PMNorthAnna3COLPEmails Resource

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Subject: RAI Letter 123, RAI 7536, FSAR Section 3.7.2, North Anna COLA (52-017)
Attachments: RAI Letter 123 RAI_7536.docx

By letter dated November 26, 2007, Dominion Virginia Power (Dominion) submitted a Combined License Application for North Anna, Unit 3, pursuant to Title 10 of the *Code of Regulations,* Part 52. The U.S. Nuclear Regulatory Commission (NRC) staff is performing a detailed review of this COLA.

The NRC staff has identified that additional information is needed to continue portions of the review and a Request for Additional Information (RAI), is enclosed. To support the review schedule, Dominion is requested to respond within 30 days of the date of this request. If the RAI response involves changes to the application documentation, Dominion is requested to include the associated revised documentation with the response.

Sincerely,
Chandu Patel
Lead Project Manager for NA3 COLA

Hearing Identifier: NorthAnna3_Public_EX
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Operating Company: Dominion
Docket No. 52-017
Review Section: 03.07.02 - Seismic System Analysis
Application Section:

QUESTIONS

03.07.02-10

FSAR 3.7.2.4.1 indicates that the SASSI2010 computer program was used to perform the site-specific seismic SSI analysis for the NA3 application. However, SASSI2010 differs from the SASSI2000 program used in the SSI analyses documented in the ESBWR DCD. As a result, it is important to ensure that in demonstrating the ESBWR DCD to be adequate for the NA3 site, the use of the SASSI2010 computer code is acceptable for performing the seismic SSI analysis for the NA3 application. Therefore, the applicant is requested to provide the following information.

(a) Identify the use of the SASSI2010 computer program as a departure (NAPS DEP 3.7-1) to DCD Section 3.7.2, Table 3.7-3, “Summary of Methods of Seismic Analysis for Primary Building Structures,” which only makes reference to SASSI2000, or explain why it was not identified as a departure.
(b) Describe how the SASSI2010 program was verified and validated for the NA3 application and for the SSI analyses with model passing frequencies of up to 50 Hz.
(c) Describe what method in SASSI2010 was utilized in the site-specific SSI analyses documented in FSAR 3.7.2.
(d) Include the above information in the relevant sections of the FSAR as appropriate.

03.07.02-11

FSAR 3.7.2.4.1 indicates that SSI input control motions for the CB are defined at the bottom of the CB foundation basemat, which is consistent with the development of the SSI inputs described in FSAR 3.7.1. However, FSAR Section 3.7.2.4.1.1 indicates that the concrete fill below the CB basemat is an integral part of the structural model used in the SSI analysis (FSAR Figures 3.7.2-205 and 206). Since the combined CB-concrete fill is modeled as an integral structure, the control motions for SSI analysis should be defined at the bottom of the concrete fill to be consistent with the guidance in ISG-17, which the applicant has committed to. The staff also notes that the difference in elevation between the bottom of the basemat and the bottom of the concrete fill is approximately 5 m. Therefore, the applicant is requested to provide the technical justification for defining the SSI input control motions for the CB at the bottom of the basemat and not at the bottom of the concrete fill.

03.07.02-12

FSAR 3.7.2.4.1.2 indicates that site-specific ground motion time histories used in the site-specific SSI analyses were developed in FSAR 3.7.1.1.5. However, FSAR 3.7.1.1.5 describes two distinct cases for the RB/FB and CB: (i) partial column spectrally matched time histories (FSAR Figures 3.7.1-241 through 243 for the RB/FB and FSAR Figures 3.7.1-253 through 255 for the CB), and (ii) full column spectrally matched time histories (e.g., FSAR Figures 3.7.1-244 through 246 for the RB/FB and FSAR Figures 3.7.1-256 through 258 for the CB). The staff could not determine which of the two cases was used in FSAR 3.7.2 for the seismic SSI analyses. Therefore, the applicant is requested to explain which set of ground motion time histories was used in the site-specific SSI analyses of the RB/FB and CB, and provide the technical basis for this choice. In addition, the applicant is requested to describe in the FSAR how was the other set of ground motion time histories used in assessing the results of the site-specific SSI analysis.

03.07.02-13

FSAR 3.7.2.4.1.4 provides a description of the models used for the site-specific SSI analyses of the RB/FB, CB, and FWSC. The description does not provide sufficient details of the structural and soil/rock models used as discussed below. This information is needed to ensure the adequacy of the site-specific SSI analyses documented in FSAR 3.7.2. Therefore, the applicant is requested to provide the following information related to the SSI models:

(a) The aspect ratios of the finite elements used in the model can affect the accuracy of the calculated results. Therefore, provide the maximum aspect ratios of the plate and brick finite elements used to model the basemat, below-grade exterior walls, and excavated volume mesh of the embedded structures (including the concrete fill, which is considered part of the structural model). Confirm that the SASSI2010 program has been verified and validated for the range of aspect ratios used in the SSI models.

(b) The use of very high Poisson’s ratios can lead to inaccuracies in the results obtained using the SASSI code. Therefore, provide the maximum value of Poisson’s ratio considered in the site models used for the site-specific SSI analyses of the RB/FB, CB, and FWSC. Confirm that the SASSI2010 program has been verified and validated for the range of Poisson’s ratios used in the SSI models.

(c) FSAR Table 3.7.2-201 provides model passing frequencies and analysis cut-off frequencies considered for the site-specific SSI analyses of the RB/FB, CB, and FWSC. Confirm that the model passing frequencies were estimated on the basis of maximum horizontal dimensions (E-W and N-S) of the excavated volume mesh, in addition to maximum vertical dimensions of the soil/rock layers.

(d) FSAR Table 3.7.2-201 indicates that the SSI models of the FWSC coupled with the LB and BE subsurface profiles have passing frequencies of 19 Hz and 33 Hz respectively, which deviates from the 50 Hz minimum passing frequency stated by the guidance in ISG-01. Provide the technical basis for the deviation from the guidance in ISG-01.

(e) FSAR 3.7.2.4.1.4, pgs. 3-119 (bottom paragraph) and 120 (top paragraph), indicates that the site models used for the SSI analyses of the RB/FB, CB, and FWSC consist of 13, 17, and 22 layers respectively. This implies that shear and compression wave velocities, unit weights, and damping ratios were adjusted from the original strain iterated profiles documented in FSAR 3.7.1. Provide a graphical comparison between the adjusted profiles used in the SSI analysis, and the corresponding strain iterated profiles documented in FSAR 3.7.1, and discuss potential impact on the results of any differences between the profiles.

(f) FSAR 3.7.2.4.1.4 indicates that the total depth of the site soil/rock models used for SSI analyses of RB/FB, CB and FWSC are approximately 96 m, 104 m and 116 m, respectively, which are on the order of two times the footprint dimension of the corresponding structures. Since computed seismic responses may be sensitive to the location of the half-space interface, explain whether sensitivity studies were performed to determine if the selected depths are appropriate, or provide acceptable technical justification for the depths selected.

03.07.02-14

FSAR 3.7.2.4.1.4 indicates that cracked concrete stiffness and SSE damping properties were assigned to the various lumped mass stick models used in the site-specific SSI analyses of the RB/FB, CB, and FWSC, on the basis of SASSI stress results for in-plane shear and out-of-plane bending moments. FSAR Tables 3.7.2-202 through 204 indicate that: (i) the RB/FB was modeled as partially cracked (cracked elements are identified in FSAR Figure 3.7.2-210); (ii) the CB was modeled as completely cracked; and (iii) the FWSC was modeled as completely uncracked.

The selection of cracked or uncracked concrete stiffness and damping properties can affect the adequacy of the site-specific SSI analyses documented in FSAR 3.7.2. In addition, the applicant's approach deviates from ESBWR DCD Appendix 3A, where cracked and uncracked cases were considered and enveloped to determine the enveloped seismic loads and the ISRS. Therefore, the applicant is requested to provide the following information related to the SSI modeling of concrete cracking.

(a) Explain the magnitude of the reduction in in-plane shear stiffness assigned to concrete structural elements where the average in-plane shear stress exceeds 3 x √ (f'c). Provide the technical basis for this cracking threshold.

(b) Explain the magnitude of the reduction in out-of-plane bending stiffness assigned to concrete structural elements where the bending moments exceeds the cracking moment criterion specified in ACI 349-01, Section 9.5.2.3.

(c) Provide the technical justification for determining whether concrete structural elements are cracked or uncracked only on the basis of the SSI analysis results for the BE subsurface profile case, as indicated in FSAR 3.7.2.4.1.4 (pg. 3-120). Explain how the seismic response obtained by this approach compares to the seismic response obtained by assuming (i) a cracked structure with LB subsurface profile, and (ii) an uncracked structure with UB subsurface profile.

(d) Provide a detailed explanation of the methodology used to identify which concrete structural elements are cracked and which are not, and how the reduced stiffness properties are implemented in the structural model (e.g., reduced factors for each stiffness component, applied to what modeling parameter, done on an element by element basis, etc.).

(e) Describe how SSE/OBE damping was assigned to all structural elements that were determined to be cracked and uncracked based on the seismic stress level.

(f) Because the site-specific seismic demand exceeds the corresponding DCD seismic demand, there is a potential for increased out-of- plane cracking effect on the floor slabs and walls (when subjected to site-specific ground motion), thereby further decreasing their out of plane stiffness and changing the damping characteristics. Therefore, confirm that the frequency ranges and the damping values of the oscillators selected for the DCD model are still adequate to capture the out-of-plane seismic response of the walls and slabs for NA 3 site-specific ground motion. Also confirm that if any other slabs and walls which are considered to be rigid in the out of plane direction in the DCD analysis would require modeling as SDOF oscillators in the stick model.

(g) Explain whether the plate finite elements used to model the basemat and below-grade exterior walls of the RB/FB, CB, and FWSC were assigned uncracked or cracked properties along with their justification for use.

(h) The diaphragm floor and the vent wall inside containment are constructed from steel plates filled with concrete. For the ESBWR design certification, these structures were modeled and evaluated separately for three cases having 0 percent, 50 percent, and 100 percent concrete stiffness contribution to the steel plates, while the full mass contribution of the concrete fill was always included. All three cases were considered to develop the floor response spectra and to design the structural members. Explain whether the same approach is used for the NA3 analysis and design or justify any deviation taken.

(i) Provide in FSAR Section 3.7.1.2 a description of the stress criteria that determines the acceptability of using SSE damping values in conjunction with cracked concrete stiffness properties for reinforced concrete members, as described under FSAR Section 3.7.2.4.1.4.

03.07.02-15

FSAR Section 3.7.2.4 describes the site-specific SSI analyses of the RB/FB, CB, and FWSC structures, performed in support of the NA3 application. The FSAR does not provide any discussion of SSI transfer functions computed for the various site-specific SSI analysis cases. The review of transfer functions is essential to ensure that the numerical implementation of the SSI analysis methodology is acceptable and consistent with the guidance in SRP 3.7.2. Therefore, the applicant is requested to provide plots of transfer functions computed at the key locations in the RB/FB, CB, and FWSC documented in FSAR 3.7.2.4, for all site-specific SSI analysis cases considered in the NA3 application. In these plots, the computed values of the transfer functions should be clearly distinguished from the values obtained by interpolation. Explain whether any numerical anomalies are observed in the transfer functions (e.g., sharp narrow spikes) and explain their potential impact on the computed seismic response.

03.07.02-16

ESBWR DCD Section 3A.8.11 describes the evaluation of structure-soil-structure interaction (SSSI) effects considered in the generic design; specifically, the effect of the RB/FB on the CB, and the effect of the CB and FWSC on each other. FSAR Section 3.7.2, however, does not describe any site-specific SSSI analyses performed in support of the NA3 application. Although DCD Section 3A.8.11 is incorporated by reference in the FSAR, without supplements or departures, this DCD section does not provide any information related to potential site-specific SSSI effects. To ensure that the site-specific SSSI effects have been adequately addressed in the NA3 application, the applicant is requested to provide an evaluation of any potential site-specific SSSI effects, or provide the technical basis for not considering site-specific SSSI effects. Also, the applicant is requested to incorporate the evaluation or basis in the FSAR.

03.07.02-17

FSAR Section 3.7.2.4.1.6.1 documents the enveloping seismic loads computed from the site-specific SSI analyses of the RB/FB, CB, and FWSC, based on the BE, LB, and UB subsurface profiles. The information provided shows that the site-specific seismic loads exceed the corresponding standard design loads at many locations in the RB/FB and CB.

FSAR Section 3.7.2.4.1.6.1 also describes the "stress ratios" (i.e., stress demand-to-capacity ratios associated with the standard design) and "scale factors" (i.e., maximum ratios of site-specific enveloping seismic loads to standard design enveloping seismic loads, where the maximum is with respect to the different seismic load components) that were developed to demonstrate the applicability of the standard design of the RB/FB and CB to the NA3 site conditions. In summary, the applicant's approach consists of demonstrating that the product of the stress ratios times the scale factors are always less than 1.0, for a given location in the structure and for the governing load combination (from the standard design) that includes seismic loads at that location. Partial results of this check are given in FSAR Tables 3.7.2-205 through 216 (for the RB/FB) and 3.7.2-217 through 219 (for the CB).

The staff's review of FSAR Tables 3.7.2-205 through 219 indicates that the applicant's simplified approach may not be appropriate because it relies on the linear dependence of the seismic stress ratios with respect to all seismic load components (e.g., for beam-column elements: shear in X, shear in Y, moment in X, moment in Y, torsion, and axial force). However, this linear dependence may not be valid for some design situations. For example, code-based design equations require total axial forces (seismic plus non-seismic) to be considered in the evaluation of shear and flexural strength of concrete walls. In the case of shear, the total axial force can increase or decrease the shear strength (depending on whether the total axial force is tension or compression). In the case of flexure, the total axial force can also affect the flexural strength. This implies that seismic stress ratios for such walls are nonlinear functions of seismic axial forces (for seismic shear stress ratios), or seismic moments and axial forces (for seismic flexural stress ratios). Additional sources of nonlinearity may arise in other design situations, and when taking into account that stress ratios for load combinations that were governing for the standard design may no longer be governing for the site-specific evaluation.

Adequate calculation of the member forces with proper consideration of the individual member force components is essential in design to ensure the structural integrity. Therefore, the staff requests that the applicant provide the results of detailed stress checks for the RB/FB and CB (and the FWSC if necessary), where the site-specific seismic loads exceed the corresponding ESBWR standard design. These stress checks should be performed in a direct manner (i.e., without scaling the DCD stress checks), using the computed site-specific seismic loads, and should include the contribution of all other load cases to the total stresses and all applicable load combinations. The applicant should demonstrate that the resulting site-specific total stress demands are bounded by the code-allowable stresses in all cases. If an alternative method is utilized to demonstrate the structural adequacy, then sufficient technical basis should be provided to justify such an approach. Particular areas of concern are the situations where the site-specific seismic loads exceed the corresponding standard design loads by a significant amount, including the following: (a) RPV and RPV support structure, (b) RSW, (c) vertical and horizontal accelerations of flexible slabs and walls (i.e., SDOF oscillators) in the RB/FB and CB, (d) PCCS condenser, and (e) new and spent fuel racks in buffer pool and spent fuel pool.

Since ESBWR DCD Appendix 3G is incorporated by reference in the FSAR, with no departures or supplements, the applicant is also requested to assess systematically the design details and evaluation results of all Seismic Category I structures, including any supports and anchorages, that are specified in DCD Appendices 3G.1 (for the RB), 3G.2 (for the CB), 3G.3 (for the FWSC), and 3G.4 (for the FB) in light of the site-specific seismic loads. The applicant should document the results of this assessment by either: (i) supplementing DCD Appendices 3G.1, 3G.2, 3G.3, and 3G.4; or (ii) providing a separate site-specific appendix to the FSAR Chapter 3.

03.07.02-18

FSAR Section 3.7.2.4.1.6.1 indicates that the site-specific enveloping seismic loads for the RPV stick model exceed the corresponding standard design enveloping seismic loads by a significant amount. To address these exceedances, the FSAR states that a decoupled model of the RPV subsystem is analyzed using SSE input loads based on the results of the site-specific SSI analysis. FSAR Section 3.7.2.4.1.8 further states that the seismic capability of the RPV is verified through the DCD Tier 1, Table 2.1.1-3, ITAAC 6. However since the site-specific seismic demand for the RPV support is not bounded by the DCD envelope, the applicant is requested to provide in the FSAR an assessment of the RPV support including its anchorage to the building structure to withstand the site-specific seismic demand based on the SSI analysis presented in FSAR Section 3.7.2. If the RPV support load used in the assessment is based on the decoupled model of the RPV, the applicant is requested to provide a summary of the RPV support loads obtained from the separate decoupled RPV analysis including a basis of its acceptance.

03.07.02-19

FSAR Section 3.7.2.4.1.6.1 indicates that the site-specific enveloping horizontal accelerations of flexible walls (i.e., SDOF oscillators) in the RB/FB exceed the corresponding standard design enveloping horizontal accelerations by as much as 84 %. However, the FSAR does not provide documentation of stress check results for flexible walls in the RB/FB. Instead, a brief description of the method used to perform the stress checks is provided in FSAR pgs. 3-127 (last paragraph) and 3-128 (first paragraph). In order to review the adequacy of the methodology used for performing the stress checks for flexible walls, additional information is needed. Therefore, the applicant is requested to describe the method in detail and explain whether the method used for the site-specific stress evaluation is different from the approach used in the ESWR DCD and, if so, provide additional information of the method in the FSAR as well as a technical validation of the method with that of the DCD or other acceptable approaches.

03.07.02-20

ESBWR DCD Section 9.1.2.4 (Mechanical and Structural Design) provides the structural assessment of new and spent fuel storage racks in the buffer pool and spent fuel pool, based on the DCD seismic demands, to demonstrate compliance with design requirements including the guidance in SRP 3.8.4. The results of the stress analysis are provided in DCD Reference 9.1-1 (GEH Licensing Topical Report NEDO-33373, "Dynamic, Load-Drop, and Thermal-Hydraulic Analysis for the ESBWR Fuel Racks"). However, FSAR Section 9.1 does not provide a site-specific structural assessment of the acceptability of the new and spent fuel storage racks for the site-specific departure (NAPS DEP 3.7-1), related to the exceedances noted in the seismic inputs at the NA3 site. The staff considers that this departure is also applicable to FSAR Section 9.1 and should be included in that section as well. In addition, a site-specific seismic analysis of the fuel racks is needed to ensure the structural adequacy of the racks. Therefore, the applicant is requested to provide the following information:

(a) Provide an assessment of the structural design of the new and spent fuel storage racks in the buffer pool and spent fuel pool, which demonstrates their acceptability for the NA 3 site-specific seismic demands.

(b) Update or supplement DCD Reference 9.1-1 and the FSAR, as needed to document the assessment requested in item (a).

(c) Provide a comparison of (i) the response spectra used in the site-specific assessment requested in item (a), and (ii) the response spectra used in the standard design of the fuel racks documented in DCD Reference 9.1-1.

(d) Provide the magnitude of the loads at the pool base slab and walls resulting from impact or interaction with the fuel racks, for the NA 3 site-specific seismic demands. Explain whether the fuel racks impact the pool walls. Confirm that these site-specific interaction loads are bounded by the corresponding loads considered in the standard design of the pool base slab and walls.

03.07.02-21

ESBWR DCD Section 3.8.2.4.1.5 and Appendix 3G.1.5.4.1.5 indicate that the structural assessment of the PCCS condensers and their support structures was performed based on the DCD seismic demands, to demonstrate compliance with design requirements in the ASME Boiler and Pressure Vessel Code. The results of the stress analysis are provided in DCD Reference 3.8-1 (GEH Licensing Topical Report NEDO-33572, "ESBWR ICS and PCCS Condenser Combustible Gas Mitigation Structural Evaluation", also designated as DCD Reference 3G.1-3). However, the FSAR does not provide a site-specific structural assessment of the acceptability of the PCCS condensers and their support structures for the site-specific conditions at the NA3 site. A site-specific seismic analysis and structural assessment of the PCCS condensers is needed to ensure the structural adequacy of these components, which are an integral part of the containment pressure boundary. Therefore, the applicant is requested to provide the following information:

(a) Provide an assessment of the structural design of the PCCS condensers and support structures, which demonstrates their acceptability for the NA 3 site-specific seismic demands.

(b) Update or supplement DCD Reference 3.8-1 and the FSAR, as needed to document the assessment requested in item (a).

(c) Provide a comparison of (i) the response spectra used in the site-specific assessment requested in item (a), and (ii) the response spectra used in the standard design of the PCCS condensers and their support structures documented in DCD Reference 3.8-1.

(d) Provide the magnitude of the loads at the interface between the PCCS condensers and support structures, and the RCCV top slab, for the NA 3 site-specific seismic demands. Confirm that these site-specific loads are bounded by the corresponding loads considered in the standard design of the RCCV top slab.

03.07.02-22

FSAR Section 3.7.2.4.1.7 indicates that site-specific seismic qualification and analyses are performed for equipment and components at locations where the site-specific ISRS are shown to exceed the standard plant design basis ISRS, to demonstrate that the standard design of the equipment and components is applicable for the NA3 site-specific conditions. Furthermore, FSAR Section 3.7.2.4.1.8 indicates that the seismic design of systems and components is evaluated to both the standard plant design basis ISRS and the corresponding site-specific ISRS.

The staff's review of the site-specific ISRS documented in the FSAR Section 3.7.2.4.1.6.2 identified that the site-specific ISRS exceed the corresponding standard plant design basis ISRS at many key locations in the RB/FB, CB, and FWSC. Therefore, to ensure the adequacy of the seismic design and qualification of substructures, systems, and components *at all plant locations*, the applicant is requested to provide the following information.

(a) Confirm that peak-broadened site-specific design ISRS are being developed at all plant locations, not just at the locations documented in FSAR Figures 3.7.2-229 through 246 (for the RB/FB), Figures 3.7.2-253 through 258 (for the CB), and Figures 3.7.2-271 through 282 (for the FWSC).

(b) Confirm that the seismic design and qualification of substructures, systems, and components, at all plant locations, are being performed to the envelope of the peak-broadened site-specific design ISRS and the corresponding standard plant design basis ISRS.

(c) In light of the responses to items (a) and (b) above, revise FSAR Sections 3.7.2.4.1.7 and 3.7.2.4.1.8 as needed to clearly document the design commitments for the NA3 application.

03.07.02-23

The site-specific ISRS documented in the FSAR Section 3.7.2.4.1.6.2 do not include response spectra for the single-degree-of-freedom (SDOF) oscillators that are used to represent the dynamic response of flexible walls and slabs in the SSI models of the RB/FB and CB. To ensure the adequacy of the seismic design and qualification of substructures, systems, and components that are supported on flexible walls and slabs in the RB/FB and CB, provide the following information.

(a) Provide a comparison of 5 percent damping site-specific ISRS with the corresponding standard design ISRS, for all SDOF oscillators in the RB/FB and CB (walls and slabs), similar to the comparisons shown in

FSAR Figures 3.7.2-211 through 228 (for the RB/FB), Figures 3.7.2-247 through 252 (for the CB), and Figures 3.7.2-259 through 270 (for the FWSC).

(b) Provide the peak-broadened site-specific design ISRS for all SDOF oscillators in the RB/FB and CB (walls and slabs), similar to those shown in FSAR Figures 3.7.2-229 through 246 (for the RB/FB), Figures 3.7.2-253 through 258 (for the CB), and Figures 3.7.2-271 through 282 (for the FWSC).

Furthermore, the staff identified the following inconsistencies and requests the applicant to provide further clarifications:

(c) FSAR Figures 3.7.2-211 and 3.7.2-212 compare the 5 percent damping site-specific ISRS obtained from the site-specific SSI analysis of the RB/FB refueling floor and RCCV top slab in the X-direction with the corresponding DCD spectra. However, the staff noted that with the exception of the titles, the figures are the same including the identification of node number and elevation. The applicant is requested to clarify this inconsistency.

(d) FSAR Figure 3.7.2-261 compares the 5 percent damping site-specific ISRS obtained from the site-specific SSI analysis of the FWSC model with the corresponding standard design ISRS in ESBWR DCD Section 3A.9.2, for the FPE top in the X-direction. The staff's review of this figure, however, indicates that standard design ISRS shown in FSAR Figure 3.7.2-261 does not appear to match the one shown in ESBWR DCD Figure 3A.9-1k. The applicant is requested to revise this figure.

03.07.02-24

FSAR Section 3.7.2.8 indicates that site-specific SSI analyses for the non-Seismic Category I TB, RW, SB, and ADB structures are performed following the methodology for Seismic Category I structures described in FSAR Section 3.7.2.4. Acceptance criteria for these site-specific SSI analyses are provided in NA3 ITAAC Tables 2.4.15-1, 2.4.16-1, 2.4.17-1 and 2.4.18-1 for the TB, RW, SB, and ADB structures respectively. However, the staff's review of the site cross sections shown in FSAR Figures 2.5.4-225 through 234 indicates that the foundations for the TB, RW, SB, and ADB structures may be supported on granular fill in some cases (e.g., FSAR Figure 2.5.4-230 for the TB) and not always on rock or concrete fill. It is not clear to the staff that the granular fill meets the requirements in FSAR Table 2.0-201 for minimum shear wave velocity for supporting soil (i.e., 1000 ft/sec). Therefore, it is not clear to the staff how the methodology for Seismic Category I structures, described in FSAR Section 3.7.2.4, is applicable to structures that are not supported on soil material that meets the requirements in FSAR Table 2.0-201. In order to ensure that the seismic analysis of the NA3 non-Seismic Category I structures are acceptable, the applicant is requested to address this inconsistency.

03.07.02-25

FSAR Sections 3.7.2.8.1 and 3.7.2.8.3 state that the seismic gaps between the TB and SB structures and the RB/FB are "less than the calculated maximum relative displacements between the two buildings during site-specific SSE event.” Since an evaluation of the potential interaction is needed to ensure the structural integrity of adjacent plant structures, the applicant is requested to review the accuracy of these statements (the gaps should be “no less than…” rather than “less than…”), and correct them as appropriate. The applicant is also requested to explain why the phrase “considering out-of-phase motion,” which appears in the equivalent statements in ESBWR DCD Sections 3.7.2.8.1 and 3.7.2.8.3, was omitted from the NA3 application.