APPENDIX Q
HAZARDOUS MATERIALS HANDLING – SUMMARY OF MODEL RESULTS

Calculation of Model Parameters

19.1% aqueous ammonia

Equation Used to Determine the Emission Rate of Ammonia:

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

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 =	97	F
MW =	17.03	grams/gram-mol
A =	10.85	ft^2
VP =	296	mm Hg
T =	309.3	K

avg daily temperature Antioch 1971-2000 (WRCC)

Drain diameter	42	inches
Unloading drain diam	24	inches

Note:
1. 20,000 gallon tank with a drain hole below tank and a drain hole in the unloading area
* area assumes 15% covered by grating

Effective spill dimensions

Area	1.008	m2
Effective Length	1.420	m
Effective Width	0.710	m

Emission Rate

QR =	0.327	lbs ammonia / min
	2.470	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 = 2.451 g / s*m^2

Alternative Scenario

stability =	D	
U =	3	m/s
T =	77	F
MW =	17.03	grams/gram-mol
A =	10.85	ft^2
VP =	148	mm Hg
T =	298.2	K

avg daily temperature Antioch 1971-2000 (WRCC)

Drain diameter	42	inches
Unloading drain diam	24	inches

Note:
1. 20,000 gallon tank with a drain hole below tank and a drain hole in the unloading area
* area assumes 15% covered by grating

Effective spill dimensions

Area	1.008	m2
Effective Length	1.420	m
Effective Width	0.710	m

Emission Rate

QR =	0.291	lbs ammonia / min
	2.197	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 = 2.180 g / s*m^2

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

WPGS worst case

SIMPLE TERRAIN INPUTS:
SOURCE TYPE = AREA
EMISSION RATE (G/(S-M**2)) = 2.45100
SOURCE HEIGHT (M) = .0000
LENGTH OF LARGER SIDE (M) = 1.4200
LENGTH OF SMALLER SIDE (M) = .7100
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 ***

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*** SCREEN AUTOMATED DISTANCES ***
1. 20,000 gallon tank with a drain hole belo 1. 20,000 gallon tank with a drain hole below tank

*** 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.	.1365E+08	6	1.5	1.5	10000.0	.00	20.
100.	.5528E+05	6	1.5	1.5	10000.0	.00	0.
200.	.1654E+05	6	1.5	1.5	10000.0	.00	0.
300.	8280.	6	1.5	1.5	10000.0	.00	0.
400.	5071.	6	1.5	1.5	10000.0	.00	0.
500.	3468.	6	1.5	1.5	10000.0	.00	0.
600.	2543.	6	1.5	1.5	10000.0	.00	0.
700.	1957.	6	1.5	1.5	10000.0	.00	0.
800.	1581.	6	1.5	1.5	10000.0	.00	0.
900.	1309.	6	1.5	1.5	10000.0	.00	0.
1000.	1107.	6	1.5	1.5	10000.0	.00	0.

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

2.	.2312E+08	6	1.5	1.5	10000.0	.00	20.

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*** SCREEN DISCRETE DISTANCES ***
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*** 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.	.1365E+08	6	1.5	1.5	10000.0	.00	20.
2.	.2052E+08	6	1.5	1.5	10000.0	.00	19.
3.	.1379E+08	6	1.5	1.5	10000.0	.00	9.
4.	.1023E+08	6	1.5	1.5	10000.0	.00	0.
5.	.7825E+07	6	1.5	1.5	10000.0	.00	0.
6.	.6136E+07	6	1.5	1.5	10000.0	.00	0.
7.	.4922E+07	6	1.5	1.5	10000.0	.00	0.
8.	.4031E+07	6	1.5	1.5	10000.0	.00	0.
9.	.3360E+07	6	1.5	1.5	10000.0	.00	0.
10.	.2844E+07	6	1.5	1.5	10000.0	.00	0.
11.	.2440E+07	6	1.5	1.5	10000.0	.00	0.
12.	.2118E+07	6	1.5	1.5	10000.0	.00	0.
13.	.1857E+07	6	1.5	1.5	10000.0	.00	0.
14.	.1641E+07	6	1.5	1.5	10000.0	.00	0.
15.	.1463E+07	6	1.5	1.5	10000.0	.00	0.
16.	.1313E+07	6	1.5	1.5	10000.0	.00	0.
17.	.1185E+07	6	1.5	1.5	10000.0	.00	0.
18.	.1075E+07	6	1.5	1.5	10000.0	.00	0.
19.	.9817E+06	6	1.5	1.5	10000.0	.00	0.
20.	.8996E+06	6	1.5	1.5	10000.0	.00	0.
21.	.8272E+06	6	1.5	1.5	10000.0	.00	0.
22.	.7637E+06	6	1.5	1.5	10000.0	.00	0.
23.	.7075E+06	6	1.5	1.5	10000.0	.00	0.
24.	.6577E+06	6	1.5	1.5	10000.0	.00	0.
25.	.6133E+06	6	1.5	1.5	10000.0	.00	0.
26.	.5735E+06	6	1.5	1.5	10000.0	.00	0.
27.	.5374E+06	6	1.5	1.5	10000.0	.00	0.
28.	.5046E+06	6	1.5	1.5	10000.0	.00	0.
29.	.4749E+06	6	1.5	1.5	10000.0	.00	0.
30.	.4478E+06	6	1.5	1.5	10000.0	.00	0.
31.	.4231E+06	6	1.5	1.5	10000.0	.00	0.

32.	.4005E+06	6	1.5	1.5	10000.0	.00	0.
33.	.3797E+06	6	1.5	1.5	10000.0	.00	0.
34.	.3606E+06	6	1.5	1.5	10000.0	.00	0.
35.	.3430E+06	6	1.5	1.5	10000.0	.00	0.
36.	.3267E+06	6	1.5	1.5	10000.0	.00	0.
37.	.3116E+06	6	1.5	1.5	10000.0	.00	0.
38.	.2976E+06	6	1.5	1.5	10000.0	.00	0.
39.	.2846E+06	6	1.5	1.5	10000.0	.00	0.
40.	.2724E+06	6	1.5	1.5	10000.0	.00	0.
41.	.2611E+06	6	1.5	1.5	10000.0	.00	0.
42.	.2503E+06	6	1.5	1.5	10000.0	.00	0.
43.	.2403E+06	6	1.5	1.5	10000.0	.00	0.
44.	.2308E+06	6	1.5	1.5	10000.0	.00	0.
45.	.2220E+06	6	1.5	1.5	10000.0	.00	0.
46.	.2136E+06	6	1.5	1.5	10000.0	.00	0.
47.	.2058E+06	6	1.5	1.5	10000.0	.00	0.
48.	.1983E+06	6	1.5	1.5	10000.0	.00	0.
49.	.1913E+06	6	1.5	1.5	10000.0	.00	0.
50.	.1847E+06	6	1.5	1.5	10000.0	.00	0.
51.	.1785E+06	6	1.5	1.5	10000.0	.00	0.
52.	.1725E+06	6	1.5	1.5	10000.0	.00	0.
53.	.1669E+06	6	1.5	1.5	10000.0	.00	0.
54.	.1615E+06	6	1.5	1.5	10000.0	.00	0.
55.	.1565E+06	6	1.5	1.5	10000.0	.00	0.
56.	.1516E+06	6	1.5	1.5	10000.0	.00	0.
57.	.1470E+06	6	1.5	1.5	10000.0	.00	0.
58.	.1426E+06	6	1.5	1.5	10000.0	.00	0.
59.	.1385E+06	6	1.5	1.5	10000.0	.00	0.
60.	.1345E+06	6	1.5	1.5	10000.0	.00	0.
61.	.1307E+06	6	1.5	1.5	10000.0	.00	0.
62.	.1270E+06	6	1.5	1.5	10000.0	.00	0.
63.	.1235E+06	6	1.5	1.5	10000.0	.00	0.
64.	.1202E+06	6	1.5	1.5	10000.0	.00	0.
65.	.1170E+06	6	1.5	1.5	10000.0	.00	0.
66.	.1139E+06	6	1.5	1.5	10000.0	.00	0.
67.	.1110E+06	6	1.5	1.5	10000.0	.00	0.
68.	.1082E+06	6	1.5	1.5	10000.0	.00	0.
69.	.1054E+06	6	1.5	1.5	10000.0	.00	0.
70.	.1028E+06	6	1.5	1.5	10000.0	.00	0.
71.	.1003E+06	6	1.5	1.5	10000.0	.00	0.
72.	.9792E+05	6	1.5	1.5	10000.0	.00	0.
73.	.9560E+05	6	1.5	1.5	10000.0	.00	0.
74.	.9337E+05	6	1.5	1.5	10000.0	.00	0.
75.	.9121E+05	6	1.5	1.5	10000.0	.00	0.
76.	.8914E+05	6	1.5	1.5	10000.0	.00	0.
77.	.8713E+05	6	1.5	1.5	10000.0	.00	0.
78.	.8520E+05	6	1.5	1.5	10000.0	.00	0.
79.	.8334E+05	6	1.5	1.5	10000.0	.00	0.
80.	.8154E+05	6	1.5	1.5	10000.0	.00	0.
81.	.7979E+05	6	1.5	1.5	10000.0	.00	0.
82.	.7811E+05	6	1.5	1.5	10000.0	.00	0.
83.	.7648E+05	6	1.5	1.5	10000.0	.00	0.
84.	.7491E+05	6	1.5	1.5	10000.0	.00	0.
85.	.7338E+05	6	1.5	1.5	10000.0	.00	0.
86.	.7191E+05	6	1.5	1.5	10000.0	.00	0.
87.	.7048E+05	6	1.5	1.5	10000.0	.00	0.
88.	.6909E+05	6	1.5	1.5	10000.0	.00	0.
89.	.6774E+05	6	1.5	1.5	10000.0	.00	0.
90.	.6643E+05	6	1.5	1.5	10000.0	.00	0.
91.	.6516E+05	6	1.5	1.5	10000.0	.00	0.
92.	.6393E+05	6	1.5	1.5	10000.0	.00	0.
93.	.6274E+05	6	1.5	1.5	10000.0	.00	0.
94.	.6158E+05	6	1.5	1.5	10000.0	.00	0.
95.	.6046E+05	6	1.5	1.5	10000.0	.00	0.
96.	.5936E+05	6	1.5	1.5	10000.0	.00	0.
97.	.5830E+05	6	1.5	1.5	10000.0	.00	0.
98.	.5727E+05	6	1.5	1.5	10000.0	.00	0.
99.	.5626E+05	6	1.5	1.5	10000.0	.00	0.
100.	.5528E+05	6	1.5	1.5	10000.0	.00	0.
101.	.5433E+05	6	1.5	1.5	10000.0	.00	0.
102.	.5341E+05	6	1.5	1.5	10000.0	.00	0.
103.	.5251E+05	6	1.5	1.5	10000.0	.00	0.
104.	.5163E+05	6	1.5	1.5	10000.0	.00	0.
105.	.5078E+05	6	1.5	1.5	10000.0	.00	0.
290.	8794.	6	1.5	1.5	10000.0	.00	0.
299.	8342.	6	1.5	1.5	10000.0	.00	0.

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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	.2052E+08	2.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
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 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

WPGS alternate case

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE                =        AREA
   EMISSION RATE (G/(S-M**2))  =      2.18000
   SOURCE HEIGHT (M)          =       .0000
   LENGTH OF LARGER SIDE (M)   =       1.4200
   LENGTH OF SMALLER SIDE (M)  =       .7100
   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 ***
1.    20,000 gallon tank with a drain hole belo 1.    20,000 gallon tank with a drain hole below tank

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

  DIST     CONC            U10M   USTK  MIX HT   PLUME  MAX DIR
   (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   (DEG)
-------  ----------  ----  -----  -----  ------  ------  -------
     1.   .3557E+07    4     3.0    3.0   960.0     .00     18.
   100.   6100.        4     3.0    3.0   960.0     .00      0.
   200.   1759.        4     3.0    3.0   960.0     .00      0.
   300.   850.9        4     3.0    3.0   960.0     .00      0.
   400.   517.3        4     3.0    3.0   960.0     .00      0.
   500.   351.8        4     3.0    3.0   960.0     .00      0.
   600.   256.8        4     3.0    3.0   960.0     .00      0.
   700.   196.8        4     3.0    3.0   960.0     .00      0.
   800.   156.3        4     3.0    3.0   960.0     .00      0.
   900.   127.6        4     3.0    3.0   960.0     .00      0.
  1000.   106.4        4     3.0    3.0   960.0     .00      0.

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND     1. M:
     2.   .5911E+07    4     3.0    3.0   960.0     .00     11.

**********************************
*** SCREEN DISCRETE DISTANCES ***
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*** 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)	MAX DIR (DEG)
1.	.3557E+07	4	3.0	3.0	960.0	.00	18.
2.	.5025E+07	4	3.0	3.0	960.0	.00	0.
3.	.2874E+07	4	3.0	3.0	960.0	.00	0.
4.	.1831E+07	4	3.0	3.0	960.0	.00	0.
5.	.1265E+07	4	3.0	3.0	960.0	.00	0.
6.	.9276E+06	4	3.0	3.0	960.0	.00	0.
7.	.7105E+06	4	3.0	3.0	960.0	.00	0.
8.	.5625E+06	4	3.0	3.0	960.0	.00	0.
9.	.4574E+06	4	3.0	3.0	960.0	.00	0.
10.	.3795E+06	4	3.0	3.0	960.0	.00	0.
11.	.3203E+06	4	3.0	3.0	960.0	.00	0.
12.	.2745E+06	4	3.0	3.0	960.0	.00	0.
13.	.2380E+06	4	3.0	3.0	960.0	.00	0.
14.	.2084E+06	4	3.0	3.0	960.0	.00	0.
15.	.1842E+06	4	3.0	3.0	960.0	.00	0.
16.	.1641E+06	4	3.0	3.0	960.0	.00	0.
17.	.1473E+06	4	3.0	3.0	960.0	.00	0.
18.	.1330E+06	4	3.0	3.0	960.0	.00	0.
19.	.1208E+06	4	3.0	3.0	960.0	.00	0.
20.	.1102E+06	4	3.0	3.0	960.0	.00	0.
21.	.1009E+06	4	3.0	3.0	960.0	.00	0.
22.	.9280E+05	4	3.0	3.0	960.0	.00	0.
23.	.8566E+05	4	3.0	3.0	960.0	.00	0.
24.	.7934E+05	4	3.0	3.0	960.0	.00	0.
25.	.7372E+05	4	3.0	3.0	960.0	.00	0.
26.	.6870E+05	4	3.0	3.0	960.0	.00	0.
27.	.6419E+05	4	3.0	3.0	960.0	.00	0.
28.	.6013E+05	4	3.0	3.0	960.0	.00	0.
29.	.5645E+05	4	3.0	3.0	960.0	.00	0.
30.	.5312E+05	4	3.0	3.0	960.0	.00	0.
31.	.5008E+05	4	3.0	3.0	960.0	.00	0.
32.	.4730E+05	4	3.0	3.0	960.0	.00	0.
33.	.4476E+05	4	3.0	3.0	960.0	.00	0.
290.	906.3	4	3.0	3.0	960.0	.00	0.
299.	857.5	4	3.0	3.0	960.0	.00	0.

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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	.5911E+07	2.	0.

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** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
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