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December 23, 2008

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Duke Energy Carolinas, LLC.
William States Lee III Nuclear Station - Docket Nos. 52-018 and 52-019
AP1000 Combined License Application for the William States Lee III Nuclear Station Units 1 and 2
Response to Request for Additional Information
(RAI Nos. 907, 908 and 925)
Ltr # WLG2008.12-29

References: Letter from Ravindra Joshi (NRC) to Peter Hastings (Duke Energy), *Request for Additional Information Letter No. 019 Related to SRP Section 6.4 for the William States Lee III Units 1 and 2 Combined License Application*, dated September 22, 2008.

Dolan to NRC Document Control Desk, Response to Request for Additional Information, (RAI Nos. 907, 908 and 925), Ltr # WLG2008.10-16, Dated October 27, 2008.

This letter provides the Duke Energy's partial response to the Nuclear Regulatory Commission's requests for additional information (RAIs) included in the referenced letter. Responses to RAI Numbers 06.04-001, 06.04-002, 06.04-004, 06.04-005, 06.04-006 and 06.04-007 are provided in this letter. Responses to 06.04-003, and 06.04-08 were previously transmitted as enclosures to the Duke Energy letter referenced above. A revised response for RAI Number 06.04-003 is also provided in this letter. This letter completes the Duke Energy response to the RAIs in NRC Letter No. 019.

Responses to the NRC information requests described in the referenced letter are addressed in separate enclosures, which also identify associated changes, when appropriate, that will be made in a future revision of the Final Safety Analysis Report for the Lee Nuclear Station.

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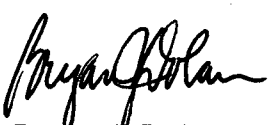
If you have any questions or need any additional information, please contact Peter S. Hastings, Nuclear Plant Development Licensing Manager, at 980-373-7820.



Bryan J. Dolan
Vice President
Nuclear Plant Development

Enclosures:

1) Duke Energy Response to Request for Additional Information Letter 019, RAI 06.04-001
2) Duke Energy Response to Request for Additional Information Letter 019, RAI 06.04-002
3) Duke Energy Revised Response to Request for Additional Information Letter 019, RAI 06.04-003
4) Duke Energy Response to Request for Additional Information Letter 019, RAI 06.04-004
5) Duke Energy Response to Request for Additional Information Letter 019, RAI 06.04-005
6) Duke Energy Response to Request for Additional Information Letter 019, RAI 06.04-006
7) Duke Energy Response to Request for Additional Information Letter 019, RAI 06.04-007

AFFIDAVIT OF BRYAN J. DOLAN

Bryan J. Dolan, being duly sworn, states that he is Vice President, Nuclear Plant Development, Duke Energy Carolinas, LLC, that he is authorized on the part of said Company to sign and file with the U. S. Nuclear Regulatory Commission this supplement to the combined license application for the William States Lee III Nuclear Station and that all the matter and facts set forth herein are true and correct to the best of his knowledge.

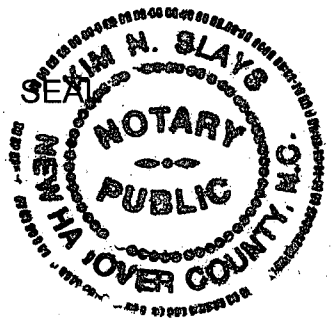
Bryan J. Dolan

Subscribed and sworn to me on December 23, 2008

Notary Public

My commission expires: April 19, 2010

SEAL



xc (w/o enclosures):

Loren Plisco, Deputy Regional Administrator, Region II
Stephanie Coffin, Branch Chief, DNRL

xc (w/enclosures):

Brian Hughes, Senior Project Manager, DNRL
Ravindra Joshi, Project Manager, DNRL

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 019

NRC Technical Review Branch: **Containment & Ventilation Branch 1 (SPCV) and Siting & Accident Consequences Branch (RSAC)**

Reference NRC RAI Number(s): **06.04-001**

NRC RAI:

WLS COL 6.4-1, states "...although concentrations at the intake may be elevated, concentrations in the control room remain well below one half of the published values...." It is important to know the actual maximum possible concentration of chlorine the control room operators may be exposed to in order to determine whether toxic gas monitoring is required or not. Therefore, please provide the results of the analysis, including the highest calculated chlorine level that the operators will be exposed to, based on the results of the EXTRAN module of HABIT 1.1 and the CHEM software module. What reference(s) did WLS use for "published values," what value was selected, and what was the basis for selecting this value?

Duke Energy Response:

The results of the EXTRAN module of HABIT V1.1 and the CHEM Code software modules are provided as Attachment 1. However, it is not possible to accurately determine the maximum concentration of chlorine in the Control Room (CR) from Attachment 1 results since HABIT V1.1 internal programming causes the analysis to terminate prior to attaining peak concentrations in the control room. In order to determine the highest calculated chlorine levels experienced by the CR operators, an alternate analysis was performed. The EXTRAN and CHEM source codes were translated into Java programming language and recompiled with a minimum of modification to avoid early termination and extend the analysis to the peak CR concentration time period of interest. The alternate analysis uses the same toxic gas transport and dispersion modeling methods and properties as applied in the HABIT V1.1 code. The results of the alternative analysis are provided in Attachment 2. The peak chlorine concentration calculated to occur inside the CR using the alternate analysis is approximately 8.6 parts per million (ppm). The 8.6 ppm alternate calculation result is based on the toxic gas release and transport analysis input parameters summarized in revised FSAR Table 2.2-209 provided in the response to RAI 06.04-002 included in this letter, and revised Table 6.4-201 provided in response to RAI 06.04-006 included in this letter.

The 8.6 ppm maximum calculated concentration of chlorine in the CR is less than the Immediately Dangerous to Life or Health (IDLH) value of 10 ppm provided in National Institute for Occupational Safety and Health (NIOSH) Chemical Abstracts Service Registry, Number 7782505, which corresponds to the Regulatory Guide (RG) 1.78 Table 1 listed toxicity limit of 10 ppm for chlorine. As stated in FSAR Subsection 2.2.3.1.3.1, the basis for selecting this "published value" as a screening criterion for airborne hazardous chemicals is provided by RG 1.78. Regulatory Position 4 of RG 1.78 states that "Implementation of protection measures for a particular chemical species may be excluded if the detailed evaluation of control room

habitability shows that the highest concentration predicted in the control room is below the toxicity limit."

The attached FSAR markup will be incorporated in a future FSAR revision.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 2.2.3.1.3.1

FSAR Subsection 2.2.3.1.3.3 (See response to RAI 06.04-003, this letter)

Table 2.2-209 (See response to RAI 06.04-002, this letter)

FSAR Subsection 6.4.4.2 and Figure 6.4-201 (See response to RAI 06.04-005, this letter)

Table 6.4-201 (See response to RAI 06.04-006, this letter)

Attachments:

1) Results of the analysis based on the EXTRAN module (Table 1) of HABIT V1.1 and the CHEM software module (Table 2) with 1 m/s wind speed.
2) Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN (Table 3) and the CHEM (Table 4) software module methodology with 1 m/s wind speed.
3) Revision to FSAR Subsection 2.2.3.1.3.1.

Lee Nuclear Station Request for Additional Information (RAI)

Attachment 1 to RAI 06.04-001

Results of the analysis based on the EXTRAN module of HABIT V1.1 and the CHEM software module with 1 m/s wind speed

TABLE 1: Chlorine EXTRAN Output

Results of the analysis based on the EXTRAN software module of HABIT V1.1 with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
0.00	1.10E-03
0.25	1.65E-03
0.50	1.88E-03
0.75	2.40E-03
1.00	2.73E-03
1.25	3.30E-03
1.50	3.74E-03
1.75	4.40E-03
2.00	4.97E-03
2.25	5.74E-03
2.50	6.45E-03
2.75	7.37E-03
3.00	8.25E-03
3.25	9.35E-03
3.50	1.04E-02
3.75	1.17E-02
4.00	1.30E-02
4.25	1.46E-02
4.50	1.62E-02
4.75	1.80E-02
5.00	1.99E-02
5.25	2.20E-02
5.50	2.43E-02
5.75	2.68E-02
6.00	2.94E-02
6.25	3.23E-02
6.50	3.54E-02
6.75	3.88E-02
7.00	4.24E-02
7.25	4.63E-02
7.50	5.05E-02
7.75	5.50E-02
8.00	5.97E-02
8.25	6.49E-02
8.50	7.04E-02
8.75	7.63E-02
9.00	8.25E-02
9.25	8.92E-02
9.50	9.63E-02
9.75	1.04E-01
10.00	1.12E-01
10.25	1.20E-01
10.50	1.30E-01
10.75	1.39E-01
11.00	1.49E-01

TABLE 1: Chlorine EXTRAN Output (cont.)

TIME (min)	CONCENTRATION (ppm)
11.25	1.60E-01
11.50	1.71E-01
11.75	1.83E-01
12.00	1.96E-01
12.25	2.09E-01
12.50	2.23E-01
12.75	2.38E-01
13.00	2.54E-01
13.25	2.70E-01
13.50	2.87E-01
13.75	3.05E-01
14.00	3.24E-01
14.25	3.44E-01
14.50	3.65E-01
14.75	3.86E-01
15.00	4.09E-01
15.25	4.33E-01
15.50	4.57E-01
15.75	4.83E-01
16.00	5.10E-01
16.25	5.38E-01
16.50	5.67E-01
16.75	5.98E-01
17.00	6.29E-01
17.25	6.62E-01
17.50	6.96E-01
17.75	7.32E-01
18.00	7.68E-01
18.25	8.07E-01
18.50	8.46E-01
18.75	8.87E-01
19.00	9.29E-01
19.25	9.73E-01
19.50	1.02E+00
19.75	1.07E+00
20.00	1.11E+00
20.25	1.16E+00
20.50	1.22E+00
20.75	1.27E+00
21.00	1.32E+00
21.25	1.38E+00
21.50	1.44E+00
21.75	1.50E+00
22.00	1.56E+00
22.25	1.63E+00
22.50	1.69E+00

TABLE 2: Chlorine CHEM CODE Output

Results of the analysis based on the CHEM CODE software module of HABIT V1.1 with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
0.00	5.10E-06
0.25	1.30E-05
0.50	2.10E-05
0.75	3.20E-05
1.00	4.50E-05
1.25	6.00E-05
1.50	7.70E-05
1.75	9.70E-05
2.00	1.20E-04
2.25	1.50E-04
2.50	1.70E-04
2.75	2.10E-04
3.00	2.40E-04
3.25	2.90E-04
3.50	3.30E-04
3.75	3.90E-04
4.00	4.40E-04
4.25	5.10E-04
4.50	5.80E-04
4.75	6.60E-04
5.00	7.50E-04
5.25	8.50E-04
5.50	9.60E-04
5.75	1.08E-03
6.00	1.21E-03
6.25	1.35E-03
6.50	1.51E-03
6.75	1.68E-03
7.00	1.87E-03
7.25	2.08E-03
7.50	2.30E-03
7.75	2.54E-03
8.00	2.81E-03
8.25	3.09E-03
8.50	3.41E-03
8.75	3.74E-03
9.00	4.11E-03
9.25	4.50E-03
9.50	4.92E-03
9.75	5.38E-03
10.00	5.88E-03
10.25	6.40E-03
10.50	6.97E-03
10.75	7.59E-03
11.00	8.24E-03

TABLE 2: Chlorine CHEM CODE Output

TIME (min)	CONCENTRATION (ppm)
11.25	8.94E-03
11.50	9.69E-03
11.75	1.05E-02
12.00	1.14E-02
12.25	1.23E-02
12.50	1.32E-02
12.75	1.43E-02
13.00	1.54E-02
13.25	1.66E-02
13.50	1.78E-02
13.75	1.91E-02
14.00	2.06E-02
14.25	2.20E-02
14.50	2.36E-02
14.75	2.53E-02
15.00	2.71E-02
15.25	2.90E-02
15.50	3.09E-02
15.75	3.30E-02
16.00	3.52E-02
16.25	3.76E-02
16.50	4.00E-02
16.75	4.26E-02
17.00	4.53E-02
17.25	4.81E-02
17.50	5.11E-02
17.75	5.43E-02
18.00	5.76E-02
18.25	6.11E-02
18.50	6.47E-02
18.75	6.85E-02
19.00	7.25E-02
19.25	7.66E-02
19.50	8.10E-02
19.75	8.56E-02
20.00	9.03E-02
20.25	9.52E-02
20.50	1.00E-01
20.75	1.06E-01
21.00	1.11E-01
21.25	1.17E-01
21.50	1.23E-01
21.75	1.30E-01
22.00	1.36E-01
22.25	1.43E-01
22.50	1.50E-01

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 2 to RAI 06.04-001

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN (Table 3) and the CHEM (Table 4) software module methodology with 1 m/s wind speed

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
0.00	0.00E+00
0.25	0.00E+00
0.50	0.00E+00
0.75	0.00E+00
1.00	0.00E+00
1.25	0.00E+00
1.50	0.00E+00
1.75	0.00E+00
2.00	0.00E+00
2.25	1.00E-02
2.50	1.00E-02
2.75	1.00E-02
3.00	1.00E-02
3.25	1.00E-02
3.50	1.00E-02
3.75	1.00E-02
4.00	1.00E-02
4.25	1.00E-02
4.50	2.00E-02
4.75	2.00E-02
5.00	2.00E-02
5.25	2.00E-02
5.50	2.00E-02
5.75	3.00E-02
6.00	3.00E-02
6.25	3.00E-02
6.50	4.00E-02
6.75	4.00E-02
7.00	4.00E-02
7.25	5.00E-02
7.50	5.00E-02
7.75	5.00E-02
8.00	6.00E-02
8.25	6.00E-02
8.50	7.00E-02
8.75	8.00E-02
9.00	8.00E-02
9.25	9.00E-02
9.50	1.00E-01
9.75	1.00E-01
10.00	1.10E-01
10.25	1.20E-01
10.50	1.30E-01
10.75	1.40E-01

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
11.00	1.50E-01
11.25	1.60E-01
11.50	1.70E-01
11.75	1.80E-01
12.00	2.00E-01
12.25	2.10E-01
12.50	2.20E-01
12.75	2.40E-01
13.00	2.50E-01
13.25	2.70E-01
13.50	2.90E-01
13.75	3.10E-01
14.00	3.20E-01
14.25	3.40E-01
14.50	3.60E-01
14.75	3.90E-01
15.00	4.10E-01
15.25	4.30E-01
15.50	4.60E-01
15.75	4.80E-01
16.00	5.10E-01
16.25	5.40E-01
16.50	5.70E-01
16.75	6.00E-01
17.00	6.30E-01
17.25	6.60E-01
17.50	7.00E-01
17.75	7.30E-01
18.00	7.70E-01
18.25	8.10E-01
18.50	8.50E-01
18.75	8.90E-01
19.00	9.30E-01
19.25	9.70E-01
19.50	1.02E+00
19.75	1.07E+00
20.00	1.11E+00
20.25	1.16E+00
20.50	1.22E+00
20.75	1.27E+00
21.00	1.32E+00
21.25	1.38E+00
21.50	1.44E+00
21.75	1.50E+00
22.00	1.56E+00
22.25	1.63E+00

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
22.50	1.69E+00
22.75	1.76E+00
23.00	1.83E+00
23.25	1.90E+00
23.50	1.97E+00
23.75	2.05E+00
24.00	2.12E+00
24.25	2.20E+00
24.50	2.28E+00
24.75	2.36E+00
25.00	2.45E+00
25.25	2.54E+00
25.50	2.62E+00
25.75	2.71E+00
26.00	2.81E+00
26.25	2.90E+00
26.50	3.00E+00
26.75	3.10E+00
27.00	3.20E+00
27.25	3.30E+00
27.50	3.40E+00
27.75	3.51E+00
28.00	3.62E+00
28.25	3.73E+00
28.50	3.84E+00
28.75	3.95E+00
29.00	4.07E+00
29.25	4.19E+00
29.50	4.31E+00
29.75	4.43E+00
30.00	4.55E+00
30.25	4.68E+00
30.50	4.80E+00
30.75	4.93E+00
31.00	5.06E+00
31.25	5.20E+00
31.50	5.33E+00
31.75	5.47E+00
32.00	5.61E+00
32.25	5.75E+00
32.50	5.89E+00
32.75	6.03E+00
33.00	6.17E+00
33.25	6.32E+00
33.50	6.47E+00
33.75	6.61E+00

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
34.00	6.76E+00
34.25	6.91E+00
34.50	7.07E+00
34.75	7.22E+00
35.00	7.37E+00
35.25	7.53E+00
35.50	7.69E+00
35.75	7.84E+00
36.00	8.00E+00
36.25	8.16E+00
36.50	8.32E+00
36.75	8.48E+00
37.00	8.65E+00
37.25	8.81E+00
37.50	8.97E+00
37.75	9.14E+00
38.00	9.30E+00
38.25	9.46E+00
38.50	9.63E+00
38.75	9.79E+00
39.00	9.96E+00
39.25	1.01E+01
39.50	1.03E+01
39.75	1.05E+01
40.00	1.06E+01
40.25	1.08E+01
40.50	1.10E+01
40.75	1.11E+01
41.00	1.13E+01
41.25	1.14E+01
41.50	1.16E+01
41.75	1.18E+01
42.00	1.19E+01
42.25	1.21E+01
42.50	1.23E+01
42.75	1.24E+01
43.00	1.26E+01
43.25	1.27E+01
43.50	1.29E+01
43.75	1.30E+01
44.00	1.32E+01
44.25	1.33E+01
44.50	1.35E+01
44.75	1.36E+01
45.00	1.38E+01
45.25	1.39E+01

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
45.50	1.41E+01
45.75	1.42E+01
46.00	1.44E+01
46.25	1.45E+01
46.50	1.46E+01
46.75	1.48E+01
47.00	1.49E+01
47.25	1.50E+01
47.50	1.52E+01
47.75	1.53E+01
48.00	1.54E+01
48.25	1.55E+01
48.50	1.56E+01
48.75	1.58E+01
49.00	1.59E+01
49.25	1.60E+01
49.50	1.61E+01
49.75	1.62E+01
50.00	1.63E+01
50.25	1.64E+01
50.50	1.65E+01
50.75	1.66E+01
51.00	1.67E+01
51.25	1.67E+01
51.50	1.68E+01
51.75	1.69E+01
52.00	1.70E+01
52.25	1.71E+01
52.50	1.71E+01
52.75	1.72E+01
53.00	1.73E+01
53.25	1.73E+01
53.50	1.74E+01
53.75	1.74E+01
54.00	1.75E+01
54.25	1.75E+01
54.50	1.76E+01
54.75	1.76E+01
55.00	1.77E+01
55.25	1.77E+01
55.50	1.77E+01
55.75	1.77E+01
56.00	1.78E+01
56.25	1.78E+01
56.50	1.78E+01
56.75	1.78E+01

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
57.00	1.78E+01
57.25	1.78E+01
57.50	1.78E+01
57.75	1.78E+01
58.00	1.78E+01
58.25	1.78E+01
58.50	1.78E+01
58.75	1.78E+01
59.00	1.78E+01
59.25	1.78E+01
59.50	1.78E+01
59.75	1.77E+01
60.00	1.77E+01
60.25	1.77E+01
60.50	1.76E+01
60.75	1.76E+01
61.00	1.76E+01
61.25	1.75E+01
61.50	1.75E+01
61.75	1.74E+01
62.00	1.74E+01
62.25	1.73E+01
62.50	1.73E+01
62.75	1.72E+01
63.00	1.71E+01
63.25	1.71E+01
63.50	1.70E+01
63.75	1.69E+01
64.00	1.69E+01
64.25	1.68E+01
64.50	1.67E+01
64.75	1.66E+01
65.00	1.66E+01
65.25	1.65E+01
65.50	1.64E+01
65.75	1.63E+01
66.00	1.62E+01
66.25	1.61E+01
66.50	1.60E+01
66.75	1.59E+01
67.00	1.58E+01
67.25	1.58E+01
67.50	1.57E+01
67.75	1.56E+01
68.00	1.55E+01
68.25	1.54E+01

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
68.50	1.52E+01
68.75	1.51E+01
69.00	1.50E+01
69.25	1.49E+01
69.50	1.48E+01
69.75	1.47E+01
70.00	1.46E+01
70.25	1.45E+01
70.50	1.44E+01
70.75	1.43E+01
71.00	1.42E+01
71.25	1.40E+01
71.50	1.39E+01
71.75	1.38E+01
72.00	1.37E+01
72.25	1.36E+01
72.50	1.35E+01
72.75	1.33E+01
73.00	1.32E+01
73.25	1.31E+01
73.50	1.30E+01
73.75	1.29E+01
74.00	1.28E+01
74.25	1.26E+01
74.50	1.25E+01
74.75	1.24E+01
75.00	1.23E+01
75.25	1.22E+01
75.50	1.20E+01
75.75	1.19E+01
76.00	1.18E+01
76.25	1.17E+01
76.50	1.16E+01
76.75	1.15E+01
77.00	1.14E+01
77.25	1.12E+01
77.50	1.11E+01
77.75	1.10E+01
78.00	1.09E+01
78.25	1.08E+01
78.50	1.07E+01
78.75	1.06E+01
79.00	1.04E+01
79.25	1.03E+01
79.50	1.02E+01
79.75	1.01E+01

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
80.00	1.00E+01
80.25	9.90E+00
80.50	9.79E+00
80.75	9.69E+00
81.00	9.58E+00
81.25	9.48E+00
81.50	9.37E+00
81.75	9.27E+00
82.00	9.17E+00
82.25	9.07E+00
82.50	8.97E+00
82.75	8.87E+00
83.00	8.77E+00
83.25	8.68E+00
83.50	8.58E+00
83.75	8.49E+00
84.00	8.39E+00
84.25	8.30E+00
84.50	8.21E+00
84.75	8.12E+00
85.00	8.03E+00
85.25	7.94E+00
85.50	7.85E+00
85.75	7.77E+00
86.00	7.68E+00
86.25	7.60E+00
86.50	7.51E+00
86.75	7.43E+00
87.00	7.35E+00
87.25	7.27E+00
87.50	7.19E+00
87.75	7.11E+00
88.00	7.03E+00
88.25	6.96E+00
88.50	6.88E+00
88.75	6.81E+00
89.00	6.73E+00
89.25	6.66E+00
89.50	6.59E+00
89.75	6.52E+00
90.00	6.45E+00
90.25	6.38E+00
90.50	6.31E+00
90.75	6.25E+00
91.00	6.18E+00
91.25	6.12E+00

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
91.50	6.05E+00
91.75	5.99E+00
92.00	5.93E+00
92.25	5.87E+00
92.50	5.81E+00
92.75	5.75E+00
93.00	5.69E+00
93.25	5.63E+00
93.50	5.57E+00
93.75	5.52E+00
94.00	5.46E+00
94.25	5.41E+00
94.50	5.36E+00
94.75	5.30E+00
95.00	5.25E+00
95.25	5.20E+00
95.50	5.15E+00
95.75	5.10E+00
96.00	5.05E+00
96.25	5.00E+00
96.50	4.96E+00
96.75	4.91E+00
97.00	4.86E+00
97.25	4.82E+00
97.50	4.78E+00
97.75	4.73E+00
98.00	4.69E+00
98.25	4.65E+00
98.50	4.60E+00
98.75	4.56E+00
99.00	4.52E+00
99.25	4.48E+00
99.50	4.44E+00
99.75	4.40E+00
100.00	4.37E+00
100.25	4.33E+00
100.50	4.29E+00
100.75	4.26E+00
101.00	4.22E+00
101.25	4.18E+00
101.50	4.15E+00
101.75	4.12E+00
102.00	4.08E+00
102.25	4.05E+00
102.50	4.02E+00
102.75	3.98E+00

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
103.00	3.95E+00
103.25	3.92E+00
103.50	3.89E+00
103.75	3.86E+00
104.00	3.83E+00
104.25	3.80E+00
104.50	3.77E+00
104.75	3.74E+00
105.00	3.71E+00
105.25	3.68E+00
105.50	3.66E+00
105.75	3.63E+00
106.00	3.60E+00
106.25	3.58E+00
106.50	3.55E+00
106.75	3.52E+00
107.00	3.50E+00
107.25	3.47E+00
107.50	3.45E+00
107.75	3.43E+00
108.00	3.40E+00
108.25	3.38E+00
108.50	3.35E+00
108.75	3.33E+00
109.00	3.31E+00
109.25	3.29E+00
109.50	3.26E+00
109.75	3.24E+00
110.00	3.22E+00
110.25	3.20E+00
110.50	3.18E+00
110.75	3.16E+00
111.00	3.13E+00
111.25	3.11E+00
111.50	3.09E+00
111.75	3.07E+00
112.00	3.05E+00
112.25	3.03E+00
112.50	3.02E+00
112.75	3.00E+00
113.00	2.98E+00
113.25	2.96E+00
113.50	2.94E+00
113.75	2.92E+00
114.00	2.90E+00
114.25	2.89E+00

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
114.50	2.87E+00
114.75	2.85E+00
115.00	2.83E+00
115.25	2.82E+00
115.50	2.80E+00
115.75	2.78E+00
116.00	2.77E+00
116.25	2.75E+00
116.50	2.73E+00
116.75	2.72E+00
117.00	2.70E+00
117.25	2.69E+00
117.50	2.67E+00
117.75	2.65E+00
118.00	2.64E+00
118.25	2.62E+00
118.50	2.61E+00
118.75	2.59E+00
119.00	2.58E+00
119.25	2.56E+00
119.50	2.55E+00
119.75	2.53E+00
120.00	2.52E+00
120.25	2.51E+00
120.50	2.49E+00
120.75	2.48E+00
121.00	2.46E+00
121.25	2.45E+00
121.50	2.44E+00
121.75	2.42E+00
122.00	2.41E+00
122.25	2.40E+00
122.50	2.38E+00
122.75	2.37E+00
123.00	2.36E+00
123.25	2.34E+00
123.50	2.33E+00
123.75	2.32E+00
124.00	2.30E+00
124.25	2.29E+00
124.50	2.28E+00
124.75	2.27E+00
125.00	2.26E+00
125.25	2.24E+00
125.50	2.23E+00
125.75	2.22E+00

TABLE 3: Chlorine Concentrations JAVA Output for the Control Room HVAC intake

Extrapolated results of the analysis based on replicating the HABIT V1.1 EXTRAN software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
126.00	2.21E+00
126.25	2.19E+00

TABLE 4: Chlorine Concentrations JAVA Output for the Control Room

Extrapolated results of the analysis based on replicating the HABIT V1.1 CHEM software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
0.00	0.00E+00
0.25	0.00E+00
0.50	0.00E+00
0.75	0.00E+00
1.00	0.00E+00
1.25	0.00E+00
1.50	0.00E+00
1.75	0.00E+00
2.00	0.00E+00
2.25	0.00E+00
2.50	0.00E+00
2.75	0.00E+00
3.00	0.00E+00
3.25	0.00E+00
3.50	0.00E+00
3.75	0.00E+00
4.00	0.00E+00
4.25	0.00E+00
4.50	0.00E+00
4.75	0.00E+00
5.00	0.00E+00
5.25	0.00E+00
5.50	0.00E+00
5.75	0.00E+00
6.00	0.00E+00
6.25	0.00E+00
6.50	0.00E+00
6.75	0.00E+00
7.00	0.00E+00
7.25	0.00E+00
7.50	0.00E+00
7.75	0.00E+00
8.00	0.00E+00
8.25	0.00E+00
8.50	0.00E+00
8.75	0.00E+00
9.00	0.00E+00
9.25	0.00E+00
9.50	0.00E+00
9.75	1.00E-02
10.00	1.00E-02
10.25	1.00E-02
10.50	1.00E-02
10.75	1.00E-02
11.00	1.00E-02
11.25	1.00E-02

TABLE 4: Chlorine Concentrations JAVA Output for the Control Room

Extrapolated results of the analysis based on replicating the HABIT V1.1 CHEM software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
11.50	1.00E-02
11.75	1.00E-02
12.00	1.00E-02
12.25	1.00E-02
12.50	1.00E-02
12.75	1.00E-02
13.00	2.00E-02
13.25	2.00E-02
13.50	2.00E-02
13.75	2.00E-02
14.00	2.00E-02
14.25	2.00E-02
14.50	2.00E-02
14.75	3.00E-02
15.00	3.00E-02
15.25	3.00E-02
15.50	3.00E-02
15.75	3.00E-02
16.00	4.00E-02
16.25	4.00E-02
16.50	4.00E-02
16.75	4.00E-02
17.00	5.00E-02
17.25	5.00E-02
17.50	5.00E-02
17.75	5.00E-02
18.00	6.00E-02
18.25	6.00E-02
18.50	6.00E-02
18.75	7.00E-02
19.00	7.00E-02
19.25	8.00E-02
19.50	8.00E-02
19.75	9.00E-02
20.00	9.00E-02
20.25	1.00E-01
20.50	1.00E-01
20.75	1.10E-01
21.00	1.10E-01
21.25	1.20E-01
21.50	1.20E-01
21.75	1.30E-01
22.00	1.40E-01
22.25	1.40E-01
22.50	1.50E-01
22.75	1.60E-01

TABLE 4: Chlorine Concentrations JAVA Output for the Control Room

Extrapolated results of the analysis based on replicating the HABIT V1.1 CHEM software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
23.00	1.70E-01
23.25	1.70E-01
23.50	1.80E-01
23.75	1.90E-01
24.00	2.00E-01
24.25	2.10E-01
24.50	2.20E-01
24.75	2.30E-01
25.00	2.40E-01
25.25	2.50E-01
25.50	2.60E-01
25.75	2.70E-01
26.00	2.80E-01
26.25	3.00E-01
26.50	3.10E-01
26.75	3.20E-01
27.00	3.30E-01
27.25	3.50E-01
27.50	3.60E-01
27.75	3.80E-01
28.00	3.90E-01
28.25	4.10E-01
28.50	4.20E-01
28.75	4.40E-01
29.00	4.60E-01
29.25	4.70E-01
29.50	4.90E-01
29.75	5.10E-01
30.00	5.30E-01
30.25	5.50E-01
30.50	5.70E-01
30.75	5.90E-01
31.00	6.10E-01
31.25	6.30E-01
31.50	6.50E-01
31.75	6.70E-01
32.00	7.00E-01
32.25	7.20E-01
32.50	7.40E-01
32.75	7.70E-01
33.00	7.90E-01
33.25	8.20E-01
33.50	8.50E-01
33.75	8.70E-01
34.00	9.00E-01
34.25	9.30E-01

TABLE 4: Chlorine Concentrations JAVA Output for the Control Room

Extrapolated results of the analysis based on replicating the HABIT V1.1 CHEM software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
34.50	9.60E-01
34.75	9.80E-01
35.00	1.01E+00
35.25	1.04E+00
35.50	1.08E+00
35.75	1.11E+00
36.00	1.14E+00
36.25	1.17E+00
36.50	1.20E+00
36.75	1.24E+00
37.00	1.27E+00
37.25	1.31E+00
37.50	1.34E+00
37.75	1.38E+00
38.00	1.42E+00
38.25	1.45E+00
38.50	1.49E+00
38.75	1.53E+00
39.00	1.57E+00
39.25	1.61E+00
39.50	1.65E+00
39.75	1.69E+00
40.00	1.73E+00
40.25	1.77E+00
40.50	1.81E+00
40.75	1.86E+00
41.00	1.90E+00
41.25	1.95E+00
41.50	1.99E+00
41.75	2.04E+00
42.00	2.08E+00
42.25	2.13E+00
42.50	2.17E+00
42.75	2.22E+00
43.00	2.27E+00
43.25	2.32E+00
43.50	2.37E+00
43.75	2.42E+00
44.00	2.47E+00
44.25	2.52E+00
44.50	2.57E+00
44.75	2.62E+00
45.00	2.67E+00
45.25	2.72E+00
45.50	2.78E+00
45.75	2.83E+00

TABLE 4: Chlorine Concentrations JAVA Output for the Control Room

Extrapolated results of the analysis based on replicating the HABIT V1.1 CHEM software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
46.00	2.88E+00
46.25	2.94E+00
46.50	2.99E+00
46.75	3.04E+00
47.00	3.10E+00
47.25	3.15E+00
47.50	3.21E+00
47.75	3.27E+00
48.00	3.32E+00
48.25	3.38E+00
48.50	3.44E+00
48.75	3.49E+00
49.00	3.55E+00
49.25	3.61E+00
49.50	3.67E+00
49.75	3.72E+00
50.00	3.78E+00
50.25	3.84E+00
50.50	3.90E+00
50.75	3.96E+00
51.00	4.02E+00
51.25	4.07E+00
51.50	4.13E+00
51.75	4.19E+00
52.00	4.25E+00
52.25	4.31E+00
52.50	4.37E+00
52.75	4.43E+00
53.00	4.49E+00
53.25	4.55E+00
53.50	4.61E+00
53.75	4.67E+00
54.00	4.73E+00
54.25	4.79E+00
54.50	4.85E+00
54.75	4.91E+00
55.00	4.96E+00
55.25	5.02E+00
55.50	5.08E+00
55.75	5.14E+00
56.00	5.20E+00
56.25	5.26E+00
56.50	5.32E+00
56.75	5.37E+00
57.00	5.43E+00
57.25	5.49E+00

TABLE 4: Chlorine Concentrations JAVA Output for the Control Room

Extrapolated results of the analysis based on replicating the HABIT V1.1 CHEM software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
57.50	5.55E+00
57.75	5.60E+00
58.00	5.66E+00
58.25	5.72E+00
58.50	5.77E+00
58.75	5.83E+00
59.00	5.88E+00
59.25	5.94E+00
59.50	5.99E+00
59.75	6.05E+00
60.00	6.10E+00
60.25	6.15E+00
60.50	6.21E+00
60.75	6.26E+00
61.00	6.31E+00
61.25	6.36E+00
61.50	6.42E+00
61.75	6.47E+00
62.00	6.52E+00
62.25	6.57E+00
62.50	6.62E+00
62.75	6.67E+00
63.00	6.71E+00
63.25	6.76E+00
63.50	6.81E+00
63.75	6.86E+00
64.00	6.90E+00
64.25	6.95E+00
64.50	6.99E+00
64.75	7.04E+00
65.00	7.08E+00
65.25	7.13E+00
65.50	7.17E+00
65.75	7.21E+00
66.00	7.25E+00
66.25	7.30E+00
66.50	7.34E+00
66.75	7.38E+00
67.00	7.41E+00
67.25	7.45E+00
67.50	7.49E+00
67.75	7.53E+00
68.00	7.57E+00
68.25	7.60E+00
68.50	7.64E+00
68.75	7.67E+00

TABLE 4: Chlorine Concentrations JAVA Output for the Control Room

Extrapolated results of the analysis based on replicating the HABIT V1.1 CHEM software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
69.00	7.71E+00
69.25	7.74E+00
69.50	7.77E+00
69.75	7.80E+00
70.00	7.84E+00
70.25	7.87E+00
70.50	7.90E+00
70.75	7.93E+00
71.00	7.95E+00
71.25	7.98E+00
71.50	8.01E+00
71.75	8.04E+00
72.00	8.06E+00
72.25	8.09E+00
72.50	8.11E+00
72.75	8.14E+00
73.00	8.16E+00
73.25	8.18E+00
73.50	8.21E+00
73.75	8.23E+00
74.00	8.25E+00
74.25	8.27E+00
74.50	8.29E+00
74.75	8.31E+00
75.00	8.33E+00
75.25	8.34E+00
75.50	8.36E+00
75.75	8.38E+00
76.00	8.39E+00
76.25	8.41E+00
76.50	8.42E+00
76.75	8.44E+00
77.00	8.45E+00
77.25	8.46E+00
77.50	8.48E+00
77.75	8.49E+00
78.00	8.50E+00
78.25	8.51E+00
78.50	8.52E+00
78.75	8.53E+00
79.00	8.54E+00
79.25	8.55E+00
79.50	8.55E+00
79.75	8.56E+00
80.00	8.57E+00
80.25	8.57E+00

TABLE 4: Chlorine Concentrations JAVA Output for the Control Room

Extrapolated results of the analysis based on replicating the HABIT V1.1 CHEM software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
80.50	8.58E+00
80.75	8.59E+00
81.00	8.59E+00
81.25	8.59E+00
81.50	8.60E+00
81.75	8.60E+00
82.00	8.60E+00
82.25	8.61E+00
82.50	8.61E+00
82.75	8.61E+00
83.00	8.61E+00
83.25	8.61E+00
83.50	8.61E+00
83.75	8.61E+00
84.00	8.61E+00
84.25	8.61E+00
84.50	8.60E+00
84.75	8.60E+00
85.00	8.60E+00
85.25	8.60E+00
85.50	8.59E+00
85.75	8.59E+00
86.00	8.59E+00
86.25	8.58E+00
86.50	8.58E+00
86.75	8.57E+00
87.00	8.56E+00
87.25	8.56E+00
87.50	8.55E+00
87.75	8.55E+00
88.00	8.54E+00
88.25	8.53E+00
88.50	8.52E+00
88.75	8.52E+00
89.00	8.51E+00
89.25	8.50E+00
89.50	8.49E+00
89.75	8.48E+00
90.00	8.47E+00
90.25	8.46E+00
90.50	8.45E+00
90.75	8.44E+00
91.00	8.43E+00
91.25	8.42E+00
91.50	8.41E+00
91.75	8.40E+00

TABLE 4: Chlorine Concentrations JAVA Output for the Control Room

Extrapolated results of the analysis based on replicating the HABIT V1.1 CHEM software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
92.00	8.39E+00
92.25	8.37E+00
92.50	8.36E+00
92.75	8.35E+00
93.00	8.34E+00
93.25	8.33E+00
93.50	8.31E+00
93.75	8.30E+00
94.00	8.29E+00
94.25	8.27E+00
94.50	8.26E+00
94.75	8.25E+00
95.00	8.23E+00
95.25	8.22E+00
95.50	8.20E+00
95.75	8.19E+00
96.00	8.18E+00
96.25	8.16E+00
96.50	8.15E+00
96.75	8.13E+00
97.00	8.12E+00
97.25	8.10E+00
97.50	8.09E+00
97.75	8.07E+00
98.00	8.05E+00
98.25	8.04E+00
98.50	8.02E+00
98.75	8.01E+00
99.00	7.99E+00
99.25	7.97E+00
99.50	7.96E+00
99.75	7.94E+00
100.00	7.92E+00
100.25	7.91E+00
100.50	7.89E+00
100.75	7.87E+00
101.00	7.86E+00
101.25	7.84E+00
101.50	7.82E+00
101.75	7.81E+00
102.00	7.79E+00
102.25	7.77E+00
102.50	7.75E+00
102.75	7.74E+00
103.00	7.72E+00
103.25	7.70E+00

TABLE 4: Chlorine Concentrations JAVA Output for the Control Room

Extrapolated results of the analysis based on replicating the HABIT V1.1 CHEM software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
103.50	7.68E+00
103.75	7.67E+00
104.00	7.65E+00
104.25	7.63E+00
104.50	7.61E+00
104.75	7.59E+00
105.00	7.58E+00
105.25	7.56E+00
105.50	7.54E+00
105.75	7.52E+00
106.00	7.50E+00
106.25	7.49E+00
106.50	7.47E+00
106.75	7.45E+00
107.00	7.43E+00
107.25	7.41E+00
107.50	7.39E+00
107.75	7.38E+00
108.00	7.36E+00
108.25	7.34E+00
108.50	7.32E+00
108.75	7.30E+00
109.00	7.28E+00
109.25	7.27E+00
109.50	7.25E+00
109.75	7.23E+00
110.00	7.21E+00
110.25	7.19E+00
110.50	7.17E+00
110.75	7.15E+00
111.00	7.14E+00
111.25	7.12E+00
111.50	7.10E+00
111.75	7.08E+00
112.00	7.06E+00
112.25	7.04E+00
112.50	7.02E+00
112.75	7.00E+00
113.00	6.99E+00
113.25	6.97E+00
113.50	6.95E+00
113.75	6.93E+00
114.00	6.91E+00
114.25	6.89E+00
114.50	6.87E+00
114.75	6.86E+00

TABLE 4: Chlorine Concentrations JAVA Output for the Control Room

Extrapolated results of the analysis based on replicating the HABIT V1.1 CHEM software module methodology with 1 m/s wind speed:

TIME (min)	CONCENTRATION (ppm)
115.00	6.84E+00
115.25	6.82E+00
115.50	6.80E+00
115.75	6.78E+00
116.00	6.76E+00
116.25	6.74E+00
116.50	6.73E+00
116.75	6.71E+00
117.00	6.69E+00
117.25	6.67E+00
117.50	6.65E+00
117.75	6.63E+00
118.00	6.61E+00
118.25	6.60E+00
118.50	6.58E+00
118.75	6.56E+00
119.00	6.54E+00
119.25	6.52E+00
119.50	6.50E+00
119.75	6.48E+00
120.00	6.47E+00
120.25	6.45E+00
120.50	6.43E+00
120.75	6.41E+00
121.00	6.39E+00
121.25	6.37E+00
121.50	6.36E+00
121.75	6.34E+00
122.00	6.32E+00
122.25	6.30E+00
122.50	6.28E+00
122.75	6.27E+00
123.00	6.25E+00
123.25	6.23E+00
123.50	6.21E+00
123.75	6.19E+00
124.00	6.18E+00
124.25	6.16E+00
124.50	6.14E+00
124.75	6.12E+00
125.00	6.10E+00
125.25	6.09E+00
125.50	6.07E+00
125.75	6.05E+00
126.00	6.03E+00
126.25	6.01E+00

Lee Nuclear Station Request for Additional Information (RAI)

Attachment 3 to RAI 06.04-001

Revision to FSAR Subsection 2.2.3.1.3.1

COLA Part 2. FSAR, Subsection 2.2.3.1.3.1, will be revised as follows:

2.2.3.1.3.1 Background

A control room habitability analysis was performed in accordance with Regulatory Guide 1.78. The Regulatory Guide specifies that mobile and stationary sources of hazardous materials within a five mile radius of the plant be analyzed as a potential threat to plant operations.

Subsections 2.2.1 and 2.2.2 provide sources of potentially airborne hazardous chemicals that may be in the area. These sources are in the form of stationary industrial facilities and transportation pathways in the form of a highway and a rail spur.

The nearby Broad River is not navigable by barges and does not transport commercial traffic, and hence is eliminated from further investigation.

Figure 2.2-201 shows the potential rail, road, and stationary industrial sources within the proximity of Lee Nuclear Station.

The screening criteria for airborne hazardous chemicals is established in Regulatory Guide 1.78 based on the National Institute for Safety and Health (NIOSH) Immediately Dangerous to Life and Health (IDLH) limits for 30 minute exposures. Per Regulatory Guide 1.78, the NIOSH IDLH values were utilized to screen chemicals and to evaluate concentrations of hazardous chemicals to determine their effect on control room habitability.

Regulatory Guide 1.78 specifies the use of HABIT software for evaluating control room habitability. The HABIT software consists of modules that evaluate radiological and toxic chemical transport and exposure. ~~The EXTRAN module of~~Although HABIT software modules were not used directly, an alternative methodology based on HABIT was utilized to model toxic chemical transport ~~from the selected release point to the HVAC intake. The CHEM module was utilized to~~and model chemical exposure to control room personnel~~, based upon EXTRAN output and~~ using control room design parameters.

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 019

NRC Technical Review Branch: Containment & Ventilation Branch 1 (SPCV)

Reference NRC RAI Number(s): 06.04-002

NRC RAI:

Table 6.4-201 of the Lee FSAR provides the input values used in CHEM analysis of a chlorine event. Table 2.2-209 of the Lee FSAR provides the parameters used in the EXTRAN analysis of a toxic chemical event. Neither Section 6.4.4.3 nor Section 2.2.3 identifies the source of the input values used in the HABIT1.1 analysis, or other assumptions needed to perform a confirmatory analysis of the toxic release event. Identify the source of the input values in Tables 6.4-201 and 2.2-209, as well as the normal VBS flow rate, the control room volume, and the in leakage rate used in these analyses. Also, provide the basis, methodology, inputs, and assumptions for calculating the toxic chemical (chlorine) concentration inside the control room with potential airflow rates.

Duke Energy Response:

In accordance with Regulatory Guide 1.78 Rev. 1, a worst-case scenario was developed using a combination of the largest credible release, based on the largest container size, along with the worst (5%) meteorological conditions determined at the site. These assumed conditions provided the basis for the input conditions and assumptions that were required to perform the analysis of the control room chlorine concentration.

There are no site-specific sources of airborne hazardous materials stored on the WLS site in sufficient quantity to affect control room habitability.

The analysis assumes an instantaneous release of the entire contents of the chemical tanker truck carrying liquid chlorine. EXTRAN determines the portion of the liquid chlorine that flashes to vapor and models the evaporation of the remaining liquid over time.

The size of spill is 20,000 kg, which is the assumed maximum capacity of a chemical tanker truck.

The height of the Control Room (CR) HVAC intake is 19.9 m based upon DCD Table 15A-7. The value of 17 m is used because lower elevations are conservative for chlorine, and the vertical opening height is such that the bottom of the intake is approximately 17.1 m above grade based on the AP1000 design shown on Westinghouse drawing APP 1000 P2 905, Rev 0.

A distance of 5,200 meters between the spill location and the CR intake is assumed in the analysis. This distance corresponds to the shortest distance from any highway in the vicinity of the plant site to the Unit 1 CR HVAC intake.

The 95th percentile worst-case meteorological conditions are established in revised FSAR Table 2.2-209 as Pasquill Stability Class G and a wind speed of 1 m/s. See response to RAI 06.04-004, this letter, for detailed justification of meteorological assumptions and parameters applied in the toxic gas analysis.

The CR volume is taken from the AP1000 Design Control Document (DCD) Table 15.6.5-2 and equals 35,700 ft^3 or 1,011 m^3.

The normal nuclear island nonradioactive ventilation system (VBS) intake flow rate is taken from AP1000 Design Control Document (DCD) Table 15.6.5-2 and equals 1,925 ft^3/min or 0.91 m^3/s.

The total HVAC volume is taken from AP1000 Design Control Document (DCD) Table 15.6.5-2 and equals 105,500 ft^3 or 2,987 m^3.

The analysis does not take credit for isolating the CR; the in-leakage is inconsequential to the results of the analysis and is not a factor in the determination of CR chlorine concentration.

An occupancy factor of "1" is applied as a HABIT V1.1 input but this variable does not affect toxic gas analysis results.

The normal air intake flow rate is:

(CR volume / Total HVAC volume)* VBS Intake flow = Intake flow supplied to the CR

(1,011 m^3 / 2,987 m^3) * 0.91 m^3/sec = 0.31 m^3/sec

Release Height is assumed to be at the plant grade. The storage temperature is assumed to be the same as air temperature and a value of 25°C is used in the evaluation.

Atmospheric pressure is assumed to be 760 mm Hg. Pressure sensitivity calculations were performed to confirm that CR concentration results are relatively insensitive to this input assumption over the range of atmospheric pressure variation anticipated for the Lee Nuclear Site.

The CHEM computer code is part of the HABIT V1.1 suite. As described in the response to RAI 06.04-001 included in this letter, an alternate analysis utilizing CHEM computer code methodology and properties is performed to analyze the control room for concentrations of hazardous chemicals. The CHEM based analysis determines the response of the CR without Main Control Room Emergency Habitability System (VES) actuation. The maximum CR concentration does not exceed the IDLH value. A graph of the calculated chlorine concentrations inside the CR and at the CR ventilation intake is presented in the new Figure 6.4-201 (see Response to RAI 06.04-005).

Figure 6.4-201, provided in the Response to RAI 06.04-005, shows that the calculated concentration in the CR reaches a maximum value of 8.6 ppm.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 6.4.4.2 and Figure 6.4-201 (See Response to RAI 06.04-005, this letter)

FSAR Subsection 2.2.3.1.3.3 (See revised Response to RAI 06.04-003, this letter)

FSAR Table 2.2-209

Attachment:

1) Revised FSAR Table 2.2-209.

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 06.04-002

Revised Table 2.2-209

COLA Part 2, FSAR Chapter 2, Table 2.2-209 will be revised as follows:

TABLE 2.2-209
PARAMETERS USED IN EXTRAN ANALYSIS OF TOXIC CHEMICALS

Parameter	Value	Unit
Initial mass	20000	(kg)
Release Height	0	(m)
Storage temperature	25	(Celsius)
Distance to intake	~~5600~~5200	(m)
Intake height	~~47~~17	(m)
Atmospheric pressure	760	(mm Hg)
Stability class	G	(N/A)
Wind speed	~~2.5~~1	(m/s)

Lee Nuclear Station Revised Response to Request for Additional Information (RAI)

RAI Letter No. 019

NRC Technical Review Branch: **Containment & Ventilation Branch 1 (SPCV) and Siting & Accident Consequences Branch (RSAC)**

Reference NRC RAI Number(s): **06.04-003**

NRC RAI:

In Section 2.2.3.1.3.3, of the Lee COL FSAR, it states "...under ideal conditions a pressurized liquid chlorine tractor trailer burst type accident...." State/define what is meant by "ideal conditions."

Duke Energy Response:

The "ideal conditions" are the "worst-case scenario conditions" associated with the release (i.e., assumed burst type accident), and meteorological parameters affecting toxic gas cloud transport and dispersion.

The toxic gas analysis has been revised and the meteorological parameters applied in the analysis have changed. The "worst-case scenario conditions" are defined in revised FSAR tables as Pasquill Stability Category G and a wind speed of 1 m/s directly toward the site. See response to RAI 06.04-004, this letter, for detailed justification of meteorological assumptions and parameters applied in the toxic gas analysis.

The attached FSAR markup will be incorporated into a future revision of the FSAR.

Note that this response and the attached FSAR markup replace in total the original response to RAI 06.04-003 transmitted as Enclosure 1 to Ltr# WLG2008.10-16 dated October 27, 2008.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 2.2.3.1.3.3

Table 2.2-209 (See response to RAI 06.04-002, this letter)

FSAR Subsection 6.4.4.2 and Figure 6.4-201 (See response to RAI 06.04-005, this letter)

Attachments:

1) Revised FSAR Subsection 2.2.3.1.3.3.

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 06.04-003

(Note that this FSAR markup replaces in total the original markup for FSAR Subsection 2.2.3.1.3.3 transmitted with Enclosure 1 of Ltr# WLG2008.10-16 dated October 27, 2008)

COLA Part 2, FSAR Chapter 2, Subsection 2.2.3.1.3.3, will be revised as follows:

2.2.3.1.3.3 Analysis of Hazardous Materials

An analysis of the surrounding area and of the materials that may be in the area reveals that the roadways pose the most significant toxic hazard to control room habitability.

Any chemical sanctioned to be legally transported by state and federal department of transportation guidelines may be transported on the roads, but due to the distance from the site it is determined that only the most toxic gaseous chemicals (DOT class 2.3) could reach the control room intake under ideal calm conditions.

An analysis of a tractor-trailer based chlorine release at the closest point of passage of Route 329 was performed using the methodology of the EXTRAN code contained in the HABIT software package, as specified in Regulatory Guide 1.78 to establish a guideline for further evaluation. Chlorine was deemed to be the worst case release of a toxic gas as it is commonly transported, is highly toxic with an IDLH of 10 PPM, and is heavier than air so it can travel laterally without significant dispersion under calm conditions. The model utilizes AP1000 HVAC parameters, worst-case meteorological ~~meteorological~~ conditions, and chemical characteristics of the modeled hazardous materials.

To model the concentration of hazardous chemicals at the control room intake several site specific parameters are gathered. These parameters include release weight, in this case the complete tractor-trailer cargo weight, along with distance to the control room, HVAC intake height, and worst case meteorological conditions.

Meteorological data was analyzed to determine the worst meteorological conditions at the site. In the case of a released gaseous hazardous material cloud, the worst case condition is essentially a calm night. A wind speed of ~~2.5~~1 m/s and Class G stability conditions were utilized in the model to represent these worst-case conditions.

Variable parameters utilized in this analysis are provided in Table 2.2-209.

The results of the ~~HABIT EXTRAN~~ analysis using the HABIT EXTRAN methodology indicate that under ~~ideal~~ worst case meteorological conditions for the site, a pressurized liquid chlorine tractor-trailer burst type accident would ~~not~~ elevate control room HVAC intake concentrations beyond IDLH values~~.~~, however, the habitability analysis discussed in Section 6.4.4.2 concluded that the concentration in the control room would be less than the chlorine IDLH value. ~~The habitability analysis discussed in Section 6.4.4.2 concluded that the concentrations in the control room would be even lower than the intake.~~

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 019

NRC Technical Review Branch: Containment & Ventilation Branch 1 (SPCV) and Siting & Accident Consequences Branch (RSAC)

Reference NRC RAI Number(s): 06.04-004

NRC RAI:

Section 2.2.3.1.3.3, of the Lee COL FSAR states "Meteorological data was analyzed to determine the worst meteorological conditions at the site. In the case of a released gaseous hazardous material cloud, the worst-case condition is essentially a calm night. A wind speed of 2.5 m/s and Class G stability conditions were utilized in the model to represent these worst-case conditions." Explain how 2.5 m/s is the worst wind speed condition (producing the highest chlorine concentration in the control room).

Duke Energy Response:

The worst-case wind speed condition is the wind speed that maximizes the chlorine concentration in the control room. For conservatism, this analysis assumes no operator response for the duration of the toxic gas release event. However, for very low wind velocities, this implies onsite plumes for an unrealistically long resident time without operator response.

The control room concentration provided by the HABIT V1.1 code did not reach a peak prior to the time of the analysis termination for the conditions being evaluated (i.e., offsite tanker truck accident at a distance of 5200 meters from the control room). In order to determine the highest calculated control room chlorine levels, an alternate analysis was performed using the same toxic gas transport and dispersion modeling methods and properties as applied in the HABIT V1.1 code. The alternate analysis allows a longer run time. The alternate analysis approach was applied and demonstrates that peak control room concentration increases with increasing atmospheric stability and decreasing wind speed. Based on this conclusion and a review of the WLS site-specific meteorological data presented in FSAR Tables 2.3-235 through 2.3-241, a combination of stability class G and a wind speed of 1 m/s is determined to satisfy RG 1.78 guidance to use 95th percentile worst-case meteorological conditions in the toxic gas analysis.

A conservative approach is applied to use the winds from the dominant directions (N, NW, and NNW) since the roadway in this direction is not much further than the 5200 m closest approach distance. The total number of hourly meteorological observations reported in FSAR Tables 2.3-235 through 2.3-241 is 8761. From FSAR Table 2.3-241, the total hours of the year in which Stability Class G exists, the wind is from the N, NW, or NNW, and the wind velocity is 1 m/s or less is the hours of calm (63 hours) plus the hours summed in the North direction of 1.0 m/s or less (also 63 hours) plus the hours summed in the NNW direction (86 hours) and the hours summed in the NW direction (87 hours). This produces a total per year of 299 hours, which is a percentage equal to 100*(63+63+86+87)/8761 = 3.41%. Thus for these directions, Stability Class G with wind speed less than or equal to 1.0 m/s exists less than 5% of the year.

The initial analysis utilized a HABIT V1.1 computer code sensitivity study to determine that a wind speed of 2.5 m/s results in the limiting case. During re-analysis, the control room ventilation air intake height was adjusted to the correct elevation above grade, and the sensitivity analysis was re-performed using the alternate analysis approach to extend analysis run time. The new analysis indicates higher control room toxic gas concentrations with lowering wind speeds. Therefore, on-site measured meteorological conditions are utilized as a basis for determining the bounding worst-case wind speed and stability class for the revised analysis.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

None

Attachments:

None

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 019

NRC Technical Review Branch: **Containment & Ventilation Branch 1 (SPCV) and Siting & Accident Consequences Branch (RSAC)**

Reference NRC RAI Number(s): **06.04-005**

NRC RAI:

The capability of the control room habitability systems to maintain a suitable environment for prolonged occupancy throughout the toxic gas release, as well as the other events in Chapter 15 is based on the AP1000 assumption of a maximum of 11 operators in the control room. Do plant procedures specify the maximum number of operators allowed in the control room when the habitability systems are intended to protect the control room occupants?

Duke Energy Response:

Toxic gas release analysis results for concentration at the control room intake and in the control room are depicted in new Figure 6.4-201 Attachment 2. This figure indicates that the maximum chlorine concentration in the control room remains below 10 parts per million (ppm) and the chlorine cloud at the control room HVAC intake begins to disperse within 1 hour for the modeled conditions. Dissipation to pre-event conditions is expected within a few hours.

Regulatory Guide 1.78 Revision 1 Table 1 gives a toxicity limit of 10 ppm for chlorine and Regulatory Position 4 states "Implementation of protection measures for a particular chemical species may be excluded if the detailed evaluation of control room habitability shows that the highest concentration predicted in the control room is below the toxicity limit." FSAR Subsection 6.4.4 will be revised as shown in Attachment 1 in a future revision of the COLA.

The postulated toxic gas release for chlorine is a short-term event and the Main Control Room Emergency Habitability System (VES) is not required for this release. If activated, the VES is designed to maintain the control room isolated and to provide sufficient breathing air for 11 people for 72 hours. As a result, the operations staff has discretion in its decision on the removal of non-essential personnel from the control room in the event of toxic gas release.

To support FSAR Chapter 15 accident scenarios, operating procedures will specify removal of non-essential personnel from the control room upon declaration of a radiological event to ensure the objective of having a maximum of 11 people in the control room. In addition, respirators and protective clothing are available in the control room for 11 persons. This equipment may be used by operations personnel as required to protect the heath and safety of the public in shutting down the reactor and maintaining it in a safe shutdown condition during a radiological accident. Though not required, this equipment may also be used for a toxic gas release scenario. Emergency Operating Procedures are addressed in the AP 1000 DCD as specified in FSAR subsection 13.5.2.1.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 6.4.4.2

FSAR Figure 6.4-201

Attachments:

1) Revised FSAR Subsection 6.4.4.2
2) New FSAR Figure 6.4-201

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 06.04-005

Revision to FSAR Subsection 6.4.4.2

COLA Part 2, FSAR Chapter 6, Subsection 6.4.4.2 will be revised as follows:

6.4.4.2 Toxic Chemical Habitability Analysis

Regulatory Guide 1.78 establishes the Occupational Safety and Health Association (OSHA) National Institute for Safety and Health (NIOSH) Immediately Dangerous to Life and Health (IDLH) guidelines for 30 minute exposure as the required screening criteria for airborne hazardous chemicals. Per Regulatory Guide 1.78, the NIOSH IDLH values were utilized to screen chemicals and to evaluate concentrations of hazardous chemicals to determine their effect on control room habitability.

Regulatory Guide 1.78 specifies the use of HABIT1.1 software for evaluating control room habitability. The HABIT1.1 software consists of modules that evaluate radiological and toxic chemical transport and exposure. ~~The EXTRAN module of HABIT1.1 is utilized to model toxic chemical transport from the selected release point to the HVAC intake. The CHEM module is utilized to model chemical exposure to control room personnel, based upon EXTRAN output and control room design parameters.~~Although HABIT1.1 software modules were not used directly, an alternative methodology based on HABIT1.1 was utilized to model toxic chemical transport and model chemical exposure to control room personnel using control room design parameters.

Subsection 2.2.3 indicates that a release of chlorine could potentially result in elevated concentrations at the control room intake. Therefore, an analysis of chlorine concentrations inside the control room was conducted.

~~Further analysis with the HABIT1.1 software package CHEM module indicates that although concentrations at the intake may be elevated, concentrations in the control room remain well below one half of the published values, thereby precluding the need for toxic gas monitoring. Input values for the CHEM analysis are summarized in Table 6.4-201.~~

Chlorine is one of the most hazardous DOT approved chemicals, and was used to model a worst case DOT 2.3 release. Other chemicals that may be transported down the roadways are bounded by the properties of chlorine, and hence are precluded from further analysis.

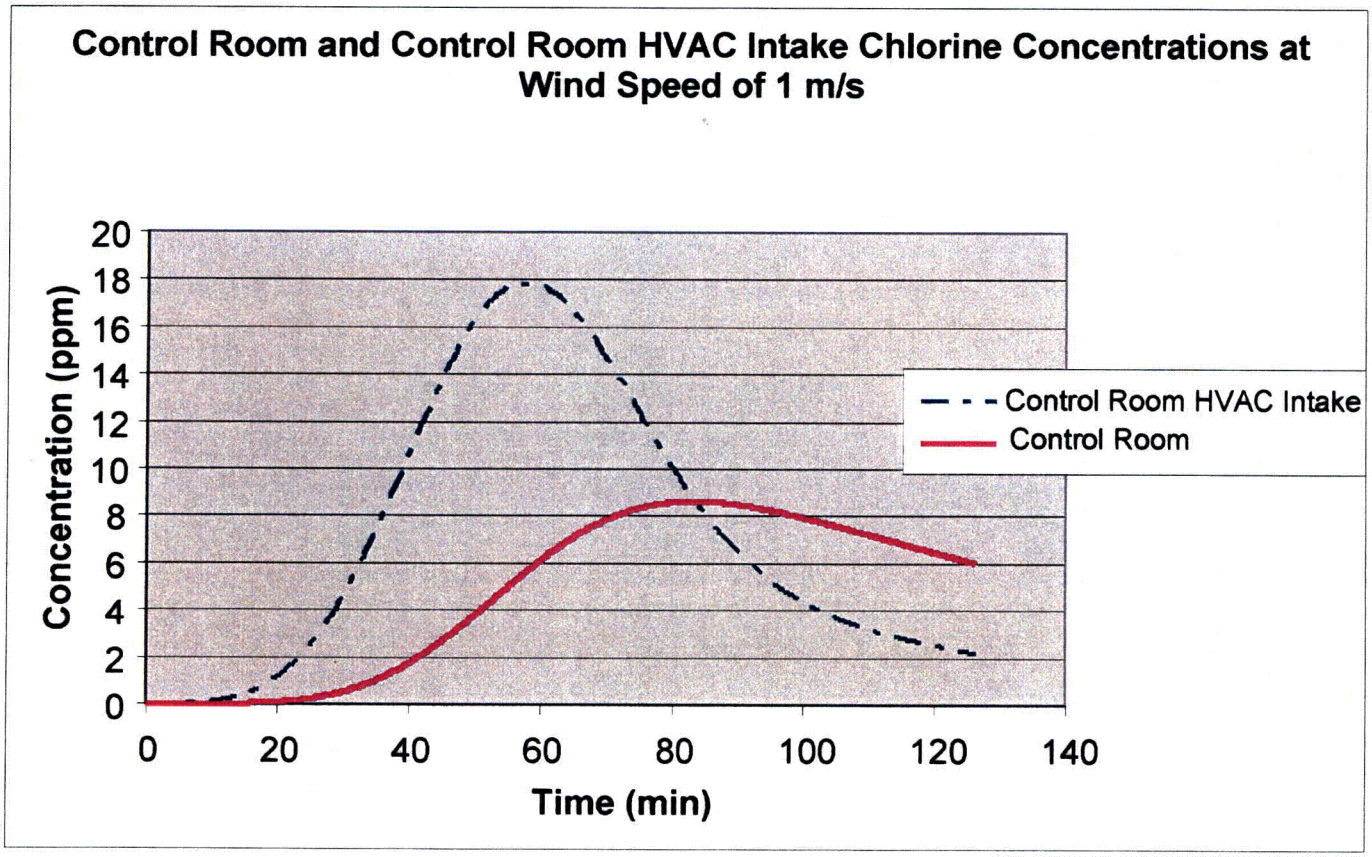
Analyses have been performed to demonstrate that concentrations in the control room remain below the Regulatory Guide 1.78 toxicity limit for chlorine. Therefore, the implementation of control room protective measures is not required. Input values for the toxic gas analysis are summarized in Tables 2.2-209 and 6.4-201.

FSAR Figure 6.4-201 indicates the concentration of chlorine in the control room assuming no action is taken to isolate the control room envelope from outside air.

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 2 to RAI 06.04-005

Add FSAR Figure 6.4-201



WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Control Room and Control Room HVAC Intake Chlorine Concentrations at Wind Speed of 1 m/s

FIGURE 6.4-201 Rev 1

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 019

NRC Technical Review Branch: Containment & Ventilation Branch 1 (SPCV)

Reference NRC RAI Number(s): 06.04-006

NRC RAI:

Table 6.4-201 of the COL, Input Values Used in Analyses of Chlorine, states that the value assumed for in leakage is 0.0023 m^3/sec. Will 0.0023 m^3/sec be confirmed in control room air tightness testing, and how will the effects of wind pressure and temperature differences (including expansion of outside cold air after entering the control room) be accounted for?

Duke Energy Response:

As discussed in the response to RAI 06.04-002, this letter, the analysis does not credit actions to isolate the control room and normal control room ventilation is assumed to continue to supply 0.31 m^3/sec of outside air to the room. Therefore, this in-leakage is insignificant as compared to the intake flow and has negligible impact on the results. In-leakage will be removed from Table 6.4-201 as shown in Attachment 1. Continued operation of the normal ventilation system also negates any impact due to the effects of wind pressure and temperature difference on the results of the analysis. Although not required for a toxic gas event, if the Main Control Room Emergency Habitability System (VES) is actuated, the control room would be pressurized to limit in-leakage consistent with levels assumed for radiological events where VES is credited.

Surveillance Requirement 3.7.6.10 (Technical Specification 3.7.6) requires periodic verification that one VES air delivery flow path maintains a 1/8-inch-water gauge positive pressure in the Main Control Room (MCR) envelope relative to the adjacent areas. This periodic surveillance confirms the necessary control room air tightness.

The FSAR will be revised to update Table 6.4-201 as shown in Attachment 1 in a future revision.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Table 6.4-201

Attachments:

1) Revised FSAR Table 6.4-201

Lee Nuclear Station Response to Request for Additional Information (RAI)

Attachment 1 to RAI 06.04-006

Revised Table 6.4-201

COLA Part 2, FSAR Chapter 6, Table 6.4-201 will be revised as follows:

TABLE 6.4-201
INPUT VALUES USED IN CHEM ANALYSIS OF CHLORINE

Control Room Parameter	Value	Unit
Control Room Volume	1011	m^3
Occupancy Factor	1	--
Normal Mode Parameters		
Intake Flow	0.31	m^3/s
~~In-leakage~~	~~0.0023~~	~~m^3/s~~

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter No. 019

NRC Technical Review Branch: Containment & Ventilation Branch 1 (SPCV)

Reference NRC RAI Number(s): 06.04-007

NRC RAI:

Lee's toxic gas analysis, discussed in FSAR Section 6.4.4.2, precludes the need for toxic gas monitoring because chlorine concentrations in the control room remain below "published values". Since no chlorine detection instruments are provided by Lee, other than the operators using their sense of smell, specify what actions (operator response) will occur if chlorine is detected by the control room operators using their sense of smell. In the response, define the human/odor threshold WLS uses for chlorine (value and units), list the bases for this threshold, and indicate if analysis predicts chlorine concentrations to reach the odor threshold in the CR. Explain how this response assures protection for the operator against the worst case accidental chlorine release. Discuss expectations related to Operations personnel baseline and periodic testing requirements that verify an operators capacity to reliably serve as a chlorine detector.

Duke Energy Response:

As indicated by new FSAR Figure 6.4-201 provided in the response to RAI 06.04-005 of this letter, the maximum concentration of chlorine present in the control room following a postulated worst-case spill, assuming no action to implement protective measures, is calculated to be 8.6 parts per million (ppm).

FSAR Subsection 6.4.4.2 does not credit operator action to isolate the control room. The control room chlorine concentration is calculated to reach a maximum of 8.6 ppm and then decline. Since the maximum concentration in the control room remains below the toxicity limits specified in Table 1 of RG 1.78, consistent with guidance provided in Regulatory Position 4, detection and implementation of emergency actions is not required.

Assuming no notification by emergency response teams or other site personnel, the control room personnel would likely sense the presence of chlorine and take conservative protective actions. One action could be to manually actuate the Main Control Room Emergency Habitability System (VES). Although this action is not required, it would quickly stop the chlorine concentration increase in the control room's atmosphere.

Since there is no required action related to detection of chlorine, there is no periodic testing requirement to verify that chlorine can be detected by an operator.

To support FSAR Chapter 15 accident scenarios, respirators and protective clothing are available in the control room for 11 persons. This equipment is available to be used by operations personnel, if needed.

New FSAR Figure 6.4-201 indicates the chlorine cloud at the intake begins to dissipate approximately 1 hour into the event for the modeled conditions. Dissipation is anticipated within

a few hours. FSAR Subsection 6.4.4 will be revised as indicated in response to RAI 06.04-005, this letter, in a future revision of the COLA.

The postulated toxic gas release for chlorine is a short term event and the VES is not required for this release. If activated, the VES is designed to maintain the control room isolated and provide sufficient breathing air for 11 people for 72 hours. The operations staff has discretion in the decision on the removal of non-essential personnel from the control room during the toxic gas release.

Although no operator actions are required for a toxic gas release, operation procedures will address discretionary actions so that guidance is available to respond to this type of event.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report:

FSAR Subsection 6.4.4.2 and Figure 6.4-201 (See response to RAI 06.04-005, this letter)

Attachments:

None