CCNPP3eRAIPEm Resource

From: Arora, Surinder
Sent: Wednesday, August 03, 2011 2:29 PM
To: Robert.Poche@unistarnuclear.com; 'cc3project@constellation.com'
Cc: CCNPP3eRAIPEm Resource; Chakrabarti, Samir; Thomas, Brian; Colaccino, Joseph; Miernicki, Michael; Wilson, Anthony; Vrahoretis, Susan; Ford, Tanya
Subject: Final RAI 315 SEB2 5927
Attachments: FINAL RAI 315 SEB2 5927.doc

Rob,

Attached please find the subject request for additional information (RAI). The draft of this RAI was sent to you on July 20, 2011. A clarification phone call requested by UniStar to discuss the draft question 03.07.02-63 was held on August 2; 2011; however, no changes were made to the draft question.

The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a schedule date for submitting your technically correct and complete response will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the review schedule of the applicable FSAR Chapter.

Your response letter should also include a statement confirming that the response does or does not contain any sensitive or proprietary information.

Thanks.

SURINDER ARORA, PE
PROJECT MANAGER,
Office of New Reactors
US Nuclear Regulatory Commission

Phone: 301 415-1421
FAX: 301 415-6406
Email: Surinder.Arora@nrc.gov

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Recipients:
"CCNPP3eRAIPEm Resource" <CCNPP3eRAIPEm.Resource@nrc.gov>
Tracking Status: None
"Chakrabarti, Samir" <Samir.Chakrabarti@nrc.gov>
Tracking Status: None
"Thomas, Brian" <Brian.Thomas@nrc.gov>
Tracking Status: None
"Colaccino, Joseph" <Joseph.Colaccino@nrc.gov>
Tracking Status: None
"Miernicki, Michael" <Michael.Miernicki@nrc.gov>
Tracking Status: None
"Wilson, Anthony" <Anthony.Wilson@nrc.gov>
Tracking Status: None
"Vrahoretis, Susan" <Susan.Vrahoretis@nrc.gov>
Tracking Status: None
"Ford, Tanya" <Tanya.Ford@nrc.gov>
Tracking Status: None
"Robert.Poche@unistarnuclear.com" <Robert.Poche@unistarnuclear.com>
Tracking Status: None
"'cc3project@constellation.com'" <cc3project@constellation.com>
Tracking Status: None

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Request for Additional Information No. 315 (eRAI 5927)

8/3/2011

Calvert Cliffs Unit 3
UniStar
Docket No. 52-016
SRP Section: 03.07.02 - Seismic System Analysis
Application Section: FSAR 3.7.2

QUESTIONS for Structural Engineering Branch 2 (ESBWR/ABWR Projects) (SEB2)

03.07.02-62

Follow-up Question to RAI 65, Question 03.07.02-18

In RAI 65, Question 03.07.02-18 the staff had asked that since the NAB (Nuclear Auxiliary Building) could potentially interact with Seismic Category I structures, the CCNPP3 FSAR needed to reconcile the U.S. EPR analysis with the site-specific soil properties and foundation input response spectra (FIRS) for the NAB, and to also demonstrate that the displacement of this structure relative to the Nuclear Island Common Basemat structure is enveloped by the results of the U.S. EPR analysis. In the response to RAI 65, Question 03.07.02-18 the applicant stated that based on the site-specific SSI analyses performed for the Nuclear Island (NI) common basemat structures, response spectra at the basemat of the NAB were generated for lower bound, best estimate, and upper bound soil cases in the X, Y, and Z directions as shown in the RAI response figures (Figures 3.7-42, 3.7-43 and 3.7-44). Similarly, the response spectra generated from the supporting analyses performed for the U.S. EPR design are shown in Figures 3.7-45, 3.7-46 and 3.7-47. Comparison between the two sets of figures indicates that the site specific response spectra at the basemat of the NAB are significantly lower than for U.S. EPR design. It was therefore concluded that the displacement of the NAB relative to the NI common basemat structure is enveloped by the results of the U.S. EPR analysis. The staff identified the following technical concerns with the response:

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First, the soil properties for CCNPP3 are significantly different from those used for the analysis of the U.S. EPR design. In addition, the NAB analysis for CCNPP3 is based on the properties of Chesapeake cemented sand, and do not account for the use of structural backfill.

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Second, to demonstrate stability of the NAB for the certified design, AREVA is performing a non-linear dynamic analysis as stability for this structure could not be demonstrated using conventional linear analysis methods. Since the shear wave velocities are considerably lower at CCNPP, there could be a significant displacement in the rocking mode of this structure and a possibility of high bearing stresses under the basemat. It may not be sufficient to simply compare ISRS between CCNPP and the U.S. EPR certified design.

Therefore, the staff requests that a complete stability analysis be performed for this structure, and the results reported to the staff as follows:

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An overview of the method of analysis;

· The seismic input for the analysis;
· The seismic model of the structure and the soil;
· The coefficients of friction assumed in the analysis and their bases;
· Whether sidewall pressures were considered and if so on what basis;
· The seismic demands considered in sliding and overturning calculations and how they were determined;
· The seismic capacities considered in sliding and overturning calculations and how they were determined;
· How peak bearing pressures are calculated and a comparison to the allowable pressure;
· The building's factors of safety against sliding and overturning;
· The net displacement between the NI and the NAB and how this value was calculated.

03.07.02-63

Follow-up Question to RAI 253, Question 03.07.02-46

In its partial response to Question 03.07.02-46, the applicant stated that the TB, SB, and AB will be analyzed and designed to prevent their failure under site-specific SSE loading conditions with a margin of safety equivalent to that of Seismic Category I structures. In addition the applicant states that to assure there is no seismic interaction between these Seismic Category II structures and the nearest Seismic Category I structure it will be verified that the separation distances are greater than their combined elastic deformations. However, for the staff to complete its review following the guidance provided in SRP 3.7.2, and be able to conclude that seismic interaction will not occur between the Seismic Category I structures and site-specific Category II structures, the applicant is requested to provide the seismic input, assumptions, modeling techniques, and methods of dynamic analysis that are used to determine the seismic loads required for design of the Seismic Category II structures. In addition, the applicant is requested to describe how these structures are designed to have a margin of safety equivalent to that of category I structures, and how the displacements for these structures are determined so as to verify the separation distances between the Seismic Category I structures and site-specific Category II structures are adequate. The applicant is also requested to provide the methods used to determine the seismic stability of these structures and to provide the results including the factors of safety against sliding and overturning. Also, include site-specific ITAAC for each structure to confirm that the as-built structure is analyzed and designed as described in the FSAR.

03.07.02-64

Follow-up Question to RAI 253, Question 03.07.02-49

A. In its response addressing whether or not uplift occurs for the EPGB or ESWB, the applicant states that the seismic spring forces in each zone are less than the tributary weight for that zone. In order for the staff to complete its evaluation the applicant should describe how the tributary weight has been calculated for each of the zones and the computer code and assumptions used in this calculation. In revised FSAR Section 3.7.2.14.2 (Enclosure 3 of Letter UN#11-107) it states that responses include the effects of seismic forces, and dynamic lateral earth pressures. Yet in its evaluation of lateral earth pressures provided with its response to RAI 253, Question 03.07.02-49, the applicant states that the sliding and overturning evaluation

that is documented in the SSI calculation considered demand and capacity from the basemat only, while effects from the side wall and side soil were neglected. Since the response contains possible conflicting information and Revision 7 of the FSAR does not provide a clear description of the stability calculation for the EPGB or ESWB, the applicant should provide the additional information as follows:

1. Provide the methodology, seismic input and seismic models used in the stability determination. The seismic models should reflect the changes made to the EPGB and ESWB certified designs recently made by AREVA for the U.S.EPR design;
2. Identify the coefficients of friction used in the sliding calculations and provide their basis;
3. Specify if adhesion was used and if so describe how it was applied in the stability calculations;
4. If adhesion was used provide a description of how the value of adhesion was determined and why its use is justified in the stability calculations;
5. Provide the details as to how the seismic demands and resisting capacity are determined in the overturning stability calculation;
6. Provide the details as to how the seismic demands and resisting capacity are determined in the sliding stability calculation;
7. Identify if lateral soil resistance was included in the EPGB and ESWB stability calculations and if so where it was used and how this resistance was determined;
8. Describe how the bearing pressures were determined and compare these to the allowable values.

B. Section 3.7.2.14.1 of the CCNPP3 FSAR states that the methodology to perform dynamic stability evaluation of the Nuclear Island Common Basemat Structures is incorporated by reference to U.S. EPR Section 3.7.2.14. However, the soil directly under the CCNPP NI consists of structural backfill whose strain-dependent properties are significantly lower than the properties of the soil under the EPR NI. As such, the results of the EPR NI stability analysis are not directly applicable to the CCNPP site. Therefore, the applicant is requested to provide the details of a site-specific stability analysis for the CCNPP NI including in its response a description of items 1 through 8 requested in Part A above for the EPGB and ESWB.

C. In RAI 304, Question 03.07.02-61, the staff has asked for information regarding the stability of the Common Basemat Intake Srructure (CBIS)**.** Based on the response to RAI 253, Question 03.07.02-49 the staff requires additional information as follows: In the portion of its response that addresses static and dynamic lateral earth pressures, the applicant states that the static and dynamic earth pressures along the embedment depth were not considered in the sliding and overturning factor of safety and the seismic stability evaluation was performed using only the dynamic and static stresses at the interface between the foundation mat and the soil. However, based on note 1 in FSAR Table 3.8-2 providing the stability results for the CBIS, it appears that friction between the side walls and backfill is used in the stability load combinations which include earthquake. FSAR Table 3.8-1 provides a static coefficient of friction of 0.52 between the CBIS sidewall and structural fill. Since it is not clear how the sliding factor of safety was determined the staff requests the applicant provide for the CBIS, information similar to what is requested in Part A above for the EPGB and ESWB.

03.07.02-65

Follow-up Question to RAI 253, Question 03.07.02-49

In its response to RAI 253, Question 03.07.02-49, the applicant provided information as to why the assumptions and results of the SSI analysis were not compromised by separation between the soil and the adjacent embedded portion of the ESWB during a seismic event. In order for the staff to be able to complete its evaluation of the response regarding lateral earth pressures on the walls of the ESWB under a seismic load, provide the following additional information:

1. In its response, the applicant states that the static lateral soil pressure is obtained by estimating compaction-induced earth pressures from the grade down to a depth that equates the at-rest soil pressure and then by following the at-rest soil pressure to the embedment depth of the embedded walls. It is assumed that the applicant is referring to the compaction of the structural backfill. If the backfill extends down to the basemat it is not clear why there should be a discontinuity in soil pressure as indicated in the response. If the backfill does not extend down to the level of the basemat, the applicant should provide a figure which indicates its depth. The applicant should also provide additional details as to the assumptions and coefficients used in the calculation of the soil pressure and include a diagram that demonstrates the variation of soil pressure as a function of the height of the sidewalls.
2. In its response, the applicant states that the solid red lines in Figures 12 through 29 represent the static soil pressure used for structural design and the dotted lines represent a lower bound estimation of static soil pressure. The applicant should describe how each of these was determined and what loads contributed to the values indicated in the figures.
3. In Figure 17 of the response, there are a number of exceedances of the solid red line while in Figure 18, which used a wider tributary wall, there are no exceedances. With the wider tributary wall, it appears that the static soil pressure increased more than did the corresponding tensile seismic force. As it is not obvious as to why this should have occurred, the applicant needs to provide an explanation for this result.

03.07.02-66

To address stability issues of the EPGB and ESWB, AREVA has redesigned both the EPGB and ESWB for the U.S. EPR. The applicant is requested to update the site specific analysis for each of these structures and describe the revised models and the seismic results in an update of the CCNPP3 FSAR.