Air Quality Impact Analysis Review
Kansas City BPU – Quindaro Unit 2
Low NO_x Burner/Overfire Air Project
Air Quality Construction Permit Application

Source ID 2090048

Kansas Department of Health and Environment
Bureau of Air
Air Permitting Section

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I. Introduction

The Kansas City Board of Public Utilities (BPU) submitted a prevention of significant deterioration (PSD) construction permit application for the installation of low NOx burner/overfire air (LNB/OFA) combustion control at their 158 MW Quindaro Unit 2 (Q2) coal-fired electric generating unit (EGU) located in Kansas City. An Air Quality Impact Analysis (AQIA) is required as part of a PSD construction permit application to show the impact of the proposed project on the National Ambient Air Quality Standards (NAAQS) and air quality-related values. This document summarizes the KDHE review and evaluation of BPU's AQIA.

The original permit application was received by the Kansas Department of Health and Environment (KDHE) September 23, 2010. The Quindaro facility is subject to the Kansas City Ozone Maintenance Plan, under which the facility is required to lower its NO_x emissions using reasonably available control technology (RACT).

Dispersion modeling for this project includes a demonstration of compliance with the NAAQS for carbon monoxide (CO), since it is the only primary pollutant that increases in emission level with the installation of LNB/OFA, and which exceed the PSD significant emission rate for CO of 100 tons per year.

II. Facility Description

The existing facility is a coal-fired electric generating station. Unit Q2, powered by a wall-fired dry bottom boiler burning Powder River Basin coal, is the primary generating unit. An 82 MW cyclone coal-fired wet bottom boiler, Q1, is also present. Three natural gas and natural gas/No. 2 fuel oil-fired combustion turbines are used for peaking power. The facility is situated at 3601 N 12th St, Kansas City, KS 66104, on the south bank of the Missouri River.

III. Air Quality Impact Analysis Applicability

The proposed facility is a major source as defined by K.A.R. 28-19-350, Prevention of Significant Deterioration. Therefore, the owner or operator must demonstrate that allowable emission increases from the proposed facility would not cause or contribute to air pollution in violation of: (1) any NAAQS in any air quality control region; or (2) any applicable maximum allowable increase of PM_{10}, SO_2, or NO_2 over the baseline concentration in any area (increment).

A review of the air quality status in the region reveals that Wyandotte County, in which Kansas City lies, is currently in attainment or unclassifiable for all pollutants. As such, the PSD program, as administered by the State of Kansas under K.A.R. 28-19-350, will apply to the proposed project. It is possible that Wyandotte County could be classified as nonattainment for ozone in the future. This project is for the installation of LNB/OFA, which will result in reductions of NO_x

with no impact to VOC, is not expected to trigger nonattainment New Source Review. As such, a change in attainment status would be moot.

IV. Model Selection

The SCREEN model was developed by EPA to provide an easy-to-use method of obtaining pollutant concentration estimates. These estimates are based on the document *Screening Procedures for Estimating The Air Quality Impact of Stationary Sources* (http://www.epa.gov/scram001/userg/screen/screen3d.pdf). SCREEN3, version 3.0 of the SCREEN model, can perform all the single source short-term calculations in the EPA screening procedures document, including:

- Estimating maximum ground-level concentrations and the distance to the maximum.
- Incorporating the effects of building downwash on the maximum concentrations for both the near wake and far wake regions.
- Estimating concentrations due to inversion break-up and shoreline fumigation.
- Incorporate the effects of simple elevated terrain on maximum concentrations.
- Estimate 24-hour average concentrations due to plume impaction in complex terrain using the VALLEY model 24-hour screening procedure.
- Calculate the maximum concentration at any number of user-specified distances in flat or elevated simple terrain, including distances out to 100 km for long-range transport.
- Examine a full range of meteorological conditions, including all stability classes and wind speeds to find maximum impacts.
- Include the effects of buoyancy-induced dispersion (BID).
- Explicitly calculates the effects of multiple reflections of the plume off the elevated inversion and off the ground when calculating concentrations under limited mixing conditions.

Based on the proposed facility emissions, carbon monoxide (CO) was evaluated as part of the AQIA. SCREEN3, was used by BPU to evaluate the impacts of CO that will result from the LNB/OFA project at Quindaro 2 for 1-hour CO and 8-hour CO. BPU's evaluation was reviewed by KDHE using Lakes Environmental's Screen View program, which incorporates SCREEN3 in its calculations (see Attachment 1).

V. Model Inputs

A. Source Data

The emission rate, point location, and stack parameters for the emission source used in the model were based on the data presented in the permit application. These input data are shown in the table below.

Stack Parameters and CO Emission Rate – Quindaro 2					
Source	**Stack height (ft)**	**Stack diameter (ft)**	**Exit velocity (ft/s)**	**Exit temp. (°F)**	**CO emission rate (lb/hr)**
Q2	350	13.3	83	326	697.2

Emissions from this unit are based on a 0.50 lb/MMBtu emission rate and Unit 1's heat input rate of 1,394.4 MMBtu/hr

B. Urban or Rural

BPU's application included a designation of "rural" for this input selection. After a review of the appropriate satellite imagery and land use data obtained from the U.S. Geological Survey (USGS), however, it was concluded that the area is "urban" for air modeling purposes, since more than 50% of the area within a 3 km radius around the facility shows residential, commercial, or other industrial use.

C. Terrain

The SCREEN3 (Screen View) model offers simple/flat, simple/elevated, and complex terrain options. A review of Digital Elevation Model (DEM) files concluded that complex terrain does not exist as such in the project area. (The complex terrain option implies that there is terrain in the study area—in this case, the area out to a radius of 20 km from the facility—that has an elevation higher than the top of the stack. That is not the case for Quindaro 2.) Thus, for the simple elevated terrain setting chosen, the model was run with several concentric rings using the minimum and maximum distance inputs of the automated distance option to define each ring, and using the maximum terrain elevation above stack base within each ring for terrain height input. The minimum and maximum distance inputs, along with the corresponding maximum terrain elevation used in the modeling analysis are presented in the following table. Note that KDHE found somewhat different values for maximum elevations using the same distance ranges as BPU, and used those values for inputs. Both sets of values are presented.

Terrain Concentric Ring Distances and Elevations – Quindaro 2				
Ring number	**Distance range (m)**		**BPU max. elevation (m)**	**KDHE max. elevation (m)**
	Min.	**Max.**		
1	1	500	0	21
2	500	1,000	54	50
3	1,000	1,500	59	51
4	1,500	2,000	71	52
5	2,000	2,500	80	53
6	2,500	3,500	87	54
7	3,500	5,000	96	74
8	5,000	20,000	104	101

D. Meteorological Data

External meteorological data is not required in the SCREEN3 (Screen View) model. Instead, for the Full Meteorology option selected, the model examines a range of stability classes and wind speeds to identify the worst-case meteorological conditions.

E. Building Downwash

Good engineering practice stack height for stacks constructed after January 12, 1979 is defined as the greater of:

- 65 meters, measured from the base of the stack, and
- Stack height calculated from the following formula:

$$Hg = H + 1.5L$$

Where

Hg = the GEP stack height

H = the height of the nearby structure

L = the lesser of the building height or the greatest crosswind distance of the building also known as maximum projected width

The Quindaro 2 generating unit stack height exceeds 65 meters; therefore, the model's Building Downwash option was selected and the building dimensions supplied by BPU were used for the model run.

F. Receptors

The SCREEN3 (Screen View) model does not require the use of user-inputted receptors.

VI. Significance Determination

A facility that proposes to emit any pollutant above the PSD significant emission rate thresholds must submit an ambient air quality impact analysis. In order to determine if a full impact model analysis and/or ambient air monitoring is necessary, a facility must complete a preliminary modeling analysis. The preliminary analysis includes only the proposed source or modification so it can be determined if a significant modeled impact will take place. For each pollutant that the model predicts the high first high concentration to be below the significant impact level (SIL) threshold, no further analysis is necessary for that pollutant.

The SCREEN3 model can only predict the 1-hr maximum concentration, with the exception of the 24-hr estimate for complex terrain impacts. As such, scaling factors are required to determine the appropriate averaging period impacts for each applicable pollutant. Using the EPA document *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised* (*http://www.epa.gov/oppt/exposure/presentations/efast/usepa_1992b_sp_for_estim_aqi_of_ss.pdf*) an 8-hr maximum concentration may be calculated by multiplying 1-hr maximum by 0.7.

The SILs and pre-application monitoring thresholds for CO and Quindaro 2 results from the preliminary analysis are shown in the following table.

Significance Determination Table							
Pollutant	Averaging Period	Operating Scenario	Maximum Predicted Concentration ($\mu g/m^3$)	Modeling Significant Impact Level (SIL) ($\mu g/m^3$)	Exceeds SIL?	Pre-application Monitoring Threshold Concentration ($\mu g/m^3$)	Exceeds Monitoring Threshold?
CO	8-hour	100% Load	129.5	500	No	575	No
	1-hour	100% Load	185.0	2,000	No	N/A	N/A

The modeled impacts for the proposed facility fall below the pre-application monitoring threshold, as well as the modeling significant impact level (SIL), for 8-hour CO and 1-hour CO.

VII. Additional PSD Impact Analyses

A. Commercial, Residential, and Industrial Growth

This project is located in Kansas City, Kansas in an area zoned as industrial. Because the project will not create additional generating capacity, it will not have an effect upon the industrial growth in the immediate area. There will be an increase in the local labor force during the construction phase of the project. It is anticipated that most of the labor force during the construction phase will commute from nearby communities. This labor force increase will be temporary and short-lived, and will not result in permanent commercial and/or residential growth occurring in the vicinity of the project.

Given the expected population of the commuting workforce, the fact that during the construction period most workers will be onsite for less than the total construction period, and an abundance of hotel and other short-term lodging options in Kansas City, it is unlikely that any substantial part of the construction workforce would choose to relocate during the construction period. Therefore, anticipated housing growth due to the project will be minimal or nonexistent, and is not expected to have a significant impact on air quality.

Finally, because the maximum model-predicted CO concentrations for the proposed project are well below the regulatory significant impact levels, air pollutant concentrations in the region resulting from this project are expected to comply with the ambient air quality standards when the proposed project becomes operational. Therefore, from an air quality impact standpoint, the proposed project is consistent with the balanced growth demonstrated by Wyandotte County to date.

B. Visibility Impairment

An additional visibility impact analysis may be used to determine if the air emission increases associated with a proposed PSD project will have an impact on Class II sensitive areas such as state parks, wilderness areas, or scenic sites and overlooks. Visibility impairment is a function of the emissions of primary particulate matter, NO_x (including NO_2), elemental carbon (soot), and primary sulfate (SO_4). This project will substantially decrease the emissions of NO_x, thereby improving visibility over current conditions. As CO, not a visibility impairing pollutant, is the only pollutant with an emission increase, the project is not predicted to negatively impact visibility.

Federally designated Class I areas are afforded special protection in the air permitting process. Generally, Class I area visibility analyses are only conducted for projects located within 100 km of a Class I area. The Quindaro facility is located approximately 307 km from the closest Class I area, Hercules-Glades Wilderness Area in Missouri. Another Class I area in relatively close proximity to the Quindaro facility is the Upper Buffalo Wilderness Are in Arkansas, approximately 375 km from the Quindaro facility. As the proposed project results in a substantial decrease in NOx emissions and no increase in any other visibility-impairing pollutants, a visibility was not required.

C. Vegetation

EPA's *New Source Review Workshop Manual: Prevention of Significant Deterioration and Nonattainment Area Permitting* (http://www.epa.gov/ttn/nsr/gen/wkshpman.pdf) states that the analysis of air pollution impacts on vegetation should be based on an inventory of plant species found in the significant impact area (SIA). Since the emissions from the proposed project did not result in any exceedances of the significant impact levels (SILs), no SIA exists for it. Therefore, an area with a 3 km radius centered at the facility was chosen for this analysis. A review of information gathered from topographic maps and imagery concluded there are no state parks or designated sensitive areas within this 3 km area.

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) was queried to determine the inventory of plant species for Wyandotte County, Kansas and Platte County, Missouri. (See http://plants.usda.gov/adv_search.html). This query resulted in a list containing approximately 1,500 species.

Unlike fauna, CO does not poison vegetation, although very high concentrations can reduce the rate of photosynthesis. According to the EPA document *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals* (1980, viewable at http://www.deq.state.va.us/air/assessments/dispersion/_documents/A_Screening_Procedure_for_the_Impacts_of_Air_Pollution_Sources.pdf), for the most sensitive vegetation a CO concentration of 1,800,000 µg/m3 (1-week averaging period) could potentially reduce the photosynthetic rate. The maximum model-predicted 1-hr CO impact of 185.0 µg/m3 produced by the proposed project is significantly lower than this screening level, even at a conservative 1 hr averaging period. Consequently, no adverse impacts to vegetation due to the proposed project are expected from CO emissions.

D. Soils

A soil inventory was completed by BPU within the 3 km radius study area surrounding the facility. The soil survey was obtained from the NRCS. The different soil classification series that were found to be in excess of 1 percent of the total study area are listed in the table below.

Soil Inventory for BPU – Quindaro Study Area	
Haynie silt loam	Made land
Kennebee silt loam	Onawa silty clay loam
Knox complex	Onawa soils
Knox silt loam	Parkville silty clay loam
Knox-Urban land complex	Waldron silty clay loam
Ladoga silt loam	Water
Leta silty clay	

Data taken from the Natural Resources Conservation Service's Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/) for the 6x6 km domain centered at the Quindaro facility.

IX. Conclusions

- Evaluation of the facility potential emissions indicated that emissions of CO above current levels are expected.
- The SCREEN3 (Screen View) model was used to determine predicted maximum ground level concentrations.
- The analysis indicated that concentration levels of CO resulting from the proposed project would not significantly cause or contribute to an exceedance of the NAAQS.
- The modeled impacts for the proposed facility fall below the pre-application monitoring threshold, as well as the modeling significant impact level (SIL), for 8-hour CO and 1-hour CO.
- The analysis indicated that concentration levels of all pollutants resulting from the proposed project would comply with PSD Class II increments.
- The analysis indicated that no evaluation of visibility impacts was required.

Attachment 1

```
02/21/11

15:14:14
  ***  SCREEN3 MODEL RUN  ***
  *** VERSION DATED 96043 ***

 C:\_Lynn\_Work\Modeling\Screen View projects\BPU22111_Q2.scr

 SIMPLE TERRAIN INPUTS:
    SOURCE TYPE            =        POINT
    EMISSION RATE (G/S)    =      87.8457
    STACK HEIGHT (M)       =     106.6800
    STK INSIDE DIAM (M)    =       4.0538
    STK EXIT VELOCITY (M/S)=      25.2984
    STK GAS EXIT TEMP (K)  =     436.4833
    AMBIENT AIR TEMP (K)   =     293.0000
    RECEPTOR HEIGHT (M)    =       0.0000
    URBAN/RURAL OPTION     =        URBAN
    BUILDING HEIGHT (M)    =      52.4300
    MIN HORIZ BLDG DIM (M) =      37.9900
    MAX HORIZ BLDG DIM (M) =      70.4800

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


 BUOY. FLUX =  335.042 M**4/S**3;  MOM. FLUX = 1765.059 M**4/S**2.

 *** FULL METEOROLOGY ***

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

 *** TERRAIN HEIGHT OF   21. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

   DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)  DWASH
 -------  ----------  ----  -----  -----  ------  ------  ------  ------
-----
      1.   0.000        1     1.0    1.4   975.2  974.21    7.37    7.37
NO
    100.  0.1327E-04    6     1.0    2.0 10000.0  220.88   35.31   34.44    NO
    200.   48.91        4    20.0   36.1  6400.0   89.71   30.94   39.68
HS
    300.   71.60        3    10.0   16.1  3200.0  116.70   62.99   60.65
HS
    400.   85.12        3     8.0   12.8  2560.0  132.65   82.80   81.12
HS
    500.   81.11        3     8.0   12.8  2560.0  140.18  101.62  101.21
HS

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND     1. M:
    413.   85.26        3     8.0   12.8  2560.0  133.74   85.47   83.93
HS
```

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

 *** TERRAIN HEIGHT OF   50. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

   DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)  DWASH
 -------  ----------  ----  -----  -----  ------  ------  ------  ------
-----
    500.   115.8        3     8.0   12.8  2560.0  111.18  101.62  101.21
HS
    600.   103.3        4     8.0   14.5  2560.0  111.36   87.61   78.89
HS
    700.   92.01        4     8.0   14.5  2560.0  117.28  100.50   90.76
HS
    800.   81.30        4     8.0   14.5  2560.0  122.92  113.01  102.34
HS
    900.   71.87        4     8.0   14.5  2560.0  128.33  125.16  113.67
HS
   1000.   64.48        4     5.0    9.0  1600.0  179.66  139.72  127.72
HS

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND   500. M:
    500.   115.8        3     8.0   12.8  2560.0  111.18  101.62  101.21
HS

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

 *** TERRAIN HEIGHT OF   51. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

   DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)  DWASH
 -------  ----------  ----  -----  -----  ------  ------  ------  ------
-----
   1000.   65.19        4     5.0    9.0  1600.0  178.66  139.72  127.72
HS
   1100.   63.64        5     4.5    9.2 10000.0  154.36  104.70   83.70    HS
   1200.   63.37        5     4.5    9.2 10000.0  154.36  112.11   86.06    HS
   1300.   62.96        5     4.5    9.2 10000.0  154.36  119.37   88.36    HS
   1400.   62.46        5     4.5    9.2 10000.0  154.36  126.48   90.62    HS
   1500.   61.86        5     4.5    9.2 10000.0  154.36  133.46   92.83    HS

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND  1000. M:
   1000.   65.19        4     5.0    9.0  1600.0  178.66  139.72  127.72
HS

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

 *** TERRAIN HEIGHT OF   52. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

   DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)  DWASH
```

```
 -------  ----------  ----  -----  -----  ------  ------  ------  ------
-----
   1500.   62.98        5     4.5    9.2 10000.0  153.36  133.46   92.83    HS
   1600.   69.66        6     1.0    2.0 10000.0  189.88  142.76   79.44    NO
   1700.   76.34        6     1.0    2.0 10000.0  189.88  149.36   81.87    NO
   1800.   82.56        6     1.0    2.0 10000.0  189.88  155.84   84.24    NO
   1900.   88.30        6     1.0    2.0 10000.0  189.88  162.21   86.56    NO
   2000.   93.55        6     1.0    2.0 10000.0  189.88  168.47   88.84    NO

 ITERATION STOPPED AT 50 - MAX NOT FOUND!!!

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND  1500. M:
   3380.   127.1        6     1.0    2.0 10000.0  189.88  245.99  116.53    NO

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

 *** TERRAIN HEIGHT OF   53. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

   DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)  DWASH
 -------  ----------  ----  -----  -----  ------  ------  ------  ------
-----
   2000.   95.83        6     1.0    2.0 10000.0  188.88  168.47   88.84    NO
   2100.   100.6        6     1.0    2.0 10000.0  188.88  174.62   91.07    NO
   2200.   104.9        6     1.0    2.0 10000.0  188.88  180.67   93.25    NO
   2300.   108.7        6     1.0    2.0 10000.0  188.88  186.63   95.39    NO
   2400.   112.2        6     1.0    2.0 10000.0  188.88  192.49   97.50    NO
   2500.   115.2        6     1.0    2.0 10000.0  188.88  198.25   99.56    NO

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND  2000. M:
   3827.   130.1        6     1.0    2.0 10000.0  188.88  267.38  124.07    NO

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

 *** TERRAIN HEIGHT OF   54. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

   DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)  DWASH
 -------  ----------  ----  -----  -----  ------  ------  ------  ------
-----
   2500.   117.4        6     1.0    2.0 10000.0  187.88  198.25   99.56    NO
   2600.   120.0        6     1.0    2.0 10000.0  187.88  203.93  101.59    NO
   2700.   122.3        6     1.0    2.0 10000.0  187.88  209.52  103.59    NO
   2800.   124.2        6     1.0    2.0 10000.0  187.88  215.03  105.55    NO
   2900.   125.9        6     1.0    2.0 10000.0  187.88  220.46  107.48    NO
   3000.   127.3        6     1.0    2.0 10000.0  187.88  225.81  109.38    NO
   3500.   131.2        6     1.0    2.0 10000.0  187.88  251.50  118.47    NO

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND  2500. M:
   3783.   131.7        6     1.0    2.0 10000.0  187.88  265.27  123.33    NO

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

*** TERRAIN HEIGHT OF   74. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

   DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)  DWASH
 -------  ----------  ----  -----  -----  ------  ------  ------  ------
-----
   3500.   169.0        6     1.0    2.0 10000.0  167.88  251.50  118.47    NO
   4000.   163.9        6     1.0    2.0 10000.0  167.88  275.60  126.97    NO
   4500.   157.5        6     1.0    2.0 10000.0  167.88  298.33  134.96    NO
   5000.   150.7        6     1.0    2.0 10000.0  167.88  319.88  142.53    NO

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND  3500. M:
   3500.   169.0        6     1.0    2.0 10000.0  167.88  251.50  118.47    NO

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

 *** TERRAIN HEIGHT OF  101. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

   DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)  DWASH
 -------  ----------  ----  -----  -----  ------  ------  ------  ------
-----
   5000.   185.0        6     1.0    2.0 10000.0  140.88  319.88  142.53    NO
   5500.   173.2        6     1.0    2.0 10000.0  140.88  340.40  149.74    NO
   6000.   162.7        6     1.0    2.0 10000.0  140.88  360.01  156.63    NO
   6500.   153.2        6     1.0    2.0 10000.0  140.88  378.81  163.23    NO
   7000.   144.6        6     1.0    2.0 10000.0  140.88  396.89  169.59    NO
   7500.   136.9        6     1.0    2.0 10000.0  140.88  414.30  175.73    NO
   8000.   129.9        6     1.0    2.0 10000.0  140.88  431.13  181.66    NO
   8500.   123.6        6     1.0    2.0 10000.0  140.88  447.41  187.41    NO
   9000.   117.8        6     1.0    2.0 10000.0  140.88  463.20  192.99    NO
   9500.   112.5        6     1.0    2.0 10000.0  140.88  478.54  198.41    NO
  10000.   107.7        6     1.0    2.0 10000.0  140.88  493.45  203.70    NO
  15000.   74.96        6     1.0    2.0 10000.0  140.88  624.84  250.54    NO
  20000.   57.37        6     1.0    2.0 10000.0  140.88  734.35  289.95    NO

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND  5000. M:
   5000.   185.0        6     1.0    2.0 10000.0  140.88  319.88  142.53    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 TERRAIN HEIGHTS ENTERED FOR  *
  *    SIMPLE ELEVATED TERRAIN PROCEDURE     *
  *******************************************

       TERRAIN        DISTANCE RANGE (M)
        HT (M)       MINIMUM     MAXIMUM
       -------      --------    --------
```

```
          21.            1.        500.
          50.          500.       1000.
          51.         1000.       1500.
          52.         1500.       2000.
          53.         2000.       2500.
          54.         2500.       3500.
          74.         3500.       5000.
         101.         5000.      20000.

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


 *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)     =    0.000        CONC (UG/M**3)     =    0.000
  CRIT WS @10M (M/S) =    99.99        CRIT WS @10M (M/S) =    99.99
  CRIT WS @ HS (M/S) =    99.99        CRIT WS @ HS (M/S) =    99.99
  DILUTION WS (M/S)  =    99.99        DILUTION WS (M/S)  =    99.99
  CAVITY HT (M)      =    85.13        CAVITY HT (M)      =    67.04
  CAVITY LENGTH (M)  =   119.04        CAVITY LENGTH (M)  =    47.07
  ALONGWIND DIM (M)  =    37.99        ALONGWIND DIM (M)  =    70.48

CAVITY CONC NOT CALCULATED FOR CRIT WS > 20.0 M/S.  CONC SET = 0.0

****************************************
      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      185.0         5000.      101.


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** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
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