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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. 721 and 722)
Ltr # WLG2008.11-16

Reference: Letter from Brian Hughes (NRC) to Peter Hastings (Duke Energy), *Request For Additional Information Letter No. 034 Related To SRP Section 02.04.13 for the William States Lee III Units 1 and 2 Combined License Application*, dated October 5, 2008

This letter provides the Duke Energy responses to the Nuclear Regulatory Commission's requests for additional information (RAIs) included in the referenced letter.

The 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

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Enclosures:

1) Duke Energy Response to Request for Additional Information Letter 034, RAI 02.04.13-001
2) Duke Energy Response to Request for Additional Information Letter 034, RAI 02.04.13-002

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.

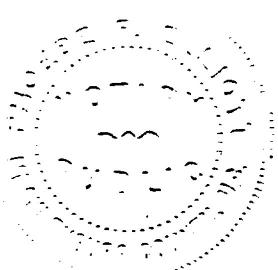
Bryan J. Dolan
Bryan J. Dolan

Subscribed and sworn to me on December 3, 2008

Phoebe P. Elliott
Notary Public

My commission expires: June 26, 2011

SEAL



xc (w/o enclosures):

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):

Brian Hughes, Senior Project Manager, DNRL

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

RAI Letter No. 034
NRC Technical Review Branch: Siting and Accident Consequences Branch (RSAC)
Reference NRC RAI Number(s): 02.04.13-001

NRC RAI:

BTP 11-6, B.4. "Specifications on Tank Waste Radioactivity Concentration Levels," specifies an evaluation of the proposed technical specification limiting the radioactivity content of the tank to ensure that the technical specification is consistent with the safety evaluation. No technical specification limits were proposed on the radioactivity content of the effluent holdup tanks. The applicant should provide the technical specification limits in the FSAR or justify why no limits are needed.

The complete analysis for pathways other than drinking water, as discussed in FSAR section 2.4.13-1, should be evaluated to determine if the results of the concentration limits in pathways such as fish and irrigation (which may concentrate the activities in uptake) would be less than 10 CFR Part 20, Appendix B, Table 2, Column 2. The applicant should analyze these additional pathways in the FSAR or justify why they were excluded.

Duke Energy Response:

NRC Branch Technical Position 11-6, "Postulated Radioactive Releases Due To Liquid-Containing Tank Failures" Section B.4, states "The reviewer will evaluate the proposed technical specification limiting the radioactivity content (becquerel, curie) of liquid-containing tanks to ensure that the technical specification is consistent with the safety evaluation. Chapter 16 of the SRP identifies the requirements for this technical specification. The radioactivity content (becquerel, curie) is based on that quantity which would not exceed the concentration limits of 10 CFR Part 20, Appendix B, Table 2, Column 2, at the nearest potable water supply, located in an unrestricted area, in the event of an uncontrolled release of the tank's contents." The referenced Chapter 16 of the SRP indicates that the Technical Specification should be based on the improved Standard Technical Specifications (STS) identified for Westinghouse plants in NUREG-1431. The pertinent liquid storage tank radioactivity is STS 5.5.12, "Explosive Gas and Storage Tank Radioactivity Monitoring Program."

The STS for this program provides controls for the quantity of radioactivity contained in **unprotected outdoor liquid storage tanks** and indicates that the program shall include a "surveillance program to ensure that the quantity of radioactivity contained in all **outdoor liquid radwaste tanks that are not surrounded by liners, dikes, or walls, capable of holding the tanks' contents and that do not have tank overflows and surrounding area drains connected to the [Liquid Radwaste Treatment System]** is less than the amount that would result in concentrations less than the limits of 10 CFR 20, Appendix B, Table 2, Column 2, at the nearest potable water supply and the nearest surface water supply in an unrestricted area, in the event of an uncontrolled release of the tanks' contents." (emphasis added)

Neither the AP1000 design, nor the site specific design, has any tanks that meet the above identified criteria for inclusion in the Technical Specifications, i.e., the design does not include any outdoor liquid radwaste tanks that are not surrounded by liners, dikes, or walls capable of holding the tanks' contents and that do not have tank overflows and surrounding area drains connected to the liquid radwaste treatment system. Thus, there was no such specification included in the AP1000 Generic Technical Specifications or in the site specific Technical Specifications included in the COL application.

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. 034

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

Reference NRC RAI Number(s): 02.04.13-002

NRC RAI:

SRP 2.4.13, under SRP Acceptance Criteria #5 references Branch Technical Position BTP 11-6 which provides guidance in assessing potential release of radioactive liquids at the nearest potable water supply, located in an unrestricted area, for direct human consumption or indirectly through animals, crops, and food processing. BTP 11-6 further states the evaluation of the release considers the use of water for direct human consumption or indirectly through animals (livestock watering), crops (agricultural irrigation), and food processing (water as an ingredient). The results of the analysis for Lee FSAR 2.4.13 responding to WLS COL 2.4-5 were presented in Table 2.4.13-204, "Radionuclide Concentration At Nearest Drinking Water Source In An Unrestricted Area Due To Effluent Holdup Tank Failure." Tritium was the only nuclide listed on the Table. The cutoff for inclusion in the table was a concentration above 1.0E-5 microcuries/ml.

The analysis does not include a discussion of pathways other than drinking water. The analysis should discuss these other pathways, especially the pathways such as fish and crop irrigation that may result in concentration of the source term. The cutoff concentration for inclusion in Table 2.4.13-204 should [be] evaluated to determine if it is appropriate considering the potential concentration of the source term via other uptake pathways. There are likely several radionuclides that were cut off the list at just below the 1.0E-5 microcuries/ml value. Either discuss other pathways, or justify why they need not be included.

Duke Energy Response:

The cutoff for inclusion in Table 2.4.13-204 is a sum of fractions contribution of greater than or equal to 1.0E-05, rather than concentration, as noted in FSAR Table 2.4.13-204, Revision 0. Table 2.4.13-204 was revised to include a total of five radionuclides as part of the response to RAI 02.04.13-004 (Reference 1), and is provided as Attachment 1 for information.

The annual precipitation for the Lee site has been determined to be 1.23 meters per year (48.41 inches per year) (Reference 2) and is sufficient to eliminate the need for additional irrigation. Also, no commercial crop irrigation has been identified in the Lee area.

Likewise, no commercial fishing has been identified in the area. As demonstrated below, any recreational fishing performed does not provide enough of an aquatic food supply to provide significant dose as a result of ingestion.

Regardless, Duke has performed a basic evaluation of the dose consequences for these two pathways to demonstrate that, in the unlikely event of a liquid effluent tank failure, there would be no significant dose due to these pathways. The evaluation is documented below.

According to Regulatory Guide 1.109, with similar discussion in NUREG-1555, Section 5.4.1, a pathway is considered significant if a conservative evaluation yields an additional dose increment equal to or greater than 10 percent of the total from all pathways.

Values for the infiltration factor for irrigation, contamination fraction, transfer factors, ingestion rates, and dose conversion factors are taken from the RESRAD-OFFSITE default values (Reference 3), which in turn use the Environmental Protection Agency's Federal Guidance Report 11 (FGR 11). Site-specific values (References 2 and 4) are used for saturated zone hydraulic conductivity (441.8 m/yr), bulk dry soil density (1.59 g/cm^3), and the source water Tritium (H^3) concentration (1.07E+05 pCi/L).

The annual dose for these two pathways is calculated below for Tritium (H^3), which accounts for greater than 99% of the detectable concentration in the receptor body (Reference 4), and is therefore the primary dose contributor that appears in the water body receptor.

Fish Ingestion

The formula for calculating the dose due to the fish ingestion pathway is a simple factor of the consumption rate, the radionuclide concentration, the transfer factor and the dose conversion factor and is presented as Equation 1.

Equation 1 – Fish Ingestion Dose Consequence

$$T_d = I * C_f * R_c * T_f * D_f$$

Where:

- T_d = Total annual dose consequence in mrem per year
- I = Food consumption in kg per year
- C_f = Contaminated food fraction
- R_c = Radionuclide concentration in picocuries per liter
- T_f = Radionuclide transfer factor
- D_f = Dose conversion factor in millirem per picocurie

Table 1 – Fish Ingestion Parameter Values

Parameter	Fish Ingestion	Reference
Food consumption (I)	20.6 kg/yr	Reference 3
Contamination Fraction (C_f)	0.5	Reference 3
Transfer Factor for H^3 (T_f)	1 pCi/kg/pCi/L	Reference 3
H^3 concentration in water (R_c)	1.07E+05 pCi/L	Reference 4
Dose Conversion Factor for H^3 (D_f)	6.4E-08 mrem/pCi	Reference 3
Total Dose from Fish Ingestion	**0.071 mrem/yr**	Calculated from Equation 1

Plant Ingestion

Calculating the dose due to plant ingestion begins with calculating the concentration of H^3 in the soil following irrigation. Using the monthly average precipitation rate as derived from the annual precipitation rate and conservatively assuming 2.54 additional centimeters per month (1 additional inch per month) of irrigation water from the receptor water body gives a total plant water availability of 153.48 centimeters per year (2.54 * 12 +123) or 12.79 centimeters per month. This means the irrigation fraction (I_f) is calculated to be I_f = 2.54/12.79 = 1.99E-01.

In order to calculate the soil water concentration, we first establish a saturation ratio using Equation 2 below, which is equation E.7 in the RESRAD Version 6 User manual (Reference 5).

Equation 2 – Saturation Ratio

$$R_s = \left(\frac{I}{K_{sat}}\right)^{\frac{1}{2b+3}}$$

Where:

R_s = Saturation ratio
I = Infiltration rate in meters per year
K_{sat} = Saturated zone hydraulic conductivity in meters per year
b = Soil specific exponential factor for sandy loam

Table 2 – Saturation Ratio Parameter Values

Parameter	Value	Reference
Infiltration rate (I) (1.23*0.8)	0.984 m/yr	Reference 3
Saturated zone hydraulic conductivity (K_{sat})	441.5 m/yr	Reference 2

Parameter	Value	Reference
Soil specific exponential factor for sandy loam (b)	4.90	Reference 5
Saturation Ratio (R_s)	**0.621**	Calculated from Equation 2

A soil makeup similar to the contaminated zone was assumed. As such, the soil density is 1.59 g/cm^3 and the total porosity is 0.08 which are site-specific values used in the accident evaluation (see response to RAI 02.04.13-007 (Reference 1)).

The concentration of H^3 in the soil water following irrigation is calculated using Equation 3 which is from Reference 5 equation L.5, adjusted for the irrigation fraction.

Equation 3 – Soil Water Concentration

$$W_{H3} = \frac{P_b * S_{H3}}{P_t * R_s} * I_f$$

Where:

W_{H3} = Concentration of H^3 in the soil water in pCi/cm^3
P_b = Bulk density of the soil in g/cm^3
S_{H3} = Concentration of H^3 in soil in pCi/g
P_t = Total porosity of the soil
R_s = Saturation ratio from Equation 2 above
I_f = Irrigation fraction

Table 3 – Soil Water Concentration Parameter Values

Parameter	Value	Reference
Bulk density of soil (P_b)	1.59 g/cm^3	Reference 2
Concentration of H^3 in soil (S_{H3})	1.07E+02 pCi/g	Reference 4
Total porosity of soil (P_t)	0.08	Reference 2
Saturation ratio (R_s)	0.621	Calculated from Equation 2
Irrigation fraction (I_f)	1.99E-01	Calculated
Concentration of H^3 in the soil water in pCi/cm^3 (W_{H3})	**6.81E+02 pCi/cm^3**	Calculated from Equation 3

For simplicity, the concentration of H^3 in soil is conservatively assumed to be equal to the receptor water body concentration resulting from the postulated release. Consequently the H^3 concentration is converted from picocuries per liter to picocuries per gram by dividing the receptor water body concentration listed in Reference 4 by 1,000. In reality, the concentration would be much lower because of dilution in the soil, soil pore space, runoff, and other factors.

The dose due to plant ingestion is calculated by Equation 4 assuming the plant water content has a density of 1 g/cm^3.

Equation 4 – Plant Ingestion Dose Consequence

$$T_d = W_{H3} * P_c * R * C_f * D_f$$

Where:

- T_d = Total dose from plant ingestion in mrem per year
- W_{H3} = Concentration of H^3 in the soil water, from Equation 3 above in pCi/cm^3
- P_c = Plant water ratio in Kg (wet plant) vs. Kg (dry soil)
- R = Plant ingestion rate in g per year
- C_f = Plant contamination fraction
- D_f = Dose conversion factor for H^3 (6.4E-08 mrem per year per pCi)

Table 4 – Plant Ingestion Parameter Values

Parameter	Value	Reference
H^3 soil water concentration (W_{H3})	6.81E+02 pCi/cm^3	Calculated from Equation 3
Plant water ratio (P_c)	0.8	Reference 5 Table L.4
Plant ingestion per year (R)	14,000 g	Reference 3
Plant Contamination Fraction (C_f)	0.5	Reference 3
Dose Conversion Factor for H^3 (D_f)	6.4E-08 mrem/pCi	Reference 3
Total Dose from Plant Ingestion (T_d)	**0.244 mrem/yr**	Calculated from Equation 4

The total dose consequence from the fish and plant ingestion pathways is:

Table 5 – Total Dose Consequence

Pathway	Annual Dose (mrem/yr)	Reference
Fish Ingestion	0.071	Calculated from Equation 1
Plant Ingestion	0.244	Calculated from Equation 4
Total Dose Consequence	**0.315**	Calculated

As is evident in Table 5, the dose consequence for H^3 is well below 1 millirem per year. By comparison, 10 CFR 20 Appendix B Table 2 Column 2 values are based on an annual exposure of 50 millirem per year. The purpose of the accident evaluation was not to calculate the dose consequence, but rather the concentration in the receptor water body, therefore the direct comparison of the dose consequence is difficult. However, comparing the total of the fish and plant ingestion dose consequence to the basis for 10 CFR 20 Appendix B Table 2 Column 2, the dose consequence is approximately 0.63 percent (0.315/50) of the 10 CFR 20 Appendix B Table 2 Column 2 basis value.

Because of the depth of the postulated release, other potential pathways, such as inhalation and direct gamma exposure, are eliminated from consideration.

References:

1) Dolan to NRC Document Control Desk, Partial Response to Request For Additional Information, (RAI No. 828), Ltr# WLG2008.11-07, Dated November 25, 2008.
2) FSAR Table 2.4.13-203, as revised by Reference 1
3) RESRAD-OFFSITE Version 2.0 Default Values
4) FSAR Table 2.4.13-204, as revised by Reference 1
5) RESRAD Version 6 User Manual

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

None

Attachment:

1) FSAR Table 2.4.13-204, as revised previously by RAI 02.04.13-004 response.

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

Attachment 1 to RAI 2.4.13-002

FSAR Table 2.4.13-204 as Revised by
RAI 02.04.13-004 Response

TABLE 2.4.13-204
RADIONUCLIDE CONCENTRATION AT NEAREST DRINKING WATER SOURCE IN AN UNRESTRICTED AREA
DUE TO EFFLUENT HOLDUP TANK FAILURE

Detected Radionuclide	Radionuclide Concentration	10 CFR 20 Appendix B Table 2 Column 2	Sum of Fractions Contribution*
	microcuries/ml	microcuries/ml	
Ag-110m	6.25E-10	6.00E-06	1.04E-04
Ce-144	3.09E-10	3.00E-06	1.03E-04
H-3	1.07E-04	1.00E-03	1.07E-01
Mn-54	2.40E-09	3.00E-05	8.01E-05
Pr-144	3.09E-10	2.00E-05	1.55E-05
			Sum of Fraction Unity Rule Value
			1.08E-01

*Those radionuclides with Sum of Fractions Contribution less than 1.0E-05 are negligible and not included in the table.