Appendix F –SCREEN3 Model Description and Model Output

SCREEN3 is currently an available tool from EPA's Office of Air Quality Planning and Standards and can calculate upper-bound gaseous residue EECs in air at the edge or at a downwind distance of a treated field. SCREEN3 uses a Gaussian plume model that incorporates source related factors and 54 combinations of meteorological factors such as wind speed (at 10-meters above ground level adjusted to ground-level according to the Log Law) and atmospheric stability to classify turbulence to estimate pollutant concentration from continuous sources. The wind speed and stability classes combinations that are considered in SCREEN3 are shown in **Table F-1**. The schematic in **Figure F-1** illustrates the plume structure along with the Gaussian nature of the contaminant concentrations within the plume. It is assumed that the pollutant does not undergo any chemical reactions, and that no other removal processes, such as wet or dry deposition, act on the plume during its transport from the source. The Gaussian model equations and the interactions of the source-related and meteorological factors are described in the Workbook of Atmospheric Dispersion Estimates (Turner, 1970). SCREEN3 estimates a concentration along the plume centerline directly downwind from the source. The size of the plume and plume rise is determined by the degree of turbulence in the atmosphere which is parameterized according to stability class (A = unstable; B= unstable; C= unstable; D= neutral; E= stable; F = stable) where the unstable regime refers to turbulent conditions and the stable regime refers to stagnate conditions. The stability classes are determined by incorporating wind speed and insolation (e.g., cloud cover) data using empirical methods (Turner, 1970 and USEPA, 1995). The SCREEN3 modeling files showing the model inputs and outputs are shown in **Figures F-2** and **Figures F-3** for surface and soil incorporated applications, respectively.

Table F-1. Generic meteorological conditions of wind speed and turbulence stability class combinations considered in SCREEN3.

Stability Class	Wind speed (m/s) at 10 meters Above Ground Level												
	1	1.5	2	2.5	3	3.5	4	4.5	5	8	10	15	20
A - Unstable	*	*	*	*	*								
B - Unstable	*	*	*	*	*	*	*	*	*				
C - Unstable	*	*	*	*	*	*	*	*	*	*	*		
D - Neutral	*	*	*	*	*	*	*	*	*	*	*	*	*
E - Stable	*	*	*	*	*	*	*	*	*				
F - Stable	*	*	*	*	*	*	*						

* From U. S. Environmental Protection Agency, 1995. SCREEN 3 Model User's Guide. EPA-454/B-95-004. EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC.

Figure F-1. Plume structure in the SCREEN3 model.

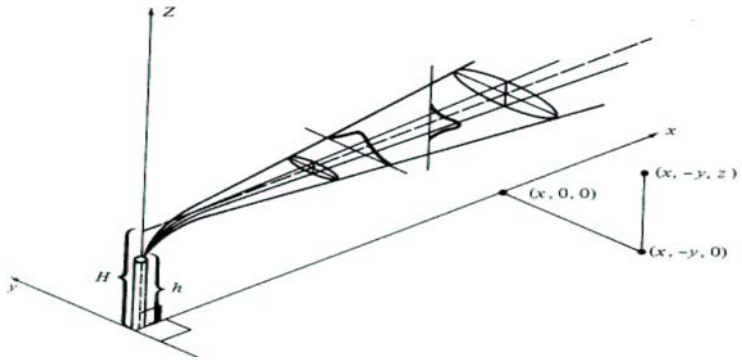

Figure F-1. SCREEN3 model simulation file for surface applications.

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11/23/10

13:05:18
  ***  SCREEN3 MODEL RUN  ***
  *** VERSION DATED 96043 ***

 test

 SIMPLE TERRAIN INPUTS:
    SOURCE TYPE                =         AREA
    EMISSION RATE (G/(S-M**2))  =      .717000E-04
    SOURCE HEIGHT (M)          =        .0000
    LENGTH OF LARGER SIDE (M)   =     569.0000
    LENGTH OF SMALLER SIDE (M)  =     569.0000
    RECEPTOR HEIGHT (M)        =        .0000
    URBAN/RURAL OPTION         =        RURAL
 THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

    MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION


 BUOY. FLUX =     .000 M**4/S**3;  MOM. FLUX =     .000 M**4/S**2.

 *** FULL METEOROLOGY ***

 **********************************
 *** SCREEN AUTOMATED DISTANCES ***
 **********************************

 *** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES
***

   DIST     CONC             U10M   USTK  MIX HT   PLUME  MAX DIR
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   (DEG)
 -------  ----------  ----  -----  -----  ------  ------  -------
      1.   .1148E+05    6     1.0    1.0 10000.0     .00     45.
    100.   .1222E+05    6     1.0    1.0 10000.0     .00     45.
    200.   .1287E+05    6     1.0    1.0 10000.0     .00     45.
    300.   .1345E+05    6     1.0    1.0 10000.0     .00     45.
    400.   .1397E+05    6     1.0    1.0 10000.0     .00     45.
    500.   6680.        6     1.0    1.0 10000.0     .00     45.
    600.   5251.        6     1.0    1.0 10000.0     .00     45.
    700.   4446.        6     1.0    1.0 10000.0     .00     45.
    800.   3904.        6     1.0    1.0 10000.0     .00     45.
    900.   3509.        6     1.0    1.0 10000.0     .00     45.
   1000.   3207.        6     1.0    1.0 10000.0     .00     45.

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND     1. M:
    403.   .1399E+05    6     1.0    1.0 10000.0     .00     45.

      ************************************
      *** SUMMARY OF SCREEN MODEL RESULTS ***
      ************************************
```

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	.1399E+05	403.	0.

Figure F-1. SCREEN3 model simulation file for soil incorporated applications.

```
12/10/10

19:18:50
  ***  SCREEN3 MODEL RUN  ***
  *** VERSION DATED 96043 ***

 Soil Incorporated Applications

 SIMPLE TERRAIN INPUTS:
    SOURCE TYPE                =         AREA
    EMISSION RATE (G/(S-M**2))  =      .188000E-04
    SOURCE HEIGHT (M)          =        .0000
    LENGTH OF LARGER SIDE (M)   =     569.0000
    LENGTH OF SMALLER SIDE (M)  =     569.0000
    RECEPTOR HEIGHT (M)        =        .0000
    URBAN/RURAL OPTION         =        RURAL
 THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

    MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION


 BUOY. FLUX =     .000 M**4/S**3;  MOM. FLUX =     .000 M**4/S**2.

 *** FULL METEOROLOGY ***

 **********************************
 *** SCREEN AUTOMATED DISTANCES ***
 **********************************

 *** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES
***

   DIST     CONC             U10M   USTK  MIX HT   PLUME  MAX DIR
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   (DEG)
 -------  ----------  ----  -----  -----  ------  ------  -------
      1.   3010.        6     1.0    1.0 10000.0     .00     45.
    100.   3205.        6     1.0    1.0 10000.0     .00     45.
    200.   3375.        6     1.0    1.0 10000.0     .00     45.
    300.   3526.        6     1.0    1.0 10000.0     .00     45.
    400.   3663.        6     1.0    1.0 10000.0     .00     45.
    500.   1752.        6     1.0    1.0 10000.0     .00     45.
    600.   1377.        6     1.0    1.0 10000.0     .00     45.
    700.   1166.        6     1.0    1.0 10000.0     .00     45.
    800.   1024.        6     1.0    1.0 10000.0     .00     45.
    900.   920.2        6     1.0    1.0 10000.0     .00     45.
   1000.   841.0        6     1.0    1.0 10000.0     .00     45.

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND     1. M:
    403.   3667.        6     1.0    1.0 10000.0     .00     45.

      ************************************
```

*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	3667.	403.	0.