APPENDIX B

Air Quality Analysis for TFO Permit Application

B.1 INTRODUCTION

This appendix provides the ambient air quality impact assessment as required by the Ohio EPA consistent with their Engineering Guide #69. Prevention of Significant Deterioration (PSD) modeling is not required because all regulated pollutants have net emissions below the PSD significant emission rates. Ohio modeling is required for SO_2 because the project net increase in emissions is greater than the pollutant-specific Ohio Modeling Significant Emission Rates provided in Engineering Guide #69. The Ohio specific modeling ensures that the impact of the project will not exceed the Ohio Acceptable Incremental Impacts.

A summary of the project's emissions in comparison to the applicable significance levels is presented in Table B-1 below. As indicated in the table below, SO_2 requires modeling for the Ohio air quality impact analysis.

Table B-1: Summary of Project Emissions Compared to Modeling Thresholds

	Emissions (Tons per Year)					
	NO_x	**SO_2**	**CO**	**PM_{10}**	**VOC**	**GHG**
Project Emissions *(after netting)*	-383.2	36.6	-36.5	3.1	33.4	152,287
PSD Significance Emission Rates	40	40	100	15	NA	NA
Is PSD Modeling Required?	*No*	*No*	*No*	*No*	*NA*	*NA*
Ohio Modeling Significance Emission Rates	25	25	100	10	NA	NA
Is Ohio Modeling Required?	*No*	***Yes***	*No*	*No*	*NA*	*NA*

A screening-level air quality impact analysis was performed to assess the impact of the proposed project emissions of SO_2 on the ambient air quality. A description of the modeling approach and data used for the assessment of air quality impact is included in the following sections. The results of this evaluation show that the results for SO_2 were less than then Ohio significant impact levels.

Additionally, increases in air toxics from new projects that exceed one ton per year (1 tpy) (except for those from fossil fuel combustion) are required by Ohio's air

toxic policy to be evaluated to determine if the Maximum Acceptable Ground-Level Concentration (MAGLC) has been exceeded. As such, increased emissions of H_2S from the coke cutting water drained to the coker coke pit were evaluated. Emission rates of project air toxic's and the results of air toxic modeling of H_2S are presented in Section B.4.2.

B.2 Description of Air Quality Dispersion Model

Dispersion modeling for this project was performed using U.S. EPA SCREEN3 dispersion model. There are a variety of U.S. EPA air dispersion models for estimating ambient air impacts from releases of air contaminants by industrial processes. SCREEN3, a simplified version of ISC3 that requires few inputs and yields conservative results is available and approved for use by U.S. EPA for initial modeling.

SCREEN3 is a single source Gaussian plume model which predicts maximum ground-level concentrations for point, area, flare, and volume sources, as well as concentrations in the cavity zone, and concentrations due to inversion break-up and shoreline fumigation. Since SCREEN3 can only model one emissions source at a time, the combined ambient impact from multiple emissions sources can be conservatively estimated using SCREEN3 by adding together the model results for each emissions source modeled separately. This is a conservative approach because the maximum impacts would not actually occur at the same location for all sources. Due to the relative ease with which SCREEN3 modeling can be completed, it has been used to determine a conservative estimate of air quality impacts from steady state air emissions sources.

B.3 Data for Air Quality Impact Assessment

B.3.1 Emissions Data

For simplicity, a unitized emission rate of 1 gram per second (g/s) was used in the SCREEN3 model as the modeled emissions rate for each project affected emissions source with an increase in SO_2 emissions. This unitized modeling yields a model output predicted ambient impact in units of microgram/cubic meter ($\mu g/m^3$) concentration per gram/second (g/s) emissions rate. The resulting maximum predicted ambient concentration for each source was then multiplied by the project source emissions rate (g/s) to determine the predicted impact of that source. This methodology is consistent with the linear nature of Gaussian models such as SCREEN3, in which the impacts vary in direct proportion to the emissions rate, and is also referenced in OEPA Engineering

Guide #69. Table B-2 summarizes project emissions used in this modeling assessment by source.

Table B-2: Project SO_2 Emissions by Source

Source Description	SO_2 emissions (lb/hr)	SO_2 emissions (tpy)
New Crude 1 Heaters	11.19	21.18
Existing Crude 1 Heater	NA	-36.56
New Vac 1 Heater	3.72	7.06
Existing Vac 1 Heater	NA	-11.25
Coker 3 Heater	NA	-7.74
ADHT Heater	0.46	0.76
Alstom Boilers	NA	5.64
SRU 1, SRU 2&3	NA	41.34

Annual SO_2 emissions from the above heaters was estimated consistent with BPH's proposed new SO_2 limits on these heaters which requires long term (annual) emissions performance better than required by applicable NSPS standards. In order to reflect the maximum emissions for the short-term (24-hr and 3-hr) averaging periods for SO_2, BPH used short term rates (pound per hour SO_2 emissions in Table B-2) based on a short-term increase to the NSPS Ja standard of 162 ppm H_2S and the maximum firing rates. This was only applicable to fuel gas combustion sources with an increase in annual emissions for the TFO project. For the long-term annual average period, the annual SO_2 emissions increase from the project was used.

B.3.2 Stack Data

Site-specific stack parameters were used for each source. Table B-3 includes the stack data that was used for the air quality impact assessment.

Table B-3: Project Source Stack Data

Equipment Name	Type	Shape	Height (ft)	Diameter (ft)	Exit Gas T @ Max (K)	Exit Gas Flow @ Max (acfm)	Distance to nearest fenceline (ft)
New Crude Heaters	Vertical	Round	270	8	450	6500	1817
New Vac Heater	Vertical	Round	230	6	450	4300	1817
ADHT Heater	Vertical	Round	100	3.5	700	10,306	1342
Alstom Boilers	Vertical	Round	100	6.25	428	105,000	1444
SRU1 & SRU 2&3	Vertical	Round	175	3.5	810	31,923	850

In order to simplify the presentation of the modeling results, the emissions from the new Crude 1 heaters exhaust are shown as if they vented through only one stack. Similarly, the Alstom Boilers and the SRU 1/ SRU 2&3 are shown as if exhausted through only one stack. Since all maximum impacts are added together (regardless of their location), the spatial differences in stack locations is unimportant.

The design for the new Crude 1 and Vacuum 1 heaters is to have stacks taller than 213 feet (65 meters). However, consistent with US EPA/OEPA guidance, the modeling was performed at 65 meters which is the maximum allowable modeled height unless a GEP analysis supports the need for a higher stack to avoid building downwash (which it did not in this case).

B.3.3 Building Downwash Analysis

A generalized formula has been designed to establish the minimum release or stack height necessary to avoid the aerodynamic downwash phenomenon. This height is defined as GEP stack height. The determination of GEP stack height for an emission source is based on the following empirical equation:

$$H_g = H_b + 1.5\, l_b$$

where,

H_g = GEP stack height;

H_b = Height of the structure on which the source is located, or nearby structure; and

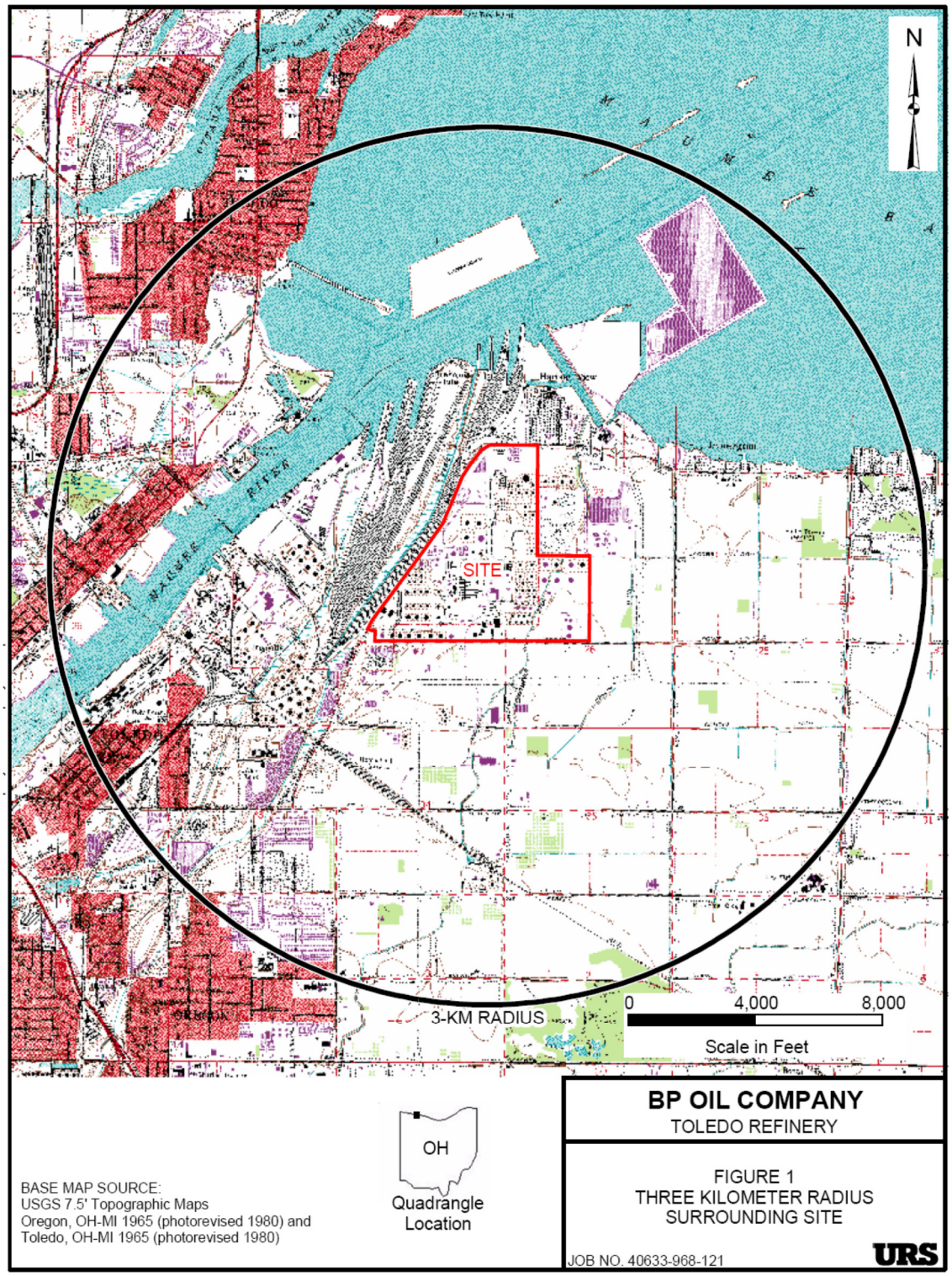
l_b = Lesser dimension (height or projected width) of the structure on which the source is located, or nearby structure.

The Coker 3 bubble tower was determined to be the largest, most influencing structure for the new Crude 1 and Vacuum 1 heaters in the surrounding area. The Coker 3 bubble tower has an estimated structure height of 116 feet and maximum projected width of 18 feet. The above formula yields a GEP stack height for this structure of 143 feet. The stacks on the new Crude heaters are currently designed for 270 feet. Similarly, the stack on the new Vac 1 heater is currently designed for 230 feet. These stack heights are above the height calculated as necessary to avoid building downwash. Consequently, downwash effects should not influence the air quality modeling. Nevertheless, the dimensions for this nearby structure were input into the SCREEN3 model and the downwash features of the model were used to assure that any slight affects would be addressed.

B.3.4 Land Use Classification

The BP-Husky refinery has historically been classified as rural for modeling purposes based on a technique developed by Irwin (1979). The classification can be based on average heat flux, land use, or population density within a 3-km radius from the site. Of these, the U.S. EPA has specified that land use is the most definitive criterion (U.S. EPA, 1986). Using the meteorological land use typing scheme established by Auer (1978) within a 3-km radius from the site, an urban classification of the site area requires more than 50 percent of the following land use types: heavy industrial (I1), light-moderate industrial (I2), commercial (C1), single-family compact residential (R2), and multi-family compact industrial (R3). Otherwise, the site area is considered rural. As shown in below Figure B-1, most of the area around the site is undeveloped, agricultural, or open waters. Since these non-urban land use types comprise more than 50 percent of the total area in the vicinity of the proposed facility, rural dispersion coefficients were employed in the model to calculate plume dispersion.

Figure B-1 Surrounding Land Use



B.3.5 Receptors and Terrain

SCREEN3 was executed for simple terrain using the full default meteorological data, and assuming rural mode.

B.4 AMBIENT AIR QUALITY MODELING RESULTS

B.4.1 Ohio Air Quality Impact of SO_2

Emissions of SO_2 were modeled using the emission and stack data described in Tables B-2 and B-3. The purpose of this analysis was to evaluate if the maximum incremental impact of total emissions from the TFO project will exceed the Ohio Acceptable Incremental Impact provided in Engineering Guide #69.

The results of this analysis is summarized below and the SCREEN3 Input and Output information and spreadsheets used to convert and compare the model output to the units of applicable standards are presented at the end of this Appendix. The Ohio EPA requires that the emission increases from new or modified sources be evaluated to determine if the maximum incremental impact of total emissions will exceed the Ohio Acceptable Incremental Impact. The applicable increments and the modeled results for this project are shown below in Table B-4.

Table B-4: Modeling Results Compared to Ohio EPA Thresholds

Pollutant	Averaging Period	Ohio Acceptable Incremental Impact* ($\mu g/m^3$)	TFO Project Modeled Impacts ($\mu g/m^3$)	% of Threshold
SO_2	Annual	10	1.74	17%
	24-hr	45.5	9.01	20%
	3-hr	256	20.27	8%

*Established in Ohio's Engineering Guide #69

As illustrated in Table B-4, the proposed project's modeled emission results indicate that predicted SO_2 concentrations are below the Ohio Acceptable Incremental Impacts, and no further analysis is needed. This analysis used the conservative SCREEN3 model the very conservative assumption that the maximum predicted impact from each source occurred at the exact same location as the maximum impact of every other emission source. Consequently, actual expected impacts should be much lower.

B.4.2 Ohio Air Toxics Analysis

In accordance with Ohio EPA's Engineering Guide #69, increases in air toxics from new projects that exceed one ton per year (1 tpy) should be evaluated to determine if the Maximum Acceptable Ground-Level Concentration (MAGLC) has been exceeded. A summary of the project's most significant air toxic emissions in comparison to the applicable significance levels are presented in Table B-5 below. Hexane and formaldehyde are the two largest HAP byproducts of fuel gas combustion and hydrogen sulfide (H_2S) is emitted from the Coker 3 during venting the coke drum and from the cutting and draining of the coke drum.

Table B-5: Summary of Project Significant Air Toxic Emissions

Emissions Source	Hexane tpy	Formaldehyde tpy	H_2S tpy
New Crude 1 Heater	3.48	0.14	NA
New Vacuum 1 Heater	1.16	0.05	NA
Coker 3 Heater	0.03	0.001	NA
ADHT Heater	0.08	0.004	NA
Steam Boilers	0.93	0.04	NA
SRU (fuel combustion emissions)	0.08	0.003	NA
Coker 3 Coke Pit	NA	NA	0.29
Project Air Toxic Emissions	5.76	0.24	0.29
Ohio Air Toxic Modeling Emission Rate	*1 tpy*	*1 tpy*	*1 tpy*
Is Ohio Toxics Modeling Performed?	*No**	*No**	*No*

**NOTE: ORC 3704.03(F)(f)(i) states that the air toxics policy does not apply to air contaminant sources that combust fossil fuels. Therefore, the increase in air toxic emissions from the combustion of fossil fuels (hexane and formaldehyde) from the affected project heaters is not required.*

As indicated in the table above, none of the air toxics from the TFO project require modeling. However, for informational purposes, a screening-level air quality impact analysis was performed using U. S. EPA's SCREEN3 model to assess the impact of the proposed project emissions of H_2S on the ground-level concentration of air toxics. Modeling inputs are summarized in Table B-9.

Table B-3: TFO Project Air Toxic Model Input Volume Source Data

Source Name	Type	Release Height (ft)	Initial Lateral Dimension (ft)	Initial Vertical Dimension (ft)	Distance to nearest fenceline (ft)
Coker 3 Maze Sump	Volume (2)	0	5.58	0.46	1276
Coker 3 Surge Tank	Volume	45	5.81	20.93	1722

Table 1 of the SCREEN3 User's Guide, dated September 1995 provides suggested procedures for estimating the initial lateral dimensions and initial vertical dimensions for volume source plumes. For a single volume source, the initial lateral dimension is estimated by dividing the length of side by 4.3. The Coker 3 maze sump is approximately 24 feet by 47 feet. Therefore, BPH assumed two (2) volume sources with the side of the volume source equal to 24 feet. The initial vertical dimension of a surface-based source is estimated by taking the vertical dimension of the volume source and dividing it by 2.15. Since the maze sump is emitted at ground level, it was assumed that the volume source was 1 foot tall.

The Coker 3 surge tank is an open top tank that is approximately 45 feet tall with a 25 foot diameter. To estimate the volume source properties, it was assumed that the volume source was emitted at 45 feet with a 25 foot side. The height of the volume source was assumed to be 1 foot tall.

Emissions of H2S are also emitted from the drum cutting water that is stored in the old coke drums of the former Coker 1 unit and emissions that occur during the Coker 3 drum venting. The source parameters modeled for these sources is given in Table B-3a below.

Table B-3a: TFO Project Air Toxic Model Input Point Source Data

Source Name	Type	Shape	Height (ft)	Diameter (ft)	Exit Gas T @ Max (K)	Exit Gas Flow @ Max (acfm)	Distance to nearest fenceline (ft)
Coker 3 Water Storage (Old Coker 1 Drums)	Vertical	Round	90	0.833	293	40.8	1549
Coker 3 Vent	Vertical	Round	109	0.833	678	2230	1276

The modeled emissions were compared to the Maximum Acceptable Ground-Level Concentration (MAGLC). The Maximum Acceptable Ground-Level Concentration (MAGLC) was calculated based on the Threshold Limit Value (TLV) and Ohio EPA methodology provided in *Option A, Review of New Sources of Air Toxic Emissions*.). The TLV value used in this analysis is from the American Conference of Governmental Industrial Hygienists (ACGIH) and represents the maximum concentration that nearly all workers may be exposed to on the basis of an 8 hour per day, 40 hour per week work schedule without adverse effects. The TLV value used was published in 2010 by ACGIH.

The MAGLC was calculated using the following formula (for a continuous emitting source):

$$\text{MAGLC} = \frac{\text{TLV}}{10} \times \frac{8\text{ hours}}{24\text{ hours}} \times \frac{5\text{ days}}{7\text{ days}} = \frac{\text{TLV}}{42}$$

From the Option A guidance, Ohio EPA requires a source to compare the maximum predicted on-hour concentration under worst-case meteorology to the estimated MAGLC above to determine the ambient air quality effects of a new project. Table B-9 shows the MAGLC value calculated for H_2S.

B-9: Air Toxic Pollutant Thresholds

Pollutant	TLV (ppm)	TLV (µg/m3)	MAGLC (Calculated) (µg/m3)
H_2S	1	1,392.6	33.16

Note: The concentration of TLV in PPM is converted to µg/m^3 by multiplying PPM by the molecular weight of the compound 34.05 (g/gmole), dividing by 24.45 liters/gmole, and multiplying by 1000 (liters/m3).

The highest predicted potential ground-level concentration for H_2S compared to the corresponding Maximum Acceptable Ground Level Concentration (MAGLC) is shown in Table B-10

Table B-10: Air Toxics Analysis Results

Air Toxic	Project Emission Increases (g/s)	TFO Maximum Predicted Concentration (µg/m3)	Ohio MAGLC (Annual) (µg/m3)
H_2S	8.31E-03	13.19	33.16

As shown in the table above, the modeled maximum ground-level concentrations for H_2S is below the calculated MAGLC. Based on the Ohio EPA Air Toxics Policy, no further analysis is necessary.

REFERENCES

American Conference of Governmental Industrial Hygienist (2006): "2006 TLVs and BELs: Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents, Biological Exposure Indices," Cincinnati, OH: ACGIH Worldwide

Auer, A. H. (1978): "Correlation of Land Use and Cover with Meteorological Anomalies, "Journal of Applied Meteorology, Volume 17, pp. 636-643.

Hazardous Substances Data Bank (HSDB), a database of the National Library of Medicine's TOXNET system (http://toxnet.nlm.nih.gov)

Irwin, J.S. (1979): "Proposed Criteria for Selection of Urban Versus Rural Dispersion Coefficients," Meteorology and Assessment Division, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina.

Ohio Environmental Protection Agency (2003): "Engineering Guide #69, Air Dispersion Modeling Guidance," Division of Air Pollution Control Air Quality Modeling and Planning Section

Ohio Environmental Protection Agency (1997): "Option A, Review of New Sources of Air Toxic Emissions", Division of Air Pollution Control, Columbus, OH

Technology Transfer Network (2008): Support Center for Regulatory Atmospheric Modeling web-based documents,
http://www.epa.gov/scram001/dispersion_screening.htm,
http://www.epa.gov/scram001/dispersion_screening.htm,
http://www.epa.gov/scram001/guidance/guide/appw_05.pdf

United States Environmental Protection Agency (1992): "Screening Procedures for estimating the Air Quality Impact of Stationary Sources, Revised," EPA-454/R-92-019

Attachment 1:

SCREEN3 Output

SCREEN3 Results for New Crude Heater Stacks

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 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

C:\Lakes\Screen View\New Crude.scr

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      1.00000
   STACK HEIGHT (M)       =      82.2960
   STK INSIDE DIAM (M)    =       2.4384
   STK EXIT VELOCITY (M/S)=       0.6569
   STK GAS EXIT TEMP (K)  =     449.8167
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       0.0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =      36.5800
   MIN HORIZ BLDG DIM (M) =       5.4900
   MAX HORIZ BLDG DIM (M) =       5.4900

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

   STACK EXIT VELOCITY WAS CALCULATED FROM
   VOLUME FLOW RATE =   3.0676556     (M**3/S)

BUOY. FLUX =    3.338 M**4/S**3;  MOM. FLUX =    0.418 M**4/S**2.

*** FULL METEOROLOGY ***

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

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
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DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	1	1.0	1.2	320.0	123.40	0.72	0.62	NO
100.	0.7542E-06	1	3.0	3.5	960.0	91.12	27.19	14.58	NO
200.	0.5433	1	3.0	3.5	960.0	91.12	50.16	29.62	NO
300.	4.658	1	2.0	2.3	640.0	99.19	72.06	47.89	NO
400.	9.468	1	1.0	1.2	320.0	123.40	93.62	72.35	NO
500.	11.54	1	1.0	1.2	320.0	123.40	113.79	105.46	NO
600.	9.728	1	1.0	1.2	320.0	123.40	133.51	154.49	NO
700.	8.401	2	1.0	1.2	320.0	123.40	112.73	75.05	NO
800.	9.051	2	1.0	1.2	320.0	123.40	126.89	86.55	NO
900.	9.017	2	1.0	1.2	320.0	123.40	140.86	98.24	NO
1000.	8.606	2	1.0	1.2	320.0	123.40	154.67	110.08	NO
1100.	8.020	2	1.0	1.2	320.0	123.40	168.33	122.05	NO
1200.	7.450	3	1.0	1.2	320.0	120.43	122.33	73.27	NO
1300.	7.725	3	1.0	1.2	320.0	120.43	131.47	78.68	NO

1400.	7.821	3	1.0	1.2	320.0	120.43	140.54	84.07	NO
1500.	7.785	3	1.0	1.2	320.0	120.43	149.56	89.43	NO
1600.	7.654	3	1.0	1.2	320.0	120.43	158.52	94.77	NO
1700.	7.460	3	1.0	1.2	320.0	120.43	167.42	100.09	NO
1800.	7.224	3	1.0	1.2	320.0	120.43	176.27	105.38	NO
1900.	6.963	3	1.0	1.2	320.0	120.43	185.07	110.65	NO
2000.	6.689	3	1.0	1.2	320.0	120.43	193.83	115.91	NO
2100.	6.411	3	1.0	1.2	320.0	120.43	202.55	121.14	NO
2200.	6.136	3	1.0	1.2	320.0	120.43	211.22	126.35	NO
2300.	5.866	3	1.0	1.2	320.0	120.43	219.85	131.55	NO
2400.	5.606	3	1.0	1.2	320.0	120.43	228.44	136.72	NO
2500.	5.357	3	1.0	1.2	320.0	120.43	237.00	141.88	NO
2600.	5.121	3	1.0	1.2	320.0	120.43	245.52	147.03	NO
2700.	4.897	3	1.0	1.2	320.0	120.43	254.01	152.16	NO
2800.	4.685	3	1.0	1.2	320.0	120.43	262.46	157.27	NO
2900.	4.487	3	1.0	1.2	320.0	120.43	270.88	162.37	NO
3000.	4.302	3	1.0	1.2	320.0	120.43	279.27	167.45	NO
3500.	4.183	4	1.0	1.4	320.0	115.89	212.47	72.32	NO
4000.	4.135	4	1.0	1.4	320.0	115.89	239.56	78.27	NO
4500.	4.003	4	1.0	1.4	320.0	115.89	266.28	83.94	NO
5000.	3.827	4	1.0	1.4	320.0	115.89	292.68	89.37	NO
5500.	3.633	4	1.0	1.4	320.0	115.89	318.78	94.60	NO
6000.	3.436	4	1.0	1.4	320.0	115.89	344.62	99.64	NO
6500.	3.243	4	1.0	1.4	320.0	115.89	370.20	104.53	NO
7000.	3.059	4	1.0	1.4	320.0	115.89	395.56	109.27	NO
7500.	2.886	4	1.0	1.4	320.0	115.89	420.71	113.88	NO
8000.	2.724	4	1.0	1.4	320.0	115.89	445.67	118.37	NO
8500.	2.574	4	1.0	1.4	320.0	115.89	470.43	122.75	NO
9000.	2.435	4	1.0	1.4	320.0	115.89	495.03	127.03	NO
9500.	2.306	4	1.0	1.4	320.0	115.89	519.45	131.23	NO
10000.	2.187	4	1.0	1.4	320.0	115.89	543.73	135.33	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

485.	11.59	1	1.0	1.2	320.0	123.40	110.99	100.49	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
554.	10.82	1	1.0	1.2	320.0	123.40	124.49	130.68	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED

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 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****************************************
     *** REGULATORY (Default) ***
    PERFORMING CAVITY CALCULATIONS
  WITH ORIGINAL SCREEN CAVITY MODEL
          (BRODE, 1988)
****************************************


 *** CAVITY CALCULATION - 1 ***        *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)     =    3320.         CONC (UG/M**3)     =    3320.
  CRIT WS @10M (M/S) =     1.00         CRIT WS @10M (M/S) =     1.00
  CRIT WS @ HS (M/S) =     1.52         CRIT WS @ HS (M/S) =     1.52
  DILUTION WS (M/S)  =     1.00         DILUTION WS (M/S)  =     1.00
  CAVITY HT (M)      =    84.73         CAVITY HT (M)      =    84.73
  CAVITY LENGTH (M)  =    25.61         CAVITY LENGTH (M)  =    25.61
  ALONGWIND DIM (M)  =     5.49         ALONGWIND DIM (M)  =     5.49

****************************************
      END OF CAVITY CALCULATIONS
****************************************


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

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------   -------   -------
SIMPLE TERRAIN      11.59          485.        0.

BLDG. CAVITY-1      3320.           26.       --  (DIST = CAVITY LENGTH)

BLDG. CAVITY-2      3320.           26.       --  (DIST = CAVITY LENGTH)


**************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
**************************************************
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SCREEN3 Results for New Vac Heater Stack 02/08/13
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 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

C:\Lakes\Screen View\New Vac.scr

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      1.00000
   STACK HEIGHT (M)       =      70.1040
   STK INSIDE DIAM (M)    =       1.8288
   STK EXIT VELOCITY (M/S)=       0.7726
   STK GAS EXIT TEMP (K)  =     449.8167
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       0.0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =      36.5800
   MIN HORIZ BLDG DIM (M) =       5.4900
   MAX HORIZ BLDG DIM (M) =       5.4900

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

   STACK EXIT VELOCITY WAS CALCULATED FROM
   VOLUME FLOW RATE =   2.0293722     (M**3/S)

BUOY. FLUX =    2.208 M**4/S**3;  MOM. FLUX =    0.325 M**4/S**2.

*** FULL METEOROLOGY ***

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

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	1	1.0	1.1	320.0	100.95	0.66	0.55	NO
100.	0.1382E-03	1	3.0	3.4	960.0	76.73	27.05	14.32	NO
200.	2.120	1	3.0	3.4	960.0	76.73	50.07	29.48	NO
300.	9.597	1	1.5	1.7	480.0	88.84	72.05	47.88	NO
400.	15.45	1	1.0	1.1	320.0	100.95	93.21	71.82	NO
500.	14.69	1	1.0	1.1	320.0	100.95	113.45	105.10	NO
600.	12.51	2	1.0	1.1	320.0	100.95	97.97	63.15	NO
700.	13.25	2	1.0	1.1	320.0	100.95	112.39	74.54	NO
800.	12.82	2	1.0	1.1	320.0	100.95	126.58	86.11	NO
900.	11.86	2	1.0	1.1	320.0	100.95	140.59	97.85	NO
1000.	11.39	3	1.0	1.2	320.0	98.89	103.52	61.82	NO
1100.	11.73	3	1.0	1.2	320.0	98.89	112.83	67.33	NO
1200.	11.72	3	1.0	1.2	320.0	98.89	122.06	72.81	NO
1300.	11.48	3	1.0	1.2	320.0	98.89	131.22	78.26	NO

1400.	11.10	3	1.0	1.2	320.0	98.89	140.31	83.67	NO
1500.	10.63	3	1.0	1.2	320.0	98.89	149.34	89.06	NO
1600.	10.13	3	1.0	1.2	320.0	98.89	158.31	94.42	NO
1700.	9.609	3	1.0	1.2	320.0	98.89	167.22	99.76	NO
1800.	9.094	3	1.0	1.2	320.0	98.89	176.08	105.07	NO
1900.	8.594	3	1.0	1.2	320.0	98.89	184.89	110.35	NO
2000.	8.116	3	1.0	1.2	320.0	98.89	193.66	115.62	NO
2100.	7.664	3	1.0	1.2	320.0	98.89	202.38	120.86	NO
2200.	7.239	3	1.0	1.2	320.0	98.89	211.06	126.09	NO
2300.	6.841	3	1.0	1.2	320.0	98.89	219.70	131.29	NO
2400.	6.739	4	1.0	1.3	320.0	95.71	151.14	57.00	NO
2500.	6.794	4	1.0	1.3	320.0	95.71	156.81	58.49	NO
2600.	6.825	4	1.0	1.3	320.0	95.71	162.46	59.96	NO
2700.	6.835	4	1.0	1.3	320.0	95.71	168.08	61.41	NO
2800.	6.827	4	1.0	1.3	320.0	95.71	173.68	62.83	NO
2900.	6.804	4	1.0	1.3	320.0	95.71	179.26	64.25	NO
3000.	6.767	4	1.0	1.3	320.0	95.71	184.82	65.64	NO
3500.	6.423	4	1.0	1.3	320.0	95.71	212.35	71.96	NO
4000.	5.992	4	1.0	1.3	320.0	95.71	239.45	77.93	NO
4500.	5.547	4	1.0	1.3	320.0	95.71	266.18	83.63	NO
5000.	5.120	4	1.0	1.3	320.0	95.71	292.59	89.08	NO
5500.	4.725	4	1.0	1.3	320.0	95.71	318.70	94.32	NO
6000.	4.366	4	1.0	1.3	320.0	95.71	344.54	99.38	NO
6500.	4.041	4	1.0	1.3	320.0	95.71	370.13	104.27	NO
7000.	3.750	4	1.0	1.3	320.0	95.71	395.50	109.02	NO
7500.	3.488	4	1.0	1.3	320.0	95.71	420.65	113.64	NO
8000.	3.252	4	1.0	1.3	320.0	95.71	445.61	118.14	NO
8500.	3.040	4	1.0	1.3	320.0	95.71	470.38	122.53	NO
9000.	2.848	4	1.0	1.3	320.0	95.71	494.97	126.83	NO
9500.	2.675	4	1.0	1.3	320.0	95.71	519.40	131.02	NO
10000.	2.518	4	1.0	1.3	320.0	95.71	543.68	135.14	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

432.	15.90	1	1.0	1.1	320.0	100.95	99.95	82.18	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
554.	12.71	1	1.0	1.1	320.0	100.95	124.18	130.38	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED

```
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****************************************
     *** REGULATORY (Default) ***
    PERFORMING CAVITY CALCULATIONS
  WITH ORIGINAL SCREEN CAVITY MODEL
          (BRODE, 1988)
****************************************


 *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)     =    3320.        CONC (UG/M**3)     =    3320.
  CRIT WS @10M (M/S) =     1.00        CRIT WS @10M (M/S) =     1.00
  CRIT WS @ HS (M/S) =     1.48        CRIT WS @ HS (M/S) =     1.48
  DILUTION WS (M/S)  =     1.00        DILUTION WS (M/S)  =     1.00
  CAVITY HT (M)      =    84.73        CAVITY HT (M)      =    84.73
  CAVITY LENGTH (M)  =    25.61        CAVITY LENGTH (M)  =    25.61
  ALONGWIND DIM (M)  =     5.49        ALONGWIND DIM (M)  =     5.49

****************************************
      END OF CAVITY CALCULATIONS
****************************************


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

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------   -------   -------
SIMPLE TERRAIN      15.90          432.        0.

BLDG. CAVITY-1      3320.           26.       --  (DIST = CAVITY LENGTH)

BLDG. CAVITY-2      3320.           26.       --  (DIST = CAVITY LENGTH)


**************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
**************************************************
```

SCREEN3 Results for ADHT Heater Stack 02/08/13
16:57:00

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 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

C:\Lakes\Screen View\ADHT.scr

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      1.00000
   STACK HEIGHT (M)       =      30.4800
   STK INSIDE DIAM (M)    =       1.0670
   STK EXIT VELOCITY (M/S)=       5.4400
   STK GAS EXIT TEMP (K)  =     699.8170
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       0.0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =      40.5000
   MIN HORIZ BLDG DIM (M) =       5.5000
   MAX HORIZ BLDG DIM (M) =       5.5000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =    8.826 M**4/S**3;  MOM. FLUX =    3.527 M**4/S**2.

*** FULL METEOROLOGY ***

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

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	0	0.0	0.0	0.0	0.00	0.00	0.00	NA
100.	4.630	1	3.0	3.2	960.0	39.63	26.85	13.95	SS
200.	15.30	1	3.0	3.2	960.0	50.36	49.97	29.30	SS
300.	17.67	3	5.0	5.6	1600.0	39.05	34.29	23.42	SS
400.	18.31	3	4.5	5.0	1440.0	40.96	44.65	29.47	SS
500.	17.57	3	3.5	3.9	1120.0	46.71	54.77	35.41	SS
600.	16.47	3	3.0	3.4	960.0	51.19	64.71	41.25	SS
700.	15.63	4	4.5	5.3	1440.0	39.91	49.26	27.87	SS
800.	15.24	4	4.0	4.7	1280.0	42.21	55.64	30.53	SS
900.	13.98	4	4.0	4.7	1280.0	42.21	61.95	31.29	SS
1000.	13.52	4	3.5	4.1	1120.0	45.27	68.19	33.51	SS
1100.	12.92	4	3.5	4.1	1120.0	45.27	74.38	35.49	SS
1200.	12.43	4	3.0	3.5	960.0	49.48	80.50	37.42	SS
1300.	11.94	4	3.0	3.5	960.0	49.48	86.58	39.29	SS
1400.	11.43	4	3.0	3.5	960.0	49.48	92.62	41.12	SS
1500.	11.03	4	2.5	3.0	800.0	55.49	98.61	42.90	SS

1600.	10.66	4	2.5	3.0	800.0	55.49	104.56	44.64	SS
1700.	10.28	4	2.5	3.0	800.0	55.49	110.47	46.34	SS
1800.	9.890	4	2.5	3.0	800.0	55.49	116.35	48.01	SS
1900.	9.510	4	2.0	2.4	640.0	64.64	122.19	49.65	SS
2000.	9.266	4	2.0	2.4	640.0	64.64	128.01	51.26	SS
2100.	9.013	4	2.0	2.4	640.0	64.64	133.79	52.84	SS
2200.	8.755	4	2.0	2.4	640.0	64.64	139.54	54.40	SS
2300.	8.748	5	1.0	1.5	10000.0	70.89	109.94	37.48	SS
2400.	8.918	5	1.0	1.5	10000.0	70.89	114.20	38.36	SS
2500.	9.055	5	1.0	1.5	10000.0	70.89	118.45	39.21	SS
2600.	9.162	5	1.0	1.5	10000.0	70.89	122.67	40.06	SS
2700.	9.242	5	1.0	1.5	10000.0	70.89	126.88	40.89	SS
2800.	9.298	5	1.0	1.5	10000.0	70.89	131.08	41.71	SS
2900.	9.333	5	1.0	1.5	10000.0	70.89	135.25	42.51	SS
3000.	9.349	5	1.0	1.5	10000.0	70.89	139.42	43.31	SS
3500.	9.220	5	1.0	1.5	10000.0	70.89	160.02	47.13	SS
4000.	8.784	5	1.0	1.5	10000.0	70.89	180.30	50.19	SS
4500.	8.326	5	1.0	1.5	10000.0	70.89	200.31	53.22	SS
5000.	8.049	6	1.0	1.8	10000.0	58.89	148.05	34.92	SS
5500.	7.962	6	1.0	1.8	10000.0	58.89	161.05	36.44	SS
6000.	7.820	6	1.0	1.8	10000.0	58.89	173.91	37.88	SS
6500.	7.643	6	1.0	1.8	10000.0	58.89	186.65	39.27	SS
7000.	7.385	6	1.0	1.8	10000.0	58.89	199.28	40.31	SS
7500.	7.162	6	1.0	1.8	10000.0	58.89	211.81	41.46	SS
8000.	6.939	6	1.0	1.8	10000.0	58.89	224.24	42.57	SS
8500.	6.720	6	1.0	1.8	10000.0	58.89	236.58	43.64	SS
9000.	6.506	6	1.0	1.8	10000.0	58.89	248.83	44.67	SS
9500.	6.300	6	1.0	1.8	10000.0	58.89	261.00	45.67	SS
10000.	6.101	6	1.0	1.8	10000.0	58.89	273.10	46.64	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

376.	18.40	3	4.5	5.0	1440.0	40.96	42.29	28.09	SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
409.	18.27	3	4.0	4.5	1280.0	43.43	45.57	30.01	SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED

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 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****************************************
     *** REGULATORY (Default) ***
    PERFORMING CAVITY CALCULATIONS
  WITH ORIGINAL SCREEN CAVITY MODEL
          (BRODE, 1988)
****************************************


 *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)     =    2993.        CONC (UG/M**3)     =    2993.
  CRIT WS @10M (M/S) =     1.00        CRIT WS @10M (M/S) =     1.00
  CRIT WS @ HS (M/S) =     1.25        CRIT WS @ HS (M/S) =     1.25
  DILUTION WS (M/S)  =     1.00        DILUTION WS (M/S)  =     1.00
  CAVITY HT (M)      =    94.81        CAVITY HT (M)      =    94.81
  CAVITY LENGTH (M)  =    26.97        CAVITY LENGTH (M)  =    26.97
  ALONGWIND DIM (M)  =     5.50        ALONGWIND DIM (M)  =     5.50

****************************************
      END OF CAVITY CALCULATIONS
****************************************


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

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------   -------   -------
SIMPLE TERRAIN      18.40          376.        0.

BLDG. CAVITY-1      2993.           27.       --  (DIST = CAVITY LENGTH)

BLDG. CAVITY-2      2993.           27.       --  (DIST = CAVITY LENGTH)


**************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
**************************************************
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SCREEN3 Results for Alstom Boiler Stacks 02/08/13
16:58:02

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 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

C:\Lakes\Screen View\Boilers.scr

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      1.00000
   STACK HEIGHT (M)       =      30.7800
   STK INSIDE DIAM (M)    =       1.9050
   STK EXIT VELOCITY (M/S)=      17.3860
   STK GAS EXIT TEMP (K)  =     427.5940
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       0.0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =      54.8600
   MIN HORIZ BLDG DIM (M) =      12.1900
   MAX HORIZ BLDG DIM (M) =      27.4300

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =   48.688 M**4/S**3;  MOM. FLUX =  187.917 M**4/S**2.

*** FULL METEOROLOGY ***

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

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	0	0.0	0.0	0.0	0.00	0.00	0.00	NA
100.	91.44	6	2.0	3.7	10000.0	35.67	11.17	21.68	SS
200.	50.23	4	4.0	4.7	1280.0	39.53	17.87	28.38	SS
300.	37.81	6	2.0	3.7	10000.0	48.80	24.57	35.08	SS
400.	33.38	6	2.0	3.7	10000.0	48.80	28.69	36.32	SS
500.	30.29	6	2.0	3.7	10000.0	48.80	31.82	36.61	SS
600.	27.77	6	2.0	3.7	10000.0	48.80	34.91	36.91	SS
700.	25.67	6	2.0	3.7	10000.0	48.80	37.98	37.20	SS
800.	23.90	6	2.0	3.7	10000.0	48.80	41.03	37.48	SS
900.	22.37	6	2.0	3.7	10000.0	48.80	44.05	37.77	SS
1000.	21.05	6	2.0	3.7	10000.0	48.80	47.04	38.05	SS
1100.	19.89	6	2.0	3.7	10000.0	48.80	50.02	38.33	SS
1200.	18.86	6	2.0	3.7	10000.0	48.80	52.98	38.61	SS
1300.	17.95	6	2.0	3.7	10000.0	48.80	55.92	38.88	SS
1400.	17.12	6	2.0	3.7	10000.0	48.80	58.84	39.16	SS
1500.	16.43	6	1.5	2.8	10000.0	55.17	61.75	36.94	SS

1600.	15.85	6	1.5	2.8	10000.0	55.17	64.64	37.23	SS
1700.	15.31	6	1.5	2.8	10000.0	55.17	67.52	37.52	SS
1800.	14.81	6	1.5	2.8	10000.0	55.17	70.38	37.80	SS
1900.	14.36	6	1.5	2.8	10000.0	55.17	73.23	38.08	SS
2000.	13.93	6	1.5	2.8	10000.0	55.17	76.06	38.36	SS
2100.	13.53	6	1.5	2.8	10000.0	55.17	78.89	38.64	SS
2200.	13.16	6	1.5	2.8	10000.0	55.17	81.70	38.92	SS
2300.	12.82	6	1.5	2.8	10000.0	55.17	84.50	39.19	SS
2400.	12.49	6	1.5	2.8	10000.0	55.17	87.30	39.46	SS
2500.	12.18	6	1.5	2.8	10000.0	55.17	90.08	39.73	SS
2600.	11.89	6	1.5	2.8	10000.0	55.17	92.85	39.99	SS
2700.	11.46	6	1.5	2.8	10000.0	55.17	95.61	39.67	SS
2800.	11.21	6	1.5	2.8	10000.0	55.17	98.36	39.94	SS
2900.	10.97	6	1.5	2.8	10000.0	55.17	101.10	40.19	SS
3000.	10.73	6	1.5	2.8	10000.0	55.17	103.84	40.42	SS
3500.	9.712	6	1.5	2.8	10000.0	55.17	117.38	41.57	SS
4000.	8.885	6	1.5	2.8	10000.0	55.17	130.74	42.67	SS
4500.	8.377	6	1.0	1.9	10000.0	66.78	132.50	40.99	SS
5000.	7.954	6	1.0	1.9	10000.0	66.78	145.67	42.11	SS
5500.	7.575	6	1.0	1.9	10000.0	66.78	158.69	43.20	SS
6000.	7.233	6	1.0	1.9	10000.0	66.78	171.58	44.24	SS
6500.	6.922	6	1.0	1.9	10000.0	66.78	184.34	45.26	SS
7000.	6.637	6	1.0	1.9	10000.0	66.78	196.99	46.24	SS
7500.	6.374	6	1.0	1.9	10000.0	66.78	209.54	47.19	SS
8000.	6.130	6	1.0	1.9	10000.0	66.78	221.98	48.12	SS
8500.	5.904	6	1.0	1.9	10000.0	66.78	234.34	49.02	SS
9000.	5.693	6	1.0	1.9	10000.0	66.78	246.61	49.90	SS
9500.	5.495	6	1.0	1.9	10000.0	66.78	258.79	50.76	SS
10000.	5.311	6	1.0	1.9	10000.0	66.78	270.90	51.60	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

91.	97.79	5	2.5	3.7	10000.0	35.00	10.64	21.14	SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
440.	32.06	6	2.0	3.7	10000.0	48.80	29.94	36.44	SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED

```
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****************************************
     *** REGULATORY (Default) ***
    PERFORMING CAVITY CALCULATIONS
  WITH ORIGINAL SCREEN CAVITY MODEL
          (BRODE, 1988)
****************************************


 *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)     =    443.0        CONC (UG/M**3)     =    996.9
  CRIT WS @10M (M/S) =     1.00        CRIT WS @10M (M/S) =     1.00
  CRIT WS @ HS (M/S) =     1.25        CRIT WS @ HS (M/S) =     1.25
  DILUTION WS (M/S)  =     1.00        DILUTION WS (M/S)  =     1.00
  CAVITY HT (M)      =   120.61        CAVITY HT (M)      =   100.68
  CAVITY LENGTH (M)  =    95.77        CAVITY LENGTH (M)  =    30.84
  ALONGWIND DIM (M)  =    12.19        ALONGWIND DIM (M)  =    27.43

****************************************
      END OF CAVITY CALCULATIONS
****************************************


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

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------   -------   -------
SIMPLE TERRAIN      97.79           91.        0.

BLDG. CAVITY-1      443.0           96.       --  (DIST = CAVITY LENGTH)

BLDG. CAVITY-2      996.9           31.       --  (DIST = CAVITY LENGTH)


**************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
**************************************************
```

SCREEN3 Results for SRU Stacks 02/08/13
16:59:29

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

C:\Lakes\Screen View\SRUs.scr

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      1.00000
   STACK HEIGHT (M)       =      53.3400
   STK INSIDE DIAM (M)    =       1.0670
   STK EXIT VELOCITY (M/S)=      16.8490
   STK GAS EXIT TEMP (K)  =     810.9280
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       0.0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =       0.0000
   MIN HORIZ BLDG DIM (M) =       0.0000
   MAX HORIZ BLDG DIM (M) =       0.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =   30.035 M**4/S**3;  MOM. FLUX =   29.195 M**4/S**2.

*** FULL METEOROLOGY ***

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

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	1	1.0	1.1	320.0	297.82	2.20	2.17	NO
100.	0.5687E-09	5	1.0	1.8	10000.0	129.34	18.11	17.40	NO
200.	0.1102E-01	1	3.0	3.4	960.0	134.83	52.01	32.65	NO
300.	0.7622	1	3.0	3.4	960.0	134.83	74.20	51.06	NO
400.	2.598	1	3.0	3.4	960.0	134.83	95.49	74.75	NO
500.	3.458	1	3.0	3.4	960.0	134.83	115.41	107.21	NO
600.	3.801	1	1.0	1.1	320.0	297.82	150.12	169.05	NO
700.	5.479	1	1.0	1.1	320.0	297.82	167.56	224.47	NO
800.	5.796	1	1.0	1.1	320.0	297.82	185.08	291.50	NO
900.	5.458	1	1.0	1.1	320.0	297.82	202.61	369.79	NO
1000.	5.038	1	1.0	1.1	320.0	297.82	220.09	459.19	NO
1100.	4.669	1	1.0	1.1	320.0	297.82	237.50	559.67	NO
1200.	4.351	1	1.0	1.1	320.0	297.82	254.82	671.23	NO
1300.	4.076	1	1.0	1.1	320.0	297.82	272.06	793.91	NO
1400.	3.834	1	1.0	1.1	320.0	297.82	289.19	927.77	NO
1500.	3.621	1	1.0	1.1	320.0	297.82	306.23	1072.88	NO

1600.	3.431	1	1.0	1.1	320.0	297.82	323.16	1229.29	NO
1700.	3.263	2	1.0	1.1	320.0	297.82	257.05	207.73	NO
1800.	3.330	2	1.0	1.1	320.0	297.82	269.48	219.70	NO
1900.	3.357	2	1.0	1.1	320.0	297.82	281.87	231.80	NO
2000.	3.352	2	1.0	1.1	320.0	297.82	294.21	244.03	NO
2100.	3.320	2	1.0	1.1	320.0	297.82	306.51	256.38	NO
2200.	3.270	2	1.0	1.1	320.0	297.82	318.76	268.83	NO
2300.	3.206	2	1.0	1.1	320.0	297.82	330.96	281.37	NO
2400.	3.134	2	1.0	1.1	320.0	297.82	343.12	294.01	NO
2500.	3.056	2	1.0	1.1	320.0	297.82	355.23	306.74	NO
2600.	2.976	2	1.0	1.1	320.0	297.82	367.30	319.54	NO
2700.	2.895	2	1.0	1.1	320.0	297.82	379.33	332.41	NO
2800.	2.816	2	1.0	1.1	320.0	297.82	391.31	345.36	NO
2900.	2.739	2	1.0	1.1	320.0	297.82	403.24	358.37	NO
3000.	2.664	2	1.0	1.1	320.0	297.82	415.14	371.44	NO
3500.	2.395	3	1.0	1.2	320.0	285.85	327.37	203.44	NO
4000.	2.419	3	1.0	1.2	320.0	285.85	367.52	227.20	NO
4500.	2.354	3	1.0	1.2	320.0	285.85	407.26	250.94	NO
5000.	2.243	3	1.0	1.2	320.0	285.85	446.60	274.62	NO
5500.	2.115	3	1.0	1.2	320.0	285.85	485.58	298.23	NO
6000.	1.986	3	1.0	1.2	320.0	285.85	524.21	321.76	NO
6500.	1.863	3	1.0	1.2	320.0	285.85	562.51	345.19	NO
7000.	1.751	3	1.0	1.2	320.0	285.85	600.50	368.53	NO
7500.	1.650	3	1.0	1.2	320.0	285.85	638.19	391.78	NO
8000.	1.560	3	1.0	1.2	320.0	285.85	675.61	414.94	NO
8500.	1.554	5	1.0	1.8	10000.0	129.34	352.69	76.01	NO
9000.	1.550	5	1.0	1.8	10000.0	129.34	371.08	78.05	NO
9500.	1.541	5	1.0	1.8	10000.0	129.34	389.35	80.05	NO
10000.	1.528	5	1.0	1.8	10000.0	129.34	407.50	82.00	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

779.	5.813	1	1.0	1.1	320.0	297.82	181.58	277.18	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
259.	0.2442	1	3.0	3.4	960.0	134.83	65.23	42.95	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED

DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

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***************************************
*** SUMMARY OF SCREEN MODEL RESULTS ***
***************************************
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CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	5.813	779.	0.

```
****************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****************************************************
```

SCREEN3 Results for Coker 3 Water Storage in Coker 2 Drum Stack 02/07/13
13:53:53

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 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

C:\Lakes\Screen View\K3 K2 H2O drum.scr

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      1.00000
   STACK HEIGHT (M)       =      27.4320
   STK INSIDE DIAM (M)    =       0.2540
   STK EXIT VELOCITY (M/S)=       0.3800
   STK GAS EXIT TEMP (K)  =     293.0000
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       0.0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =      27.4320
   MIN HORIZ BLDG DIM (M) =      12.1900
   MAX HORIZ BLDG DIM (M) =      27.4300

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =    0.000 M**4/S**3;  MOM. FLUX =    0.002 M**4/S**2.

*** FULL METEOROLOGY ***

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

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	0	0.0	0.0	0.0	0.00	0.00	0.00	NA
100.	462.5	4	1.0	1.2	320.0	27.43	11.69	20.30	SS
200.	328.8	4	1.0	1.2	320.0	27.43	18.39	26.97	SS
300.	224.9	4	1.0	1.2	320.0	27.43	26.02	33.29	SS
400.	174.8	4	1.0	1.2	320.0	27.43	32.79	35.28	SS
500.	142.1	4	1.0	1.2	320.0	27.43	39.42	37.22	SS
600.	119.1	4	1.0	1.2	320.0	27.43	45.94	39.09	SS
700.	103.2	6	1.0	1.7	10000.0	27.43	37.54	34.21	SS
800.	95.10	6	1.0	1.7	10000.0	27.43	40.59	34.52	SS
900.	88.21	6	1.0	1.7	10000.0	27.43	43.61	34.84	SS
1000.	82.25	6	1.0	1.7	10000.0	27.43	46.61	35.15	SS
1100.	77.04	6	1.0	1.7	10000.0	27.43	49.59	35.45	SS
1200.	72.45	6	1.0	1.7	10000.0	27.43	52.55	35.76	SS
1300.	68.37	6	1.0	1.7	10000.0	27.43	55.49	36.06	SS
1400.	64.72	6	1.0	1.7	10000.0	27.43	58.42	36.36	SS
1500.	61.44	6	1.0	1.7	10000.0	27.43	61.33	36.65	SS

1600.	58.46	6	1.0	1.7	10000.0	27.43	64.22	36.94	SS
1700.	55.76	6	1.0	1.7	10000.0	27.43	67.10	37.23	SS
1800.	53.28	6	1.0	1.7	10000.0	27.43	69.96	37.52	SS
1900.	51.02	6	1.0	1.7	10000.0	27.43	72.82	37.81	SS
2000.	48.93	6	1.0	1.7	10000.0	27.43	75.65	38.09	SS
2100.	47.00	6	1.0	1.7	10000.0	27.43	78.48	38.37	SS
2200.	45.21	6	1.0	1.7	10000.0	27.43	81.30	38.64	SS
2300.	43.55	6	1.0	1.7	10000.0	27.43	84.10	38.92	SS
2400.	42.00	6	1.0	1.7	10000.0	27.43	86.89	39.19	SS
2500.	40.55	6	1.0	1.7	10000.0	27.43	89.67	39.46	SS
2600.	39.20	6	1.0	1.7	10000.0	27.43	92.45	39.73	SS
2700.	38.23	6	1.0	1.7	10000.0	27.43	95.21	39.39	SS
2800.	37.03	6	1.0	1.7	10000.0	27.43	97.96	39.66	SS
2900.	35.89	6	1.0	1.7	10000.0	27.43	100.70	39.92	SS
3000.	34.83	6	1.0	1.7	10000.0	27.43	103.44	40.17	SS
3500.	30.32	6	1.0	1.7	10000.0	27.43	116.99	41.33	SS
4000.	26.80	6	1.0	1.7	10000.0	27.43	130.35	42.44	SS
4500.	23.98	6	1.0	1.7	10000.0	27.43	143.54	43.51	SS
5000.	21.67	6	1.0	1.7	10000.0	27.43	156.59	44.55	SS
5500.	19.74	6	1.0	1.7	10000.0	27.43	169.50	45.55	SS
6000.	18.11	6	1.0	1.7	10000.0	27.43	182.28	46.52	SS
6500.	16.71	6	1.0	1.7	10000.0	27.43	194.95	47.47	SS
7000.	15.50	6	1.0	1.7	10000.0	27.43	207.51	48.39	SS
7500.	14.44	6	1.0	1.7	10000.0	27.43	219.97	49.28	SS
8000.	13.50	6	1.0	1.7	10000.0	27.43	232.34	50.15	SS
8500.	12.67	6	1.0	1.7	10000.0	27.43	244.62	51.01	SS
9000.	11.93	6	1.0	1.7	10000.0	27.43	256.82	51.84	SS
9500.	11.27	6	1.0	1.7	10000.0	27.43	268.94	52.65	SS
10000.	10.67	6	1.0	1.7	10000.0	27.43	280.99	53.45	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

83.	510.6	3	1.0	1.1	320.0	27.43	10.62	19.22	SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
472.	150.1	4	1.0	1.2	320.0	27.43	37.57	36.68	SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED

```
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****************************************
     *** REGULATORY (Default) ***
    PERFORMING CAVITY CALCULATIONS
  WITH ORIGINAL SCREEN CAVITY MODEL
          (BRODE, 1988)
****************************************


 *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)     =    886.0        CONC (UG/M**3)     =    1994.
  CRIT WS @10M (M/S) =     1.00        CRIT WS @10M (M/S) =     1.00
  CRIT WS @ HS (M/S) =     1.22        CRIT WS @ HS (M/S) =     1.22
  DILUTION WS (M/S)  =     1.00        DILUTION WS (M/S)  =     1.00
  CAVITY HT (M)      =    52.06        CAVITY HT (M)      =    39.39
  CAVITY LENGTH (M)  =    62.53        CAVITY LENGTH (M)  =    19.39
  ALONGWIND DIM (M)  =    12.19        ALONGWIND DIM (M)  =    27.43

****************************************
      END OF CAVITY CALCULATIONS
****************************************


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

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------   -------   -------
SIMPLE TERRAIN      510.6           83.        0.

BLDG. CAVITY-1      886.0           63.       --  (DIST = CAVITY LENGTH)

BLDG. CAVITY-2      1994.           19.       --  (DIST = CAVITY LENGTH)


**************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
**************************************************
```

SCREEN3 Results for Coker 3 Vent Stack 02/08/13
16:42:32

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

C:\Lakes\Screen View\K3 stack.scr

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      1.00000
   STACK HEIGHT (M)       =      33.3146
   STK INSIDE DIAM (M)    =       0.2540
   STK EXIT VELOCITY (M/S)=      20.7702
   STK GAS EXIT TEMP (K)  =     376.7056
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       0.0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =      54.8600
   MIN HORIZ BLDG DIM (M) =      12.1900
   MAX HORIZ BLDG DIM (M) =      27.4300

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =    0.730 M**4/S**3;  MOM. FLUX =    5.412 M**4/S**2.

*** FULL METEOROLOGY ***

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

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	0	0.0	0.0	0.0	0.00	0.00	0.00	NA
100.	327.7	4	1.0	1.2	320.0	33.70	11.17	21.68	SS
200.	258.8	4	1.0	1.2	320.0	33.70	17.87	28.38	SS
300.	194.3	4	1.0	1.2	320.0	33.70	24.57	35.08	SS
400.	146.1	4	1.0	1.2	320.0	33.70	32.32	37.93	SS
500.	119.8	4	1.0	1.2	320.0	33.70	38.96	39.79	SS
600.	101.2	4	1.0	1.2	320.0	33.70	45.48	41.60	SS
700.	87.27	4	1.0	1.2	320.0	33.70	51.92	43.37	SS
800.	76.49	4	1.0	1.2	320.0	33.70	58.27	45.10	SS
900.	67.88	4	1.0	1.2	320.0	33.70	64.55	46.80	SS
1000.	61.49	6	1.0	1.9	10000.0	34.03	47.04	38.05	SS
1100.	57.75	6	1.0	1.9	10000.0	34.03	50.02	38.33	SS
1200.	54.44	6	1.0	1.9	10000.0	34.03	52.98	38.61	SS
1300.	51.49	6	1.0	1.9	10000.0	34.03	55.92	38.88	SS
1400.	48.85	6	1.0	1.9	10000.0	34.03	58.84	39.16	SS
1500.	46.47	6	1.0	1.9	10000.0	34.03	61.75	39.43	SS

1600.	44.32	6	1.0	1.9	10000.0	34.03	64.64	39.70	SS
1700.	42.35	6	1.0	1.9	10000.0	34.03	67.52	39.97	SS
1800.	40.66	6	1.0	1.9	10000.0	34.03	70.38	39.83	SS
1900.	39.01	6	1.0	1.9	10000.0	34.03	73.23	40.09	SS
2000.	37.50	6	1.0	1.9	10000.0	34.03	76.06	40.33	SS
2100.	36.09	6	1.0	1.9	10000.0	34.03	78.89	40.56	SS
2200.	34.79	6	1.0	1.9	10000.0	34.03	81.70	40.79	SS
2300.	33.58	6	1.0	1.9	10000.0	34.03	84.50	41.02	SS
2400.	32.45	6	1.0	1.9	10000.0	34.03	87.30	41.25	SS
2500.	31.39	6	1.0	1.9	10000.0	34.03	90.08	41.47	SS
2600.	30.40	6	1.0	1.9	10000.0	34.03	92.85	41.70	SS
2700.	29.47	6	1.0	1.9	10000.0	34.03	95.61	41.92	SS
2800.	28.59	6	1.0	1.9	10000.0	34.03	98.36	42.14	SS
2900.	27.77	6	1.0	1.9	10000.0	34.03	101.10	42.36	SS
3000.	26.99	6	1.0	1.9	10000.0	34.03	103.84	42.58	SS
3500.	23.65	6	1.0	1.9	10000.0	34.03	117.38	43.65	SS
4000.	21.03	6	1.0	1.9	10000.0	34.03	130.74	44.68	SS
4500.	18.92	6	1.0	1.9	10000.0	34.03	143.92	45.68	SS
5000.	17.19	6	1.0	1.9	10000.0	34.03	156.96	46.65	SS
5500.	15.73	6	1.0	1.9	10000.0	34.03	169.87	47.59	SS
6000.	14.49	6	1.0	1.9	10000.0	34.03	182.65	48.51	SS
6500.	13.42	6	1.0	1.9	10000.0	34.03	195.31	49.40	SS
7000.	12.50	6	1.0	1.9	10000.0	34.03	207.87	50.27	SS
7500.	11.68	6	1.0	1.9	10000.0	34.03	220.33	51.12	SS
8000.	10.96	6	1.0	1.9	10000.0	34.03	232.70	51.95	SS
8500.	10.32	6	1.0	1.9	10000.0	34.03	244.98	52.76	SS
9000.	9.743	6	1.0	1.9	10000.0	34.03	257.17	53.55	SS
9500.	9.224	6	1.0	1.9	10000.0	34.03	269.29	54.33	SS
10000.	8.954	6	1.0	1.9	10000.0	34.03	281.34	53.07	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

91.	332.2	4	1.0	1.2	320.0	33.70	10.64	21.14	SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
389.	149.7	4	1.0	1.2	320.0	33.70	31.58	37.72	SS

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED

```
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****************************************
     *** REGULATORY (Default) ***
    PERFORMING CAVITY CALCULATIONS
  WITH ORIGINAL SCREEN CAVITY MODEL
          (BRODE, 1988)
****************************************


 *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)     =    443.0        CONC (UG/M**3)     =    996.9
  CRIT WS @10M (M/S) =     1.00        CRIT WS @10M (M/S) =     1.00
  CRIT WS @ HS (M/S) =     1.27        CRIT WS @ HS (M/S) =     1.27
  DILUTION WS (M/S)  =     1.00        DILUTION WS (M/S)  =     1.00
  CAVITY HT (M)      =   120.61        CAVITY HT (M)      =   100.68
  CAVITY LENGTH (M)  =    95.77        CAVITY LENGTH (M)  =    30.84
  ALONGWIND DIM (M)  =    12.19        ALONGWIND DIM (M)  =    27.43

****************************************
      END OF CAVITY CALCULATIONS
****************************************


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

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------   -------   -------
SIMPLE TERRAIN      332.2           91.        0.

BLDG. CAVITY-1      443.0           96.       --  (DIST = CAVITY LENGTH)

BLDG. CAVITY-2      996.9           31.       --  (DIST = CAVITY LENGTH)


**************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
**************************************************
```

SCREEN3 Results for Coker 3 Maze Sump Volume Source 02/07/13
14:10:42

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

C:\Lakes\Screen View\K3 H2O pit.scr

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE              =       VOLUME
   EMISSION RATE (G/S)      =      1.00000
   SOURCE HEIGHT (M)        =       0.0000
   INIT. LATERAL DIMEN (M)  =       1.7012
   INIT. VERTICAL DIMEN (M) =       0.1420
   RECEPTOR HEIGHT (M)      =       0.0000
   URBAN/RURAL OPTION       =        RURAL

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =    0.000 M**4/S**3;  MOM. FLUX =    0.000 M**4/S**2.

*** FULL METEOROLOGY ***

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

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	0	0.0	0.0	0.0	0.00	0.00	0.00	
100.	0.2423E+05	6	1.0	1.0	10000.0	0.00	5.50	2.39	NO
200.	8462.	6	1.0	1.0	10000.0	0.00	9.09	4.14	NO
300.	4476.	6	1.0	1.0	10000.0	0.00	12.55	5.67	NO
400.	2820.	6	1.0	1.0	10000.0	0.00	15.93	7.09	NO
500.	1963.	6	1.0	1.0	10000.0	0.00	19.23	8.43	NO
600.	1457.	6	1.0	1.0	10000.0	0.00	22.48	9.72	NO
700.	1132.	6	1.0	1.0	10000.0	0.00	25.69	10.94	NO
800.	920.3	6	1.0	1.0	10000.0	0.00	28.85	11.99	NO
900.	766.1	6	1.0	1.0	10000.0	0.00	31.98	12.99	NO
1000.	650.1	6	1.0	1.0	10000.0	0.00	35.07	13.96	NO
1100.	562.9	6	1.0	1.0	10000.0	0.00	38.14	14.83	NO
1200.	493.4	6	1.0	1.0	10000.0	0.00	41.18	15.66	NO
1300.	437.1	6	1.0	1.0	10000.0	0.00	44.20	16.48	NO
1400.	390.6	6	1.0	1.0	10000.0	0.00	47.20	17.27	NO
1500.	351.7	6	1.0	1.0	10000.0	0.00	50.17	18.04	NO
1600.	318.9	6	1.0	1.0	10000.0	0.00	53.13	18.79	NO
1700.	290.8	6	1.0	1.0	10000.0	0.00	56.07	19.52	NO
1800.	266.6	6	1.0	1.0	10000.0	0.00	58.99	20.24	NO
1900.	245.6	6	1.0	1.0	10000.0	0.00	61.90	20.94	NO
2000.	227.2	6	1.0	1.0	10000.0	0.00	64.79	21.63	NO

2100.	211.8	6	1.0	1.0	10000.0	0.00	67.66	22.21	NO
2200.	198.1	6	1.0	1.0	10000.0	0.00	70.52	22.78	NO
2300.	185.9	6	1.0	1.0	10000.0	0.00	73.37	23.34	NO
2400.	174.8	6	1.0	1.0	10000.0	0.00	76.21	23.89	NO
2500.	164.9	6	1.0	1.0	10000.0	0.00	79.03	24.43	NO
2600.	155.9	6	1.0	1.0	10000.0	0.00	81.85	24.95	NO
2700.	147.6	6	1.0	1.0	10000.0	0.00	84.65	25.47	NO
2800.	140.1	6	1.0	1.0	10000.0	0.00	87.44	25.98	NO
2900.	133.2	6	1.0	1.0	10000.0	0.00	90.22	26.48	NO
3000.	126.9	6	1.0	1.0	10000.0	0.00	92.99	26.98	NO
3500.	102.9	6	1.0	1.0	10000.0	0.00	106.70	28.98	NO
4000.	85.88	6	1.0	1.0	10000.0	0.00	120.20	30.84	NO
4500.	73.19	6	1.0	1.0	10000.0	0.00	133.52	32.57	NO
5000.	63.44	6	1.0	1.0	10000.0	0.00	146.68	34.21	NO
5500.	55.75	6	1.0	1.0	10000.0	0.00	159.69	35.76	NO
6000.	49.54	6	1.0	1.0	10000.0	0.00	172.57	37.23	NO
6500.	44.45	6	1.0	1.0	10000.0	0.00	185.32	38.64	NO
7000.	40.20	6	1.0	1.0	10000.0	0.00	197.96	40.00	NO
7500.	36.74	6	1.0	1.0	10000.0	0.00	210.50	41.16	NO
8000.	33.77	6	1.0	1.0	10000.0	0.00	222.94	42.28	NO
8500.	31.20	6	1.0	1.0	10000.0	0.00	235.29	43.36	NO
9000.	28.96	6	1.0	1.0	10000.0	0.00	247.55	44.40	NO
9500.	26.99	6	1.0	1.0	10000.0	0.00	259.73	45.41	NO
10000.	25.25	6	1.0	1.0	10000.0	0.00	271.83	46.38	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

5.	0.5578E+06	6	1.0	1.0	10000.0	0.00	1.92	0.33	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
384.	3013.	6	1.0	1.0	10000.0	0.00	15.39	6.86	NO
389.	2950.	6	1.0	1.0	10000.0	0.00	15.56	6.93	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

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

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

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------   -------   -------
SIMPLE TERRAIN     0.5578E+06        5.        0.


**************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
**************************************************
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SCREEN3 Results for Coker 3 Surge Tank Volume Source 02/07/13
13:48:15

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

C:\Lakes\Screen View\K3 H2O tnk.scr

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE              =       VOLUME
   EMISSION RATE (G/S)      =      1.00000
   SOURCE HEIGHT (M)        =      13.7160
   INIT. LATERAL DIMEN (M)  =       1.7721
   INIT. VERTICAL DIMEN (M) =       6.3800
   RECEPTOR HEIGHT (M)      =       0.0000
   URBAN/RURAL OPTION       =        RURAL

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =    0.000 M**4/S**3;  MOM. FLUX =    0.000 M**4/S**2.

*** FULL METEOROLOGY ***

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

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	0	0.0	0.0	0.0	0.00	0.00	0.00	
100.	1299.	6	1.0	1.2	10000.0	13.72	5.57	7.76	NO
200.	1028.	6	1.0	1.2	10000.0	13.72	9.15	9.08	NO
300.	851.1	6	1.0	1.2	10000.0	13.72	12.61	10.34	NO
400.	703.7	6	1.0	1.2	10000.0	13.72	15.99	11.13	NO
500.	603.9	6	1.0	1.2	10000.0	13.72	19.29	12.17	NO
600.	524.0	6	1.0	1.2	10000.0	13.72	22.54	13.17	NO
700.	459.5	6	1.0	1.2	10000.0	13.72	25.74	13.86	NO
800.	407.3	6	1.0	1.2	10000.0	13.72	28.90	14.73	NO
900.	363.9	6	1.0	1.2	10000.0	13.72	32.03	15.58	NO
1000.	327.4	6	1.0	1.2	10000.0	13.72	35.13	16.39	NO
1100.	296.4	6	1.0	1.2	10000.0	13.72	38.20	17.18	NO
1200.	269.9	6	1.0	1.2	10000.0	13.72	41.24	17.95	NO
1300.	247.0	6	1.0	1.2	10000.0	13.72	44.26	18.71	NO
1400.	227.1	6	1.0	1.2	10000.0	13.72	47.25	19.44	NO
1500.	209.6	6	1.0	1.2	10000.0	13.72	50.23	20.16	NO
1600.	194.2	6	1.0	1.2	10000.0	13.72	53.18	20.87	NO
1700.	180.6	6	1.0	1.2	10000.0	13.72	56.12	21.56	NO
1800.	171.0	6	1.0	1.2	10000.0	13.72	59.04	21.70	NO
1900.	160.4	6	1.0	1.2	10000.0	13.72	61.95	22.28	NO
2000.	150.8	6	1.0	1.2	10000.0	13.72	64.84	22.85	NO

2100.	142.2	6	1.0	1.2	10000.0	13.72	67.71	23.41	NO
2200.	134.3	6	1.0	1.2	10000.0	13.72	70.57	23.96	NO
2300.	127.2	6	1.0	1.2	10000.0	13.72	73.42	24.49	NO
2400.	120.7	6	1.0	1.2	10000.0	13.72	76.26	25.02	NO
2500.	114.7	6	1.0	1.2	10000.0	13.72	79.08	25.54	NO
2600.	109.2	6	1.0	1.2	10000.0	13.72	81.90	26.05	NO
2700.	104.1	6	1.0	1.2	10000.0	13.72	84.70	26.55	NO
2800.	100.5	6	1.0	1.2	10000.0	13.72	87.49	26.66	NO
2900.	96.16	6	1.0	1.2	10000.0	13.72	90.27	27.12	NO
3000.	92.25	6	1.0	1.2	10000.0	13.72	93.04	27.53	NO
3500.	76.26	6	1.0	1.2	10000.0	13.72	106.75	29.49	NO
4000.	64.55	6	1.0	1.2	10000.0	13.72	120.25	31.32	NO
4500.	55.64	6	1.0	1.2	10000.0	13.72	133.57	33.02	NO
5000.	48.68	6	1.0	1.2	10000.0	13.72	146.72	34.63	NO
5500.	43.10	6	1.0	1.2	10000.0	13.72	159.73	36.16	NO
6000.	38.55	6	1.0	1.2	10000.0	13.72	172.61	37.62	NO
6500.	34.78	6	1.0	1.2	10000.0	13.72	185.37	39.02	NO
7000.	31.71	6	1.0	1.2	10000.0	13.72	198.01	40.20	NO
7500.	29.08	6	1.0	1.2	10000.0	13.72	210.54	41.35	NO
8000.	26.82	6	1.0	1.2	10000.0	13.72	222.98	42.46	NO
8500.	24.85	6	1.0	1.2	10000.0	13.72	235.33	43.54	NO
9000.	23.12	6	1.0	1.2	10000.0	13.72	247.59	44.57	NO
9500.	21.60	6	1.0	1.2	10000.0	13.72	259.77	45.57	NO
10000.	20.24	6	1.0	1.2	10000.0	13.72	271.87	46.55	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

5.	2422.	4	1.0	1.0	320.0	13.72	2.25	6.61	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

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

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
384.	722.0	6	1.0	1.2	10000.0	13.72	15.45	10.96	NO
389.	716.2	6	1.0	1.2	10000.0	13.72	15.62	11.01	NO
525.	582.0	6	1.0	1.2	10000.0	13.72	20.11	12.42	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****

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

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	2422.	5.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

Model Inputs

	New Crude 1 Heater (A)	New Crude 1 Heater (B)	New Vac 1 Heater	Coker 3 Heater	ADHT Heater	Steam Boilers	SRU 1	SRU 2&3	Coker 3 H2O Stg (Coker 2 drums)	Coker 3 Vent
Emission Rate (g/s)	1	1	1	1	1	1	1	1	1	1
Stack Height (m)*	82.296	82.296	70.104	56.388	30.48	30.78	69.49	53.34	27.432	33.315
Stack Diameter (m)	2.4384	2.4384	1.8288	1.905	1.067	1.905	1.067	1.524	0.254	0.254
Exit Velocity (m/s)	6.747	6.747	7.935	5.944	5.44	17.386	16.849	16.764	0.38	20.7702
Exit Temperature (K)	450	450	450	755	700	428	811	922	293	376.71
Exit Temperature (R)	809.67	809.67	809.67	1359.67	1259.671	769.6692	1459.67	1659.67	527	678.4
Distance to Fence line (m)	554	554	554	368	409	440	259	266	472	389.03
Downwash										
BUILDING HEIGHT (M)	36.58	36.58	36.58	54.86	40.5	54.86	NA	NA	54.86	54.86
MIN HORIZ BLDG DIM (M)	5.49	5.49	5.49	12.19	5.5	12.19	NA	NA	12.19	12.19
MAX HORIZ BLDG DIM (M)	5.49	5.49	5.49	27.43	5.5	27.43	NA	NA	27.43	27.43
GEP Height	44.82	44.82	44.82	73.15	48.75	73.15			73.15	73.15
	(Coker 3 bubble tower	(Coker 3 bubble tower	(Coker 3 bubble tower	Coker 3 structure	Crude Tower	Coker 3 structure			Coker 2 structure (assume same as Coker 3)	Coker 3 structure

Notes:
When running model, assume no stack height over 65 meters
estimated velocity by V =nRT/P; (R = 10.73 ft^3*psia/lb-mol^{o}R), P = 14.1 psia)
Assume all emissions from Crude Heaters emit through only one stack
Assume SRU1 and SRU 2&3 emit through the worst-case stack (SRU1)
**Downwash structures determined by using info from BPIP file*

Additional Parameter Assumptions:
- Rural
- Full meteorology
- Simple/Flat Terrain
- Including downwash

Model Inputs (conti)

Volume Source	Coker 3 Maze Sump (1)	Coker 3 Maze Sump (1)	Coker 3 Surge Tank
Emission Rate (g/s)	1.0000	1.0000	1.0000
Release Height (m)	0	0	13.716
Initial Lateral Dimension (m)	1.7012	1.7012	1.7721
Initial Vertical Dimension (m)	0.142	0.142	6.380
Distance to Fence line (m)	389.03	383.96	525.23

Note: Toxics from Coker 3 Cutting Water is emitted from the Water pit, open top tank, and Coker 2 drums
The Coker 3 water pit is 47' x 24' so made 2 volume sources each 24' square
Initial Lateral Dimension = length of side/ 4.3
Initial Vertical Dimension = vertical dimension/ 2.15
For elevated release = release height/ 2.15

TFO Project Emission Increases

Pollutant (tons/yr)	New Crude Heaters	New Vac 1 Heater	Coker 3 Heater	ADHT Heater	Steam Boilers	SRU 1 & SRU 2&3	Coker 3 Vent	Coker 3 Cutting	Coker 3 Maze Sump	Coker 3 Surge Tank	Coker 3 H2O Stg
H_2S	NA	NA	NA	NA	NA	NA	6.56E-02	2.97E-02	0.14	0.04	0.013
SO_2	21.18	7.06	-7.74	0.76	5.64	41.34	NA	NA	NA	NA	NA

Pollutant (lb/hr)	New Crude Heaters	New Vac 1 Heater	Coker 3 Heater	ADHT Heater	Steam Boilers	SRU 1 & SRU 2&3
SO_2	11.19	3.72	NA	0.46	NA	NA

*lb/hr SO_2 emissions are based on past actual to potential firing rates and 162 ppm H2S for a maximum short-term worst-case
These emissions were used for the 24-hr and 3-hr SO_2 modeling analysis

Pollutant (g/s)	New Crude Heaters	New Vac 1 Heater	Coker 3 Heater	ADHT Heater	Steam Boilers	SRU 1 & SRU 2&3	Coker 3 Vent	Coker 3 Cutting	Coker 3 Maze Sump	Coker 3 Surge Tank	Coker 3 H2O Stg
H_2S	NA	NA	NA	NA	NA	NA	1.89E-03	8.53E-04	3.99E-03	1.20E-03	3.74E-04
SO_2 (annual)	6.09E-01	2.03E-01	-2.23E-01	2.19E-02	1.62E-01	1.19	NA	NA	NA	NA	NA
SO_2 (24hr/ 3hr)	1.41	0.47	NA	0.06	NA	NA	NA	NA	NA	NA	NA

Screen3 Modeling Results for SO_2

(Raw Results) 1-hr average concentrations (µg/m^3)

Distance (m)	New Crude Heaters	New Vac 1 Heater	ADHT Heater	Steam Boilers	SRU 1, SRU 2&3
Emissions (g/s)	1	1	1	1	1
1	0.00	0.00	0.00	0.00	0.00
100	7.54E-07	1.38E-04	4.63	91.44	5.69E-10
200	5.43E-01	2.12	15.30	50.23	1.10E-02
259	-	-	-	-	0.24
300	4.66	9.60	17.67	37.81	0.76
400	9.47	15.45	18.31	33.38	2.60
409	-	-	18.27	-	-
440	-	-	-	32.06	-
500	11.54	14.69	17.57	30.29	3.46
554	10.82	12.71	-	-	-
600	9.73	12.51	16.47	27.77	3.80
700	8.40	13.25	15.63	25.67	5.48
800	9.05	12.82	15.24	23.90	5.80
900	9.02	11.86	13.98	22.37	5.46
1000	8.61	11.39	13.52	21.05	5.04
1100	8.02	11.73	12.92	19.89	4.67
1200	7.45	11.72	12.43	18.86	4.35
1300	7.73	11.48	11.94	17.95	4.08
1400	7.82	11.10	11.43	17.12	3.83
1500	7.79	10.63	11.03	16.43	3.62
1600	7.65	10.13	10.66	15.85	3.43
1700	7.46	9.61	10.28	15.31	3.26
1800	7.22	9.09	9.89	14.81	3.33
1900	6.96	8.59	9.51	14.36	3.36
2000	6.69	8.12	9.27	13.93	3.35
2100	6.41	7.66	9.01	13.53	3.32
2200	6.14	7.24	8.76	13.16	3.27
2300	5.87	6.84	8.75	12.82	3.21
2400	5.61	6.74	8.92	12.49	3.13
2500	5.36	6.79	9.06	12.18	3.06
2600	5.12	6.83	9.16	11.89	2.98
2700	4.90	6.84	9.24	11.46	2.90
2800	4.69	6.83	9.30	11.21	2.82
2900	4.49	6.80	9.33	10.97	2.74
3000	4.30	6.77	9.35	10.73	2.66
3500	4.18	6.42	9.22	9.71	2.40
4000	4.14	5.99	8.78	8.89	2.42
4500	4.00	5.55	8.33	8.38	2.35
5000	3.83	5.12	8.05	7.95	2.24
5500	3.63	4.73	7.96	7.58	2.12
6000	3.44	4.37	7.82	7.23	1.99
6500	3.24	4.04	7.64	6.92	1.86
7000	3.06	3.75	7.39	6.64	1.75
7500	2.89	3.49	7.16	6.37	1.65
8000	2.72	3.25	6.94	6.13	1.56
8500	2.57	3.04	6.72	5.90	1.55
9000	2.44	2.85	6.51	5.69	1.55
9500	2.31	2.68	6.30	5.50	1.54
10000	2.19	2.52	6.10	5.31	1.53

Notes:

- Concentrations are in ug/m^3

Modeling Results for SO_2

(Annual) 1-hr average concentrations (µg/m^3)

Distance (m)	New Crude Heaters	New Vac 1 Heater	ADHT Heater	Steam Boilers	SRU 1, SRU 2&3
Emissions (g/s)	**0.609**	**0.203**	**0.022**	**0.162**	**1.189**
1	0.00	0.00	0.00	0.00	0.00
100	4.60E-07	2.81E-05	0.10	14.84	6.76E-10
200	3.31E-01	0.43	0.33	8.15	1.31E-02
259	-	-	-	-	0.29
300	2.84	1.95	0.39	6.13	0.91
400	5.77	3.14	0.40	5.42	3.09
409	-	-	0.40	-	-
440	-	-	-	5.20	-
500	7.03	2.98	0.38	4.91	4.11
554	6.59	2.58	-	-	-
600	5.93	2.54	0.36	4.51	4.52
700	5.12	2.69	0.34	4.16	6.52
800	5.51	2.60	0.33	3.88	6.89
900	5.49	2.41	0.31	3.63	6.49
1000	5.24	2.31	0.30	3.42	5.99
1100	4.89	2.38	0.28	3.23	5.55
1200	4.54	2.38	0.27	3.06	5.17
1300	4.71	2.33	0.26	2.91	4.85
1400	4.77	2.25	0.25	2.78	4.56
1500	4.74	2.16	0.24	2.67	4.31
1600	4.66	2.06	0.23	2.57	4.08
1700	4.55	1.95	0.22	2.48	3.88
1800	4.40	1.85	0.22	2.40	3.96
1900	4.24	1.75	0.21	2.33	3.99
2000	4.08	1.65	0.20	2.26	3.99
2100	3.91	1.56	0.20	2.20	3.95
2200	3.74	1.47	0.19	2.14	3.89
2300	3.57	1.39	0.19	2.08	3.81
2400	3.42	1.37	0.19	2.03	3.73
2500	3.26	1.38	0.20	1.98	3.63
2600	3.12	1.39	0.20	1.93	3.54
2700	2.98	1.39	0.20	1.86	3.44
2800	2.85	1.39	0.20	1.82	3.35
2900	2.73	1.38	0.20	1.78	3.26
3000	2.62	1.37	0.20	1.74	3.17
3500	2.55	1.30	0.20	1.58	2.85
4000	2.52	1.22	0.19	1.44	2.88
4500	2.44	1.13	0.18	1.36	2.80
5000	2.33	1.04	0.18	1.29	2.67
5500	2.21	0.96	0.17	1.23	2.52
6000	2.09	0.89	0.17	1.17	2.36
6500	1.98	0.82	0.17	1.12	2.22
7000	1.86	0.76	0.16	1.08	2.08
7500	1.76	0.71	0.16	1.03	1.96
8000	1.66	0.66	0.15	0.99	1.86
8500	1.57	0.62	0.15	0.96	1.85
9000	1.48	0.58	0.14	0.92	1.84
9500	1.40	0.54	0.14	0.89	1.83
10000	1.33	0.51	0.13	0.86	1.82

Notes:

- Concentrations are in ug/m^3
- Concentrations are estimated by multiplying the SCREEN3 results from (1 g/s) by the actual estimated project emission increase

Modeling Results for SO_2

(Short-term) 1-hr average concentrations (µg/m^3)

Distance (m)	New Crude Heaters	New Vac 1 Heater	ADHT Heater
Emissions (g/s)	**1.410**	**0.469**	**0.058**
1	0.00	0.00	0.00
100	1.06E-06	6.48E-05	0.27
200	0.77	0.99	0.89
259	-	-	-
300	6.57	4.50	1.02
400	13.35	7.24	1.06
409	-	-	1.06
440	-	-	-
500	16.27	6.89	1.02
554	15.26	5.96	-
600	13.72	5.87	0.95
700	11.84	6.21	0.91
800	12.76	6.01	0.88
900	12.71	5.56	0.81
1000	12.13	5.34	0.78
1100	11.31	5.50	0.75
1200	10.50	5.49	0.72
1300	10.89	5.38	0.69
1400	11.03	5.20	0.66
1500	10.98	4.98	0.64
1600	10.79	4.75	0.62
1700	10.52	4.50	0.60
1800	10.19	4.26	0.57
1900	9.82	4.03	0.55
2000	9.43	3.81	0.54
2100	9.04	3.59	0.52
2200	8.65	3.39	0.51
2300	8.27	3.21	0.51
2400	7.90	3.16	0.52
2500	7.55	3.19	0.52
2600	7.22	3.20	0.53
2700	6.90	3.20	0.54
2800	6.61	3.20	0.54
2900	6.33	3.19	0.54
3000	6.07	3.17	0.54
3500	5.90	3.01	0.53
4000	5.83	2.81	0.51
4500	5.64	2.60	0.48
5000	5.40	2.40	0.47
5500	5.12	2.22	0.46
6000	4.84	2.05	0.45
6500	4.57	1.89	0.44
7000	4.31	1.76	0.43
7500	4.07	1.64	0.42
8000	3.84	1.52	0.40
8500	3.63	1.43	0.39
9000	3.43	1.34	0.38
9500	3.25	1.25	0.37
10000	3.08	1.18	0.35

Screen3 Modeling Results for H_2S

1-hr average concentrations ($\mu g/m^3$)

Model run with 1 g/s emissions

Distance (m)	Coker 3 H2O Pit	Coker 3 H2O tank	Coker 3 (Coker 2 Twr) H2O	Coker 3 stack
Source type	**Volume**	**Volume**	**Point**	**Point**
Emissions (g/s)	**1**	**1**	**1**	**1**
1	0.00	0.00	0.00	0.00
100	24230	1299	463	328
200	8462	1028	329	259
300	4476	851	225	194
384	3013			
389				150
400	2820	704	175	146
472			150.1	
500	1963	604	142	120
525		582		
600	1457	524	119	101
700	1132.00	459.50	103.20	87.27
800	920.30	407.30	95.10	76.49
900	766.10	363.90	88.21	67.88
1000	650.10	327.40	82.25	61.49
1100	562.90	296.40	77.04	57.75
1200	493.40	269.90	72.45	54.44
1300	437.10	247.00	68.37	51.49
1400	390.60	227.10	64.72	48.85
1500	351.70	209.60	61.44	46.47
1600	318.90	194.20	58.46	44.32
1700	290.80	180.60	55.76	42.35
1800	266.60	171.00	53.28	40.66
1900	245.60	160.40	51.02	39.01
2000	227.20	150.80	48.93	37.50
2100	211.80	142.20	47.00	36.09
2200	198.10	134.30	45.21	34.79
2300	185.90	127.20	43.55	33.58
2400	174.80	120.70	42.00	32.45
2500	164.90	114.70	40.55	31.39
2600	155.90	109.20	39.20	30.40
2700	147.60	104.10	38.23	29.47
2800	140.10	100.50	37.03	28.59
2900	133.20	96.16	35.89	27.77
3000	126.90	92.25	34.83	26.99
3500	102.90	76.26	30.32	23.65
4000	85.88	64.55	26.80	21.03
4500	73.19	55.64	23.98	18.92
5000	63.44	48.68	21.67	17.19
5500	55.75	43.10	19.74	15.73
6000	49.54	38.55	18.11	14.49
6500	44.45	34.78	16.71	13.42
7000	40.20	31.71	15.50	12.50
7500	36.74	29.08	14.44	11.68
8000	33.77	26.82	13.50	10.96
8500	31.20	24.85	12.67	10.32
9000	28.96	23.12	11.93	9.74
9500	26.99	21.60	11.27	9.22
10000	25.25	20.24	10.67	8.95

Notes:

- Concentrations are in ug/m^3

Modeling Results for H_2S

1-hr average concentrations ($\mu g/m^3$)

Results with actual emissions

Distance (m)	Coker 3 H2O Pit (2)	Coker 3 H2O tank	Coker 3 (Coker 2 Twr) H2O	Coker 3 stack
Source type	**Volume (2)**	**Volume**	**Point**	**Point**
Emissions (g/s)	**3.99E-03**	**1.20E-03**	**3.74E-04**	**2.74E-03**
1	0.00	0.00	0.00	0.00
100	96.71	1.56	0.17	0.90
200	33.77	1.23	0.12	0.71
300	17.87	1.02	8.41E-02	0.53
384	**12.03**			
389				0.41
400	11.26	0.85	6.54E-02	0.40
472			**0.056**	0.00
500	7.84	0.73	5.31E-02	0.33
525		**0.699**		
600	5.82	0.63	4.45E-02	0.28
700	4.52	0.55	3.86E-02	0.24
800	3.67	0.49	3.56E-02	0.21
900	3.06	0.44	3.30E-02	0.19
1000	2.59	0.39	3.08E-02	0.17
1100	2.25	0.36	2.88E-02	0.16
1200	1.97	0.32	2.71E-02	0.15
1300	1.74	0.30	2.56E-02	0.14
1400	1.56	0.27	2.42E-02	0.13
1500	1.40	0.25	2.30E-02	0.13
1600	1.27	0.23	2.19E-02	0.12
1700	1.16	0.22	2.08E-02	0.12
1800	1.06	0.21	1.99E-02	0.11
1900	0.98	0.19	1.91E-02	0.11
2000	0.91	0.18	1.83E-02	0.10
2100	0.85	0.17	1.76E-02	9.89E-02
2200	0.79	0.16	1.69E-02	9.53E-02
2300	0.74	0.15	1.63E-02	9.20E-02
2400	0.70	0.14	1.57E-02	8.89E-02
2500	0.66	0.14	1.52E-02	8.60E-02
2600	0.62	0.13	1.47E-02	8.33E-02
2700	0.59	0.13	1.43E-02	8.07E-02
2800	0.56	0.12	1.38E-02	7.83E-02
2900	0.53	0.12	1.34E-02	7.61E-02
3000	0.51	0.11	1.30E-02	7.39E-02
3500	0.41	9.16E-02	1.13E-02	6.48E-02
4000	0.34	7.75E-02	1.00E-02	5.76E-02
4500	0.29	6.68E-02	8.97E-03	5.18E-02
5000	0.25	5.85E-02	8.10E-03	4.71E-02
5500	0.22	5.18E-02	7.38E-03	4.31E-02
6000	0.20	4.63E-02	6.77E-03	3.97E-02
6500	0.18	4.18E-02	6.25E-03	3.68E-02
7000	0.16	3.81E-02	5.79E-03	3.42E-02
7500	0.15	3.49E-02	5.40E-03	3.20E-02
8000	0.13	3.22E-02	5.05E-03	3.00E-02
8500	0.12	2.98E-02	4.74E-03	2.83E-02
9000	0.12	2.78E-02	4.46E-03	2.67E-02
9500	0.11	2.59E-02	4.21E-03	2.53E-02
10000	0.10	2.43E-02	3.99E-03	2.45E-02

Notes:

- Concentrations are in ug/m^3
- Concentrations are estimated by multiplying the SCREEN3 results from (1 g/s) by the actual estimated project emission increase

TFO Ohio EPA Modeling Analysis

Maximum Predicted 1-hr Average Concentration

Pollutant ($\mu g/m^3$)	New Crude Heaters	New Vac 1 Heater	ADHT Heater	Steam Boilers	SRU 1, SRU 2&3	Coker 3	Total
H_2S	NA	NA	NA	NA	NA	13.19	13.19
SO_2 (annual)	6.59	2.69	0.40	5.20	6.89	NA	21.78
SO_2 (short term)	15.26	6.21	1.06	NA	NA	NA	22.53

Notes:
- Concentration is the maximum concentration past the fence line for each stack
- Short-term emissions modeled are based on 162 ppm H_2S

Screen3 1-hr Average Conversation Factors

Converting to	Multiply by
3-hr	0.9
24-hr	0.4
Annual	0.08

Calculation for MAGLC

$$MAGLC = \frac{TLV}{10} \times \frac{8\,hours}{24\,hours} \times \frac{5\,days}{7\,days} = \frac{TLV}{42}$$

H_2S: TLV = 1 ppm, M.W. = 34.05 lb/lbmole

Modeled Results Compared to Ohio EPA Thresholds

Pollutant	Averaging Period	Ohio Acceptable Incremental Impact[1] (ug/m^3)	Maximum Predicted Concentration (ug/m^3)
SO_2	Annual	10	1.74
	24-hr	45.5	9.01
	3-hr	256	20.27

Notes:
1 - Established in Ohio's Engineering Guide #69

Air Toxic Modeled Results

Air Toxic	Ohio MAGLC (Annual) (ug/m^3)	Maximum Predicted Concentration (ug/m^3)
H_2S	33.16	13.19

Notes:
- PPM converts to ug/m3 by multiplying ppm by the compound molecular weight (g/gmole), dividing by 24.45 liters/gmole, times 1000 (liters/m3)