

Data and Modeling Procedures

Dispersion modeling was performed using the U.S. EPA's Screen3 model. This model is a screening tool which gives predictions of ambient ground level concentrations for a single stack. Due to the assumptions made in the model, particularly those regarding meteorological conditions, these predictions will always be more conservative than predictions made by the ISC3 model.

There is one source of APFO emissions on the Circleville site....describe emission source. The following parameters for this source were used in the model:

Stack Height: 65 feet
Diameter: 15.5 inches
Temperature: 303°F
Flow Rate: 1927 acfm
C8 Emission Rate: 130 kg/yr

The C8 emission rate is based on mass balance estimates provided by the site.

To determine the impacts of building downwash on dispersion from the stack, the Screen3 model uses only the dominant downwash structure as an input to the model. The dominant downwash structure can be found by first locating all buildings which have an area of influence encompassing the stack. The area of influence is defined by EPA as a distance of five times the lesser of the height or the maximum projected width of the building. Once all of the potential downwash structures are located, the dominant downwash structure is determined by calculating the GEP (Good Engineering Practice) stack height for each building. The building with the greatest GEP stack height is the building that should be included in the Screen3 model. The GEP stack height is calculated according to the following formula:

$$H = h + 1.5L$$

where H = GEP stack height

h = building height

L = lesser of the building height or maximum projected width

The following table shows the buildings that were included in the downwash analysis and their respective GEP's:

Building	Height (ft)	Length (ft)	Width (ft)	Max Projected Width (ft)	GEP (ft)
Coating	52	92	62	111	130
Powerhouse	35	67	25	72	87.5
EP*	60	50	50	71	150
Building 3	35	150	150	212	87.5

*This building has the highest GEP and was used in the model.

Modeling Results

Using the above data the Screen3 model predicted a maximum off-site ground level concentration of $1.306 \mu\text{g}/\text{m}^3$ at a distance of 1500 feet from the source. This concentration is based on a 1-hour averaging time. To convert a Screen3 model result to an annual average, EPA guidance directs the user to multiply the predicted Screen3 concentration by a value of 0.05. This gives an annual average concentration of $0.065 \mu\text{g}/\text{m}^3$. A copy of the Screen3 model output is attached.

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

CIRCLEVILLE APFO EMISSIONS ** 0

SIMPLE TERRAIN INPUTS:

SOURCE TYPE = POINT
EMISSION RATE (G/S) = 0.412200E-02
STACK HEIGHT (M) = 19.8120
STK INSIDE DIAM (M) = 0.3937
STK EXIT VELOCITY (M/S) = 7.4706
STK GAS EXIT TEMP (K) = 423.7056
AMBIENT AIR TEMP (K) = 293.0000
RECEPTOR HEIGHT (M) = 0.0000
URBAN/RURAL OPTION = RURAL
BUILDING HEIGHT (M) = 18.2880
MIN HORIZ BLDG DIM (M) = 15.2400
MAX HORIZ BLDG DIM (M) = 15.2400

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 = 0.90944278 (M**3/S)

BUOY. FLUX = 0.876 M**4/S**3; MOM. FLUX = 1.495 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
457.	1.306	6	1.0	1.5	10000.0	24.01	16.55	19.46	SS
500.	1.213	6	1.0	1.5	10000.0	24.01	17.97	19.77	SS
600.	1.042	6	1.0	1.5	10000.0	24.01	21.24	20.48	SS
700.	0.9144	6	1.0	1.5	10000.0	24.01	24.46	21.18	SS
800.	0.8110	6	1.0	1.5	10000.0	24.01	27.63	21.34	SS
900.	0.7331	6	1.0	1.5	10000.0	24.01	30.78	21.97	SS
1000.	0.6687	6	1.0	1.5	10000.0	24.01	33.88	22.55	SS
1100.	0.6146	6	1.0	1.5	10000.0	24.01	36.96	23.11	SS
1200.	0.5685	6	1.0	1.5	10000.0	24.01	40.01	23.66	SS
1300.	0.5286	6	1.0	1.5	10000.0	24.01	43.04	24.20	SS
1400.	0.4937	6	1.0	1.5	10000.0	24.01	46.05	24.73	SS
1500.	0.4629	6	1.0	1.5	10000.0	24.01	49.03	25.26	SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 457. M:

457.	1.306	6	1.0	1.5	10000.0	24.01	16.55	19.46	SS
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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)

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*** CAVITY CALCULATION - 1 ***
CONC (UG/M**3) = 9.860
CRIT WS @10M (M/S) = 1.00
CRIT WS @ HS (M/S) = 1.15
DILUTION WS (M/S) = 1.00
CAVITY HT (M) = 28.19
CAVITY LENGTH (M) = 25.71
ALONGWIND DIM (M) = 15.24

*** CAVITY CALCULATION - 2 ***
CONC (UG/M**3) = 9.860
CRIT WS @10M (M/S) = 1.00
CRIT WS @ HS (M/S) = 1.15
DILUTION WS (M/S) = 1.00
CAVITY HT (M) = 28.19
CAVITY LENGTH (M) = 25.71
ALONGWIND DIM (M) = 15.24

END OF CAVITY CALCULATIONS

*** SUMMARY OF SCREEN MODEL RESULTS ***

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	1.306	457.	0.
BLDG. CAVITY-1	9.860	26.	-- (DIST = CAVITY LENGTH)
BLDG. CAVITY-2	9.860	26.	-- (DIST = CAVITY LENGTH)

Note: The off-site concentration referenced in the report is the concentration shown for simple terrain. Although the model predicted a building cavity concentration that is higher than the predicted value for simple terrain, this concentration will occur on site and is not applicable for this analysis.