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SOUTHERN COMPANY
Energy to Serve Your World℠

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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Southern Nuclear Operating Company
Vogtle Electric Generating Plant Units 3 and 4 Combined License Application
Response to Request for Additional Information Letter No. 018

Ladies and Gentlemen:

By letter dated March 28, 2008, Southern Nuclear Operating Company (SNC) submitted an application for combined licenses (COLs) for proposed Vogtle Electric Generating Plant (VEGP) Units 3 and 4 to the U.S. Nuclear Regulatory Commission (NRC) for two Westinghouse AP1000 reactor plants, in accordance with 10 CFR Part 52. During the NRC's detailed review of this application, the NRC identified a need for additional geotechnical information required to complete their review of the COL application's Final Safety Analysis Report (FSAR) Section 3.7, "Seismic Design." By letter dated December 15, 2008, the NRC provided SNC with Request for Additional Information (RAI) Letter No. 018 concerning this geotechnical information need. This RAI letter contains two RAI questions numbered 03.07.02-1 and 03.07.02-2. The enclosure to this letter provides the SNC response to these RAIs.

If you have any questions regarding this letter, please contact Mr. Wes Sparkman at (205) 992-5061.

D092
NRO

Mr. J. A. (Buzz) Miller states he is a Senior Vice President of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

Joseph A. (Buzz) Miller

Sworn to and subscribed before me this 14th *day of* January, *2009*

Notary Public: Brenda W. Singleton

My commission expires: October 11, 2009

JAM/BJS/lac

Enclosure: Response to NRC RAI Letter No. 018 on the VEGP Units 3 & 4 COL Application Involving Seismic Design

cc: Southern Nuclear Operating Company
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Document Services RTYPE: AR01.1053
File AR.01.02.06

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Southern Nuclear Operating Company

ND-09-0001

Enclosure

Response to NRC RAI Letter No. 018

on the VEGP Units 3 & 4 COL Application

Involving

Seismic Design

FSAR Section 3.7, Seismic Design

eRAI Tracking No. 1615

NRC RAI Number 03.07.02-1:

ADEQUACY OF 2D SEISMIC RESPONSE ANALYSIS

The FSAR cites the SSAR, Section 2.5E, Subsection 5.1, 2D SASSI Analyses and Parameter Studies, in concluding that the 2D analyses demonstrate that the Vogtle Plant 3&4 seismic design is within the SSE design response spectra level of the certified seismic design response spectra (CSDRS) at Vogtle's plant grade.

The VEGP site-specific ground motion response spectra (GMRS) are applied in the free-field at plant grade and the foundation input response spectra (FIRS) are developed at the foundation depth (40 ft below plant grade). In certain locations, there are exceedances of the CSDRS by the GMRS and FIRS; therefore, the applicant performed a plant-specific seismic evaluation to demonstrate that the AP1000 design is acceptable for the Vogtle site. The FSAR in section 3.7-1 concludes that the 2D site-specific analysis sufficiently demonstrates that the generic AP1000 design is acceptable at the Vogtle site. That conclusion is based on comparisons of in-structure amplified response spectra (ARS) generated by the 2D generic AP1000 CSDRS (Appendix 3G, Section 3G.3) and the site-specific 2D response analyses at critical selected nodes (see Table 5.1-1 of Site-Specific Seismic Evaluation Report SVO-1000-S2R-802).

The generic AP1000 DCD seismic analysis is based on detailed 3D response analysis, while the site-specific analyses are two-dimensional (horizontal and vertical responses). The site-specific report (SVO-1000-S2R-802) cites Westinghouse Report APP-GW-S2R-010, "Extension of Nuclear Island Seismic Analyses to Soil Sites," hereafter referred to as TR3. Section 6.1 of TR3 states that using 2D models is adequate and conservative for horizontal response comparisons. However, using the shell model (3D) allows the development of design response spectra that reflect the seismic response across an elevation (floor) that is more realistic; consequently, using the shell model produces more realistic vertical seismic response spectra.

DCD Section 2.5.2.1 states that 2D SASSI results should be compared to the 2D CSDRS results in DCD Appendix 3G; however, Appendix 3G does not give any 2D-based vertical response spectra. In addition, this section [of the DCD] concludes that if the 2D results are not clearly enveloped, then a 3D analysis is indicated. The figures in Section 6.1 of TR3 indicate that the vertical responses for the 2D response analysis are not enveloped in selected frequency ranges in the vertical (Z) direction when compared to the 3D response analysis.

Please justify the adequacy of the 2D SASSI response analysis in light of the magnitude of the vertical response in the 3D SASSI detailed response analysis models.

SNC Response:

While the limitations of the 2D modeling are recognized, results of the 2D SSI analysis were deemed to be adequate for assessment of the design applicability to the site due to the large margin between the 2D site-specific SSI analysis results and the CSDRS-based ISRS (SSAR, Section 2.5E). However, to resolve the concerns raised in this RAI, a Vogtle site-specific SASSI SSI analysis using a three dimensional model of the AP1000 Nuclear Island is being performed. The results of this analysis in terms of acceleration response spectra (ARS) at the six key locations in the AP1000 plant will be compared with the CSDRS-based ARS at these locations. The results are scheduled to be submitted to the NRC on or before March 2, 2009.

NRC RAI Number 03.07.02-2:

DAMPING VALUES FOR FLOOR RESPONSE SPECTRA

Section 3.7.1.1.1 of the Vogtle FSAR states that the site-specific seismic analysis for Vogtle given in ESPA SSAR Appendix 2.5E demonstrates the adequacy of the CSDRS-based seismic analysis given in the AP1000 DCD. This conclusion is presumably based on the GMRS-based in-structure response spectra (ISRS) being enveloped by the CSDRS-based ISRS when compared at six locations within the nuclear island given in Table 5.1-1 of the SSAR.

Section 3.7.1.3 of the DCD cites Regulatory Guide 1.61 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-based 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. As discussed in Section 1.2 of the Guide, the GMRS response levels, if they are expected to be significantly less than the DCD CSDRS-based response, may necessitate the use of smaller damping values corresponding to those in Table 2 of the Guide. As demonstrated in Figures 5.1-1 through 5.1-18 of the SSAR, the GMRS seismic response is indeed significantly less than the CSDRS seismic response. Correspondingly, as stated in RG 1.61, for response spectra generation the applicant should utilize damping-compatible structural response.

Please provide a plant-specific technical basis for use of damping values that are higher than the OBE damping values specified in RG 1.61 Table 2, but not greater than the SSE damping values specified in RG 1.61 Table 1 for GMRS-based response levels.

SNC Response:

The justification for use of SSE damping for site-specific SSI analysis as required by RG 1.61, Section 1.2 is as follows.

The Vogtle site is a very deep soil site extending to a depth of nearly 1000 ft. The upper soil layers to the depth of approximately 86 ft will be excavated and replaced with engineered fill. The AP1000 Nuclear Island (NI) has an embedment depth of 40 ft. Therefore, the AP1000 NI will be fully surrounded and directly founded on this engineered fill. Based on these site conditions, the Vogtle AP1000 NI can be classified as an embedded stiff structure on a deep soil site. As shown in the AP1000 DCD, and consistent with the previous SSI studies, seismic structural responses of an embedded stiff nuclear structure on deep soil sites are controlled by the SSI effects. The SSI effects are in turn controlled by the soil stiffness and foundation radiation damping. The radiation damping associated with an embedded foundation on a deep soil site is much higher than the Regulatory Guide 1.61 specified structural damping values which are in the range of about 4% to 7%. Based on this observation and experience gained from previous SSI analyses, it is concluded that a change of structural damping from 7% to 4% will have a very small effect on the floor response spectra and, therefore, will not affect the conclusions provided in FSAR Subsection 3.7.1.1.1.