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September 28, 2010

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 No. 4961)
Ltr# WLG2010.09-05

Reference: Letter from Brian Hughes (NRC) to Peter Hastings (Duke Energy),
Request for Additional Information Letter No. 092 Related to
SRP Sections 2.3.4, 2.3.3, 2.3.5, and 2.0; Appendix 2CC - Short Term
Atmospheric Dispersion Estimates for Accident Releases in Ground and
Surface Waters [sic] for the William States Lee III Units 1 and 2 Combined
License Application, dated August 24, 2010 (ML102360015)

This letter provides the Duke Energy response to the Nuclear Regulatory Commission's request for additional information (RAI) included in the referenced letter. It should be noted that this RAI itself is not related to ground and surface waters.

The response to the NRC information request described in the referenced letter is addressed in a separate enclosure, which also identifies associated changes, when appropriate, that will be made in a future revision of the Final Safety Analysis Report for the Lee Nuclear Station.

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

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NR0

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Enclosure:

- 1) Duke Energy Response to Request for Additional Information Letter 092, SRP Sections 2.3.4, 2.3.3, 2.3.5, and 2.0; Appendix 2CC

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.

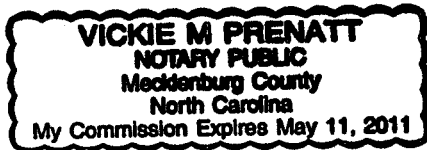
Bryan J. Dolan
Bryan J. Dolan

Subscribed and sworn to me on September 28, 2010

Vickie M Prenatt
Notary Public

My commission expires: May 11, 2011

SEAL



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xc (w/o enclosure):

Loren Plisco, Deputy Regional Administrator, Region II

xc (w/ enclosure):

Brian Hughes, Senior Project Manager, DNRL

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

RAI Letter No. 092

NRC Technical Review Branch: Siting and Accident Consequences Branch (RSAC)

Reference NRC RAI Number(s): RAI 02.03.04-006

NRC RAI:

The Staff considered the Applicant's response to RAI Question No. 02.03.04-4 for the William States Lee III Nuclear Station (WLS), Units 1 & 2 combined license (COL) Final Safety Analysis Report (FSAR) ("RAI Response"), submitted on April 6, 2010 (ML101060138). RAI Question No. 02.03.04-4 addressed issues relating to the design-basis accident onsite (i.e., Control Room) and offsite atmospheric dispersion modeling analyses in the initial COL FSAR application submittal having been based on only one year of onsite meteorological data.

In its RAI Response, the Applicant provided:

- the requested input and output files for the PAVAN and ARCON96 dispersion model runs using a two-year onsite meteorological data set;
- revisions to related text in COL FSAR Sections 2.3.3.1 and 2.3.4; and
- revisions to related tabular summaries of the modeling results in COL FSAR Tables 2.0-201 and 2.0-202 (comparing site parameter and corresponding site characteristic dispersion factors (X/Q values)), and COL FSAR Tables 2.3-283 and 2.3-285 (presenting various offsite and onsite X/Q values, respectively).

After reviewing this information, the Staff identified a number of discrepancies and omissions. Therefore, the Applicant should address the following issues to fully resolve the Staff's concerns regarding the revised material:

(a) The proposed revision to COL FSAR Section 2.3.3.1 (new Paragraph 2) indicates that the long-term dispersion modeling is based on a 12-month (i.e., December 2005 through November 2006) onsite meteorological data set and that the short-term dispersion modeling is based on a 24-month (i.e., December 1, 2005 to November 30, 2007) data set. However, no explanation is provided, either here or in COL FSAR Section 2.3.4, as to why the two different periods of record (PORs) are used. At a minimum, clarify the linkages between these sections and COL FSAR Appendix 2CC, as appropriate.

(b) The proposed revision to COL FSAR Section 2.3.4.1 (Paragraph 5, Sentences 3 and 4) states that the joint frequency distribution (JFD) corresponding to the two-year onsite meteorological data set from December 1, 2005 through November 30, 2007 is reported in COL FSAR Tables 2.3-235 through 2.3-241. However, the data listed in those tables (as of Revision 2 to the COL FSAR) still cover the one year POR from December 1, 2005 through November 30, 2006.

- Either provide an additional set of tables in COL FSAR Section 2.3 that covers the two-year POR or reference the corresponding table(s) in Appendix 2CC to COL FSAR Chapter 2 from COL FSAR Sections 2.3.4 and 2.3.5.

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- Also, column labels for all JFD tables (i.e., current COL FSAR Tables 2.3-235 through 2.3-241, and COL FSAR Appendix 2CC Tables 2CC-203 through 2CC-209) are misleading in that they imply the data counts represent a cumulative frequency of occurrence (i.e., ≤ 0.50 , ≤ 0.75 , ≤ 1.00 , ≤ 1.25 , etc.) with increasing wind speed which does not appear to be the case. Rather, the distributions appear to account for occurrences within a range of wind speeds. Clarify the column labels in the referenced current tables and any other JFD tables that might be added based on the earlier portion of this comment.

(c) The proposed revisions to COL FSAR Table 2.3-283 indicate a revised 5 percent Overall Site Limit 0-2 hour X/Q value for the Exclusion Area Boundary (EAB) of $3.00E-04 \text{ sec/m}^3$. On reviewing the PAVAN output file "LEE2YR15.OUT", included as one of the files on the CD provided as Attachment 1 of the RAI Response, that value does not appear in the summary table at the end of the EAB modeling results. All Site Limit X/Qs are reported as "0.00E+00" for the short-term accident time intervals. Further, the ordered distribution of "Five Percent Overall Site Limit" X/Q values, earlier in the referenced output file, does not suggest the revised value listed in Table 2.3-283. The last line of that segment of the PAVAN model output lists an error message "ERROR IN SUBROUTINE ENVLOP". Regulatory Position C.4 in Regulatory Guide 1.145 states that the X/Q value for Exclusion Area Boundary evaluations should be the maximum sector X/Q determined in accordance with Regulatory Position 2, or the 5 percent overall site X/Q determined in accordance with Regulatory Position 3, whichever is higher. Given the above and that there is no explanation in the proposed revision to COL FSAR Section 2.3.4.2 regarding the basis for the "5 percent direction independent overall site dispersion at the EAB" as listed on revised Table 2.3-283 (Sheet 1 of 2), explain how the higher of the "0.5 percent direction dependent maximum sector relative dispersion" and the "5 percent direction independent overall site dispersion at the EAB" was determined, as listed on revised FSAR Table 2.3-283 (Sheet 2 of 2) and summarized at the end of Section 2.3.4.2, as proposed to be revised.

(d) COL FSAR Section 2.3.4.3 (Paragraph 1, Sentence 3), as originally provided in the Applicant's response to RAI Question No. 02.03.04-3, dated October 10, 2008 (see ML082910110), is incorrect in that it states COL FSAR Table 2.3-284 presents directions from the release points (sources) to the receptors (i.e., Control Room HVAC Intake and Annex Building entrance). The same discrepancy remains in Revision 2 of the COL FSAR. Conversely, Table 2.3-284 indicates that the direction entries are from the receptors to the release points (sources). The Staff determined that the Table 2.3-284 entries match the ARCON96 model input files, as supplied on the CD provided as Attachment 1 of the RAI Response, and that these orientations are consistent with related plant drawings (e.g., Tier 2, Figure 15A-1 in Revision 17 of Appendix 15A to the AP1000 Design Control Document (DCD)). The latter orientation is called for by the ARCON96 model input. Correct the phrase in Section 2.3.4.3 (Paragraph 1, Sentence 3) accordingly.

(e) The proposed revisions to COL FSAR Table 2.0-202 appear to include an incorrect DCD site parameter X/Q value for "PORV and Safety Valve Releases" for the 2- to 8-hour time interval at the Annex Building Door. The value is shown as " $3.2E-04$ ". The correct value, based on Tier 2, Table 15A-6 in Revision 17 of Appendix 15A to the AP1000 DCD, is " $3.2E-03$ ". Correct the site parameter value in COL FSAR Table 2.0-202 accordingly.

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Duke Energy Response:

(a) FSAR Subsection 2.3.5.1 was previously revised in the Duke Energy response to RAI 02.03.05-005 (Reference 3) to add a discussion regarding the conclusions of Appendix 2CC and the justification for use of one year of meteorological data for the long-term atmospheric dispersion values used for normal gaseous effluent releases. FSAR Subsection 2.3.3.1, first paragraph, will also be revised (Attachment 1) to add a discussion regarding the results and conclusions of Appendix 2CC, and the justification for use of one year of meteorological data for the long-term atmospheric dispersion values used for normal gaseous effluent releases. These proposed changes supersede the revisions to the first paragraph of FSAR Subsection 2.3.3.1 provided earlier in Attachment 2 to Enclosure 1 of the Duke Energy response to RAI 02.03.04-004 (Reference 1). Proposed changes to FSAR Subsection 2.3.4.1 regarding the results and conclusions of Appendix 2CC are discussed in item (b) below.

(b) FSAR Subsection 2.3.4.1, fifth paragraph, sentences 3 and 4, erroneously state that the joint frequency distribution (JFD) corresponding to the two-year onsite meteorological data set from December 1, 2005 through November 30, 2007 is reported in FSAR Tables 2.3-235 through 2.3-241. This paragraph will be revised (Attachment 2) to correctly state that the JFD for the two-year meteorological data set is reported in Tables 2CC-205, 2CC-206, 2CC-209, and 2CC-210 of FSAR Appendix 2CC. These proposed changes supersede the revisions to the fifth paragraph of FSAR Subsection 2.3.4.1 provided earlier in Attachment 2 to Enclosure 1 of the Duke Energy response to RAI 02.03.04-004 (Reference 1).

The intent of the column labels for FSAR Tables 2.3-235 through 2.3-241, and Tables 2CC-203 through 2CC-209 of FSAR Appendix 2CC, was to represent a range of wind speeds, not cumulative values. To improve clarity, the column headings will be revised as follows:

FSAR Tables 2.3-235 through 2.3-241 column headings for wind speed are changed to:

$U \leq 0.5$	$0.5 < U \leq 0.75$	$0.75 < U \leq 1.0$	$1.0 < U \leq 1.25$	$1.25 < U \leq 1.5$	$1.5 < U \leq 2.0$	$2.0 < U \leq 3.0$
	$3.0 < U \leq 4.0$	$4.0 < U \leq 5.0$	$5.0 < U \leq 6.0$	$6.0 < U \leq 8.0$	$U > 8$	

Tables 2CC-203 through 2CC-204 of FSAR Appendix 2CC column headings for wind speed are changed to:

$U \leq 0.5$	$0.5 < U \leq 0.75$	$0.75 < U \leq 1.0$	$1.0 < U \leq 1.25$	$1.25 < U \leq 1.5$	$1.5 < U \leq 2.0$	$2.0 < U \leq 3.0$
	$3.0 < U \leq 4.0$	$4.0 < U \leq 5.0$	$5.0 < U \leq 6.0$	$6.0 < U \leq 8.0$	$8 < U < 10$	

Tables 2CC-205 through 2CC-206 of FSAR Appendix 2CC column headings for wind speed are changed to:

$U \leq 0.5$	$0.5 < U \leq 0.75$	$0.75 < U \leq 1.0$	$1.0 < U \leq 1.25$	$1.25 < U \leq 1.5$	$1.5 < U \leq 2.0$	$2.0 < U \leq 3.0$
	$3.0 < U \leq 4.0$	$4.0 < U \leq 5.0$	$5.0 < U \leq 6.0$	$6.0 < U \leq 8.0$	$8 < U \leq 10$	$10 < U \leq 12$

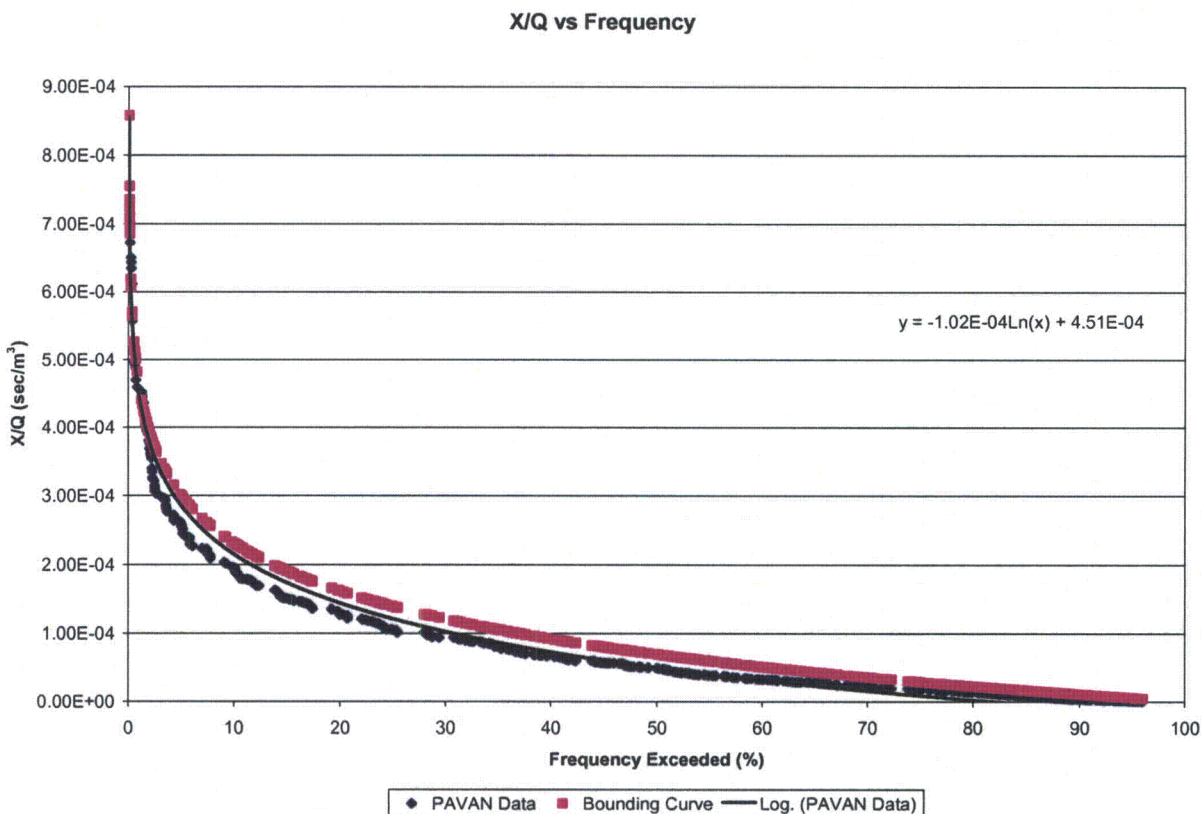
Tables 2CC-207 through 2CC-210 of FSAR Appendix 2CC column headings for wind speed are changed to:

$U \leq 0.45$	$0.45 < U \leq 0.75$	$0.75 < U \leq 1.0$	$1.0 < U \leq 1.25$	$1.25 < U \leq 1.5$	$1.5 < U \leq 2.0$	$2.0 < U \leq 3.0$
	$3.0 < U \leq 4.0$	$4.0 < U \leq 5.0$	$5.0 < U \leq 6.0$	$6.0 < U \leq 8.0$	$8 < U \leq 10$	$U > 10$

Mark-ups of these tables are not included in this RAI response because of the simplicity of the revisions and the large number of tables involved.

(c) FSAR Subsection 2.3.4.2 discusses the comparison of the direction dependent and the direction independent χ/Q values for the Exclusion Area Boundary (EAB) and Low Population

Zone (LPZ). Regulatory Position 4 of Regulatory Guide 1.145 requires that the EAB and LPZ χ/Q values be calculated based on both a directionally independent methodology (overall site limit) and a directionally dependent methodology (maximum sector), and that the most conservative (highest) values be chosen. However, due to limitations of the PAVAN computer code, the EAB overall site limit is not calculated when an irregular EAB is used. This limitation is indicated by the message "Error in Subroutine ENVLOP" that appears in the output file. As a result, the overall site χ/Q (direction independent) value which was equaled or exceeded 5.0% of the time was manually calculated using Microsoft Excel, based on the upper envelope of the ordered χ/Q frequency values extracted from the PAVAN output file. The ordered χ/Q values for the EAB and the frequency that the values are reached or exceed were obtained from the PAVAN output file, LEE2YR15.OUT. The χ/Q values were plotted versus the frequency (see figure below), and an equation for the curve was determined using the Microsoft Excel logarithmic trend line function. The coefficient of the natural log and the intercept for the curve were then adjusted slightly to obtain the equation for a bounding or enveloping curve for the EAB. The equation of this bounding curve was then used to determine the 5% overall site limit χ/Q values for the EAB.



The equation shown above is the curve fit for the PAVAN data. The equation for the bounding curve is:

$$y = -1.0E-04 * \ln(x) + 4.61E-04$$

which gives a 5% overall site limit atmospheric dispersion value of $3.00E-04 \text{ sec/m}^3$.

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The calculation documenting the methodology used in determining the 5.0% dispersion values can be made available for review upon request. For the EAB, the 0.5 percent direction dependent maximum sector relative atmospheric dispersion value of $3.46\text{E-}04 \text{ sec/m}^3$, listed in the output file "LEE2YR15.OUT" (SE sector), is limiting.

(d) FSAR Subsection 2.3.4.3, first paragraph, third sentence, will be revised (Attachment 3) to state that the directions provided in FSAR Table 2.3-284 are relative to True North from the Control Room HVAC Intake and Annex Building Entrance (receptors) to the assumed release points (sources). These proposed changes supersede the revisions to the first paragraph of FSAR Subsection 2.3.4.3 provided earlier in Attachment 1 to Enclosure 3 of the Duke Energy response to RAI 02.03.04-003 (Reference 2).

(e) FSAR Table 2.0-202 provided earlier in Attachment 2 to Enclosure 1 of the Duke Energy response to RAI 02.03.04-004 (Reference 1) included an incorrect AP1000 DCD site parameter X/Q value for "PORV and Safety Valve Releases" for the 2 to 8 hour time interval at the Annex Building Door of $3.2\text{E-}4 \text{ sec/m}^3$. FSAR Table 2.0-202, Sheet 2 of 4, will be revised (Attachment 4) to reflect a value of $3.2\text{E-}03 \text{ sec/m}^3$ as originally presented in FSAR Revision 2. These proposed changes supersede the revisions to FSAR Table 2.0-202 provided earlier in Reference 1.

References:

1. Letter from Bryan J. Dolan (Duke Energy) to Document Control Desk, U.S. Nuclear Regulatory Commission, Response to Request for Additional Information (RAI No. 3726 and 3727), Ltr# WLG2010.04-01, dated April 6, 2010 (ML101060138).
2. Letter from Bryan J. Dolan (Duke Energy) to Document Control Desk, U.S. Nuclear Regulatory Commission, Response to Request for Additional Information (RAI No. 449), Ltr# WLG2008.10-06, dated October 10, 2008 (ML082910110).
3. Letter from Bryan J. Dolan (Duke Energy) to Document Control Desk, U.S. Nuclear Regulatory Commission, Response to Request for Additional Information (RAI No. 4959 and 4960), Ltr# WLG2010.09-02, dated September 16, 2010. (ML102640040)

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

FSAR Subsection 2.3.3.1

FSAR Subsection 2.3.4.1

FSAR Subsection 2.3.4.3

FSAR Table 2.0-202, Sheet 2 of 4

FSAR Tables 2.3-235 through 2.3-241, 2CC-203 through 2CC-210

Attachments:

- 1) Mark-up of FSAR Subsection 2.3.3.1
- 2) Mark-up of FSAR Subsections 2.3.4.1
- 3) Mark-up of FSAR Subsection 2.3.4.3
- 4) Mark-up of FSAR Table 2.0-202, Sheet 2 of 4

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

Attachment 1 to RAI 02.03.04-006

Mark-up of FSAR Subsection 2.3.3.1

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COLA Part 2, FSAR Chapter 2, Subsection 2.3.3.1, first paragraph is revised and separated into two paragraphs as follows:

Two meteorological towers are currently at the site. The meteorological monitoring for the pre-construction phase utilized the primary meteorological tower (Tower 2), located east of the planned Nuclear Island. Either prior to or during the construction phase, Tower 2 is expected to be terminated. A separate tower is expected to be installed as the primary meteorological tower for the construction and operational phases.

Calculations to determine diffusion estimates for both short- and long-term conditions are provided in Subsection 2.3.4 and 2.3.5 respectively. These analyses were completed using data from the meteorological Tower 2, ~~meteorological instrumentation during the 12-month period of December 2005 through November 2006.~~ The short-term X/Q modeling is based on the 24-month period from December 1, 2005 to November 30, 2007. However, the long-term X/Q modeling is based on the 12-month period of December 2005 through November 2006. A separate tower is expected to be installed as the primary meteorological tower for the construction and operational phases. Appendix 2CC evaluates and justifies the use of two years of onsite meteorological data (December 2005 through November 2007) in determining the short-term atmospheric dispersion of accident releases, and the use of one year of onsite meteorological data (December 2005 through November 2006) in determining the long-term atmospheric dispersion of normal airborne effluent releases. As discussed in Appendix 2CC, direct comparison of the atmospheric dispersion values for the one-year and two-year data sets is not possible because of the large number of source and receptor pairs, with some atmospheric dispersion values decreasing while others increase when using the two different sets of data. Instead, a comparison of the maximum individual and population offsite doses resulting from postulated normal airborne effluent releases using these two sets of data was performed. Comparison of the maximum individual and population doses showed that, although the doses increased slightly when the two-year data set was used, the doses are still only a fraction of the 10 CFR Part 50, Appendix I limits. Therefore, the X/Q and D/Q values for normal airborne effluent releases based on the one-year of site meteorological data are retained.

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

Attachment 2 to RAI 02.03.04-006

Mark-up of FSAR Subsection 2.3.4.1

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COLA Part 2, FSAR Chapter 2, Subsection 2.3.4.1, fifth paragraph, is revised as follows:

Using joint frequency distributions of wind direction and wind speed by atmospheric stability, PAVAN provides the χ/Q values as functions of direction for various time periods at the EAB and the LPZ. The meteorological data needed for this calculation includes wind speed, wind direction, and atmospheric stability. The meteorological data used for this analysis was obtained from the onsite meteorological Tower 2 data from December 1, 2005 through November 30, 2006⁷. The joint frequency distribution for this period is reported in Tables ~~2.3-235 through 2.3-244~~ 2CC-205, 2CC-206, 2CC-209, and 2CC-210. Other plant specific data included tower height at which wind speed was measured (10.0 m) and distances to the EAB and LPZ. The Exclusion Area Boundary (EAB) for Lee Nuclear Station is shown in FSAR Figure 2.1-209. The minimum EAB distances are reported in Table 2.3-282. In this table, the distances are measured from a 550-foot radius effluent release boundary to the EAB. The low population zone (LPZ) is defined as a circle with a 2-mile radius centered on the midpoint between the Unit 1 and 2 containment buildings.

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

Attachment 3 to RAI 02.03.04-006

Mark-up of FSAR Subsection 2.3.4.3

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COLA Part 2, FSAR, Chapter 2, Subsection 2.3.4.3, first paragraph, will be revised as follows:

The atmospheric dispersion estimates for the Lee Nuclear ~~e~~Control ~~r~~Room were calculated based on the guidance provided in Regulatory Guide 1.194. The ~~e~~Control ~~r~~Room χ/Q s were calculated for all probable release points to the ~~e~~Control ~~r~~Room HVAC Intake and the Annex Building ~~e~~Entrance using the ARCON96 computer code (Reference 230) based on the hourly meteorological data. The directions relative to ~~t~~True ~~n~~North from the Control Room HVAC Intake and Annex Building Entrance (receptors) to the assumed release points to the Control Room HVAC Intake and Annex Building Entrance (sources) are provided in Table 2.3-284. In all cases, the intervening structures between the release points (sources) and the ~~control room intake-receptors~~ were ignored for calculational simplicity, thereby underestimating the true distance from the release points ~~to the control room intakes~~. This conservatism results in overestimating the Control Room χ/Q values.

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

Attachment 4 to RAI 02.03.04-006

Mark-up of FSAR Table 2.0-202, Sheet 2 of 4

TABLE 2.0-202 (Sheet 2 of 4)
 COMPARISON OF CONTROL ROOM ATMOSPHERIC DISPERSION FACTORS FOR ACCIDENT ANALYSIS
 FOR AP1000 DCD AND LEE NUCLEAR STATION UNITS 1 & 2 (REFERENCE TABLE 2.3-285)

	χ/Q (s/m ³) at HVAC Intake for the Identified Release Points ^(a)		χ/Q (s/m ³) at Annex Building Door for the Identified Release Points ^(b)	
	Ground Level Containment Release Points ^{(d)(h)}		Ground Level Containment Release Points ^(d)	
	DCD	FSAR	DCD	FSAR
0 - 2 hours	6.0E-03	2.70E-03	1.0E-03	4.9501E-04
2 - 8 hours	3.6E-03	1.879E-03	7.5E-04	3.98E-04
8 - 24 hours	1.4E-03	7.039E-04	3.5E-04	1.659E-04
1 - 4 days	1.8E-03	6.290E-04	2.8E-04	1.236E-04
4 - 30 days	1.5E-03	4.375E-04	2.5E-04	8.5976E-05

	χ/Q (s/m ³) at HVAC Intake for the Identified Release Points ^(a)		χ/Q (s/m ³) at Annex Building Door for the Identified Release Points ^(b)	
	PORV and Safety Valve Releases ^(e)		PORV and Safety Valve Releases ^(e)	
	DCD	FSAR	DCD	FSAR
0 - 2 hours	2.0E-02	1.408E-02	4.0E-03	8.671E-04
2 - 8 hours	1.8E-02	5.362E-03	3.2E-03	6.83E-04
8 - 24 hours	7.0E-03	2.328E-03	1.2E-03	2.96E-04
1 - 4 days	5.0E-03	1.789E-03	1.0E-03	4.9205E-04
4 - 30 days	4.5E-03	1.347E-03	8.0E-04	1.446E-04