89 121.18
DISCCART 39.10 221.60 112.45 121.18
DISCCART 43.40 246.20 112.99 120.84
    
```

**Figure 47. Partial AERMAP output for FLOWVECTOR.**

Once AERMAP has been run for all receptors, AERSCREEN processes each flow vector every 10 degrees from 10 degrees to 360 degrees. The appropriate building dimensions and meteorological files are used for each flow vector. During processing, AERSCREEN notifies the user what season or month and flow vector is being processed (Figure 48). A sample AERMOD.INP file is shown in Figure 49 with projected building dimensions and receptors for a particular flow vector. Note that the y-coordinate for each receptor is reset to 0. After AERMOD is executed for each flow vector, AERSCREEN checks the AERMOD.OUT file and notifies the user of any warning or error messages for that flow vector (Figure 50).

```
CA: Command Prompt - aerscreen.exe
AERSCREEN BETA1 - beta release version
----- DERIVING WORST CASE FLOW SECTOR -----
Processing Winter
+ Processing wind flow sector 10
+ Processing wind flow sector 20
+ Processing wind flow sector 30
+ Processing wind flow sector 40
+ Processing wind flow sector 50
+ Processing wind flow sector 60
+ Processing wind flow sector 70
+ Processing wind flow sector 80
+ Processing wind flow sector 90
+ Processing wind flow sector 100
+ Processing wind flow sector 110
+ Processing wind flow sector 120
+ Processing wind flow sector 130
+ Processing wind flow sector 140
+ Processing wind flow sector 150
+ Processing wind flow sector 160
+ Processing wind flow sector 170
+ Processing wind flow sector 180
+ Processing wind flow sector 190
+ Processing wind flow sector 200
+ Processing wind flow sector 210
+ Processing wind flow sector 220
+ Processing wind flow sector 230
+ Processing wind flow sector 240
+ Processing wind flow sector 250
+ Processing wind flow sector 260
```

Figure 48. AERSCREEN processing during FLOWVECTOR.

DRAFT

```
SO STARTING
LOCATION SOURCE POINT 0.0 0.0 126.80
SRCPARAM SOURCE 0.1000E+01 10.000 300.000 15.000 0.500

BUILDHGT SOURCE 36*34.00
BUILDWID SOURCE 36*133.28
BUILDLEN SOURCE 36*97.42
XBADJ SOURCE 36*-115.27
YBADJ SOURCE 36*7.70

URBANSRC SOURCE

SRCGROUP ALL

SO FINISHED

RE STARTING
** Fenceline receptor
DISCCART 30.0 0.0 120.70 120.70
** Automatic receptors
DISCCART 50.0 0.0 120.75 120.75
DISCCART 75.0 0.0 120.72 120.72
.
.
.
RE FINISHED
```

Figure 49. Partial AERMOD.INP file used in FLOWVECTOR for 20 degree flow vector.

```
Running AERMOD
Processing Winter
*****
Processing wind flow sector 10

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector 10

0 receptors skipped due to missing elevations
***** WARNING MESSAGES *****
*** NONE ***

*****
.
.
*****
Processing wind flow sector 360

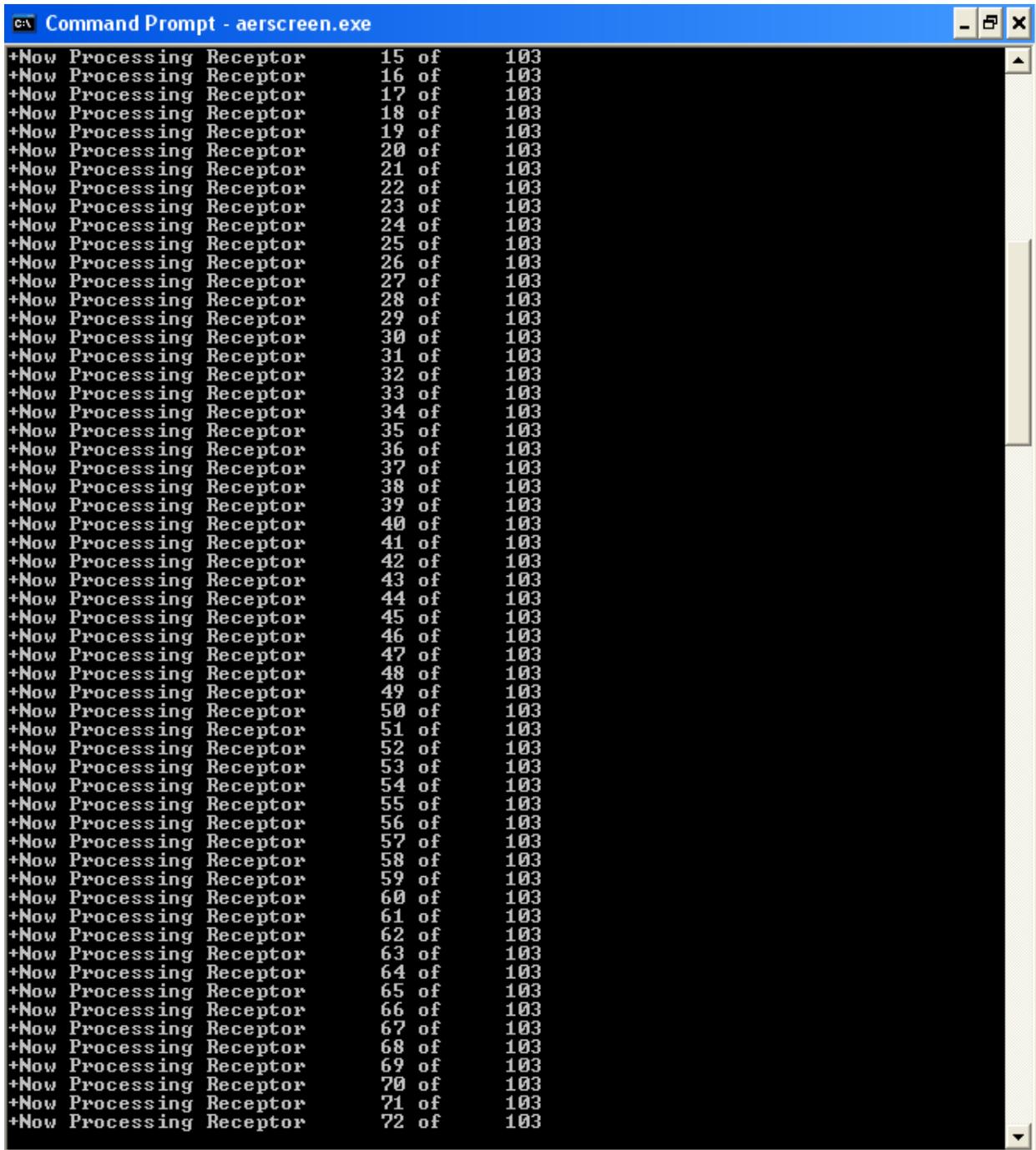
AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector 360

0 receptors skipped due to missing elevations
***** WARNING MESSAGES *****
*** NONE ***

FLOWSECTOR ended 07/21/10 11:41:27
```

Figure 50. AERSCREEN.LOG partial output of AERMOD.OUT checks for FLOWVECTOR.

After FLOWVECTOR, AERSCREEN enters the REFINE subroutine and calculates the overall maximum concentration and its associated distance, flow vector, projected building dimensions, terrain and meteorology. AERSCREEN then reruns AERMAP (Figure 51) and AERMOD with refined receptor spacing using the terrain, projected building dimensions, and meteorology of the maximum concentration's flow vector. The receptors include the fenceline receptor and receptors near the maximum concentration with 1 to 5 m spacing. See Figure 52 for the partial AERMOD.INP file used in REFINE. Messages from AERSCREEN.LOG for REFINE and final processing are shown in Figure 53. The maximum concentration is along the 180 degree flow vector. AERSCREEN ends and notifies the user that AERSCREEN ended successfully with warnings and gives the end time. AERSCREEN also outputs the overall maximum 1-hour concentration and maximum 1-hour fenceline concentration, with scaled 3, 8, 24-hour, and annual average concentrations (Figure 54). Also listed are the distances, flow vectors direction, and receptor elevations relative to the source elevation. For the example case, the overall maximum 1-hour concentration was  $378 \mu\text{g}/\text{m}^3$  at 117 m toward  $290^\circ$  and the receptor's elevation was 13.08 m below the source or 113.72 m. The maximum fenceline concentration was  $310.3 \mu\text{g}/\text{m}^3$  north of the source at an elevation of about 120 m, -6.05 m below the source elevation.



```
CA Command Prompt - aerscreen.exe
+Now Processing Receptor 15 of 103
+Now Processing Receptor 16 of 103
+Now Processing Receptor 17 of 103
+Now Processing Receptor 18 of 103
+Now Processing Receptor 19 of 103
+Now Processing Receptor 20 of 103
+Now Processing Receptor 21 of 103
+Now Processing Receptor 22 of 103
+Now Processing Receptor 23 of 103
+Now Processing Receptor 24 of 103
+Now Processing Receptor 25 of 103
+Now Processing Receptor 26 of 103
+Now Processing Receptor 27 of 103
+Now Processing Receptor 28 of 103
+Now Processing Receptor 29 of 103
+Now Processing Receptor 30 of 103
+Now Processing Receptor 31 of 103
+Now Processing Receptor 32 of 103
+Now Processing Receptor 33 of 103
+Now Processing Receptor 34 of 103
+Now Processing Receptor 35 of 103
+Now Processing Receptor 36 of 103
+Now Processing Receptor 37 of 103
+Now Processing Receptor 38 of 103
+Now Processing Receptor 39 of 103
+Now Processing Receptor 40 of 103
+Now Processing Receptor 41 of 103
+Now Processing Receptor 42 of 103
+Now Processing Receptor 43 of 103
+Now Processing Receptor 44 of 103
+Now Processing Receptor 45 of 103
+Now Processing Receptor 46 of 103
+Now Processing Receptor 47 of 103
+Now Processing Receptor 48 of 103
+Now Processing Receptor 49 of 103
+Now Processing Receptor 50 of 103
+Now Processing Receptor 51 of 103
+Now Processing Receptor 52 of 103
+Now Processing Receptor 53 of 103
+Now Processing Receptor 54 of 103
+Now Processing Receptor 55 of 103
+Now Processing Receptor 56 of 103
+Now Processing Receptor 57 of 103
+Now Processing Receptor 58 of 103
+Now Processing Receptor 59 of 103
+Now Processing Receptor 60 of 103
+Now Processing Receptor 61 of 103
+Now Processing Receptor 62 of 103
+Now Processing Receptor 63 of 103
+Now Processing Receptor 64 of 103
+Now Processing Receptor 65 of 103
+Now Processing Receptor 66 of 103
+Now Processing Receptor 67 of 103
+Now Processing Receptor 68 of 103
+Now Processing Receptor 69 of 103
+Now Processing Receptor 70 of 103
+Now Processing Receptor 71 of 103
+Now Processing Receptor 72 of 103
```

Figure 51. Status of AERMAP processing for REFINE.

*Beta Release DRAFT*

```
SO STARTING
LOCATION SOURCE POINT      0.0    0.0    126.80
SRCPARAM SOURCE   0.1000E+01  10.000  300.000  15.000  0.500

BUILDHGT SOURCE  36*.00
BUILDWID SOURCE  36*.00
BUILDLEN SOURCE  36*.00
XBADJ   SOURCE  36*.00
YBADJ   SOURCE  36*.00

URBANSRC SOURCE

SRCGROUP ALL

SO FINISHED

RE STARTING
** Fenceline receptor
DISCCART   30.0      0.0   115.43   120.84
** Refined receptors
DISCCART   75.0      0.0   115.68   115.68
DISCCART   76.0      0.0   115.66   115.66
DISCCART   77.0      0.0   115.63   115.63
DISCCART   78.0      0.0   115.62   115.62
.
.
.
RE FINISHED
```

**Figure 52. Partial AERMOD.INP file for REFINE processing.**

```
REFINE      started 07/21/10 11:41:27
*****
Running AERMAP for REFINE
*** AERMAP Finishes Successfully *** for stage 3
***** WARNING MESSAGES *****
OU W473    123 NEDCHK:Default elevation units of METERS used; NED file:      1

AERMOD Finishes Successfully for REFINE stage 3 Winter sector 290

    0 receptors skipped due to missing elevations
***** WARNING MESSAGES *****
*** NONE ***

REFINE      ended 07/21/10 11:41:30

*****
AERSCREEN Finished Successfully
But with Warnings
Source coordinates switched from lat/lon to UTM
    0 receptors skipped for FLOWVECTOR
    0 receptors skipped for REFINE
Check log file for details
*****
```

**Figure 53. REFINE and final AERSCREEN.LOG messages.**

```

c:\ Command Prompt
AERSCREEN BETA1 - beta release version
Calculating max concentrations by distance

      MAXIMUM      SCALED      SCALED      SCALED      SCALED
CALCULATION      1-HOUR      3-HOUR      8-HOUR      24-HOUR      ANNUAL
PROCEDURE        CONC        CONC        CONC        CONC        CONC
                <ug/m3>    <ug/m3>    <ug/m3>    <ug/m3>    <ug/m3>
-----
ELEVATED TERRAIN  378.0      378.0      340.2      226.8      37.80

DISTANCE FROM SOURCE  117.0 meters directed toward 290 degrees
RECEPTOR HEIGHT    -13.08 meters

IMPACT AT THE
AMBIENT BOUNDARY    310.3      310.3      279.2      186.2      31.03

DISTANCE FROM SOURCE  30.0 meters directed toward 360 degrees
RECEPTOR HEIGHT    -6.75 meters

** Restart file is written to "AERSCREEN.INP" **
** Output is written to "AERSCREEN.OUT" **

*****
AERSCREEN Finished Successfully
But with Warnings
Source coordinates switched from lat/lon to UTM
  0 receptors skipped for FLOWVECTOR
  0 receptors skipped for REFINE
Check log file for details
*****

```

Figure 54. Overall maximum and maximum fence line concentration statistics.

#### 4.2 AERSCREEN output

Output from AERSCREEN is written to AERSCREEN.OUT. Following are sections with explanations.

The first section shown lists information also shown in the log file, emissions inputs, terrain information (input terrain file and probe distance), and building inputs in both metric and English units (Figure 55).

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```

AERSCREEN BETA1 / AERMOD 09292 - beta release version                                07/21/10
                                                                                      11:41:30

TITLE: Example stack

-----
***** STACK PARAMETERS *****
-----

SOURCE EMISSION RATE:          1.0000 g/s              7.937 lb/hr
STACK HEIGHT:                  10.00 meters          32.81 feet
STACK INNER DIAMETER:          0.500 meters          19.69 inches
PLUME EXIT TEMPERATURE:        300.0 K                80.3 Deg F
PLUME EXIT VELOCITY:           15.000 m/s             49.21 ft/s
STACK AIR FLOW RATE:            6241 ACFM
STACK BASE LONGITUDE:          -78.7819 deg          700197. Easting
STACK BASE LATITUDE:           35.8919 deg          3974236. Northing
STACK BASE UTM ZONE:            17
REFERENCE DATUM (NADA):        4
STACK BASE ELEVATION:           126.80 meters          416.01 feet
RURAL OR URBAN:                URBAN
POPULATION:                    2400000

DIGITAL ELEVATION MAP(S)       NED_22944813\NED_22944813.tif

INITIAL PROBE DISTANCE =       1000. meters          3281. feet

-----
***** BUILDING DOWNWASH PARAMETERS *****
-----

BUILDING HEIGHT:                34.0 meters          111.5 feet
MAX BUILDING DIMENSION:         120.0 meters          393.7 feet
MIN BUILDING DIMENSION:         60.0 meters          196.9 feet
BUILDING ORIENTATION TO NORTH:  90. degrees
STACK DIRECTION FROM CENTER:    27. degrees
STACK DISTANCE FROM CENTER:     67.0 meters          219.8 feet

```

**Figure 55. AERSCREEN.OUT section with source and building information.**

The next section gives information about the results of FLOWSECTOR (Figure 56). The header for the section gives the receptor spacing, 25 m. Next, follows the flow sectors from 10 to 360 degrees. Included for each sector are the projected building width and length output from BPIPPRM, the x and y building adjustments from BPIPPRM, the maximum 1-hour concentration ( $\mu\text{g}/\text{m}^3$ ), the downwind distance from the source, and the elevation of the receptor relative to the source (receptor – source). Concentrations are written in with the “G” FORTRAN descriptor with 4 significant digits. Concentrations were written in scientific notation or real notation, depending on the magnitude. The sector followed by an “\*” indicates that this is the highest concentration sector or “worst case sector.” In this case it is flow sector 290 degrees with a concentration of approximately  $376.2 \mu\text{g}/\text{m}^3$  at 125 m from the source. The relative

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receptor elevation is -13.59 m, meaning the receptor is at an elevation of approximately 113 m. The temporal period associated with the maximum concentration is winter.

```

***** FLOW SECTOR ANALYSIS *****
25 meter receptor spacing: 30. meters - 1000. meters
    
```

FLOW SECTOR	BUILD WIDTH	BUILD LENGTH	XBADJ	YBADJ	MAXIMUM 1-HR CONC (ug/m3)	IMPACT DIST (m)	RECEPTOR HEIGHT (m)	TEMPORAL PERIOD
10	128.60	79.93	-104.17	19.14	274.9	50.0	-6.19	SPR
20	133.28	97.42	-115.27	7.70	220.8	50.0	-6.05	SPR
30	133.92	111.96	-122.86	-3.97	164.6	50.0	-5.90	WIN
40	130.49	123.10	-126.73	-15.53	90.03	500.0	-3.46	SUM
50	123.10	130.49	-126.74	-26.61	79.09	100.0	-5.30	SPR
60	111.96	133.92	-122.90	-36.88	115.3	75.0	-5.31	WIN
70	97.42	133.28	-115.32	-46.04	131.3	75.0	-5.14	WIN
80	79.93	128.60	-104.25	-53.79	253.5	75.0	-4.98	WIN
90	0.00	0.00	0.00	0.00	308.3	100.0	-4.40	WIN
100	0.00	0.00	0.00	0.00	308.8	100.0	-4.32	WIN
110	0.00	0.00	0.00	0.00	308.6	100.0	-4.35	WIN
120	111.96	133.92	-62.99	-66.88	243.2	75.0	-4.70	WIN
130	123.10	130.49	-49.72	-65.18	222.1	100.0	-4.49	WIN
140	130.49	123.10	-34.94	-61.49	223.8	125.0	-4.76	WIN
150	133.92	111.96	-19.10	-55.94	236.4	150.0	-5.41	WIN
160	133.28	97.42	-2.68	-48.68	233.5	175.0	-5.84	WIN
170	128.60	79.93	13.83	-39.95	254.2	175.0	-5.62	WIN
180	120.00	60.00	29.91	-30.00	233.7	125.0	-5.08	WIN
190	128.60	79.93	24.25	-19.14	245.8	175.0	-5.22	WIN
200	133.28	97.42	17.85	-7.70	240.5	175.0	-5.71	WIN
210	133.92	111.96	10.90	3.97	250.2	175.0	-6.72	WIN
220	130.49	123.10	3.63	15.53	223.7	200.0	-11.50	WIN
230	123.10	130.49	-3.76	26.61	203.9	175.0	-19.32	WIN
240	111.96	133.92	-11.03	36.88	177.6	200.0	-18.94	WIN
250	97.42	133.28	-17.96	46.04	207.4	150.0	-21.45	WIN
260	79.93	128.60	-24.35	53.79	248.2	75.0	-14.63	SUM
270	0.00	0.00	0.00	0.00	376.2	125.0	-16.31	WIN
280	0.00	0.00	0.00	0.00	376.2	125.0	-14.96	WIN
290*	0.00	0.00	0.00	0.00	376.2	125.0	-13.59	WIN
300	111.96	133.92	-70.94	66.88	231.8	50.0	-11.31	WIN
310	123.10	130.49	-80.77	65.18	175.2	100.0	-10.05	WIN
320	130.49	123.10	-88.16	61.49	191.5	100.0	-9.21	AUT
330	133.92	111.96	-92.86	55.94	168.8	75.0	-8.57	WIN
340	133.28	97.42	-94.75	48.68	105.7	75.0	-8.03	WIN
350	128.60	79.93	-93.75	39.95	227.3	50.0	-6.36	SUM
360	120.00	60.00	-89.91	30.00	314.0	50.0	-6.29	WIN

\* = worst case flow sector

**Figure 56. FLOWSECTOR results in AERSCREEN.OUT.**

Next, follows meteorological inputs and meteorology used to calculate the overall worst case scenario (Figure 57). Listed first are the inputs: minimum and maximum temperatures (K), minimum wind speed and anemometer height. Also listed is the dominant season and surface roughness sector associated with the worst case concentration. For this case it is winter and roughness sector 4 with beginning direction 90 degrees and ending with 120 degrees. Note that this is the sector of the upwind direction of the worst case scenario. Shown below the season and sector are the surface characteristics for that season and sector.

Next, follows the meteorological parameters used to predict the worst case concentration at the fence line (Figure 56): year, month, day, Julian date, hour, heat flux,  $u^*$ ,  $w^*$ , lapse rate, convective mixing height, mechanical mixing height, Monin-Obukhov length, surface roughness, Bowen ratio, albedo reference wind speed, anemometer height, temperature, and temperature measurement height, 2 m. The surface characteristics listed should match those listed in association with the dominant season and sector in the AERSURFACE output file or AERSCREEN.LOG file. After the meteorological parameters, the final plume rise is also shown. After that are listed the meteorological parameters and plume height of the maximum concentration at the fence line distance. Plume heights do not include downwash effects

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-----
***** MAKEMET METEOROLOGY PARAMETERS *****
-----

MIN/MAX TEMPERATURE:    261.4 / 313.1 (K)

MINIMUM WIND SPEED:      1.5 m/s

ANEMOMETER HEIGHT:      10.000 meters

SURFACE CHARACTERISTICS INPUT: aersurface_12.out

DOMINANT SECTOR:         4 ( 90 120)
DOMINANT SEASON:         Winter

ALBEDO:                  0.15
BOWEN RATIO:              0.85
ROUGHNESS LENGTH:        0.029 (meters)

-----
METEOROLOGY CONDITIONS USED TO PREDICT OVERALL MAXIMUM IMPACT
-----

YR MO DY JDY HR
-- -- -- -- --
10 01 09  9 01

  H0      U*      W*  DT/DZ ZICNV ZIMCH  M-O LEN      Z0  BOWEN ALBEDO  REF WS
  -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
-2.90  0.051 -9.000  0.020 -999.  27.    4.5 0.029  0.85  0.15  1.50

  HT  REF TA      HT
  -- -- -- -- --
  10.0  313.1  2.0

ESTIMATED FINAL PLUME HEIGHT (non-downwash):  22.7 meters

-----
METEOROLOGY CONDITIONS USED TO PREDICT AMBIENT BOUNDARY IMPACT
-----

YR MO DY JDY HR
-- -- -- -- --
10 01 09  9 01

  H0      U*      W*  DT/DZ ZICNV ZIMCH  M-O LEN      Z0  BOWEN ALBEDO  REF WS
  -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
-2.95  0.052 -9.000  0.020 -999.  27.    4.6 0.031  0.85  0.15  1.50

  HT  REF TA      HT
  -- -- -- -- --
  10.0  313.1  2.0

ESTIMATED FINAL PLUME HEIGHT (non-downwash):  22.6 meters

```

**Figure 57. Meteorological data associated with maximum FLOWSECTOR concentration and fence line concentration.**

After the meteorological parameters, is a summary of maximum concentrations by distance (Figure 58). The concentrations shown are not necessarily in the same direction as the overall maximum concentration shown in the flow sector analysis, i.e., the maximum 30 m concentration may not be directed toward 180. Details about the concentrations' meteorology can be found in the file max\_conc\_distance.txt, whose format is listed in Table 1. The maximum concentration and its distance (125 m) found from FLOWSECTOR should be listed in the table and in max\_conc\_distances.txt.

```

-----
***** AERSCREEN AUTOMATED DISTANCES *****
OVERALL MAXIMUM CONCENTRATIONS BY DISTANCE
-----

```

DIST (m)	MAXIMUM 1-HR CONC (ug/m3)	RECEPTOR HEIGHT (m)	DIST (m)	MAXIMUM 1-HR CONC (ug/m3)	RECEPTOR HEIGHT (m)
30.0	310.3	-6.75	525.0	205.0	-8.77
50.0	314.0	-6.29	550.0	198.9	-9.71
75.0	281.8	-4.72	575.0	191.3	-11.14
100.0	367.7	-14.57	600.0	192.4	-10.05
125.0	376.2	-13.59	625.0	196.5	-8.14
150.0	356.3	-14.44	650.0	195.7	-7.57
175.0	328.0	-15.64	675.0	191.8	-7.94
200.0	299.2	-17.38	700.0	186.5	-8.75
225.0	272.1	-18.80	725.0	181.0	-9.64
250.0	247.7	-22.37	750.0	176.8	-10.12
275.0	226.1	-23.56	775.0	172.2	-10.71
300.0	213.0	-14.32	800.0	167.6	-11.29
325.0	208.1	-15.57	825.0	162.1	-12.26
350.0	210.6	-13.11	850.0	154.4	-14.24
375.0	215.0	-10.82	875.0	145.7	-17.26
400.0	220.7	-8.63	900.0	142.6	-17.47
425.0	223.8	-7.11	925.0	140.4	-17.16
450.0	220.4	-6.96	950.0	135.2	-18.77
475.0	215.5	-7.50	975.0	128.2	-22.69
500.0	209.6	-8.30	1000.0	127.5	-20.50

**Figure 58. Summary of maximum concentrations by distance in AERSCREEN.OUT. Concentration in red text is maximum concentration output by FLOWSECTOR.**

The final section of the output file lists the results of REFINE (Figure 59). This is the overall maximum concentration in the direction of the worst case scenario found in FLOWSECTOR, using the same surface characteristics (winter, 90 to 120 degrees sector). In addition to the 1-hour concentration calculated by AERMOD, the scaled 3-hr, 8-hr, 24-hr, and annual concentrations are calculated by AERSCREEN and output. Also output is the distance of the maximum concentration and its direction. Similar output is listed for the maximum concentration at fence line distance.

```

-----
***** AERSCREEN MAXIMUM IMPACT SUMMARY *****
-----

```

CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m3)	SCALED 3-HOUR CONC (ug/m3)	SCALED 8-HOUR CONC (ug/m3)	SCALED 24-HOUR CONC (ug/m3)	SCALED ANNUAL CONC (ug/m3)
ELEVATED TERRAIN	378.0	378.0	340.2	226.8	37.80
DISTANCE FROM SOURCE 117.0 meters directed toward 290 degrees					
RECEPTOR HEIGHT -13.08 meters					
IMPACT AT THE AMBIENT BOUNDARY	310.3	310.3	279.2	186.2	31.03
DISTANCE FROM SOURCE 30.0 meters directed toward 360 degrees					
RECEPTOR HEIGHT -6.75 meters					

**Figure 59. Maximum concentration impact and fence line distance summaries in AERSCREEN.OUT.**

Figure 60 shows partial output for max\_conc\_distances.txt. Note that the overall maximum concentration 378.0  $\mu\text{g}/\text{m}^3$  is denoted by the asterisk. See Table 2 for format.

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Concentration	Distance	Elevation	Flow	Season/Month	Zo sector	Date	H0	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O	LEN	Z0	BOWEN	ALBEDO	REF	WS	HT	REF TA	HT
0.31027E+03	30.0	-6.75	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.31400E+03	50.0	-6.29	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.28181E+03	75.0	-4.72	110	Winter	270-300	10010601	-5.73	0.081	-9.000	0.020	-999.	53.	8.9	0.244	0.85	0.15	1.50	10.0	313.1	2.0		
0.36774E+03	100.0	-14.57	270	Winter	90-120	10010901	-2.90	0.051	-9.000	0.020	-999.	27.	4.5	0.029	0.85	0.15	1.50	10.0	313.1	2.0		
* 0.37804E+03	117.0	-13.08	290	Winter	90-120	10010901	-2.90	0.051	-9.000	0.020	-999.	27.	4.5	0.029	0.85	0.15	1.50	10.0	313.1	2.0		
0.37619E+03	125.0	-13.59	290	Winter	90-120	10010901	-2.90	0.051	-9.000	0.020	-999.	27.	4.5	0.029	0.85	0.15	1.50	10.0	313.1	2.0		
0.35634E+03	150.0	-14.44	290	Winter	90-120	10010901	-2.90	0.051	-9.000	0.020	-999.	27.	4.5	0.029	0.85	0.15	1.50	10.0	313.1	2.0		
0.32800E+03	175.0	-15.64	290	Winter	90-120	10012501	-2.06	0.051	-9.000	0.020	-999.	27.	6.3	0.029	0.85	0.15	1.50	10.0	313.1	2.0		
0.29922E+03	200.0	-17.38	270	Winter	90-120	10012501	-2.06	0.051	-9.000	0.020	-999.	27.	6.3	0.029	0.85	0.15	1.50	10.0	313.1	2.0		
0.27214E+03	225.0	-18.80	270	Winter	90-120	10012501	-2.06	0.051	-9.000	0.020	-999.	27.	6.3	0.029	0.85	0.15	1.50	10.0	313.1	2.0		
0.24771E+03	250.0	-22.37	270	Winter	90-120	10012501	-2.06	0.051	-9.000	0.020	-999.	27.	6.3	0.029	0.85	0.15	1.50	10.0	313.1	2.0		
0.22609E+03	275.0	-23.56	270	Winter	90-120	10012501	-2.06	0.051	-9.000	0.020	-999.	27.	6.3	0.029	0.85	0.15	1.50	10.0	313.1	2.0		
0.21301E+03	300.0	-14.32	360	Winter	180-210	10011501	-0.99	0.094	-9.000	0.020	-999.	66.	80.4	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.20811E+03	325.0	-15.57	360	Winter	180-210	10011501	-0.99	0.094	-9.000	0.020	-999.	66.	80.4	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.21059E+03	350.0	-13.11	360	Winter	180-210	10011501	-0.99	0.094	-9.000	0.020	-999.	66.	80.4	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.21498E+03	375.0	-10.82	360	Winter	180-210	10011501	-0.99	0.094	-9.000	0.020	-999.	66.	80.4	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.22067E+03	400.0	-8.63	360	Winter	180-210	10011501	-0.99	0.094	-9.000	0.020	-999.	66.	80.4	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.22378E+03	425.0	-7.11	360	Winter	180-210	10011501	-0.99	0.094	-9.000	0.020	-999.	66.	80.4	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.22039E+03	450.0	-6.96	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.21547E+03	475.0	-7.50	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.20956E+03	500.0	-8.30	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.20503E+03	525.0	-8.77	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.19886E+03	550.0	-9.71	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.19129E+03	575.0	-11.14	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.19242E+03	600.0	-10.05	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.19649E+03	625.0	-8.14	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.19575E+03	650.0	-7.57	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.19180E+03	675.0	-7.94	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.18649E+03	700.0	-8.75	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.18101E+03	725.0	-9.64	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.17684E+03	750.0	-10.12	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.17216E+03	775.0	-10.71	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.16760E+03	800.0	-11.29	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.16208E+03	825.0	-12.26	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.15442E+03	850.0	-14.24	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.14574E+03	875.0	-17.26	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.14264E+03	900.0	-17.47	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.14036E+03	925.0	-17.16	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.13516E+03	950.0	-18.77	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.12824E+03	975.0	-22.69	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		
0.12749E+03	1000.0	-20.50	360	Winter	180-210	10010901	-2.95	0.052	-9.000	0.020	-999.	27.	4.6	0.031	0.85	0.15	1.50	10.0	313.1	2.0		

Figure 60. Output of max\_conc\_distance.txt.

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After processing, AERSCREEN creates a new AERSCREEN.INP file, with any user input changes added (Figure 61). Note that any options that are alphabetic have been set to uppercase. AERSCREEN sets all flags to uppercase internally for program efficiency. AERSCREEN will also output the surface characteristics for the maximum concentration as the user-entered values in the MAKEMET DATA section and lists the time, flow vector, and surface roughness sector of the overall maximum concentration.

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```
** STACK DATA      Rate      Height      Temp.      Velocity      Diam.      Flow
**                0.1000E+01  10.0000    300.0000    15.0000     0.5000     6241.

** BUILDING DATA  BPIP      Height      Max dim.     Min dim.     Orient.     Direct.     Offset
**                Y          34.0000    120.0000    60.0000     90.0000    26.6000    67.0000

** MAKEMET DATA   MinT      MaxT      Speed      AnemHt      Surf      Clim      Albedo      Bowen      Length      SC FILE
**                261.40    313.10    1.5        10.000     9         0         0.1500     0.8500     0.0290     "aersurface_12.out"

** TERRAIN DATA   Terrain    UTM East    UTM North    Zone      Nada      Probe      PROFBASE    Use AERMAP elev
**                Y          700197.0    3974235.5    17         4         1.0        126.80     N

** UNITS/POPULATION  Units      R/U      Population      Amb. dist.     Flagpole      Flagpole height
**                M          U          2400000.        30.000         N             0.00

** Temporal sector: Winter, flow vector: 290 degrees, spatial sector: 4
```

**Figure 61. Header portion of new AERSCREEN.INP file.**

## 5. References

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## **Appendix A. Input parameters and invalid responses**

In Tables A-1 through A-4, AERSCREEN input parameters are listed with invalid responses and actions taken by AERSCREEN when reading the data from the AERSCREEN.INP file or prompts. Some variables are only checked if the appropriate flags are set. Building dimensions are not checked if downwash is not included in AERSCREEN processing. Other variables such as urban population or flagpole heights are not checked if the source is not urban or flagpole receptors are not used.

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**Table A-1. Source parameters and invalid values.**

<b>Parameter</b>	<b>Source type</b>	<b>Invalid response</b>	<b>AERSCREEN.INP</b>	<b>Prompts</b>
Units flag	All	If prompts, response is not upper or lower case E or M. If input file, response is not upper or lowercase M.	Issue message and stop	Re-prompt
Source type	All	Response is not upper or lower-case: P, F, H, A, C, S, or V	Issue message and stop	Re-prompt
Emission rate	All	Negative	Issue message and stop	Re-prompt
Stack height	Point, capped stack, horizontal stack	Negative	Issue message and stop	Re-prompt
Stack diameter	Point, capped stack, horizontal stack	Negative	Issue message and stop	Re-prompt
Negative exit velocity	Point, capped stack, horizontal stack	N/A	Issue message and reset to $1 \times 10^{-5}$ m/s	Issue message and reset to $1 \times 10^{-5}$ m/s
Flare height	Flare	Negative	Issue message and stop	Re-prompt
Negative heat loss fraction	Flare	N/A	Issue message and reset to 0	Issue message and reset to 0
Release height	Area, volume, circular area	Negative	Issue message and stop	Re-prompt
Initial vertical dimension	Area, volume, circular area	Negative	Issue message and stop	Re-prompt
Initial lateral dimension	Volume	Negative	Issue message and stop	Re-prompt
Circular radius	Circular area	Negative	Issue message and stop	Re-prompt
Rectangular area source horizontal dimensions	Area	Negative	Issue message and stop	Re-prompt
Urban/rural flag	All	Response is not upper or lower-case Y or N	Issue message and stop	Re-prompt
Urban population	All	Negative or less than 100 people	Issue message and stop (if source is urban)	Re-prompt
Fence line distance	All	Negative or if volume source, inside the volume.	Issue message and reset to minimum distance based on source type	Re-prompt
Flagpole receptor use flag	All	Response is not upper or lower-case Y or N	Issue message and stop	Re-prompt
Flagpole height	All	Negative	Issue message and stop (if flagpole receptors used)	Re-prompt

**Table A-2 Invalid building parameter inputs.**

<b>Parameter</b>	<b>Invalid response</b>	<b>AERSCREEN.INP</b>	<b>Prompts</b>
Downwash flag	Response is not upper or lower-case Y or N	Issue message and stop	Re-prompt
Building height	Negative	Issue message and stop	Re-prompt
Maximum building horizontal dimension	Negative	Issue message and stop	Re-prompt
Minimum building horizontal dimension	Negative or exceeds maximum horizontal dimension	Issue message and stop	Re-prompt
Angle of maximum horizontal dimension relative to North	Less than zero or exceeds 179 degrees	Issue message and stop	Re-prompt
Angle of stack location relative to North	Less than zero or exceeds 360 degrees	Issue message and stop	Re-prompt
Distance from stack to building center	Negative	Issue message and stop	Re-prompt
Use pre-existing BPIP input file	File does not exist	Issue message and stop	Re-prompt
	Processing flag in file incorrectly set for AERMOD.	Issue message and stop	Issue message and stop

**Table A-3. Invalid meteorological data inputs.**

<b>Parameter</b>	<b>Invalid response</b>	<b>AERSCREEN.INP</b>	<b>Prompts</b>
Minimum Temperature	Minimum temperature is equal to or exceeds maximum temperature	Issue message and stop	Re-prompt for temperatures
Maximum Temperature			
Minimum wind speed	Negative	Issue message and stop	Re-prompt
Anemometer height	Negative	Issue message and stop	Re-prompt
Surface code	Negative or greater than 9	Issue message and stop	Re-prompt
Climatology code	Exceeds 4 if surface code between 1 and 8 inclusive	Issue message and stop	Re-prompt
AERSURFACE output file	Does not exist (if surface code = 9)	Issue message and stop	Re-prompt for surface characteristics type

**Table A-4. Invalid terrain data inputs.**

<b>Parameter</b>	<b>Invalid response</b>	<b>AERSCREEN.INP</b>	<b>Prompts</b>
Terrain flag	Response is not upper or lower-case Y or N	Issue message and stop	Re-prompt
Latitude	Absolute value exceeds 90 degrees	N/A	Re-prompt
Longitude	Absolute value exceeds 180 degrees	N/A	Re-prompt
UTM Easting	N/A	N/A	N/A
UTM Northing	N/A	N/A	N/A
UTM zone	Negative	Issue message and stop	Re-prompt
NAD code	Not equal to 1 or 4	Issue message and stop	Re-prompt
Probe distance	Negative or less than fence line distance	Issue message and stop	Re-prompt
Source elevation	N/A	N/A	N/A
AERMAP use flag	Response is not upper or lower-case Y or N	Issue message and stop	Re-prompt
NADGRIDS directory or folder	No grid files are in directory or folder or NADGRIDS keyword not listed in demlist.txt	Issue message and stop	Issue message and stop