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October 17, 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. 717 and 718)
Ltr # WLG2008.10-11

Reference: Letter from Ravindra Joshi (NRC) to Peter Hastings (Duke Energy), *Request For Additional Information Letter No. 014 Related To SRP Section 11.03 for the William States Lee III Units 1 And 2 Combined License Application*, dated September 17, 2008.

This letter provides the Duke Energy partial response to the Nuclear Regulatory Commission's requests for additional information (RAIs) included in the referenced letter. Responses to RAI Numbers 11.03-02 and 11.03-03 are provided in this letter. A response to RAI Number 11.03-01 will be provided in a future submittal on or about October 30, 2008.

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.

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

D093
NRO

Enclosures:

1) Duke Energy Response to Request for Additional Information Letter 014, RAI 11.03-002
2) Duke Energy Response to Request for Additional Information Letter 014, RAI 11.03-003

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.

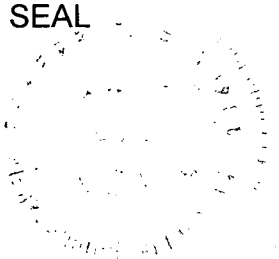
Bryan J. Dolan

Subscribed and sworn to me on October 17, 2008

Notary Public

My commission expires: June 26, 2011

SEAL



xc (w/o enclosures):

Michael Johnson, Director, Office of New Reactors
Gary Holahan, Deputy Director, Office of New Reactors
David Matthews, Director, Division of New Reactor Licensing
Scott Flanders, Director, Site and Environmental Reviews
Glenn Tracy, Director, Division of Construction Inspection and Operational Programs
Charles Ader, Director, Division of Safety Systems and Risk Assessment
Michael Mayfield, Director, Division of Engineering
Luis Reyes, Regional Administrator, Region II
Loren Plisco, Deputy Regional Administrator, Region II
Thomas Bergman, Deputy Division Director, DNRL
Stephanie Coffin, Branch Chief, DNRL

xc (w/enclosures):

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

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

RAI Letter No. 014

NRC Technical Review Branch: Health Physics Branch (CHPB)

Reference NRC RAI Number(s): 11.03-002

NRC RAI:

Please provide detailed information to enable the staff to validate and verify the estimated doses in FSAR section 11.3.3.4 with respect to the dose objectives of Appendix I to 10 CFR Part 50 and the dose limits in 10 CFR 20.1301(e); please revise the FSAR to include this information, or justify its exclusion. The information should include the following:

- a complete description of how the applicant derived all the values listed in Table 11.3-201, including all assumptions made
- citations to any reference material used (for documents not publicly available please provide a copy for staff's use)
- detailed breakdown of individual doses by pathway and organ
- detailed breakdown of population doses by pathway and organ

Duke Energy Response:

Regulatory Guide 1.206, Revision 0, and Standard Review Plan 11.3, Revision 3, require the parameters used to determine estimated doses from the gaseous effluent system to be provided in the FSAR, but neither requires the FSAR to provide a detailed basis for each parameter. In lieu of providing this detail in the FSAR, the requested material is provided in the annotated table provided in Attachment 1. The annotated table provides additional information on how the values in FSAR Table 11.3-201 were derived. This annotated Table is not part of the FSAR and will not be included in future revisions to the COLA. Citations to the reference material are provided. The referenced material is publicly available.

Attachments 2, 3, and 4 will be incorporated into a future revision of the FSAR. A detailed breakdown of individual doses by pathway and organ is provided in the revised Table 11.3-202 in Attachment 2. A detailed breakdown of population doses by pathway and organ is provided in the revised Table 11.3-204 in Attachment 2.

Associated Revision to the Lee Nuclear Station Final Safety Analysis Report

FSAR Tables 11.3-202 and 11.3-204

FSAR Tables 11.3-205, 11.3-206, and 11.3-207

FSAR Section 11.3

FSAR Table 2.3-289

Attachments:

1) Annotated FSAR Table 11.3-201
2) Revised FSAR Tables 11.3-202 and 11.3-204, and new FSAR Tables 11.3-205, 11.3-206 and 11.3-207
3) Revised FSAR Section 11.3
4) Revised FSAR Table 2.3-289

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

Attachment 1 to RAI 11.03-002

Annotated FSAR Table 11.3-201

FSAR Table 11.3-201 (annotated)

GASPAR II INPUT[1]

Input Parameter	Value	Basis
Number of Source Terms	1	GASPAR Job Control Option
Distance from site to NE Corner of the US (mi.)	790	Note 2
Source Term	DCD Table 11.3-3	DCD Table 11.3-3
Population Data	Table 2.1-203 and Table 2.1-204, year 2056	Note 3
Fraction of the year leafy vegetables are grown	0.58	Note 4
Fraction of max individual's vegetable intake from own garden	0.76	GASPAR default per NUREG/CR-4653, Table 2.3.
Fraction of the year milk cows are on pasture	0.75	Note 4
Fraction of milk-cow feed intake from pasture while on pasture	1	Conservative assumption, because it maximizes the feed from potentially contaminated pasture. GASPAR default per NUREG/CR-4653, Table 2.3.
Fraction of the year goats are on pasture	0.83	Note 4
Fraction of goat feed intake from pasture while on pasture	1	Conservative assumption, because it maximizes the feed from potentially contaminated pasture. GASPAR default per NUREG/CR-4653, Table 2.3.
Fraction of the year beef cattle are on pasture	0.75	Note 4
Fraction of beef-cattle feed intake from pasture while on pasture	1	Conservative assumption, because it maximizes the feed from potentially contaminated pasture. GASPAR default per NUREG/CR-4653, Table 2.3.

Total Production Rate for the 50-mile area		
• Vegetables (kg/yr)	151,333,289	Note 5
• Milk (L/yr)	84,765,807	Note 6
• Meat (kg/yr)	354,508,878	Note 7
Special Location Data	Section 2.3	Note 8
Meteorological Data	Section 2.3	Note 9
Average Absolute Humidity (g/m^3)	8	GASPAR default per NUREG/CR-4653, Table 2.3.

Notes

1. Input parameters not specified use default GASPAR II values as provided in NUREG/CR-4653, GASPAR II Technical Reference and User Guide.
2. Distance from site to NE Corner of the US determined using Google Earth. Note, this parameter is used by GASPAR to calculate the NEPA population doses and does not affect the doses calculated to demonstrate compliance with Appendix I of 10 CFR Part 50 or 10 CFR Part 20.
3. NUREG-1555 requires a population projected out to five years from the time of the licensing action. The population used for this calculation is projected out to 2056 to conservatively bound the 5-year criteria. The population distribution for each of the 22½-degree radial sectors centered on the 16 cardinal compass directions for radial distances of 1, 2, 3, 4, 5, 10, 20, 30, 40, and 50 miles is calculated based on FSAR Tables 2.1-203 and 2.1-204, which give the projected populations in sectors of 2, 4, 6, 8, 10, 16, 40, 60, and 80 km. The adjustment of the population distribution to the radial sectors given in miles is described in the response to RAI 11.03-3.
4. The length of the vegetable growing season and the amount of time cows and goats spend grazing on pasture are estimated using Figure 2.2 of NUREG/CR-4653 and the methodology therein. The results are a growing season for vegetables of seven months, milk and beef cows are on pasture for nine months, and goats are on pasture for ten months.
5. Section 1 of NUREG/CR-4653 states that GASPAR is capable of evaluating the doses due to ingestion of contaminated vegetables (including grains). Therefore, root crops, cereals, and fruits are conservatively included in the calculation of the annual vegetable production within 50 miles of the site. U.S. Department of Agriculture (USDA) data and statistics available at http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp provided data for "34 Major Vegetables" for each state in 2005. However, no breakdown by county for each state was provided for 2005 data. 2002 census data on "Vegetables Harvested for Sale" by county

was used to apportion quantities for the counties (available at http://www.nass.usda.gov/Census/Create_Census_US_CNTY.jsp). Where the number of farms reporting was small and the actual number was not disclosed, the average acreage harvested per farm statewide was used (this only applied to Union County, North Carolina). Note that the 2002 data included vegetables and melons, whereas the 2005 data was strictly vegetables. The assumption was made that the county to state acre ratio for 2002 data was similar to 2005.

There were no root crops listed for North Carolina or South Carolina. The cereal crops listed for the counties of interest were corn, wheat, barley, and oats. USDA conversion factors, available at http://www.nass.usda.gov/ks/wq/2002/whtqlbk.htm, provided the conversion of 56 pounds per bushel for corn, 60 pounds per bushel for wheat, 48 pounds per bushel for barley, and 32 pounds per bushel for oats.

The USDA data provided national statistics on fruit production with the exception of persimmons, kiwifruit, nectarines, and plums. The average yield for the years available was calculated (1996-2004), and was used as the yield for the 50-mile area. The "Crop Profile for Persimmons in California" provided a yield of 6.76 tons per acre for persimmons in California, and is assumed to be a valid assumption for persimmon yield in the 50-mile area. The "Non-Citrus Fruits and Nuts", available at http://usda.mannlib.cornell.edu/reports/nassr/fruit/pnf-bb/ncit0103.pdf, provided nation-wide crop yields for figs, kiwifruit, nectarines, and plums for the years 2000, 2001, and 2002. The average of these three years is used as the fruit yield in the 50-mile area. The number of total county acres is multiplied by the average national yield per acre to get fruit produced in that county. In some instances data is not provided for total farm acreage, but the number of farms is given. For these fruits, the state average acres per farm is multiplied by the average national yield for that fruit. However, total farm acreage was not provided for "Sweet Cherries" in South Carolina, so the average acres per farm in North Carolina was assumed to be the same as that for South Carolina

6. The livestock data from (http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp) includes milk cows. The data provides the total production of milk in pounds and the average yield per cow. Where the milk quantity per county was too small for an individual report, the counties were combined in a district total, and the number of milk cows in each of these counties was calculated by multiplying the number of milk cows in the district by the ratio of total cattle in the counties to total cattle in the district. Kilograms of milk were converted to liters of milk using the density conversion of 1.03 kg/L ("The Physics Factbook," available online at http://www.hypertextbook.com/facts/2002/AliciaNoelleJones.shtml). Note that there were no milk cows reported in South Carolina for Chester, Fairfield, Lancaster, and York Counties.

7. The total meat production in the 50-mile area around the Lee Nuclear site includes beef, pork, chicken, mutton, and turkey. Data at http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp provides a tally of

livestock inventory, but it does not provide slaughter data broken down by county. The contribution of the state total from each county is assumed to be proportional in the same ratio as the beef cows in that county to the total number of beef cows in the state. The conversion factor from pounds to kilograms of 0.4535924 is taken from http://www.onlineconversion.com.

The same methodology used for beef is used for pork. However, the data from http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp does not provide the net weight of the animals slaughtered. Therefore, the live weight reported to the USDA is used as the weight of the pork produced. This is conservative because the live weight includes weight not consumed by humans. The pork produced in a particular county is assumed to be proportional to the live animal inventory of that county relative to the state total inventory. http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp does not provide slaughter data for hogs in South Carolina, but there is data on the number of state hogs. It is assumed that the ratio of the number of state hogs to the total slaughter weight in South Carolina is proportional to the ratio of the number of state hogs and total slaughter weight in North Carolina. Some of the counties in the states are assumed to have a headcount less than would be reported individually, so the USDA combined those counties in a district total. It is assumed that the number of hogs in the county is proportional to the number of beef cows in the county. This assumption is made to apportion the hogs to each county. The hog numbers were not apportioned to all counties in the district, but to all counties that are, at least partially, in the 50-mile area around the Lee Nuclear site.

The methodology used for beef and pork was also used to estimate chicken. However, http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp shows no "Broiler" data for North Carolina, so data from http://www.nass.usda.gov/Census/Create_Census_US_CNTY.jsp is used for the number of slaughtered as well as the number per county. Also, the data at http://www.nass.usda.gov/Census/Create_Census_US_CNTY.jsp does not include a quantity reported for Iredell County, North Carolina, and the data is not broken out by district. Therefore, the assumption is made that the quantity of chickens in Iredell County is one half the smallest county of concern in North Carolina (Cabarrus).

The same methodology used previously was used to estimate mutton. There are no sheep slaughtered in South Carolina, however, and no data was given by county for the sheep in North Carolina. It is assumed that the number of county sheep is proportional to the number of county cows.

The same methodology used previously was used to estimate turkey. http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp does not show data by county for turkeys in North Carolina. It is assumed that the number of county turkeys is proportional to the number of county cows. The counties in South Carolina that did not have a number explicitly given were estimated in the same manner as was pork.

8. The special locations consist of the most conservative locations for meat, milk, a garden, and the EAB. For each type of location, the receptor resulting in the highest dose due to the pathway(s) relevant to that location was selected and the χ/Q and D/Q values from FSAR Table 2.3-289 for that location were input into GASPAR. For the milk pathway, the two locations resulting in the highest dose were selected, where one location applied for goats and the other applied for cows. The χ/Q and D/Q values were determined based on meteorological data from December 1, 2005 to November 30, 2006.
9. One year of site meteorological beginning December 1, 2005 and ending November 30, 2006 was used to generate the χ/Q and D/Q values in Tables 2.3-287, 2.3-290, 2.3-291, and 2.3-292. These χ/Q and D/Q values were used as input to GASPAR.

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

Attachment 2 to RAI 11.03-002

Mark-Up of FSAR Tables 11.3-202 and 11.3-204
New FSAR Tables 11.3-205, 11.3-206, and 11.3-207

TABLE 11.3-202 (Sheet 1 of 2)
INDIVIDUAL DOSE RATES[a]

~~Age Group~~ Pathway	Dose (mrem/yr) Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Adult								
Plume	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.99E-01	2.06E+00
Ground	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.23E-01
Vegetable	1.27E-01	1.28E-01	5.70E-01	1.27E-01	1.23E-01	8.87E-01	1.18E-01	1.17E-01
Meat	4.32E-02	4.79E-02	1.89E-01	4.33E-02	4.28E-02	7.41E-02	4.24E-02	4.23E-02
Cow Milk	4.71E-02	4.30E-02	1.72E-01	4.95E-02	4.74E-02	7.99E-01	4.21E-02	4.15E-02
Goat Milk	4.79E-02	3.65E-02	1.33E-01	5.30E-02	4.46E-02	8.85E-01	3.67E-02	3.50E-02
Inhalation	4.76E-02	4.82E-02	7.29E-03	4.87E-02	4.95E-02	4.35E-01	6.16E-02	4.62E-02
Total	7.88E-01	7.79E-01	1.55E+00	7.97E-01	7.82E-01	3.56E+00	8.05E-01	2.47E+00
Teen								
Plume	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.99E-01	2.06E+00
Ground	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.23E-01
Vegetable	1.91E-01	1.93E-01	9.10E-01	1.95E-01	1.90E-01	1.20E+00	1.81E-01	1.79E-01
Meat	3.50E-02	3.77E-02	1.59E-01	3.53E-02	3.49E-02	5.75E-02	3.46E-02	3.45E-02
Cow Milk	7.79E-02	7.34E-02	3.15E-01	8.55E-02	8.20E-02	1.27E+00	7.28E-02	7.15E-02
Goat Milk	7.11E-02	5.95E-02	2.41E-01	8.90E-02	7.45E-02	1.40E+00	6.09E-02	5.75E-02
Inhalation	4.82E-02	4.86E-02	8.82E-03	5.00E-02	5.11E-02	5.43E-01	6.98E-02	4.66E-02
Total	8.98E-01	8.87E-01	2.11E+00	9.30E-01	9.08E-01	4.95E+00	9.23E-01	2.57E+00
Child								
Plume	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.99E-01	2.06E+00
Ground	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.23E-01
Vegetable	4.22E-01	4.15E-01	2.15E+00	4.32E-01	4.22E-01	2.36E+00	4.08E-01	4.06E-01
Meat	6.34E-02	6.46E-02	2.99E-01	6.39E-02	6.33E-02	9.76E-02	6.30E-02	6.29E-02
Cow Milk	1.73E-01	1.67E-01	7.72E-01	1.89E-01	1.83E-01	2.55E+00	1.67E-01	1.65E-01
Goat Milk	1.40E-01	1.28E-01	5.84E-01	1.80E-01	1.55E-01	2.80E+00	1.32E-01	1.27E-01
Inhalation	4.26E-02	4.21E-02	1.07E-02	4.44E-02	4.54E-02	6.32E-01	6.04E-02	4.12E-02
Total	1.32E+00	1.29E+00	4.29E+00	1.38E+00	1.34E+00	8.91E+00	1.33E+00	2.99E+00

TABLE 11.3-202 (Sheet 2 of 2)
INDIVIDUAL DOSE RATES

Pathway	Dose (mrem/yr)							
	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Infant								
Plume	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.70E-01	3.99E-01	2.06E+00
Ground	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.05E-01	1.23E-01
Vegetable	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Meat	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cow Milk	3.46E-01	3.36E-01	1.49E+00	3.84E-01	3.64E-01	6.12E+00	3.38E-01	3.35E-01
Goat Milk	2.66E-01	2.51E-01	1.10E+00	3.55E-01	2.96E-01	6.74E+00	2.59E-01	2.50E-01
Inhalation	2.46E-02	2.40E-02	5.39E-03	2.65E-02	2.64E-02	5.66E-01	3.71E-02	2.37E-02
Total	1.11E+00	1.09E+00	3.07E+00	1.24E+00	1.16E+00	1.39E+01	1.14E+00	2.79E+00

~~a) Dose rates represent the summation of dose rates from each pathway.~~

TABLE 11.3-204
POPULATION DOSES

~~Annual Dose (Person-rem)~~

~~Whole Body 4.79~~
~~Thyroid 9.52~~

(person-rem)

Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	1.43E+00	1.43E+00	1.43E+00	1.43E+00	1.43E+00	1.43E+00	1.65E+00	1.43E+01
Ground	2.78E-01	2.78E-01	2.78E-01	2.78E-01	2.78E-01	2.78E-01	2.78E-01	3.26E-01
Inhalation	3.90E-01	3.91E-01	4.41E-02	3.97E-01	4.02E-01	2.99E+00	4.74E-01	3.82E-01
Vegetable	7.15E-01	7.14E-01	3.15E+00	7.17E-01	7.04E-01	7.29E-01	6.99E-01	6.97E-01
Cow Milk	2.59E-01	2.52E-01	1.08E+00	2.69E-01	2.62E-01	1.81E+00	2.51E-01	2.50E-01
Meat	1.72E+00	1.79E+00	7.72E+00	1.72E+00	1.71E+00	2.30E+00	1.70E+00	1.70E+00
Total	4.79E+00	4.85E+00	1.37E+01	4.81E+00	4.78E+00	9.52E+00	5.06E+00	1.76E+01

TABLE 11.3-205
CALCULATED MAXIMUM INDIVIDUAL DOSES COMPARED TO 10 CFR PART 50 APPENDIX I LIMITS

Description	Limit	Calculated Values
Noble Gases [1]		
Gamma Dose (mrad)	10	6.13E-01
Beta Dose (mrad)	20	2.93E+00
Total Body Dose (mrem)	5	3.70E-01
Skin Dose (mrem)	15	2.06E+00
Radioiodines and Particulates		
Total Body Dose (mrem)	-	9.50E-01
Max to Any Organ (mrem) [2]	15	1.39E+01

1) Doses due to noble gases in the released plume are calculated at the location of maximum dose at the site boundary (location of highest χ/Q values). This location is 0.83 miles southeast of the plant.
2) The maximum dose to any organ is the dose to the thyroid of an infant.

TABLE 11.3-206
MAXIMUM INDIVIDUAL DOSES FROM BOTH UNITS DUE TO ROUTINE GASEOUS EFFLUENTS COMPARED TO 10 CFR 20.1301 LIMITS

Description	Limit	Calculated Values
TEDE (mrem)	100	3.17E+00
Maximum Dose per Hour (mrem/hr)	2	3.62E-04

TABLE 11.3-207

COLLECTIVE GASEOUS DOSES COMPARED TO 40 CFR PART 190 LIMITS

Description	Limit	Calculated Values for Both Units
Total Body Dose Equivalent (mrem)	25	2.64E+00
Thyroid Dose (mrem)	75	2.78E+01
Max to Any Other Organ (mrem) [1]	25	8.58E+00

1) Note that the maximum dose to any organ other than the thyroid is the dose to the bone of a child.

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

Attachment 3 to RAI 11.03-002

Mark-Up of FSAR Section 11.3

11.3 GASEOUS WASTE MANAGEMENT SYSTEMS

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

11.3.3.4 Estimated Doses

Add the following information at the end of DCD subsection 11.3.3.4.

The calculated gaseous doses for the maximum exposed individual are compared to the regulatory limits from Appendix I of 10 CFR Part 50 and 10 CFR Part 20.1301 for acceptance. Tables 11.3-205 and 11.3-206 display this comparison and demonstrate that the calculated gaseous doses for the maximally exposed individual are less than the regulatory limits. The Lee Nuclear Station site-specific values are bounded by the DCD identified acceptable releases. With the annual airborne releases listed in DCD Table 11.3-3, the site-specific air doses at ground level at the site boundary are 0.613 mrad for gamma radiation and 2.93 mrad for beta radiation. These doses are based on the annual average atmospheric dispersion factor from Section 2.3. These doses are below the 10 CFR Part 50, Appendix I design objectives of 10 mrad per year for gamma radiation or 20 mrad per year for beta radiation.

Dose and dose rate to man were calculated using the GASPAR II computer code. This code is based on the methodology presented in Regulatory Guide 1.109. Factors common to both estimated individual dose rates and estimated population dose are addressed in this subsection. Unique data are discussed in the respective subsections.

Activity pathways considered are plume, ground deposition, inhalation, and ingestion of vegetables, meat, and milk (both cow and goat).

Based on site meteorological conditions, the highest rate of plume exposure and ground deposition occurs at the Exclusion Area Boundary (EAB) 0.83 mi. SE of the plant.

Agricultural products are estimated from U.S. Department of Agriculture National Agricultural Statistics Service. GASPAR II evenly distributes the food production over the entire 50 miles when given a total production for calculating dose.

Population distribution within the 50-mi. radius is presented in FSAR Tables 2.1-203 and 2.1-204.

11.3.3.4.1 Estimated Individual Doses

Dose rates to individuals are calculated for airborne decay and deposition, inhalation, and ingestion of milk (goat and cow), meat and vegetables. Dose from plume and ground deposition are calculated as affecting all age groups equally.

Plume exposure approximately 0.83 mi. SE of Lee Nuclear Station produced a maximum dose rate to a single organ of 2.06 mrem/yr to skin. The maximum total body dose rate was calculated to be 3.70E-1 mrem/yr.

Ground deposition approximately 0.83 mi. SE of Lee Nuclear Station produced a maximum dose rate to a single organ of 1.23E-1 mrem/yr to skin. The maximum total body dose rate was calculated to be 1.05E-1 mrem/yr.

Inhalation Dose at the EAB, 0.83 mi. SE of the plant, results in a maximum dose rate to a single organ of 6.32E-1 mrem/yr to a child's thyroid. The maximum total body dose rate is calculated to be 4.82E-2 mrem/yr to a teenager.

Vegetable consumption assumes that the dose is received from the garden special location, approximately 1.01 mi. SSE of the plant. GASPAR II default vegetable consumption values are used in lieu of site-specific vegetable consumption data as permitted by Regulatory Guide 1.109. The estimated maximum dose rate to a single organ is 2.36~~E-1~~ mrem/yr to a child's thyroid. The maximum total body dose rate is calculated to be 4.22E-1 mrem/yr to a child.

Meat consumption assumes that the dose is received from the animal special location, approximately 1.47 mi. SE of the plant. GASPAR II default meat consumption values are used in lieu of site-specific meat consumption data as permitted by Regulatory Guide 1.109. The estimated maximum dose rate to a single organ is 2.99E-1 mrem/yr to a child's bone. The maximum total body rate is calculated to be 6.34E-2 mrem/yr to a child.

Cow milk consumption assumes that the dose is received from the animal special location, approximately 1.09 mi. SSE of the plant. GASPAR II default cow milk consumption values are used in lieu of site-specific cow milk consumption data as permitted by Regulatory Guide 1.109. The estimated maximum dose rate to a single organ is 6.12 mrem/yr to an infant's thyroid. The maximum total body dose rate is calculated to be 3.46E-1 mrem/yr to an infant.

Goat milk consumption assumes that the dose is received from the nearest milk animal special location, approximately 1.06 mi. SSW of the plant. GASPAR II default goat milk consumption values are used in lieu of site-specific goat milk consumption data as permitted by Regulatory Guide 1.109. The estimated maximum dose rate to a single organ is 6.74 mrem/yr to an infant's thyroid. The maximum total body dose rate is calculated to be 2.66E-1 mrem/yr to an infant.

The maximum dose rate to any organ considering every pathway is calculated to be 1.39E+1 mrem/yr to an infant's thyroid. The maximum total body dose rate is calculated to be 1.32 mrem/yr to a child. These are below the 10 CFR 50, Appendix I design objectives of 5 mrem/yr to total body, and 15 mrem/yr to any organ, including skin.

Table 11.3-201 contains GASPAR II input data for dose rate calculations. Information regarding the special locations for man, milk animal, garden, school, and the EAB is located

in Section 2.3. Table 11.3-202 contains total organ dose rates based on age group and pathway. Table 11.2-203 contains total air dose at each special location.

11.3.3.4.2 Estimated Population Dose

The population dose analysis performed to determine off-site dose from gaseous effluents is based upon the AP1000 generic site parameters included in DCD Chapter 11 and DCD Tables 11.3-1, 11.3-2 and 11.3-4, and the year 2056 population data in FSAR Tables 2.1-203 and 2.1-204. The population doses are shown in Table 11.3-204.

This section adopts NEI 07-11 (Reference 201) which is currently under review by the NRC staff. The application of the methodology of NEI 07-11 satisfies the cost-benefit analysis requirements of 10 CFR Part 50, Appendix I, Section II.D. The augments provided in NEI 07-11 were reviewed and were found not to be cost beneficial due to the low population doses.

11.3.3.5 Quality Assurance

Add the following to the end of DCD Subsection 11.3.3.6:

Since the impact of radwaste systems on safety is limited, the extent of control required by Appendix B to 10 CFR Part 50 is similarly limited. Thus, a supplemental quality assurance program applicable to design, construction, installation, and testing provisions of the gaseous radwaste system is established by procedures that complies with the guidance presented in Regulatory Guide 1.143.

11.3.4 COMBINED LICENSE INFORMATION

11.3.5.1 Cost Benefit Analysis of Population Doses

This COL Item is addressed in Subsections 11.3.3.4, 11.3.3.4.1, and 11.3.3.4.2.

11.3.6 REFERENCES

201. NEI 07-11, "Generic FSAR Template Guidance for Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors," Rev. 0, September 2007

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

Attachment 4 to RAI 11.03-002

Mark-Up of FSAR Table 2.3-289

TABLE 2.3-289

χ/Q AND D/Q VALUES FOR NORMAL RELEASES

~~NO DECAY, DEPLETED AND UNDEPLETED, AT EACH RECEPTOR LOCATION~~

Type of Location	Sector	Distance (miles)	Distance (meters)	χ/Q (sec/m^3) No Decay Undepleted	χ/Q (sec/m^3) No Decay Depleted	χ/Q (sec/m^3) 2.26 Day Decay Undepleted	χ/Q (sec/m^3) 8.00 Day Decay Depleted	D/Q (m^{-2})
EAB	S	0.87	1395	2.10E-06	1.90E-06	2.10E-06	1.90E-06	4.80E-09
EAB	SSW	0.87	1395	1.70E-06	1.50E-06	1.70E-06	1.50E-06	4.60E-09
EAB	SW	0.96	1547	1.50E-06	1.30E-06	1.50E-06	1.30E-06	4.00E-09
EAB	WSW	1.02	1649	1.50E-06	1.30E-06	1.50E-06	1.30E-06	3.10E-09
EAB	W	0.75	1208	2.70E-06	2.40E-06	2.70E-06	2.40E-06	4.70E-09
EAB	WNW	0.75	1208	2.50E-06	2.20E-06	2.50E-06	2.20E-06	4.30E-09
EAB	NW	0.75	1215	2.40E-06	2.20E-06	2.40E-06	2.20E-06	5.40E-09
EAB	NNW	0.42	668	4.60E-06	4.20E-06	4.60E-06	4.20E-06	1.50E-08
EAB	N	0.4	644	3.60E-06	3.30E-06	3.60E-06	3.30E-06	1.80E-08
EAB	NNE	0.4	644	2.40E-06	2.20E-06	2.40E-06	2.20E-06	1.90E-08
EAB	NE	0.44	705	1.90E-06	1.80E-06	1.90E-06	1.80E-06	1.70E-08
EAB	ENE	0.59	952	1.20E-06	1.10E-06	1.20E-06	1.10E-06	7.30E-09
EAB	E	0.8	1282	6.30E-07	5.60E-07	6.30E-07	5.60E-07	2.50E-09
EAB	ESE	0.96	1544	1.80E-06	1.60E-06	1.80E-06	1.60E-06	4.80E-09
EAB	SE	0.83	1339	5.80E-06	5.10E-06	5.70E-06	5.10E-06	1.20E-08
EAB	SSE	0.83	1339	2.90E-06	2.60E-06	2.90E-06	2.60E-06	5.90E-09
NEAREST HOUSE	S	1.6	2578	8.40E-07	7.10E-07	8.30E-07	7.10E-07	1.70E-09

Type of Location	Sector	Distance (miles)	Distance (meters)	χ/Q (sec/m^3) No Decay Undepleted	χ/Q (sec/m^3) No Decay Depleted	χ/Q (sec/m^3) 2.26 Day Decay Undepleted	χ/Q (sec/m^3) 8.00 Day Decay Depleted	D/Q (m^{-2})
NEAREST HOUSE	WSW	2.57	4143	4.00E-07	3.20E-07	3.90E-07	3.20E-07	6.20E-10
NEAREST HOUSE	W	1.77	2846	7.50E-07	6.30E-07	7.40E-07	6.30E-07	1.10E-09
NEAREST HOUSE	NW	2.5	4025	4.20E-07	3.40E-07	4.10E-07	3.40E-07	6.90E-10
NEAREST HOUSE	NNW	2.02	3245	4.00E-07	3.30E-07	3.90E-07	3.30E-07	1.10E-09
NEAREST HOUSE	SE	1	1607	4.30E-06	3.80E-06	4.30E-06	3.80E-06	8.90E-09
NEAREST HOUSE	SSE	1.1	1775	1.90E-06	1.60E-06	1.90E-06	1.60E-06	3.70E-09
NEAREST GARDEN	SSW	1.5	2410	7.60E-07	6.40E-07	7.50E-07	6.40E-07	1.80E-09
NEAREST GARDEN	SW	1.2	1927	1.10E-06	9.20E-07	1.10E-06	9.20E-07	2.70E-09
NEAREST GARDEN	WSW	2.56	4123	4.00E-07	3.20E-07	3.90E-07	3.20E-07	6.30E-10
NEAREST GARDEN	W	2.47	3968	4.70E-07	3.80E-07	4.60E-07	3.80E-07	6.00E-10
NEAREST GARDEN	WNW	2.54	4094	4.20E-07	3.40E-07	4.10E-07	3.40E-07	5.30E-10
NEAREST GARDEN	NW	2.02	3258	5.60E-07	4.60E-07	5.50E-07	4.60E-07	1.00E-09
NEAREST GARDEN	NNW	1.51	2431	6.00E-07	5.10E-07	5.90E-07	5.10E-07	1.70E-09
NEAREST GARDEN	N	1.4	2246	5.30E-07	4.50E-07	5.30E-07	4.50E-07	2.20E-09
NEAREST GARDEN	NNE	1.37	2203	3.80E-07	3.20E-07	3.70E-07	3.20E-07	2.50E-09
NEAREST GARDEN	NE	1.11	1794	4.60E-07	4.00E-07	4.60E-07	4.00E-07	3.60E-09
NEAREST GARDEN	ENE	0.97	1567	5.40E-07	4.70E-07	5.40E-07	4.70E-07	3.20E-09
NEAREST GARDEN	E	2.78	4469	1.00E-07	8.40E-08	1.00E-07	8.30E-08	2.90E-10
NEAREST GARDEN	ESE	2.71	4355	4.10E-07	3.30E-07	4.10E-07	3.30E-07	7.90E-10
NEAREST GARDEN	SE	4.1	6591	6.30E-07	4.80E-07	6.20E-07	4.80E-07	7.50E-10
NEAREST GARDEN	SSE	1.01	1627	2.20E-06	1.90E-06	2.10E-06	1.90E-06	4.30E-09

Type of Location	Sector	Distance (miles)	Distance (meters)	χ/Q (sec/m^3) No Decay Undepleted	χ/Q (sec/m^3) No Decay Depleted	χ/Q (sec/m^3) 2.26 Day Decay Undepleted	χ/Q (sec/m^3) 8.00 Day Decay Depleted	D/Q (m^{-2})
MILK COW/GOAT	SSW	1.06	1705	1.30E-06	1.10E-06	1.20E-06	1.10E-06	3.30E-09
MILK COW/GOAT	SW	1.26	2026	9.90E-07	8.50E-07	9.80E-07	8.50E-07	2.50E-09
MILK COW/GOAT	WSW	2.79	4494	3.60E-07	2.90E-07	3.50E-07	2.90E-07	5.40E-10
MILK COW/GOAT	W	2.39	3850	4.90E-07	4.00E-07	4.80E-07	4.00E-07	6.30E-10
MILK COW/GOAT	WNW	2.5	4016	4.30E-07	3.50E-07	4.20E-07	3.50E-07	5.50E-10
MILK COW/GOAT	NW	3.82	6143	2.50E-07	1.90E-07	2.40E-07	1.90E-07	3.30E-10
MILK COW/GOAT	N	2.31	3715	2.60E-07	2.10E-07	2.60E-07	2.10E-07	9.20E-10
MILK COW/GOAT	NNE	3.39	5449	1.00E-07	8.10E-08	1.00E-07	8.00E-08	5.10E-10
MILK COW/GOAT	ENE	1.22	1957	3.90E-07	3.40E-07	3.90E-07	3.40E-07	2.20E-09
MILK COW/GOAT	E	3.06	4926	9.20E-08	7.30E-08	9.00E-08	7.20E-08	2.40E-10
MILK COW/GOAT	ESE	3.12	5017	3.50E-07	2.70E-07	3.40E-07	2.70E-07	6.10E-10
MILK COW/GOAT	SE	4.62	7437	5.50E-07	4.10E-07	5.30E-07	4.10E-07	6.10E-10
MILK COW/GOAT	SSE	1.09	1749	1.90E-06	1.70E-06	1.90E-06	1.70E-06	3.80E-09
ANIMAL FOR MEAT	SSW	1.06	1705	1.30E-06	1.10E-06	1.20E-06	1.10E-06	3.30E-09
ANIMAL FOR MEAT	SW	1.26	2026	9.90E-07	8.50E-07	9.80E-07	8.50E-07	2.50E-09
ANIMAL FOR MEAT	WSW	2.79	4494	3.60E-07	2.90E-07	3.50E-07	2.90E-07	5.40E-10
ANIMAL FOR MEAT	W	2.39	3850	4.90E-07	4.00E-07	4.80E-07	4.00E-07	6.30E-10
ANIMAL FOR MEAT	WNW	2.5	4016	4.30E-07	3.50E-07	4.20E-07	3.50E-07	5.50E-10
ANIMAL FOR MEAT	NW	2.41	3876	4.40E-07	3.60E-07	4.30E-07	3.60E-07	7.40E-10
ANIMAL FOR MEAT	NNW	1.47	2360	6.30E-07	5.30E-07	6.20E-07	5.30E-07	1.80E-09
ANIMAL FOR MEAT	N	2.31	3715	2.60E-07	2.10E-07	2.60E-07	2.10E-07	9.20E-10

Type of Location	Sector	Distance (miles)	Distance (meters)	χ/Q (sec/m^3) No Decay Undepleted	χ/Q (sec/m^3) No Decay Depleted	χ/Q (sec/m^3) 2.26 Day Decay Undepleted	χ/Q (sec/m^3) 8.00 Day Decay Depleted	D/Q (m^{-2})
ANIMAL FOR MEAT	NNE	3.39	5449	1.00E-07	8.10E-08	1.00E-07	8.00E-08	5.10E-10
ANIMAL FOR MEAT	NE	1.11	1792	4.60E-07	4.00E-07	4.60E-07	4.00E-07	3.60E-09
ANIMAL FOR MEAT	ENE	1.22	1957	3.90E-07	3.40E-07	3.90E-07	3.40E-07	2.20E-09
ANIMAL FOR MEAT	E	2.78	4469	1.00E-07	8.40E-08	1.00E-07	8.30E-08	2.90E-10
ANIMAL FOR MEAT	ESE	3.12	5017	3.50E-07	2.70E-07	3.40E-07	2.70E-07	6.10E-10
ANIMAL FOR MEAT	SE	1.47	2373	2.40E-06	2.10E-06	2.40E-06	2.10E-06	4.50E-09
ANIMAL FOR MEAT	SSE	1.09	1749	1.90E-06	1.70E-06	1.90E-06	1.70E-06	3.80E-09

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

RAI Letter No. 014

NRC Technical Review Branch: Health Physics Branch (CHPB)

Reference NRC RAI Number(s): RAI 11.03-3

NRC RAI:

The population data presented by the applicant is inconsistent with the guidance of NUREG/CR-4653, "GASPAR II – Technical Reference and User Guide." The applicant specified that the population data inputs for their GASPAR II analysis were based on the year 2056 population data in FSAR Tables 2.1-203 and 2.1-204. These tables provide population data for nine (9) distance interval, in terms of kilometers (km). NUREG /CR-4653, "GASPAR II – Technical Reference and User Guide," p. 2-9 specifies that "The 50-mi population distribution is defined for 160 area elements bounded by 16 compass direction sections (N, NNE, etc." and 10 distance intervals (1, 2, 3, 4, 5, 10, 20, 30, 40, and 50 mi)." This NUREG guidance is also consistent with the guidance of RG 1.109, Appendix D. The data set for each compass direction should contain data for the 10 distance intervals. It is not obvious how the applicant performed their GASPAR II analysis given this population data. The applicant needs to address how the population data inputs provided in FSAR Tables 2.1-203 and 2.1-204 were applied to provide consistent population dose assessments in accordance with regulatory guidance, or justify an alternative approach.

Duke Energy Response:

The population distribution for each of the 22½-degree radial sectors centered on the 16 cardinal compass directions for radial distances of 1, 2, 3, 4, 5, 10, 20, 30, 40, and 50 miles were calculated based on Tables 2.1-203 and 2.1-204 from the William States Lee III FSAR, which gives the projected populations in sectors of 2, 4, 6, 8, 10, 16, 40, 60, and 80 km. To adjust the population distribution to the radial sectors given in miles, the population distributions are assumed to be uniform throughout the given sectors in kilometers. Then, the population distributions for the radial segments in miles were adjusted based on the ratio of land area of that radial segment that falls within the different radial segments in kilometers to the total land area in each relevant radial segment in kilometers. A sample calculation is given below.

Land Area within a 0 – 2 km Radius = 4.85 mi^2

2056 Projected Population within a 0 – 2 km radius in the North Sector = 28 people

Land Area within a 0 – 1 mi Radius = 3.14 mi^2

$$\text{2056 Projected Population within a 0 - 1 mi Radius in the North Sector} = 28\left(\frac{3.14}{4.85}\right) = 18 \text{ people}$$

The 2056 projected population within a 1 – 2 mi radius in the north sector consists of the remaining 10 people from the 0 – 2 km radial sector as well as a portion of the 124 people in the 2 – 4 km radial distance in the north sector. This portion is based on the ratio of the land area in a

1 – 2 mi radius that lies within a 2 – 4 km radius to the land area within a 2 – 4 km radius of the plant. This ratio is calculated below.

Land Area within a 2 – 4 km Radius = 14.56 mi^2

Land Area within a 1 – 2 mi Radius = 9.42 mi^2

$$\text{Ratio} = \frac{9.42 - (4.85 - 3.14)}{14.56} = 0.53$$

2056 Projected Population within a 1 - 2 mi Radius in the North Sector = $10 + 124(0.53) = 76$ people

The population distributions for the remaining sectors were calculated using this same methodology. The projected population for the year 2056 in each radial segment in miles from the WLS site is given in the table below.

2056 Projected Population for each Radial Segment in Miles

Direction	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	18	76	160	314	637	5,150	29,277	30,148	31,255	65,569
NNE	16	63	120	173	205	2,690	22,173	42,941	69,784	96,132
NE	15	48	73	93	131	1,431	48,023	65,908	84,724	127,831
ENE	12	23	29	71	208	2,108	32,207	105,315	331,190	783,607
E	11	27	29	33	64	1,372	24,844	95,125	246,892	468,889
ESE	3	22	42	71	120	1,045	18,848	54,700	83,971	52,928
SE	1	20	31	37	62	1,866	3,750	10,907	16,433	9,222
SSE	7	39	39	18	25	378	1,779	2,497	3,000	3,764
S	10	51	57	53	103	274	2,283	2,956	3,812	6,455
SSW	7	36	52	55	59	422	10,582	8,888	7,851	23,872
SW	3	47	80	81	52	654	4,415	10,538	22,039	38,601
WSW	0	52	87	96	113	2,790	38,221	65,171	111,733	193,920
W	1	54	141	292	552	7,584	29,102	57,774	89,520	107,391
WNW	3	53	197	369	459	25,572	14,405	17,530	19,043	28,049
NW	4	37	109	199	272	3,166	10,825	24,816	32,221	11,536
NNW	8	104	214	329	462	2,664	13,729	13,523	13,446	30,148

The total population within 50 miles projected to the year 2056 is 4,195,333 people based on the table above. Due to rounding, this value is two people less than the total population projected to 2056 based on the radial distances in km. The population distribution in the table above was used in the GASPAR II code to calculate the population doses due to routine gaseous effluents.

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

None

Attachments:

None