CCNPP3COLA PEmails

From: Arora, Surinder
Sent: Thursday, August 27, 2009 11:37 AM
To: Poche, Robert; Jennifer.McQueeney@unistarnuclear.com; michael.stevenson@unistarnuclear.com
Cc: CCNPP3COL Resource; Colaccino, Joseph; Biggins, James; Jeng, David; Samaddar, Sujit; Miernicki, Michael; Simon, Marcia; Vrahoretis, Susan
Subject: Final RAI No. 144 SEB 2196
Attachments: FINAL RAI No 144 SEB 2196.doc

Rob,

As discussed in our phone call today, attached please find the subject request for additional information (RAI). A draft of this RAI was provided to you on August 13, 2009.

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.

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

Thanks

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From: Arora, Surinder

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Request for Additional Information No. 144 (eRAI 2196)

8/27/2009

Calvert Cliffs Unit 3
UniStar
Docket No. 52-016
SRP Section: 03.08.04 - Other Seismic Category I Structures
Application Section: FSAR 03.08.04

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

03.08.04-1

(RAI 3.8-2 Internal)

Calvert Cliffs Unit 3 FSAR Section 3.8.4.1 provides a description of Seismic Category I Structures other than containment and containment internal structures. Address the following items related to these structures.

1. FSAR Section 3.8.4.1 states:

> The U.S. EPR FSAR includes the following COL Items in Section 3.8.4:
>
> A COL applicant that references the U.S. EPR design certification will describe any differences between the standard plant layout and design of Seismic Category I structures required for site-specific conditions.
>
> A COL applicant that references the U.S. EPR design certification will address site-specific Seismic Category I structures that are not described in this section.

The Calvert Cliffs Unit 3 FSAR provided information to address the second COL item but not the first. The applicant is requested to address the first COL item as well, or state in the FSAR (as was done for the other items) that “No departures or supplements” apply.

2. FSAR Section 3.8.4.1 lists several site-specific Seismic Category I structures, including the UHS Makeup Water Intake Structure. However, FSAR Figure 9.2-4 - UHS Makeup Water and CW Intake Structures, shows several structural features which are not included in the list of site-specific Seismic Category I structures in FSAR Section 3.8.4.1. Identify whether the structural features listed below (obtained from Figure 9.2-4) are considered as Seismic Category I, and if not, explain why.

a. Existing Bulkhead
b. New Sheet Pile Bulkhead
c. New Channel Wall
d. New Dredged Intake Channel

Identify where all of these items are listed in FSAR Table 3.2-1. If these items are considered as Seismic Category I or II, identify where the design and analysis descriptions are provided.

3. FSAR Figure 9.2-4 shows that the CW Intake Structure is quite close to the UHS Makeup Water Intake Structure. According to FSAR Table 3.2-1, the CW Intake Structure is classified as Seismic Category “CS” which means Conventional Seismic. Explain why this structure isn’t classified as Seismic Category II since it appears that consideration of potential seismic interaction effects with the adjacent UHS Makeup Water Intake Structure is needed.

4. The EPR FSAR and the CCNPP Unit 3 FSAR do not provide a description of the analysis and design results for the radwaste structures consisting of the Nuclear Auxiliary Building (NAB) and the Radioactive Waste Processing Building (RWPB). Explain where this information is located. Similarly, where is the description of the analysis and design results for Seismic Category II structures?

03.08.04-2

(RAI 3.8-3 Internal)

Calvert Cliffs Unit 3 FSAR Section 3.8.4.3.1 describes the design loads used for Seismic Category I structures other than containment and containment internal structures. Provide additional information to address the items listed below.

1. Section 3.8.4.3.1 identifies the Severe Environmental Loads for the Standard Project Hurricane (SPH) and Extreme Environmental Loads for the Probable Maximum Hurricane (PMH). Provide the location in the FSAR where all of the specific quantitative data for these loads are developed. Describe how the hurricane parameters given in this section are used to calculate the pressures to be applied to the structures. Since the information provided in Section 3.8.4.3.1 only appears to be fluid pressure loads, explain what quantitative wind load is used in conjunction with the SPH and PMH for the site-specific structures and identify where this information is presented in the FSAR. Also, explain what wind loading identified as W is used for the other load combinations included in U.S. EPR FSAR Section 3.8.4.3.2 that do not include PMH and SPH.

2. Section 3.8.4.3.1 states that “the UHS Makeup Water Intake Structure (MWIS) and UHS Electrical Building are designed to withstand a peak positive overpressure (due to postulated explosions) of at least 1 psi without loss of function.” Provide the basis for selection of this quantitative overpressure loading and explain how this criterion is used to demonstrate that an explosion on transportation routes (e.g., railway, highway, or navigable waterway) is not likely to have an adverse effect on plant operation or to prevent a safe shutdown of the plant. Confirm whether the evaluation for explosions is performed in accordance with NRC Regulatory Guide 1.91, Rev. 1, “Evaluations of Explosions Postulated to Occur on Transportation Routes near Nuclear Power Plants.”

3. For the site-specific structures, some information is provided for hurricane loads and pressure loads due to explosions. For the site-specific structures provide a description of all the other applicable loads or explain whether the identical description and quantitative data presented in the EPR FSAR are utilized for the CCNPP Unit 3 structures as well.

03.08.04-3

(RAI 3.8-4 Internal)

Calvert Cliffs Unit 3 FSAR Sections 3.8.4.3.1, 3.8.5.5.2, and 3.8.5.5.3 identify that the EPR certified design groundwater level is exceeded in 2 instances, based on site-specific groundwater analyses. From information provided in the License Renewal application for Units 1 and 2, the staff is aware that there is an underground drain system for Units 1 and 2, whose purpose is to maintain the groundwater at a level lower than would naturally occur. The staff requests the applicant to provide the following information for Unit 3:

1. Will this existing drain system be relied on to maintain the Unit 3 groundwater at a level lower than would naturally occur? If so, describe quantitatively the estimated effect on the level of the groundwater; describe the operating experience and current condition of the drain system; describe any repairs/upgrades that will be implemented; and describe the maintenance program that will be relied on to ensure continued functioning of the existing drain system throughout the Unit 3 operating life.

2. Will a new underground drain system be installed for Unit 3, to maintain the Unit 3 groundwater at a level lower than would naturally occur? If so, describe quantitatively the estimated effect on the level of the groundwater; and describe the maintenance program that will be relied on to ensure continued functioning of the new drain system throughout the Unit 3 operating life.

3. If either existing or new underground drain system(s) are relied upon, then explain why the system(s) are not identified as safety related systems.

03.08.04-4

(RAI 3.8-5 Internal)

Calvert Cliffs Unit 3 FSAR Sections 3.8.4.6.1 and 3.8.5.6.1 state that “all natural soils at the site are considered aggressive to concrete.” Based on this statement, address the following items:

1. Describe in detail, the waterproofing system that is used for all below grade concrete structures including the buried electrical duct banks and buried piping. The description should include the type of waterproofing membrane, material composition, thickness, type of joints for the membrane, and installation process. For the installation process, explain how it is assured that the waterproofing membrane will not be damaged in any manner.

2. Sections 3.8.4.6.1 and 3.8.5.6.1 indicate that the waterproofing system in combination with improved concrete mix design will adequately protect the below-grade foundations (walls and basemats) and buried duct banks. Reference is also made to ACI 201.2R-01 (Guide to Durable Concrete) and ACI 515.1R-79 (Guide to the Use of Waterproofing, Damp Proofing, Protective, and Decorative Barrier Systems for Concrete) (ACI, 1985). Provide more details on the specific measures that are being specified to ensure that no degradation of the concrete foundations and buried duct banks will occur over the potential 60 year design life of the plant. This should include a quantitative discussion of the aggressiveness of the soil/groundwater, the specific concrete mix design to be

specified, which recommendations of ACI 201.2R and ACI 515.1R will be specified, and the construction procedures that will be followed to ensure durable and dense concrete. Will rubber water stops be utilized at all construction joints that may occur up to grade elevation? Additional questions related to the use of improved concrete mix design are contained in RAI 3.8-11(Internal).

3. Describe the operating experience for other below grade reinforced concrete structures that currently exist at the site which contain similar waterproofing membranes and are also exposed to comparable aggressive groundwater over long periods of time.

4. Provide vendor test data or other operating experience which demonstrates that the type of waterproofing membrane to be used has adequate water-retarding properties under aggressive saturated soil conditions for long periods of time without degrading.

03.08.04-5

(RAI 3.8-6 Internal)

Calvert Cliffs Unit 3 FSAR Section 3.8.4.3.2 presents two additional load combinations for the UHS MWIS and UHS Electrical Building to address the hurricane loadings SPH and PMH. The Severe Environment SPH load combination appears to correspond to one of the Service Load Combinations presented in the EPR FSAR and ACI 349, when the wind load W is replaced by the hurricane load SPH. The Extreme Environment PMH appears to correspond to one of the Factored Load Combinations that are presented in the EPR FSAR and ACI 349, when the tornado load Wt is replaced by the hurricane load PMH. Address the following items related to these load combinations:

1. Explain why these two load combinations are only applicable to the UHS MWIS and UHS Electrical Building, and not to the other Seismic Category I structures as well.

2. The load combination U = (0.75)(1.4D + 1.4F + 1.7L + 1.7H + 1.7W + 1.7To +1.7Ro) appears in the EPR FSAR and ACI 349. Explain why a load combination corresponding to U = (0.75)(1.4D + 1.4F + 1.7L + 1.7H + 1.7SPH (replacing W) + 1.7To +1.7Ro) is not considered.

3. In order to be consistent with the Factored Load Combinations in the EPR FSAR and ACI 349 that contain Wt (tornado wind), explain why the load To was omitted in the “Extreme Environment PMH” load combination presented in Section 3.8.4.3.2 of the CCNPP Unit 3 FSAR.

03.08.04-6

(RAI 3.8-7 Internal)

Calvert Cliffs Unit 3 FSAR Section 3.8.4.4.5 provides a limited description of the analysis and design procedures for buried electrical duct banks and buried Essential Service Water pipes. The first COL Item listed in Section 3.8.4.4.5 indicates that a COL applicant will describe the design and analysis procedures for the conduit and buried pipe. Section 3.8.4.4.5 refers to Section 3.7.3 for the seismic design of buried duct banks and buried pipe. Information for the analysis and design procedures for all of the other loads is lacking. Therefore, provide a description of the analysis and design procedures for all of the other loads imposed on all the buried duct banks and buried pipes. This description should include the procedures for analysis and design under vertical earth loads, permanent surface loads, surface live loads, internal pressure (for pipe), fluid transients (if applicable), buoyancy, thermal expansion (if applicable), and frost effects (e.g., heave for pipes placed above the frost line). This description should also clearly state (1) whether the approach follows the analysis and design procedures presented in EPR FSAR Section 3.8.4.4.5, including the AREVA report entitled U.S. Piping Analysis and Pipe Support Design Topical Report (Reference 37 of the EPR FSAR) for buried piping and (2) the extent to which the procedures in EPR FSAR Section 3.8.4.4.5 and EPR Reference 37 are used for buried electrical duct banks. If a different approach is used for either buried duct banks or buried pipe, provide a detailed description of the approach used. Since the ground water table is probably above the buried electrical duct banks, explain what types of joints are used and what provisions are made to prevent water intrusion.

03.08.04-7

(RAI 3.8-8 Internal)

Calvert Cliffs Unit 3 FSAR Sections 3.8.4.4.6 (Other Seismic Category I Structures – Design Report) and 3.8.5.4.5 (Foundations - Design Report), state “No departures or supplements.” Since there are three site-specific Seismic Category I structures defined in the FSAR, a Design Report is required for each of these structures. Therefore, provide a Design Report for the UHS Makeup Water Intake Structure, UHS Electrical Building, and the buried electrical duct banks and buried piping. The Design Reports should be prepared in accordance with the guideline described in NRC SRP 3.8.4, Appendix C. The Design Reports could be separate documents referenced by the FSAR or included as part of the FSAR as an Appendix. If Appendix 3E.4 is used for the purpose of the Design Reports, then it would need to be expanded to include the other information described in SRP 3.8.4, Appendix C.

03.08.04-8

(RAI 3.8-9 Internal)

Calvert Cliffs Unit 3 FSAR Section 3.8.4.4.7 provides information about the design and analysis procedures for the UHS Makeup Water Intake Structure and the UHS Electrical Building. The discussion of design and analysis procedures for the UHS Makeup Water

Intake Structure and the UHS Electrical Building needs to be expanded to provide more detailed information. The additional information should include:

1. For the UHS Makeup Water Intake Structure:

a. For determining member forces in the structure for design purposes, provide more detailed information on the finite element model (FEM) and analysis than that described in Section 3.8.4, 3.8.5, and Appendix 3E. This should include information on: (1) soil representation used in the FEM (e.g., why pinned supports rather than soil springs), (2) how equivalent static loads are determined and then applied, (3) consideration of any local dynamic amplification for slabs and walls for seismic loading, (4) seismic load application (were loads applied simultaneously in three directions or applied separately? If separately, how are the responses combined? Due to non-symmetry conditions are seismic loads considered to act in plus and minus horizontal directions?), (5) representation of water within the structure and outside the structure.

b. If the same model and approach described in FSAR Section 3.7.2 is used for representation of water, simply stating that it was done in accordance with ACI 350.3-06 and Army Corps of Engineers Manual EM-1110-2-6051 is not acceptable. These standards have not been previously reviewed and endorsed by the NRC and many elements of these standards are not applicable to nuclear power plants. Provide a description of how the water contained within the structure and outside the structure was considered in the model for developing member forces.

c. Explain why the concrete shear keys below the basemat are not included in the FEM and why the sloped concrete walls on the North-West side of the UHS Makeup Water Intake Structure, shown on Figure 3E.4-2, are not also sloped in the FEM on Figure 3.8-5.

d.. Provide a description of how all the loads were determined and applied to this model. This should include soil loads from dead weight, live load, surcharge, seismic, and soil passive pressure (if relied upon for stability evaluation); water pressure within and outside the building; and the hurricane induced loadings (pressure loadings from wind, storm surge and wave run-up).

e. Section 3.8.4.4.7 states that the “results from the GT STRUDL static analysis are used to design reinforced concrete shear walls and slabs according to provisions of ACI 349-01 (ACI, 2001a) (with supplemental guidance of Regulatory Guide 1.142 (NRC, 2001)), ACI 350-06 (ACI, 2006a) and ACI 350.3-06 (ACI, 2006b).” These ACI standards have not been previously reviewed and generically endorsed by the NRC and some elements of these standards are not applicable to nuclear power plants. Furthermore, the referenced Regulatory Guide 1.142 endorses ACI 349-97, not ACI 349-01. Therefore, specifically identify which sections/provisions in the three ACI referenced standards are used for design and describe how they compare to ACI 349-97, supplemented by Regulatory Guide 1.142. Note that this item, related to the appropriate ACI Standard(s), is also applicable to the UHS Electrical Building and to the buried electrical conduit duct banks.

2. For the UHS Electrical Building:

Section 3.8.4.4.7 states “Due to its relative simplicity and treatment as a soil inclusion, the design of the embedded UHS Electrical Building is performed by manual calculations. Reinforced concrete shear walls and slabs are designed in accordance with ACI 349-01 (ACI, 2001a) (with supplemental guidance of Regulatory Guide 1.142 (NRC, 2001)), ACI 350-06 (ACI, 2006a) and ACI 350.3-06 (ACI, 2006b).”

a. Explain what is meant by the phrase “soil inclusion.”

b. Since Section 3.8.4.4 is supposed to present the design and analysis procedures, provide a description of how the manual calculations were performed for the various loads.

c. Address the same question raised under Item 1.e above, regarding the use of the three ACI standards, as it applies to the UHS Electrical Building.

03.08.04-9

(RAI 3.8-10 Internal)

Calvert Cliffs Unit 3 FSAR Section 3.8.4.5 indicates that Section 3E.4 of Appendix 3E provides the details for the design of the basemat and typical wall for the UHS Makeup Water Intake Structure and the UHS Electrical Building. What is the technical basis for only selecting a typical wall for each structure? Explain why other concrete walls and slabs were not considered. Since the buried electrical duct banks and buried piping are also site-specific Seismic Category I structures, provide corresponding analysis and design information for critical sections of electrical duct banks and buried piping to represent this group of structures/components.

03.08.04-10

(RAI 3.8-11 Internal)

Calvert Cliffs Unit 3 FSAR Sections 3.8.4.6.1 and 3.8.5.6.1 refer to “the use of dense concrete with a low water cement ratio and improved concrete mixture design.” According to Section 3.8.5.6.1, the compressive strength of the concrete for the foundation of the UHS Makeup Water Intake Structure and UHS Electrical Building is f’c = 5,000 psi. Provide information to address the following related items:

1. FSAR Sections 3.8.1 through 3.8.5 should identify any specific water cement ratios needed for the concrete mix for all Seismic Category I structures. The tables in Part 10, Section 2.4 (ITAAC) specify that the acceptance criterion is a maximum water cement ratio of 0.45 for all below grade concrete sections. Explain how this value was selected considering that usually a lower value of the water cement ratio, high compressive strength f’c, and large concrete cover over steel reinforcement are recommended for aggressive concrete surface conditions. As an example, ACI 350-01 recommends a water cement ratio of 0.40 and f’c = 5,000 psi for severe aggressive conditions. Also,

clarify where in the FSAR the water cement ratios for Seismic Category II and II-SSE structures are specified.

2. In view of the aggressiveness of the soil conditions at CCNPP Unit 3, explain why the concrete compressive strength for most of the other Seismic Category I structures is less than 5,000 psi, which is the value used for the UHS Makeup Water Intake Structure and UHS Electrical Building. EPR FSAR Sections 3.8.4.6.1 and 3.8.5.6.1 indicate that 4,000 psi is specified for the foundations of Seismic Category I structures including the buried electrical duct banks. Also clarify where in the FSAR the compressive strength for the Seismic Category II and II-SSE structures is specified and address this issue for these structures as well.

03.08.04-11

(RAI 3.8-12 Internal)

U.S. EPR FSAR Sections 3.8.4.6.1 and 3.8.5.6.1 require a COL applicant that references the U.S. EPR design certification to evaluate the use of waterproofing membranes and epoxy coated rebar based on site-specific groundwater conditions. Describe the evaluation performed to determine whether epoxy coated rebar is needed in accordance with the referenced COL item.

03.08.04-12

(RAI 3.8-13 Internal)

Calvert Cliffs Unit 3 FSAR Sections 3.8.4.7 and 3.8.5.7 describe testing and in-service inspection requirements. The CCNPP Unit 3 below-grade concrete degradation program for aggressive ground water/soil “provides a periodic surveillance program to monitor the condition of normally inaccessible below-grade concrete for signs of degradation.” This program includes below-grade walls and buried duct banks, addressed in Sections 3.8.4.7, and foundations, addressed in Section 3.8.5.7. This in-service inspection program is limited to examination of exposed portions of below-grade concrete for signs of degradation when adjacent soil is excavated for any reason. Address the following items related to the in-service inspection requirements:

1. The staff notes that the approach to limit the in-service inspection program to examination of exposed portions of below-grade concrete for signs of degradation when adjacent soil is excavated for any reason has been used and accepted at sites where the soil is not aggressive. Therefore, provide more details about this program and why is it considered adequate for below grade concrete foundations when subjected to aggressive soil conditions. The description should include a discussion of the scope, locations, schedule, parameters inspected, inspection methods, and acceptance criteria. Also provide the technical basis for assuming that the presence of a waterproof membrane is sufficient justification to follow an in-service inspection program normally used where the soil is not aggressive.

2. Explain why the description in the FSAR refers to this as a periodic surveillance program while in a later discussion it indicates that the inspection is limited to

examination of the surfaces when the adjacent soil is excavated for any reason. Provide the basis for why examination of exposed portions of below-grade concrete, when adjacent soil is excavated for any reason, is considered adequate rather than supplementing this requirement with a specified maximum time period.

3. Explain why the FSAR does not state that such a program is also applicable to buried piping considering the aggressive soil conditions present at the site.

4. For the waterproofing membrane beneath the foundation basemats and on the below grade walls, explain what type of inspection is to be specified to ensure that the waterproofing membrane has not been damaged or shows sign of degradation. Explain whether this inspection will be performed prior to the placement of soil backfill and during the periodic below-grade concrete degradation program.

5. Explain whether the monitoring and maintenance of all Seismic Category I, II, and II-SSE structures, including the site-specific structures, will be performed in accordance with the requirements of 10 CFR 50.65, supplemented with the guidance in Regulatory Guide 1.160. For the UHS Makeup Water Intake Structure and CW Intake Structure explain whether the inspections will also be performed in accordance with NRC Regulatory Guide 1.127, Rev. 1, “Inspection of Water-Control Structures Associated with Nuclear Power Plants.”

03.08.04-13

(RAI 3.8-18 Internal)

Calvert Cliffs Unit 3 FSAR Table 3E.4-1 presents the governing design load combinations for the UHS Makeup Water Intake Structure and UHS Electrical Building. Provide the following information related to the load definition and load combinations for these site-specific structures:

1. Confirm that all of the load definitions for these site-specific structures are the same as those defined in the US EPR FSAR.

2. Confirm that the methods utilized to determine the individual loads are consistent with the approach used in the US EPR FSAR and provide the magnitude of the live load and snow load for these site-specific structures.

3. Explain why the load combinations in Table 3E.4-1 are considered to bound all of the other load combinations tabulated in the US EPR FSAR.

4. Confirm that for every load combination, where any load reduces the effects of other loads, a load factor of zero is applied/considered for that load.

5. For the stability evaluation load combinations 6 through 8, confirm that the effects due to the buoyancy force based on the maximum groundwater elevation and permanent surcharge loads (of adjacent structure(s)) are also considered.

03.08.04-14

(RAI 3.8-21 Internal)

Calvert Cliffs Unit 3 FSAR Section 3E.4 provides a description of the analysis and design of the UHS Makeup Water Intake Structure and UHS Electrical Building and some limited information about the results in terms of demand member forces for several critical sections (basemats and walls). For the most critical concrete members in the basemat and walls for the UHS Makeup Water Intake Structure and the UHS Electrical Building, provide the resulting member forces (membrane forces, shears, and moments) and comparisons to the section strengths, at least for the most critical governing load combination(s). This information would show the level of margin existing in the design. To facilitate the review, such information is usually presented in tables. Include in these tables the steel areas provided which correspond to the tabulated section strengths.