LeeRAIsPEm Resource

From: Brian Hughes
Sent: Tuesday, October 21, 2008 1:18 PM
To: LeeRAIsPEm Resource
Subject: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 041 RELATED TO SRP SECTION 3.07, 3.08 FOR THE WILLIAM STATES LEE III UNITS 1 AND 2 COMBINED LICENSE APPLICATION
Attachments: LEE-RAI-LTR-041.doc

Hearing Identifier: Lee_COL_RAI
Email Number: 48

Mail Envelope Properties (D841D501B2C4D244B75AB897F70C149481B28FBE5E)

Subject: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 041 RELATED TO SRP SECTION 3.07, 3.08 FOR THE WILLIAM STATES LEE III UNITS 1 AND 2 COMBINED LICENSE APPLICATION
Sent Date: 10/21/2008 1:18:19 PM
Received Date: 10/21/2008 1:18:19 PM
From: Brian Hughes

Created By: Brian.Hughes@nrc.gov

Recipients:
"LeeRAIsPEm Resource" <LeeRAIsPEm.Resource@nrc.gov>
Tracking Status: None

Post Office: HQCLSTR01.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	3	10/21/2008 1:18:19 PM
LEE-RAI-LTR-041.doc	67182	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

October 21, 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. 041 RELATED TO SRP SECTION 3.07, 3.08 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

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. 1003, 1004

Enclosure:
Request for Additional Information

Distribution:

Public	MSpencer	MComar
RidsNroDnrlNwe1	SCoffin	BTegeler
RidsNroLAKGoldstein	BHughes	BThomas
RidsOgcMailCenter	C.Araguas	
RidsAcrsAcnwMailCenter	RidsRgn2MailCenter	RidsNroDnrlNwe2

NRO-002

OFFICE	SEB1/BC	SEB1	OGC	NWE1/L-PM
NAME	BThomas*	BTegeler*	MSpencer*	BHughes*
DATE	8/13/08	10/18/08	08/28/08	10/21/08

*Approval captured electronically in the electronic RAI system.

OFFICIAL RECORD COPY

Request for Additional Information No. 1003 Revision 0

10/21/2008

William States Lee III, Units 1 and 2
Duke Energy Carolinas, LLC
Docket No. 52-018 and 52-019
SRP Section: 03.07.01 - Seismic Design Parameters
Application Section: 3.7.1

QUESTIONS for Structural Engineering Branch 1 (AP1000/EPR Projects) (SEB1)

03.07.01-1

AP1000 DCD, REV16, Tier 1, Table 5.0-1 (Site Parameters) states: “Soils supporting the nuclear island should not have extreme variations in subgrade stiffness:

Case 1: For a layer with low strain shear wave velocity greater than or equal to 2,500 feet per second, the layer should have approximately uniform thickness, should have a dip not greater than 20 degrees, and should have less than 20 percent variation in shear wave velocity from the average velocity in any layer.”

Additionally, detailed soil-structure-interaction (SSI) analysis described in AP1000 DCD REV 16, Appendix 3G, “Nuclear Island Seismic Analyses”, indicate that uniform soil (or soft rock) layers were assumed beneath and adjacent to the nuclear island (reference Figure 3G.2-11).

Lee FSAR Figure 2.5.4-245, “Planned Excavation Profile, Geologic Cross Section U-U’ (Unit 1, East-West)”, indicates that the Unit 1 nuclear island is supported by approximately 10-20 feet of lean concrete fill material beneath the foundation basemat. Further, FSAR Figure 2.5.4-245 shows that the geologic stratigraphy west of the Lee NI is not representative of conditions east of the NI. Additionally, FSAR Figures 2.5.4-248 and 2.5.4-249 indicate a significant difference (i.e., greater than 20-percent) in shear wave velocity profiles for Unit 1 Centerline (Profile A) and Unit 1 Northwest Corner (Profile B).

Based on these site-specific issues, the staff requests clarification on (1) how the above Case 1 criteria are addressed, and (2) the applicability of AP1000 DCD, REV 16, SSI analyses, which assumes uniform layers beneath and adjacent to the nuclear island.

03.07.01-2

Lee FSAR Figures 2.5.4-245 and 246 show that the geologic stratigraphy west of the Lee NI is not made up of uniform soil layers.

AP1000 DCD, REV16, Tier 2, Section 3.7.2.8 states that the Seismic Category II Annex Building is seismically analyzed as a Seismic Category I structure using the SASSI computer code and the range of soil properties are given in DCD Section 3.7.1.4 for the soil layer above rock at the nuclear island foundation level.

AP1000 DCD, REV16, Tier 1, Table 5.0-1 (Site Parameters) states: "Soils supporting the nuclear island should not have extreme variations in subgrade stiffness" Further, detailed soil-structure-interaction (SSI) analysis described in AP1000 DCD REV 16, Appendix 3G, "Nuclear Island Seismic Analyses," indicate that uniform soil (or soft rock) layers were assumed beneath and adjacent to the nuclear island (reference Figure 3G.2-11).

Based on this site-specific issue, the staff requests the applicant to clarify how the AP1000 DCD, REV 16, SSI analysis for the Annex Building is applicable when it assumes uniform layer(s) adjacent to the nuclear island.

03.07.01-3

AP1000 Appendix 3I, Section 3I.6.4 states that certain components (Group 3) will need to be evaluated and/or tested to high frequency seismic spectra based on the GMRS thus necessitating development of in-structure floor response spectra.

It will be necessary to develop GMRS-based amplified floor response spectra for various locations (e.g., main control room) throughout the nuclear island for the purposes of qualification of selected components to hard rock high frequency (HRHF) seismic motion. Neither Section 3.7 of the Lee FSAR or the DCD itself discuss the details of the GMRS structural response. Section 3.7.1.2 establishes requirements for the design time histories, among them durations and directional statistical independence. Section 3.7.1.3 cites Regulatory Guide 1.61 among others for structural damping values associated with the CSDRS response analysis, presumably from Table 1 of the Guide. The critical damping values for the nuclear island structural GMRS response analysis may not be the same as the damping values utilized for the CSDRS analyses in the DCD. As stated in Regulatory Guide 1.61, the damping values in Table 1 of the Guide are for structural stress states near code limits. The GMRS response levels are expected to be significantly less which may necessitate the use of smaller damping values corresponding to Table 2 of the Guide. As stated in RG 1.61 for response spectra generation it is necessary to utilize damping-compatible structural response.

The staff requests the applicant to (1) provide the technical basis for the development of in-structure floor spectra using the site-specific GMRS, (2) identify the analysis codes used and (3) provide the methodology for addressing site-specific structural damping given that the seismic demand (in the lower frequency range) is significantly less than that of the AP1000 CSDRS.

Request for Additional Information No. 1004 Revision 0

10/21/2008

William States Lee III, Units 1 and 2
Duke Energy Carolinas, LLC
Docket No. 52-018 and 52-019
SRP Section: 03.08.05 - Foundations
Application Section: 3.8.5

QUESTIONS for Structural Engineering Branch 1 (AP1000/EPR Projects) (SEB1)

03.08.05-1

The NRC staff reviewed the supplement COL information item related to foundations. Lee Station FSAR Section 3.8.5.1 "Description of the Foundations" refers to Section 2.5.4 for information about overburden and depth of embedment. Section 2.5.4.5.2.1 describes certain foundation conditions, including the use of fill concrete to "bring the subgrade elevation up to the nuclear island foundation elevation within the foundation support zone of the nuclear island for the Lee Nuclear Station." Since the fill concrete is not part of the standard AP1000 design, it should be evaluated as a site characteristic. It is not clear whether the WLS Site Characteristics for bearing strength listed in FSAR Table 2.0-201 account for the fill concrete.

The staff requests the following additional information:

1. Provide static and dynamic bearing capacities of the fill concrete, the basis for the capacities, and a comparison to the relevant AP1000 DCD Site Parameters for "Soil" in Lee Station FSAR Table 2.0-201 (Sheet 2 of 6).

2. For load combinations including seismic, the fill concrete must also transmit base shear loads to the continuous rock face. Please provide the shear capacity of the fill concrete, the basis for the capacity, and a comparison to the SSE seismic base shear demand.

03.08.05-2

Lee Station FSAR Figure 2.5.4-241 contains a contour map showing the top of continuous rock. Lee Station FSAR Figures 2.5.4-245 and 2.5.4-246 show planned excavation profiles of the northwest corner area of Unit 1. The continuous rock in the northwest corner is shown to be 20 to 30 feet below the basemat, with a significant slope. For vertical foundation loads, a shear stress will exist at the interface of the fill concrete and continuous rock when the rock surface is sloped. Refer to the FSAR Figure 2.5.4-241 elevation contours below the Unit 1 nuclear island basemat west edge, near the northwest corner. The slope of the continuous rock under this area is relatively steep and, therefore shear stresses at the concrete/rock interface is significant. Additional information is requested regarding the load transfer to the continuous rock:

The staff requests additional information on (1) the design assumptions for transfer of shear across the concrete/rock interface, (2) the magnitude of the shear force at the concrete/rock interface, and (3) the shear capacities at the fill/rock interface and its basis and its relationship, if any, with the required static and dynamic bearing capacities listed in Lee Station FSAR Table 2.0-201 Sheet 2 of 6. Please list the maximum shear stresses at the fill/rock interface.

03.08.05-3

Lee FSAR Section 2.5.4.10 states that "The base mat and below-grade walls are waterproofed to accommodate hydrostatic pressure due to groundwater." AP1000 DCD, Revision 16, Section 3.4.1.1.1 describes two methods for waterproofing the nuclear island basemat: 1.) a cementitious crystalline additive, and 2.) an HDPE membrane as shown in DCD Figures 3.4-1 and 3.4-2. TR-134 (pages 645 and 646) adds another method for waterproofing the nuclear island basemat by using a spray-on type of membrane. The staff requests additional information regarding the waterproofing of the Lee Nuclear Island basemat:

1. Identify the type of waterproofing to be used for the Lee Nuclear Island basemat, and identify the areas where it will be placed.
2. Provide chemical and structural (mechanical) properties of the waterproof membrane.
3. Explain how the waterproofing affects the transfer of seismic base shear from the Nuclear Island basemat to the ground (soil foundation).
4. State whether the waterproof membrane has been used in structures in which a minimum 0.7 coefficient of friction between the waterproof membrane and concrete was achieved, and, if so, describe the structure and data obtained to show that the 0.7 coefficient of friction was met.
5. If no data indicating that a minimum 0.7 coefficient of friction between the waterproofing membrane and concrete exist, provide the basis for the adequacy of the design assumption that the basemat will not slide relative to the ground, or in the case of the spray-on membrane that the upper portion of the mud mat will not move relative to the lower portion of the mud mat, during the SSE.
6. Describe the qualification and test programs that will be used to demonstrate that the waterproof membrane meets the waterproofing and friction requirements.

03.08.05-4

With respect to the stability of the nuclear island structure, the staff requests the following information:

1. For stability analysis during the SSE, state whether (1) the bottom of the basemat is allowed to move relative to the top of the mud mat, (2) the bottom of the mud mat is allowed to move relative to the ground (soil foundation), and (3) the upper portion of the mudmat is allowed to move relative to the lower portion of the mudmat in the case of the spray-on type of membrane, or not. If relative movement is predicted, state the maximum value of the horizontal movement during the SSE and the basis for accepting that amount of movement. If relative movement is not predicted or allowed, state the maximum magnitude of the horizontal force generated in the nuclear island structure during the SSE, and the magnitude of the frictional force provided at the interface for the above three cases.

2. If the magnitude of the frictional force provided at the interface between the mud mat and the ground is less than the maximum magnitude of the horizontal force generated in the nuclear island structure during the SSE, state the magnitude of forces due to the passive earth pressure on the one side and the active earth pressure on the opposite side of the embedded nuclear island walls generated through the rotation of the nuclear island structure, and describe how these horizontal forces are in equilibrium so that the bottom of the mud mat will

not move relative to its ground. At that equilibrium stage, state (1) the rotational angle of the basemat with respect to the vertical axis, and the horizontal displacement value at the top surface of soils adjacent to the nuclear island structure during the SSE, and (2) whether or not buoyancy force due to ground water and vertical seismic forces were subtracted from the total weight of the nuclear island. For the above stability analysis, state (1) the value of the subgrade modulus underneath the basemat, (2) the type of backfill materials behind the embedded sidewalls and their corresponding values of spring constants and how the values were obtained, (3) the stress distribution shape of the active and passive earth pressures, and (4) the analysis method.