# APPENDIX P
# OFFSITE CONSEQUENCE ANALYSIS MODELING DATA

**Calculation of Model Parameters**
**Sentinel**
29.4% aqueous ammonia

**Equation Used to Determine the Emission Rate of Ammonia:**

$$QR = \frac{0.284 U^{0.78} MW^{2/3} A \times VP}{82.05T}$$

where:
QR = emission rate of ammonia (pounds per minute)
U = wind speed (meters per second)
MW = molecular weight of ammonia (grams per gram-mole)
A = surface area of spilled liquid pool (square feet)
VP = vapor pressure of ammonia above solution (millimeters of mercury)
T = temperature of liquid (degrees Kelvin)

**Worst-Case Scenario:**

| | | |
|---|---|---|
| stability = | F | |
| U = | 1.5 | m/s |
| T = | 117 | F |
| MW = | 17.03 | grams/gram-mol |
| A = | 19.03 | $ft^2$ |
| VP = | 734 | mm Hg |
| T = | 320.4 | K |

**Alternative Scenario**

| | | |
|---|---|---|
| stability = | D | |
| U = | 3 | m/s |
| T = | 73.9 | F |
| MW = | 17.03 | grams/gram-mol |
| A = | 259.94 | $ft^2$ |
| VP = | 243 | mm Hg |
| T = | 296.4 | K |

avg max temperature Palm Springs 1927 - 2006 (WRCC)

| | | |
|---|---|---|
| Drain diameter | 42 | inches |
| Unloading drain diam | 24 | inches |

Note:
2 12,000 gallon tanks with a drain hole below each tank and a drain hole in the unloading area
* area assumes 15% covered by grating

| | | | | |
|---|---|---|---|---|
| Pipe Diam | 0.08 | feet | | |
| Pipe length | 1500.00 | feet | | |
| Volume of pipe | 8.18 | ft3 | 61.2 | gallon |
| Volume pumped in 1 min | 3.00 | gallons | | |
| **total volume spilled** | **8.58** | ft3 | 64.2 | gallon |

ammonia spilled directly on ground, no containment

Effective spill dimensions

| | | |
|---|---|---|
| Area | 1.768 | m2 |
| Effective Length | 1.880 | m |

| | | |
|---|---|---|
| length | 1500.00 | feet |
| thickness | 0.03 | feet (=1 cm) |

| | | | | | |
|---|---|---|---|---|---|
| Effective Width | 0.940 | m | spread | 0.1733 | feet |
| | | | Effective Length | 4.914 | m |
| | | | Effective Width | 4.914 | m |

**Emission Rate**

| | | | | | |
|---|---|---|---|---|---|
| QR = | 1.370 | lbs ammonia / min | QR = | 11.479 | lbs ammonia / min |
| | 10.357 | g ammonia / s | | 86.779 | g ammonia / s |

**Equation Used to Determine the Emission Rate Per Area:**

*(parameter required for dispersion model)*

$$E = \frac{QR}{A}$$

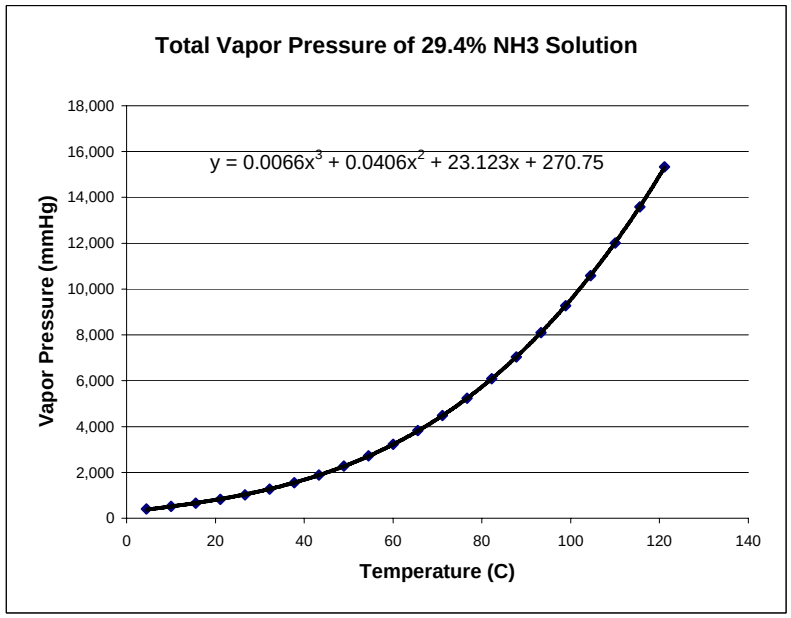
where:

E = emission rate of ammonia (g / s*m$^2$)
QR = emission rate of ammonia (g/s)
A = surface area of spilled liquid pool (m$^2$)

| | | | | | |
|---|---|---|---|---|---|
| E = | 5.859 | g / s*m$^2$ | E = | 3.593 | g / s*m$^2$ |

From Perry's Chemical Engineering Handbook
Table 2-24: Total Vapor Pressures of Aqueous Solutions of NH3
29.4% aqueous solution by wt

| | Solution wt (%) | | | | |
|---|---|---|---|---|---|
| | **28.81** | **33.71** | **29.4** | | |
| Temp deg F | | VP (lb/in2) | | Temp deg C | VP (mmHg) |
| 40 | 5.21 | 8.06 | 7.7168 | 4.44 | 399.08 |
| 50 | 6.75 | 10.35 | 9.9165 | 10.00 | 512.83 |
| 60 | 8.65 | 13.22 | 12.6697 | 15.56 | 655.21 |
| 70 | 11.01 | 16.56 | 15.8917 | 21.11 | 821.84 |
| 80 | 13.86 | 20.61 | 19.7972 | 26.67 | 1023.81 |
| 90 | 17.23 | 25.48 | 24.4866 | 32.22 | 1266.32 |
| 100 | 21.32 | 31.16 | 29.9752 | 37.78 | 1550.16 |
| 110 | 26.07 | 37.81 | 36.3964 | 43.33 | 1882.24 |
| 120 | 31.69 | 45.62 | 43.9427 | 48.89 | 2272.49 |
| 130 | 38.25 | 54.55 | 52.5873 | 54.44 | 2719.55 |
| 140 | 45.73 | 64.78 | 62.4862 | 60.00 | 3231.47 |
| 150 | 54.43 | 76.61 | 73.9393 | 65.56 | 3823.77 |
| 160 | 64.25 | 89.88 | 86.7939 | 71.11 | 4488.54 |
| 170 | 75.55 | 104.84 | 101.3132 | 76.67 | 5239.41 |
| 180 | 88.17 | 121.68 | 117.6451 | 82.22 | 6084.01 |
| 190 | 102.56 | 140.75 | 136.1516 | 87.78 | 7041.07 |
| 200 | 118.68 | 161.81 | 156.6168 | 93.33 | 8099.43 |
| 210 | 136.42 | 185.1 | 179.2385 | 98.89 | 9269.31 |
| 220 | 156.41 | 211.24 | 204.6380 | 104.44 | 10582.84 |
| 230 | 178.28 | 239.7 | 232.3045 | 110.00 | 12013.61 |
| 240 | 202.74 | 270.92 | 262.7106 | 115.56 | 13586.06 |
| 250 | 229.62 | 305.6 | 296.4514 | 121.11 | 15330.96 |




For a 29.4% solution of aqueous ammonia, the Vapor pressure is estimated from the data above from Perry's

| Scenario | Temp deg K | Temp deg F | Temp deg C | Estimated VP (mmHg) | 10min avg VP (mmHg) | 10min VP factor correction RMP OCA Guideline vs Estimate |
|---|---|---|---|---|---|---|
| Worst-case | 320.37 | 117 | 47.22 | 1967 | 734 | 0.37306 |
| Alternate | 296.43 | 73.9 | 23.28 | 870 | 243 | 0.27867 |
| Base temp | 297.04 | 75 | 23.89 | 890 | 248 | 0.27867 |

Note the 10-min average vapour pressure (mmHg) from RMP OCA Guideline for 30% ammonia at 1.5m/s is 332 and 3m/s is 248 (Table B-3)

06/13/07
15:12:20

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

Sentinel ammonia release worst case

SIMPLE TERRAIN INPUTS:
SOURCE TYPE = AREA
EMISSION RATE (G/(S-M**2)) = 5.62800
SOURCE HEIGHT (M) = .0000
LENGTH OF LARGER SIDE (M) = 1.8800
LENGTH OF SMALLER SIDE (M) = .9400
RECEPTOR HEIGHT (M) = .0000
URBAN/RURAL OPTION = RURAL
THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION

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

*** STABILITY CLASS 6 ONLY ***
*** ANEMOMETER HEIGHT WIND SPEED OF 1.50 M/S ONLY ***

**********
*** 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) | MAX DIR (DEG) |
|---|---|---|---|---|---|---|---|
| 1. | .3962E+08 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 20. |
| 100. | .2223E+06 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 200. | .6657E+05 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 300. | .3333E+05 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 400. | .2041E+05 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 500. | .1396E+05 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 600. | .1024E+05 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 700. | 7877. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 800. | 6362. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 900. | 5270. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 1000. | 4454. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 1100. | 3844. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 1200. | 3360. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 1300. | 2970. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 1400. | 2649. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 1500. | 2382. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 1600. | 2156. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 1700. | 1964. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 1800. | 1798. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 1900. | 1655. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 2000. | 1529. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2100. | 1424. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 2200. | 1331. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 2300. | 1248. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 2400. | 1174. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 2500. | 1106. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 2600. | 1045. | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 2700. | 989.3 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 2800. | 938.5 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 2900. | 891.9 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 3000. | 849.2 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 3500. | 687.7 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 4000. | 573.0 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 4500. | 487.8 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 5000. | 422.5 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 5500. | 371.0 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 6000. | 329.5 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 6500. | 295.5 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 7000. | 267.2 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 7500. | 244.1 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 8000. | 224.4 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 8500. | 207.3 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 9000. | 192.4 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 9500. | 179.2 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 10000. | 167.6 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2. | .6510E+08 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 20. |

**********
*** 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) | MAX DIR (DEG) |
|---|---|---|---|---|---|---|---|
| 250. | .4548E+05 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 240. | .4876E+05 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 225. | .5444E+05 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 230. | .5244E+05 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 231. | .5205E+05 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 120. | .1620E+06 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 140. | .1238E+06 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 130. | .1409E+06 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 132. | .1372E+06 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 131. | .1390E+06 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 105. | .2042E+06 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 104. | .2077E+06 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 103. | .2112E+06 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 50. | .7412E+06 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 30. | .1787E+07 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 35. | .1372E+07 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 36. | .1308E+07 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |
| 34. | .1442E+07 | 6 | 1.5 | 1.5 | 10000.0 | .00 | 0. |

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

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------   -------   -------
SIMPLE TERRAIN      .6510E+08        2.        0.


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

06/19/07
14:31:42

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

Sentinel Alternative

SIMPLE TERRAIN INPUTS:
SOURCE TYPE = AREA
EMISSION RATE (G/(S-M**2)) = 3.59300
SOURCE HEIGHT (M) = .0000
LENGTH OF LARGER SIDE (M) = 4.9140
LENGTH OF SMALLER SIDE (M) = 4.9140
RECEPTOR HEIGHT (M) = .0000
URBAN/RURAL OPTION = RURAL
THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION

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

*** STABILITY CLASS 4 ONLY ***
*** ANEMOMETER HEIGHT WIND SPEED OF 3.00 M/S ONLY ***

**********
*** 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) | MAX DIR (DEG) |
|---|---|---|---|---|---|---|---|
| 1. | .1751E+08 | 4 | 3.0 | 3.0 | 960.0 | .00 | 45. |
| 100. | .2378E+06 | 4 | 3.0 | 3.0 | 960.0 | .00 | 27. |
| 200. | .6927E+05 | 4 | 3.0 | 3.0 | 960.0 | .00 | 24. |
| 300. | .3357E+05 | 4 | 3.0 | 3.0 | 960.0 | .00 | 7. |
| 400. | .2042E+05 | 4 | 3.0 | 3.0 | 960.0 | .00 | 7. |
| 500. | .1389E+05 | 4 | 3.0 | 3.0 | 960.0 | .00 | 7. |
| 600. | .1014E+05 | 4 | 3.0 | 3.0 | 960.0 | .00 | 16. |
| 700. | 7769. | 4 | 3.0 | 3.0 | 960.0 | .00 | 31. |
| 800. | 6171. | 4 | 3.0 | 3.0 | 960.0 | .00 | 31. |
| 900. | 5037. | 4 | 3.0 | 3.0 | 960.0 | .00 | 31. |
| 1000. | 4201. | 4 | 3.0 | 3.0 | 960.0 | .00 | 24. |
| 1100. | 3622. | 4 | 3.0 | 3.0 | 960.0 | .00 | 26. |
| 1200. | 3164. | 4 | 3.0 | 3.0 | 960.0 | .00 | 10. |
| 1300. | 2793. | 4 | 3.0 | 3.0 | 960.0 | .00 | 10. |
| 1400. | 2490. | 4 | 3.0 | 3.0 | 960.0 | .00 | 26. |
| 1500. | 2237. | 4 | 3.0 | 3.0 | 960.0 | .00 | 10. |
| 1600. | 2023. | 4 | 3.0 | 3.0 | 960.0 | .00 | 26. |
| 1700. | 1842. | 4 | 3.0 | 3.0 | 960.0 | .00 | 10. |
| 1800. | 1685. | 4 | 3.0 | 3.0 | 960.0 | .00 | 10. |
| 1900. | 1550. | 4 | 3.0 | 3.0 | 960.0 | .00 | 26. |
| 2000. | 1431. | 4 | 3.0 | 3.0 | 960.0 | .00 | 19. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2100. | 1327. | 4 | 3.0 | 3.0 | 960.0 | .00 | 19. |
| 2200. | 1235. | 4 | 3.0 | 3.0 | 960.0 | .00 | 35. |
| 2300. | 1153. | 4 | 3.0 | 3.0 | 960.0 | .00 | 35. |
| 2400. | 1079. | 4 | 3.0 | 3.0 | 960.0 | .00 | 19. |
| 2500. | 1013. | 4 | 3.0 | 3.0 | 960.0 | .00 | 19. |
| 2600. | 953.3 | 4 | 3.0 | 3.0 | 960.0 | .00 | 19. |
| 2700. | 899.2 | 4 | 3.0 | 3.0 | 960.0 | .00 | 35. |
| 2800. | 850.0 | 4 | 3.0 | 3.0 | 960.0 | .00 | 35. |
| 2900. | 805.0 | 4 | 3.0 | 3.0 | 960.0 | .00 | 19. |
| 3000. | 763.9 | 4 | 3.0 | 3.0 | 960.0 | .00 | 19. |
| 3500. | 605.6 | 4 | 3.0 | 3.0 | 960.0 | .00 | 19. |
| 4000. | 495.3 | 4 | 3.0 | 3.0 | 960.0 | .00 | 13. |
| 4500. | 414.9 | 4 | 3.0 | 3.0 | 960.0 | .00 | 13. |
| 5000. | 354.1 | 4 | 3.0 | 3.0 | 960.0 | .00 | 13. |
| 5500. | 306.9 | 4 | 3.0 | 3.0 | 960.0 | .00 | 13. |
| 6000. | 269.3 | 4 | 3.0 | 3.0 | 960.0 | .00 | 13. |
| 6500. | 238.8 | 4 | 3.0 | 3.0 | 960.0 | .00 | 28. |
| 7000. | 213.7 | 4 | 3.0 | 3.0 | 960.0 | .00 | 13. |
| 7500. | 192.7 | 4 | 3.0 | 3.0 | 960.0 | .00 | 13. |
| 8000. | 175.0 | 4 | 3.0 | 3.0 | 960.0 | .00 | 13. |
| 8500. | 159.8 | 4 | 3.0 | 3.0 | 960.0 | .00 | 33. |
| 9000. | 146.7 | 4 | 3.0 | 3.0 | 960.0 | .00 | 33. |
| 9500. | 135.3 | 4 | 3.0 | 3.0 | 960.0 | .00 | 33. |
| 10000. | 125.3 | 4 | 3.0 | 3.0 | 960.0 | .00 | 13. |

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4. | .2475E+08 | 4 | 3.0 | 3.0 | 960.0 | .00 | 45. |

**********
*** 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) | MAX DIR (DEG) |
|---|---|---|---|---|---|---|---|
| 250. | .4649E+05 | 4 | 3.0 | 3.0 | 960.0 | .00 | 27. |
| 240. | .5001E+05 | 4 | 3.0 | 3.0 | 960.0 | .00 | 29. |
| 235. | .5192E+05 | 4 | 3.0 | 3.0 | 960.0 | .00 | 31. |
| 230. | .5396E+05 | 4 | 3.0 | 3.0 | 960.0 | .00 | 31. |
| 232. | .5313E+05 | 4 | 3.0 | 3.0 | 960.0 | .00 | 31. |
| 234. | .5232E+05 | 4 | 3.0 | 3.0 | 960.0 | .00 | 30. |
| 140. | .1309E+06 | 4 | 3.0 | 3.0 | 960.0 | .00 | 7. |
| 138. | .1342E+06 | 4 | 3.0 | 3.0 | 960.0 | .00 | 8. |
| 135. | .1396E+06 | 4 | 3.0 | 3.0 | 960.0 | .00 | 9. |
| 110. | .2008E+06 | 4 | 3.0 | 3.0 | 960.0 | .00 | 31. |
| 108. | .2075E+06 | 4 | 3.0 | 3.0 | 960.0 | .00 | 31. |
| 85. | .3168E+06 | 4 | 3.0 | 3.0 | 960.0 | .00 | 41. |
| 55. | .6771E+06 | 4 | 3.0 | 3.0 | 960.0 | .00 | 35. |
| 40. | .1163E+07 | 4 | 3.0 | 3.0 | 960.0 | .00 | 45. |
| 35. | .1451E+07 | 4 | 3.0 | 3.0 | 960.0 | .00 | 42. |
| 36. | .1385E+07 | 4 | 3.0 | 3.0 | 960.0 | .00 | 44. |
| 37. | .1324E+07 | 4 | 3.0 | 3.0 | 960.0 | .00 | 43. |

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

| CALCULATION PROCEDURE | MAX CONC (UG/M**3) | DIST TO MAX (M) | TERRAIN HT (M) |
|---|---|---|---|
| SIMPLE TERRAIN | .2475E+08 | 4. | 0. |

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