CCNPP3eRAIPEm Resource

From: Arora, Surinder
Sent: Wednesday, October 12, 2011 8:57 AM
To: Infanger, Paul
Cc: CCNPP3eRAIPEm Resource; Colaccino, Joseph; Miernicki, Michael; Wilson, Anthony; Vrahoretis, Susan; Thomas, Brian; Chakrabarti, Samir
Subject: Final RAI 323 SEB2 6074
Attachments: FINAL RAI 323 SEB2 6074.doc

Paul,

Attached please find the subject request for additional information (RAI). The draft of this RAI was sent to you on September 28, 2011. As stated in your email of October 11, 2011, UniStar did not require a clarification phone call to discuss the draft questions. The RAI is, therefore, being issued as "Final".

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

Hearing Identifier: CalvertCliffs_Unit3Col_RAI
Email Number: 153

Mail Envelope Properties (B46615B367D1144982B324704E3BCEED85D50BA8AC)

Subject: Final RAI 323 SEB2 6074
Sent Date: 10/12/2011 8:57:05 AM
Received Date: 10/12/2011 8:57:08 AM
From: Arora, Surinder

Created By: Surinder.Arora@nrc.gov

Recipients:
"CCNPP3eRAIPEm Resource" <CCNPP3eRAIPEm.Resource@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
"Thomas, Brian" <Brian.Thomas@nrc.gov>
Tracking Status: None
"Chakrabarti, Samir" <Samir.Chakrabarti@nrc.gov>
Tracking Status: None
"Infanger, Paul" <paul.infanger@unistarnuclear.com>
Tracking Status: None

Post Office: HQCLSTR01.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	1167	10/12/2011 8:57:08 AM
FINAL RAI 323 SEB2 6074.doc	38394	

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

Request for Additional Information No. 323 (eRAI 6074)

10/12/2011

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)

03.07.02-68

Follow-up to Question 03.07.02-55

In response to **Question 03.07.02-55** regarding the criteria used to determine whether a section is cracked, the applicant states that equations 9-8 and 9-9 of ACI 349-01 were used to make this determination purposes. These are standard formulas for determining the cracking moment in concrete and as such the staff finds the use of these formulas to be acceptable. However, certain other aspects of the applicant's response are not clear and require additional information:

1. To solve formula 9-9 of ACI 349-01 a value for the concrete compressive strength must be defined. CCNPP FSAR Section 3.8.4.6.1 provides a concrete compressive strength of 5000 psi for the CBIS. The applicant is directed to confirm the compressive strength used or provide the value and basis for using a compressive strength other than 5000 psi.

2. The load combinations for the normal load Nmin and Nmax are not found in U.S. EPR FSAR Section 3.8.4.3.2. The applicant should explain the basis of the two equations and in particular why the live load, L, is reduced to .25L and the snow load, S, is reduced to .75S in the equation for Nmax. In addition the applicant should describe if there are differences in the cracking determination when the normal loads, Nmin and Nmax, are combined with the earthquake loads and if there is a difference, how this was treated in the analysis.

3. Compressive forces will increase the moment value required to induce cracking. The applicant is directed to state if compression loads were considered, and if not to provide justification for not considering them.

4. In determining the load effect of seismic acceleration the applicant states the seismic accelerations are applied separately in each of the three directions and the corresponding three analyses produce three sets of results. The results yielded by the three analyses for each load effect are subsequently combined using a summation of the absolute values. In its response to **Question 03.07.02-58** the applicant states that earthquake load effects are determined by the SRSS method not by the absolute sum method. The applicant is directed to provide additional information regarding how the loads effects are combined in the calculations for section cracking and if different from the SRSS method to provide a basis for the difference.

5. There are three soil cases considered for the design at CCNPP. The applicant's response does not address if all three soil cases were considered in its cracking analysis. The applicant is directed to address whether the process described was applied in each of the three soil cases and if it was not to provide the technical basis for not doing so.

03.07.02-69

Follow-up to Question 03.07.02-58

In **Question 03.07.02-58** the staff had asked the applicant for additional information regarding the methods used to calculate the forces and moments for building design as determined from the results of a building's seismic analysis. In its response the applicant stated that the seismic loads are determined from the SASSI analysis in which the acceleration response in a given direction is determined from the algebraic sum of the time history responses in that direction due to the application of three separate earthquakes (x, y, and z). As the input earthquake time histories are statistically independent the staff finds this approach to be acceptable. In addition the process is repeated for each of three sets of soil properties. Accelerations are determined at predefined locations which are the corners and centers of walls and floors. The largest of the maximum total accelerations in each direction at each location is applied to a STAAD static finite element model. In its description of the static analysis using STAAD certain aspects are not clear and require additional information.

1. It is not clear from the description how the accelerations at the predefined locations are applied to the static model. For example, if the acceleration is calculated at the center of a wall or floor, is this acceleration applied to the entire area of the wall or floor? The applicant is directed to provide additional details on this aspect of the analysis. In addition the applicant should describe and justify the selection of the acceleration values applied to the impulsive and convective portions of the water contained within the CBIS.

2. The convective water mass is normally assigned a damping value of 0.5 percent. The applicant should confirm this value was used or justify the use of a different value. The applicant is directed to describe how the convective damping value was included in the SSI seismic analysis.

3. The applicant states that the structure is divided into groups each of which comprises a floor and its supporting walls. There is no description of how the reaction loads at the boundaries of a particular structural group are transferred to an adjacent group or to the building foundation. The applicant is directed to provide a description.

4. In its earlier response to Question **03.07.02-50** the applicant stated that horizontal hydrodynamic pressure on a vertical wall due to vertical vibration was not included in the building design. However as part of its response to **Question 03.07.02-58** the applicant notes that the hydrodynamic loads induced by the vertical accelerations are obtained as recommended by ACI 350.3-06. The recommendation of ACI 350.2-06 is to include the hydrodynamic pressures on vertical walls due to a vertical acceleration. The applicant is directed to confirm that this is now the case for the CBIS analysis as the staff finds that ignoring this effect may be difficult to justify.

5. The applicant states that according to ACI 350.3-06, the convective hydrodynamic loads are not in phase with the impulsive loads and are therefore analyzed

separately in the x- and y-directions. The applicant is directed to demonstrate that this [**define "this **] is true for the CBIS and if not to justify why the convective loads are not additive to the impulsive loads.

6. Similar to the response provided in **Question 03.07.02-55** the applicant has provided two load combinations Nmin and Nmax for enveloping the effect of combining seismic loads with normal loads. The load combinations for Nmin and Nmax are not found in U.S. EPR FSAR Section 3.8.4.3.2. The applicant should explain the basis of the two equations and in particular for Nmax describe why the live load, L, is reduced to .25L and the snow load, S, is reduced to .75S.

7. The applicant is directed to provide examples of the calculations used to determine the modeling of the hydrodynamic masses in the SSI analysis of the CBIS and how the hydrodynamic pressures are subsequently calculated in the static model.

8. The applicant is directed to address how the process described for the static analysis considered the three soil cases (UB, BE, LB) and how the design loads were determined from this consideration. If the three soil cases were not considered the applicant should describe what was done and provide appropriate technical justification for its basis.

9. FSAR Section 3.7.2.6 states that the maximum member forces and moments due to the three earthquake components are combined using the “100-40-40” rule. In its response to Question 03.07.02-58 the applicant states that these are combined using the SRSS method. The applicant is directed to resolve this discrepancy.