LeeRAIsPEm Resource

From: Brian Hughes
Sent: Monday, September 22, 2008 7:25 AM
To: LeeRAIsPEm Resource
Subject: LEE-RAI-LTR-017.doc REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 012 RELATED TO SRP SECTION 2.3.4 FOR THE WILLIAM STATES LEE III UNITS 1 AND 2 COMBINED LICENSE APPLICATION
Attachments: LEE-RAI-LTR-017.doc

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From: Brian Hughes

Created By: Brian.Hughes@nrc.gov

Recipients:
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September 19, 2008

Mr. Peter S. Hastings, P.E.
Licensing Manager, Nuclear Plant Development
Duke Energy
526 South Church Street
Charlotte, NC 28201-1006

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 012 RELATED TO SRP SECTION 2.3.4 FOR THE WILLIAM STATES LEE III UNITS 1 AND 2 COMBINED LICENSE APPLICATION

Dear Mr. Hastings:

By letter dated December 12, 2007, as supplemented by letters dated January 28, 2008, February 6, 2008 and February 8, 2008, Duke Energy submitted its application to the U. S. Nuclear Regulatory Commission (NRC) for a combined license (COL) for two AP1000 advance passive pressurized water reactors pursuant to 10 CFR Part 52. The NRC staff is performing a detailed review of this application to enable the staff to reach a conclusion on the safety of the proposed application.

The NRC staff has identified that additional information is needed to continue portions of the review. The staff's request for additional information (RAI) is contained in the enclosure to this letter.

To support the review schedule, you are requested to respond within 30 days of the date of this letter. If changes are needed to the final safety analysis report, the staff requests that the RAI response include the proposed wording changes.

If you have any questions or comments concerning this matter, you may contact me at 301-415-6582.

Sincerely,

/**RA**/

Brian Hughes, Senior Project Manager
AP1000 Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket Nos. 52-018
52-019

Enclosure:
Request for Additional Information

CC: see next page

P.Hastings

If you have any questions or comments concerning this matter, you may contact me at 301-415-6582.

Sincerely,

/**RA**/

Brian Hughes, Senior Project Manager
AP1000 Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket Nos. 52-018
52-019

eRAI Tracking No. 820, 821,822,823,824, 825, 826, 828

Enclosure:
Request for Additional Information

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NAME	MThaggard	NTiruneh	SBrock*	BHughes*
DATE	7/11/08	7/10/08	08/31/08	9/19/08

*Approval captured electronically in the electronic RAI system.

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Request for Additional Information No. 826 Revision 0

9/19/2008

William States Lee III, Units 1 and 2
Duke Energy Carolinas, LLC
Docket No. 52-018 and 52-019
SRP Section: 02.04.12 - Groundwater
Application Section: 2.4

QUESTIONS

02.04.12-1

The applicant needs to describe the process followed to determine the conceptual models used to establish subsurface site characteristics related to groundwater to ensure that plausible conceptual models that are adequately conservative have been identified.

02.04.12-2

In Section 2.4.12.3.3, quantify the distribution of well depths in the region. If there are any wells deeper than 150 ft deep, provide the number and whether any are within a mile of the plant boundary. If the modern trend is for people to abandon wells and convert over to municipal water from Draytonville (or elsewhere), provide a reference.

02.04.12-3

One of the goals of the one-year monitoring period portrayed by Figure 2.4-12-203 is to demonstrate how groundwater height and flow direction responds to precipitation spatially and temporally. Provide monthly precipitation amounts with the figure (i.e., for April 2006 through April 2007). Explain how the precipitation received during this period related to normal monthly amounts. In addition, characterize the precipitation conditions for the 7 months (i.e., Oct 2005 to April 2006) previous to the monitoring period to provide context to the start of the observation period.

02.04.12-4

Explain how effective porosity was determined. Define the terms used and identify the raw data or references such that an independent determination can be made. Corroborate values determined for the Lee site with published values used to represent similar settings elsewhere in the Piedmont region.

02.04.12-5

Identify in Table 2.4.12-203 which parameters were measured and which were estimated. Provide data traceability for all parameters. Provide clarification of the methods used to estimate parameters.

02.04.12-6

The high-water mark in the excavation (579 ft) was proposed as an indicator of the maximum groundwater height that would be expected. Being able to use that mark depends, in part, on understanding the historical conditions that affected the water level. Specify in which month and year pumping ceased at the former Cherokee Nuclear site and in which month and year pumping resumed at the Lee Nuclear Site. For the interval when pumping did not occur, provide the annual precipitation amounts for each year and their deviation from normal. Describe what is known about whether the site owners altered the water levels in the excavation. Section 2.5.4.6.1 states that the long term groundwater elevation is expected to fluctuate over time between 584 and 574, i.e., 579 +/- 5 ft. Also, 579 ft will be 10.5 ft below final grade of 589.5 ft. Figure 2.4.12-203 shows that some wells with groundwater within 10-15 ft of the surface responded up to 5 ft during a six-month period in 2007. Explain whether a similar seasonal response is or is not expected in the vicinity of the nuclear island. Explain how such seasonal variations alter groundwater flow paths and how those variable flow paths were evaluated with respect to the transport calculations that support Section 2.4.13.

02.04.12-7

Figure 2.4.12-202 shows the radius of influence of Cherokee construction dewatering. Specify which years of groundwater data were used to establish this zone. Identify the location of the Mullinax well. If it is not in the figure, describe in the text where it is located (distance and direction) relative to the excavation. Identify the maximum depth of the Mullinax well, the screened zone interval, and the geologic condition of the screened zone.

02.04.12-8

Explain how Figure 2.4.12-204 (sheet 8), was produced. Because there are no groundwater level data for conditions uninfluenced by dewatering, there is significant uncertainty regarding the exact nature of the future groundwater surface. Therefore, identify alternative conceptual models of the future groundwater surface that bracket the possible worst case conditions that would cause flow to proceed in at least four directions: north to Holdup Pond A and the river; east to Makeup Pond A and the river; west to Holdup Pond B, it's dam, and the river; and due north of Unit 1 toward the river (along a path to the west of Holdup Pond A. Identify the groundwater transport pathway for each combination of flow direction and Unit and calculate the groundwater gradient, velocity, and travel time. If the future groundwater surface is to be managed, such as through the use of surface features, monitoring, and conduits, explain how such management will occur and what the goals of such management will be.

02.04.12-9

Update Figure 2.4.12-201 to include an outline of the Lee Nuclear Island (for reference purposes) and the locations of springs and seeps. Differentiate between the springs and seeps that existed before the original Cherokee construction and the current springs and seeps.

02.04.12-10

FSAR Figure 2.4.12-207 displays conductivity data as a function of depth. The figure combines data from two separate time periods (1970s and 2006) that have distinctly different surface elevations (and thus different depths) because of the geoengineering of the site. Describe how the depth data have been adjusted or rectified to reflect the correct elevation in the figure for the conductivity data points. Explain any added “noise” and “bias” to the K versus depth comparison caused by the depth differences.

02.04.12-11

Provide a discussion of the post-operational monitoring plan. Include in that discussion how the plan will be designed to reduce uncertainties in the groundwater flow paths used for Section 2.4.13 of the FSAR.

02.04.12-12

One potential groundwater flow pathway is along the top of the groundwater surface, particularly if the leaked solution is buoyant or neutrally buoyant. Under these conditions, flow would occur laterally through the fill to a point where it could exit directly into a surface water body or along one of the slopes above the water bodies. If this scenario is not valid, explain why. Otherwise, add this pathway(s) to the list of alternative pathways to be considered in Section 2.4.13.

02.04.12-13

Figure 2.4.12-205 shows estimates of groundwater gradients (0.034 and 0.036) that are slightly different than values (0.033 and 0.035) calculated from the reported measurements (i.e., max groundwater elevation 579 ft; holdup pond A 535 ft; river 511 ft; distance to holdup pond A 1340 ft; distance to river 1935 ft). Confirm which values are correct.

02.04.12-14

FSAR Figure 2.4.12-204, Sheet 8, shows the projected post-development water table. This water table is dominated by two groundwater divides, one west and one east of the planned nuclear power units and trending generally north and south. These divides apparently diverge from a groundwater high at a point about 2,500 feet south of Unit 1. Between the divides, the projected water table implies that groundwater flows generally northward and converges on Hold-Up Pond A.

Groundwater conditions were, however, significantly different before construction associated with the Cherokee Nuclear Station. According to the Cherokee Nuclear Station Environmental Report, Vol. 1 (1974), the pre-construction water table (Figure 2.5.4-2) had a western groundwater divide whose location was similar to that of the western groundwater divide projected for the Lee plant (FSAR Figure 2.4.12-204). A second groundwater divide diverged from the western divide at a point located about 800 feet south-southwest of the proposed Lee Unit 1 reactor containment. This second divide ran to the northeast between the locations of the proposed Lee Units 1 and 2.

The difference between the Cherokee (pre-construction) and Lee (post-construction) groundwater configurations is potentially highly significant. For example, if the actual configuration were more like the Cherokee case, then a release to groundwater at Lee Unit 2 would flow southeastward toward Make-Up Pond A rather than northward as is hypothesized in the Lee FSAR.

Please provide a detailed discussion of the projected post-development water table, the factors that govern its configuration, and why the post-construction water table is expected to differ significantly from the observed pre-construction water table. Staff believes that hydrogeological modeling will be necessary to examine these issues in sufficient detail; if modeling is not used, its omission should be clearly justified. To the extent that the discussion is based on the similarity of the projected water table to the post-construction topography, provide a detailed discussion, with appropriate analysis and literature references, to support this approach.

Request for Additional Information No. 820 Revision 0

9/19/2008

William States Lee III, Units 1 and 2
Duke Energy Carolinas, LLC
Docket No. 52-018 and 52-019
SRP Section: 02.04.02 - Floods
Application Section: 2.4

QUESTIONS

02.04.02-1

The applicant needs to describe the process followed to determine the conceptual models for floods from local intense precipitation, probable maximum flood in the drainage area upstream of the site, surges, seiche, tsunami, seismically-induced dam failures, landslides, and ice effects to ensure that the design-basis flood is based on the most conservative of plausible conceptual models.

02.04.02-2

Provide input files used in the HEC-RAS analysis described in FSAR Section 2.4.2.3. Provide details of the iterative process used with the HEC-RAS model to determine water surface elevations during the local intense precipitation event described in FSAR

Section 2.4.2.3. In Table 2.4.2-204, how were the times of concentration for the site drainage areas determined? Provide the locations of safety-related structures where the maximum water surface elevations for each of the site drainage areas in Table 2.4.2-204 are presented.

Request for Additional Information No. 821 Revision 0

9/19/2008

William States Lee III, Units 1 and 2
Duke Energy Carolinas, LLC
Docket No. 52-018 and 52-019
SRP Section: 02.04.03 - Probable Maximum Flood (PMF) on Streams and Rivers
Application Section: 2.4

QUESTIONS

02.04.03-1

The applicant needs to describe the process followed to determine the conceptual models for floods in streams and rivers and in site drainage system to ensure that the design-basis flood is based on the most conservative of plausible conceptual models.

02.04.03-2

Describe the relevance of HMR 53 for determining the PMP in the Broad River basin as presented in FSAR Section 2.4.3.1.

02.04.03-3

Explain why unit hydrographs calibrated using observed runoff events produced by precipitation much smaller than the PMP event in the Broad River basin is appropriate to use for estimation of the PMF in the basin, or update the PMF analysis with techniques recommended by other federal agencies or those used in standard practice.

02.04.03-4

In FSAR Section 2.4.2.2, Flood Design Considerations, and in Table 2.0-201, Comparison of AP1000 DCD Site Parameters and Lee Nuclear Station Units 1 & 2 Site Characteristics, the maximum flood water surface elevation at the site is stated as 583.85 ft MSL. In FSAR Section 2.4.3.5, Water Level Determinations, the maximum water surface elevation corresponding for McKowns Creek/Make-Up Pond B under conservative PMF conditions is stated as 589.40 ft MSL, followed by a discussion of the need to install a debris collection boom near the Make-Up Pond B spillway. Clarify which of the two analyses forms the basis for selection of the design-basis flood water surface elevation at the Lee Nuclear Station site. Why is installation of a debris collection boom considered? If it is required to maintain the flood water surface

elevation below the site grade, would the debris collection boom be considered a safety-related structure or system?

02.04.03-5

Wind-induced wave heights were not estimated in the determination of the design-basis flood. Provide an update to the design-basis flood analysis that accounts for wind-induced waves. Provide wind-induced wave heights for floods other than the design-basis flood to demonstrate that the selected design-basis flood mechanism is appropriately chosen.

Request for Additional Information No. 822 Revision 0

9/19/2008

William States Lee III, Units 1 and 2
Duke Energy Carolinas, LLC
Docket No. 52-018 and 52-019
SRP Section: 02.04.04 - Potential Dam Failures
Application Section: 2.4

QUESTIONS

02.04.04-1

The applicant needs to describe the process followed to determine the conceptual models for flood waves from severe breaching of upstream dams, domino-type or cascading failures of dams, dynamic effects on safety-related SSCs, loss of safety-related water supplies, sediment deposition and erosion, and failure of on-site water control or storage structures to ensure that the most conservative of plausible conceptual models has been identified.

02.04.04-2

Provide wind-induced wave heights coincident with the controlling dam breach flooding scenario described in FSAR Section 2.4.4.

Request for Additional Information No. 823 Revision 0

9/19/2008

William States Lee III, Units 1 and 2
Duke Energy Carolinas, LLC
Docket No. 52-018 and 52-019
SRP Section: 02.04.05 - Probable Maximum Surge and Seiche Flooding
Application Section: 2.4

QUESTIONS

02.04.05-1

The applicant needs to describe the process followed to determine the conceptual models for probable maximum hurricane, probable maximum wind storm, seiche and resonance, wave runup, and sediment erosion and deposition to ensure that the most conservative of plausible conceptual models has been identified.

02.04.05-2

Provide an assessment of meteorologically and seismically-induced seiches in Make-Up Ponds A and B.

Request for Additional Information No. 824 Revision 0

9/19/2008

William States Lee III, Units 1 and 2
Duke Energy Carolinas, LLC
Docket No. 52-018 and 52-019
SRP Section: 02.04.06 - Probable Maximum Tsunami Flooding
Application Section: 2.4

QUESTIONS

02.04.06-1

The applicant needs to describe the process followed to determine the conceptual models for probable maximum tsunami, tsunami propagation, wave runup, inundation, and drawdown, hydrostatic and hydrodynamic forces, debris and water-borne projectiles, and sediment erosion and deposition to ensure that the most conservative of plausible conceptual models has been identified.

02.04.06-2

Provide an assessment of landslide and slope-failure potentials on the shores of Make-Up Ponds A and B. Provide an assessment of tsunami-like waves that may be generated by these landslides and slope failures resulting in bank material falling in Make-Up Ponds A and B. Describe the potential of these tsunami-like waves to inundate the site grade, 590 ft MSL.

Request for Additional Information No. 825 Revision 0

9/19/2008

William States Lee III, Units 1 and 2
Duke Energy Carolinas, LLC

Docket No. 52-018 and 52-019
SRP Section: 02.04.11 - Low Water Considerations
Application Section: 2.4

QUESTIONS

02.04.11-1

Please describe the process followed to determine the conceptual models for low water from drought and from other phenomena and the effects of low water on safety-related water supplies under possible water use limits to ensure that the site characteristics related to low-water events are based on plausible conceptual models that are adequately conservative.

02.04.11-2

FSAR Section 2.4.11.5 states: "Make-Up Pond B has sufficient capacity to support full power operations for approximately 35 days. Make-Up Pond A has sufficient capacity to support full power operations for an additional 11 days. Make-Up Pond A has sufficient capacity to conduct a normal plant shutdown." Describe "normal plant shutdown." Describe the extent to which any safety-related water is needed during normal plant shutdown.

Request for Additional Information No. 828 Revision 0

9/19/2008

William States Lee III, Units 1 and 2
Duke Energy Carolinas, LLC
Docket No. 52-018 and 52-019
SRP Section: 02.04.13 - Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters
Application Section: 2.4

QUESTIONS

02.04.13-3

The applicant needs to describe the process followed to determine the conceptual models for surface and subsurface pathways and for the site characteristics that affect transport of radioactive liquid effluents in ground and surface waters to ensure that the most conservative of plausible conceptual models has been identified.

02.04.13-4

Explain why the travel distance in Section 2.4.12 is 1935 ft (589.8 m) and it is 1847 ft (562.86 m) in Table 2.4.13-203.

02.04.13-5

In Table 2.4.13-203, effective porosity is set equal to saturated porosity in the calculation of contaminant transport within RESRAD. In contrast, in Section 2.4.12, the actual effective porosity (not the saturated porosity) is used to calculate travel time. Explain why different values are used in each section and, if for conservativeness, explain why each is conservative. If each is conservative for a different reason (e.g., in one case, to maximize volume; in the second, to minimize travel time), evaluate and present the results of both cases.

02.04.13-6

The contaminated zone hydraulic conductivity is set equal to 441.5 m/yr, which is 1.4 E-3 cm/s, which suggests the contaminated zone is PWR. This value is called the conservative value in Table 2.4.12-204. FSAR text on p. 2.4-67 says the highest measured hydraulic conductivity in the weather rock is used. From Table 2.4-12-204, the highest value for PWR is 9.89E-3 cm/s. Explain which value was intended.

02.04.13-7

The value for the porosity of the contaminated zone in Table 2.4.12-204 is 0.41, which suggests the material is fill. The conductivity value is 441.5 m/yr (1.4 E-3 cm/s), which suggests the material is PWR, which has a porosity of 0.44. Define the nature of the contaminated zone.

02.04.13-8

Table 2.4.13-203 states that the bulk density of the contaminated zone is 1.59 g/cm3. The data in Table 2.4.12-203 suggest that the bulk density of PWR is 1.80 g/cm3 (e.g., (140/62.4)-0.44 = 1.80). Explain how and from what data bulk density was calculated.

02.04.13-9

Section 2.4.13 mentions dispersion coefficients, but Table 2.4.13-203 does not show dispersion coefficient values. Provide the dispersion coefficients used for each material type.

02.04.13-10

Section 2.4.13 describes K_d values as being dependent on the texture of soils (sand, loam, clay, organic soils), the organic matter content, pH, soil solution ratio, pore water concentration, and the presence of competing cations and complexing agents. The section goes on to say that, because of its dependence on many soil properties, the K_d value for a specific radionuclide can range over several orders of magnitude. Describe the geochemical conditions in the groundwater, the chemical conditions in the effluent holdup tank, and the conditions under which the K_d was measured for the three soil samples. Describe how well the lab measurements ought to represent field behavior during and after the leak event. Quantify the likely variation in K_d that should be

expected given the range of conditions that might be encountered, including the variability in soil and rock properties along the flow pathways.

02.04.13-11

Section 2.4.13 states that the precipitation that is not lost to runoff or evapotranspiration infiltrates and contributes to groundwater transport. Table 2.4.13-203 identifies that the runoff coefficient is 0.36. Explain how this value was determined. The table lists annual precipitation as 101 cm/yr. That suggests that annual runoff is 36.4 cm (about 14.3 inches). State whether this value is consistent with observations. Table 2.4.13-203 does not identify the value of evapotranspiration, which is needed to understand how much infiltrates. Explain how much infiltration is estimated to occur and the basis for the assumption.

02.04.13-12

Table 2.4.13-203 contains K_d values for one sample of fill and two of soil/saprolite. These materials contain high quantifies of silt and clay, both of which could contribute to high K_d values. The primary transport pathway considered in Section 2.4.13 is through the PWR material, which is low in silt and clay. Explain why K_d values measured on fill and soil/saprolite can be used to represent PWR. Because of the uncertainty in K_d values, provide an evaluation of the sensitivity of the model results to K_d values.

02.04.13-13

Provide input files and a summary of output results for each of the RESRAD analyses employed in the analysis of the accidental release of radioactive liquid effluent in groundwater and surface waters.

02.04.13-14

Make available the calculation package used to convert source concentration values in DCD Tables 11.1-2 and 11-1-8 to RESRAD input values (with units of pCi/g water).

02.04.13-15

Provide groundwater concentrations at the point just before entry into the Broad River. Explain how RESRAD dilutes groundwater concentrations as the groundwater mixes with the Broad River and why this approach is considered to be appropriate. Explain the meaning of the statement “no credit is taken for dilution in the river by water flow.“ If there is dilution in the river, how much is it and why was that value selected? What is the residence time in the river and why was this value selected?

02.04.13-16

Explain more fully the conceptual model of the accidental release. Does the fluid drain from the tank and sink below the water table or does it travel horizontally and why? The text states that the fluid fills the pore space in an area large enough to contain the leaked fluid. Describe that "volume" in terms of length, width, and height. Confirm that this "volume" of soil accounts for the volume occupied by the soil matrix. Explain what becomes of the existing groundwater that is displaced. Explain how RESRAD treats the source term. Are the contaminants instantaneously distributed within the "volume" as if in the groundwater system or are they in a separate model compartment and released at a defined rate (e.g., diffusion-controlled)?

02.04.13-17

Explain why the evaluation period was limited to 50 years and not to a period sufficient to capture major peak concentrations that may occur after 50 years.

02.04.13-18

Another consideration of the post-construction water table as described in RAI 2.4.12.-13 may indicate that a different groundwater flow path for radionuclide transport should be considered. Discuss the probability of such an alternative flow path, and whether it would be more conservative than the path considered in the FSAR. If such a path would be more conservative, discuss the changes that are required in RESRAD inputs, and the corresponding consequences for the analysis of accidental releases to groundwater.