PMComanchePeakPEm Resource

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Cc: ComanchePeakCOL Resource; Ward, William
Subject: Comanche Peak RCOL Section 3.8.4 - RAI Number 122
Attachments: RAI 3006 (RAI 122).doc

The NRC staff has identified that additional information is needed to continue its review of the combined license application. The NRC staff's request for additional information (RAI) is contained in the attachment. Luminant is requested to inform the NRC staff if a conference call is needed.

The response to this RAI is due within 35 calendar days of October 9, 2009

Note: If changes are needed to the safety analysis report, the NRC staff requests that the RAI response include the proposed changes.

thanks,

Stephen Monarque
U. S. Nuclear Regulatory Commission
NRO/DNRL/NMIP
301-415-1544

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Request for Additional Information (RAI) No. 3006

RAI Number 122

10/9/2009

Comanche Peak Units 3 and 4
Luminant Generation Company, LLC.
Docket No. 52-034 and 52-035
SRP Section: 03.08.04 - Other Seismic Category I Structures
Application Section: SRP 3.8.4

QUESTIONS for Structural Engineering Branch 1 (AP1000/EPR Projects) (SEB1)

03.08.04-18

This Request for Additional Information (RAI) is necessary for the NRC staff to determine if the application meets the requirements of 10 CFR Part 50, Appendix A, General Design Criteria (GDC) 2.

CP combined license (COL) 3.8(29) in Comanche Peak Nuclear Power Plant (CPNPP) COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.1, “Introduction,” the first paragraph (Page 3KK-1) states that “The SASSI model is confirmed by comparing the structural frequencies between the SASSI model mesh and the fine mesh design model. The structural frequencies are calculated from modal analysis performed in ANSYS, and the similar results ensure compatibility between the two models and indicate that the SASSI model is acceptable.”

The applicant is requested to provide the following information:

(a) Describe the “fine mesh design model” mentioned in the first sentence.

(b) Provide a table listing the natural frequency, modal participating factor, and modal participating mass ratio for the first three modes in the directions, x, y, and z, assuming the fixed base condition for both ANSYS and SASSI models. The modal participating factor should be calculated by Eq. 3.2-4 of American Society of Civil Engineers (ASCE) 4-98.

03.08.04-19

This Request for Additional Information (RAI) is necessary for the NRC staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.1, “Introduction,” the second paragraph (Page 3KK-1) states that “Dynamic analysis is performed in SASSI to obtain seismic response of the structure that includes SSI [soil-structure interaction] effects. Response spectra analyses are performed in ANSYS to obtain seismic design demands.”

The applicant is requested to provide the following information:

(a) Explain the purpose of performing the SASSI analysis. Are the results obtained from the SASSI analysis used only in checking the results obtained from the ANSYS analysis?

(b) Specify which response spectra are used in the response spectra analyses in ANSYS.

In Subsection 3.8.4.4.3.2, “UHSRS,” the second paragraph states that the soil springs based on the ASCE 4 Section 3.3.4.2 are placed at the bottom of the base slab in the ANSYS model. This model is the so-called “non-classical damped system,” and the classical normal mode analysis cannot be performed. As a result of this, the response spectra analysis cannot be carried out. Provide the technical basis and provide information that shows how these response spectra analyses were performed in the CPNPP COL FSAR.

03.08.04-20

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.1, “Introduction,” the second paragraph (Page 3KK-1) states that “Due to the low seismic response at the Comanche Peak Nuclear Power Plant site and lack of high frequency exceedances, the SASSI capability to consider incoherence of the input control motion is not implemented in the design of the UHSRS.”

The applicant is requested to explain what are “high frequency exceedances”. Is this a prerequisite for not considering the incoherence of the input control motion?

03.08.04-21

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.2, “Model Description and Analysis Approach,” the second paragraph (Page 3KK-1) states that “Due to symmetry, soil-structure interaction (SSI) analysis is performed only on UHSRS B/D, and the responses are deemed applicable to the other UHSRS.”

CPNPP COL FSAR Figure 3.8-201 shows the layout of the ultimate heat sink related structures (UHSRS) A, B, C, and D. UHSRS A and B are next to each other, and UHSRS C and D are next to each other. UHSRS A and B are separated from UHSRS C and D by a distance of about 58 ft. The applicant is requested to explain why the SSI analysis is performed on UHSRS B/D, and not UHSRS A/B or UHSRS C/D. Figure 3.8-201 shows that UHSRS A/B are perfectly symmetric with UHSRS C/D.

03.08.04-22

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.2, “Model Description and Analysis Approach,” the third paragraph (Page 3KK-2) states that “The input within-layer motion and strain-compatible backfill properties for the SASSI analysis are developed from site response analyses described in Section 3NN.2 of Appendix 3NN by using the site-specific foundation input response spectra (FIRS) discussed in Subsection 3.7.1.1.”

In CPNPP COL FSAR in Subsection 3.7.1.1, CP COL 3.7(5) presents Figure 3.7-201, which compares FIRS1, FIRS2, FIRS3, and FIRS4, with the certified seismic design response spectra (CSDRS) anchored at 0.1g. Also, Note 1 in the figure indicates that FIRS1 is the site-specific ground motion response spectra (GMRS).

The applicant is requested to:

(a) Provide information that explains how the strain-compatible backfill properties are obtained or computed. Appendix 3NN did not provide information for variations of shear modulus and damping ratio with shear strain level used in the calculation. Provide this information.

(b) Explain the relationship between FIRS and SSE. According to Appendix S to 10 CFR 50, the SSE should be used in the design. Provide the rationale and the technical basis to show that structures designed for FIRS can meet the SSE demands.

Furthermore, in US-APWR DCD Tier 2, Subsection 3.7.1.1, the second paragraph under "Site-Specific GMRS" on Page 3.7-4 states that “Site-specific GMRS are developed at a sufficient number of frequencies (at least 25) that adequately represent that local and regional seismic hazards using the site-specific geological, seismological, and geophysical input data.”

In addition, the first paragraph under the title of "FIRS" on Page 3.7-4 in the US-APWR DCD states that “The site-specific GMRS serves as the basis for the development of FIRS that define the horizontal and vertical response spectra of the outcrop ground motion at the bottom elevation of the seismic category I and II basemats. Free-field outcrop spectra of site-specific horizontal ground motion are derived from the horizontal GMRS using site response analyses that consider only the wave propagation effects in materials that are below the control point elevation at the bottom of the basemat. The material present above the control point elevation can be excluded from the site response analysis.”

The applicant is requested to explain:

a. Why the FIRS presented in CPNPP COL FSAR Figure 3.7-201 are defined by seven frequencies, not 25 frequencies, as stated in US-APWR DCD?

b. How are the FIRS derived from the GMRS.

c. Why FIRS are not scaled up to anchor at 0.1g before making the comparisons, in order to meet the minimum ground acceleration required by 10CFR, Appendix S to Part 5?

03.08.04-23

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.2, “Model Description and Analysis Approach,” the 3rd paragraph, last two sentences (Page 3KK-2) state, in part, “To account for uncertainty in the site-specific properties, three profiles of subgrade properties are considered, including best estimate (BE), lower bound (LB), and upper bound (UB). For backfill, an additional high bound (HB) profile is also used together with the UB subgrade profile to account for expected uncertainty in the backfill properties.”

The applicant is requested to describe the values of the expected uncertainties in the backfill properties, and to reference the source of the data used to establish the uncertainty.

03.08.04-24

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.2, “Model Description and Analysis Approach,” the fourth paragraph (Page 3KK-2) states that “The following SSI analyses and site profiles are used for calculating seismic responses of UHSRS:

- a surface foundation condition (without the presence of backfill) for the lower bound case
- an embedded foundation without separation of the backfill from the UHSRS exterior walls for the best estimate case
- an embedded foundation with separation of the backfill from the UHSRS exterior walls for all four soil cases, namely; LB, BE, UB, and HB

The backfill separation is modeled by reducing the shear wave velocity by a factor of 10 for the soil elements adjacent to the structure that are determined to be separated. The potential for separation of backfill is determined using an iterative approach that compares the peak envelope soil pressure results for the best estimate (BE) case to the at-rest soil pressure.”

The applicant is requested to provide the following information:

(a) Explain why in the first bullet, only the LB case is considered and in the second bullet, only the BE case is considered; whereas, for the third bullet, LB, BE, UB, and HB are considered.

(b) Provide the rationale for choosing a factor of 10 for reducing the shear wave velocity to model the backfill separation.

(c) Provide details that show how the interactive approach was done. Does this analysis correspond to the case of the third bullet? If yes, why is only the BE case considered in the iterative procedure to determine the potential of separation? In the third bullet statement, it is stated that all four soil profiles were considered.

(d) Once the separation condition is met, is the shear wave velocity reduced for the entire surrounding soil, or just one side of the soil? Justify the method of analysis if the shear wave velocity is reduced for the entire surrounding soil. In reality, when one side of the soil separates, the other side of the soil will not separate during the earthquake.

(e) Provide information that shows how the results of these analyses are used in design.

03.08.04-25

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.2, “Model Description and Analysis Approach,” the last paragraph on Page 3KK-2 states that “Shell elements are used to model the basemat and brick elements are used for the concrete fill that is present beneath basemat.”

The applicant is requested to provide information that shows how the interface between the basemat and concrete fill is modeled. Are shell elements in contact with the brick elements directly? If yes, how is the shell element connected to the brick element?

03.08.04-26

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.2, “Model Description and Analysis Approach,” the paragraph at the top of Page 3KK-3 gives three equations used to modify the slab elements to account for the cracked out-of-plane flexural stiffness and non-cracked in-plane axial and shear stiffness of the slabs.

The applicant is requested to provide the technical basis for these equations and the reference to the source of the equations.

03.08.04-27

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.2, “Model Description and Analysis Approach,” the last paragraph on Page 3KK-3 states that “The hydrodynamic effects of the water contained in the basins, cooling towers, and pump room of the UHS [ultimate heat sink] are considered in the model. The water is separated into rectangular regions in which water sloshing can develop under horizontal seismic excitation. Using the methodology specified in ACI [American Concrete Institute] 350.3-06 (Reference 3KK-5), the water within each region is separated into impulsive (fixed) and convective (sloshing) masses. The impulsive mass of the water is lumped uniformly along the height of the walls at each end of the rectangular region in the direction perpendicular to the wall. For the response spectra analyses performed to obtain seismic design demands, the sloshing mass is not required to be modeled since its fundamental frequency is much lower than the structural or soil frequencies. The vertical mass of the water is distributed uniformly across the basemat.”

The applicant is requested to provide the following information:

(a) The second sentence in the above quoted paragraph, “The water is separated into rectangular regions in which water sloshing can develop under horizontal seismic excitation,” is confusing. Is water separated into rectangular regions so that water sloshing can develop? Is water sloshing a needed feature? Why?

(b) The meaning of the third sentence is not clear. Explain the meaning of “impulsive (fixed)” in this sentence. Does “fixed” mean fixed with respect to the ground? Is the flexibility of the tank wall considered?

(c) Is the possibility of water separating from the wall considered in the analysis?

(d) List the fundamental sloshing frequency, the structural frequency, and the soil frequency. Are the sloshing forces included in the design of walls? If yes, describe how they are considered. If not, explain the rationale for ignoring these sloshing effects.

(e) Are there any conditions where one of the basins is empty while the adjacent basin is filled with water? If so, summarize the results of the analysis for that condition. If not, provide the rationale for not considering those conditions.

03.08.04-28

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.3, “Seismic Analysis Results,” the second paragraph (Page 3KK-4) states that “The base shear and moment demands on walls, calculated in SASSI calculated lateral dynamic soil pressures and equivalent pressure used for design analysis, were compared and the design pressure profile shown to be conservative. The peak design vertical soil pressure calculated under the base slab is 11.7 ksf, which reduces away from edges. This value excludes the peak corner pressure of 23.0 ksf calculated on a single element, representing less than 0.2 percent of the total base slab area. The average peak vertical seismic pressure calculated under the base slab is 1.6 ksf.”

The applicant is requested to:

(a) Revise first sentence in the above quoted paragraph as it seems confusing.

(b) Provide the definition for “equivalent pressure” that is used for design analysis. Also, provide technical information that shows how it is calculated.

(c) Provide information for the design pressure profile mentioned in the paragraph.

(d) Provide the technical rationale for excluding the 23.0 ksf for the corner pressure. Explain why the peak corner pressure of 23.0 ksf appears in the analysis. Why does this high stress only occur in one element?

(e) Show the data for any comparisons made between demand and design loads that support the conclusion that the results are conservative.

03.08.04-29

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.3, “Seismic Analysis Results,” the third paragraph (Page 3KK-4) states that “The response spectra analysis includes sloshing effects on the basins considering 0.5 percent damping, and follows the Lindley-Yow method (Reference 3KK-8) and 10 percent modal combination method.”

In CPNPP COL FSAR, Appendix 3KK, Section 3KK.2, “Model Description and Analysis Approach,” the last paragraph (Page 3KK-3) states that “For the response spectra analyses performed to obtain seismic design demands, the sloshing mass is not required to be modeled since its fundamental frequency is much lower than the structural or soil frequencies.”

The two statements above regarding the sloshing effect conflict. The first states the sloshing effect is included; whereas, the second states that the sloshing effect is not

included. The applicant is requested to clarify this matter by clearly stating whether or not the sloshing effect is included in the analysis.

03.08.04-30

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.3, “Seismic Analysis Results,” the third paragraph (Page 3KK-4) states that “The spectrum is increased by a factor of 1.57, which is equal to the ratio of 0.5% damped spectral values to 5 percent damped values for the frequency range in which the sloshing modes act.”

The applicant is requested to provide the technical basis for using the factor of 1.57 in the analyses.

03.08.04-31

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.3, “Seismic Analysis Results,” the last sentence of the third paragraph (Page 3KK-4) states that “The spectra used for this approach were confirmed to be higher than the enveloped base spectra calculated from the SASSI analysis.”

How were the spectra mentioned in the above quoted sentence obtained? Provide information for the structural model, the input motions, and the method of analysis used to obtain the spectra.

03.08.04-32

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.3, “Seismic Analysis Results,” the second paragraph on Page 3KK-5 states that “The model used for response spectra seismic design analysis considered two bounding base slab behaviors; (a) flexible base slab – modeled with slab supported by using soil springs calculated using ASCE 4 (Reference 3KK-3) methodology, and (b) rigid base slab – modeled by fixing the nodes across the base of the structure.”

The applicant is requested to provide the following information:

(a) In case (a) above for the flexible base slab, the applicant states that the soil springs of ASCE 4 were used in the model. However, the soil springs of ASCE 4 assume the massless rigid base slab. Provide justification for using these springs for the flexible base slab.

(b) The model for a structure with soil springs of ASCE is a non-classical damped system that does not have the classical vibration modes. Provide the technical basis and information that shows how CPNPP COL FSAR solved the non-classical damped system and then performed the response spectrum analysis. What is the damping value used in the analysis?

03.08.04-33

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.2, "UHSRS", which references Appendix 3KK. In Appendix 3KK, Section 3KK.4, “In-Structure Response Spectra (ISRS),” the last sentence of the paragraph (Page 3KK-5) states that “For the design of seismic category I and II subsystems and components mounted to the UHSRS walls, it is required to account for the effects of out-of-plane wall flexibility.”

The applicant is requested to provide information that shows how the effects of out-of-plane wall flexibility are considered in the analyses.

03.08.04-34

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” section 3LL.1, “Introduction”, the paragraph (Page 3LL-1) states that “The computer program SASSI (Reference 3LL-1) serves as the platform for the soil-structure interaction (SSI) analyses. The three-dimensional (3D) finite element (FE) models used in SASSI are condensed from FE models with finer mesh patterns initially developed using the ANSYS computer program (Reference 3LL-2). The dynamic analysis of the SASSI 3D FE model in the frequency domain provides results for the ESWPT seismic response that include SSI effects. The SASSI model results for maximum accelerations and seismic soil pressures are used as input to the ANSYS models for performing the detailed structural design, including loads and load combinations in accordance with the requirements of Section 3.8.”

The applicant is requested to:

(a) Provide a description, including figures, that shows how the surrounding soil was modeled in the SASSI SSI analysis. What are the assumed boundary conditions? Address the location where the input motions were applied to the model. Were the input motions in time domain or in the form of response spectra? What is the damping ratio assumed for the input motions?

(b) Explain how the SASSI model results for maximum accelerations are used as input to the ANSYS model. List the locations of these maximum accelerations. If the results of SASSI SSI analysis are in time domain, explain how maximum accelerations at different locations are obtained from different time histories.

03.08.04-35

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” section 3LL.1, “Introduction”, the last sentence of the paragraph (Page 3LL-1) states that “Due to the low seismic response at the Comanche Peak Nuclear Power Plant site and the lack of high-frequency exceedances, the SASSI capability to consider incoherence of the input control motion is not implemented in the design of the ESWPT.”

The response of underground tunnels is produced primarily by the ground deformations under free-field conditions; therefore, the wave passage, including non-vertically propagating waves, and the wave incoherence effects may be important in the response calculation. The applicant is requested to address the issue, “Are the effects of the seismic wave passage on the tunnel considered in the analysis?” If yes, provide a description of the wave fields considered and the impinging angles assumed. If not, provide the technical justification for not considering the wave passage effects. Also, provide the technical justification for not considering the wave incoherence effects.

03.08.04-36

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” section 3LL.2, “Model Description and Analysis Approach,” the first sentence of the first paragraph (Page 3LL-1) states that “The ESWPT is modeled with three separate models, each model representing a physical portion of the ESWPT.”

The applicant is requested to provide a description for the boundary conditions assumed for the interfaces of three segments and provide technical justification for the assumptions.

Also, expansion joints are provided near the corner junctions of the intersecting ESWPT segments, as well as those located within the straight portion of the segments away from the intersections. The applicant is requested to address the following issues:

a. How were the analyses performed so that they account for the seismic behavior of the tunnel walls at the corner junctions of these intersecting segments? Provide a description of the results of this analysis.

b. Also, describe the nature of the design of these expansion joints and provide data regarding their properties and behavior over time.

03.08.04-37

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” section 3LL.2, “Model Description and Analysis Approach,” the last sentence of the first paragraph (Page 3LL-1) states that “Shell elements model the roof, interior, and exterior walls, and basemat. Brick elements model the backfill and fill concrete below the ESWPT basemat.”

The shell element has six degrees of freedom per node; whereas, the brick element has only three degrees of freedom per node. The applicant is requested to explain how shell elements are connected to the brick elements.

03.08.04-38

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” section 3LL.2, “Model Description and Analysis Approach,” the second paragraph (Page 3LL-1) states that “Site-specific strain-compatible backfill and rock properties are used in determining the within-layer motion.”

The applicant is requested to provide information for the soil shear modulus and soil material (hysteretic) damping ratio as a function of soil shear strain used in the analysis to obtain the site-specific strain-compatible soil properties.

03.08.04-39

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” section 3LL.2, “Model Description and Analysis Approach,” the first paragraph on Page 3LL-2 states that “The ESWPT model is developed and analyzed using methods and approaches consistent with ASCE 4 (Reference 3LL-3) and accounting for the site-specific stratigraphy and subgrade conditions described in Chapter 2, as well as the backfill conditions around the embedded portions of the ESWPT.”

The applicant is requested to provide information for the exact section number(s) of ASCE 4 that were used in the ESWPT analysis.

03.08.04-40

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” section 3LL.3, “Seismic Analysis Results,” the first paragraph (Page 3LL-2) states that “Table 3LL-4 presents the natural frequencies and descriptions of the associated modal responses obtained from the fixed-base ANSYS analysis of the straight portion of the ESWPT (Segment 1 Model). These frequencies were compared to the frequencies calculated from the transfer functions for the SASSI model to confirm adequacy of the coarser mesh SASSI model to represent dynamic behavior of the tunnels. Table 3LL-5 presents a summary of SSI effects on the seismic response of the ESWPT segments.”

Provide the following information:
(a) Essential service water pipe tunnel (ESWPT) is an underground structure. The surrounding soil should be included in the analysis. The approach used in the CPNPP COL FSAR in which, first, the natural frequencies of the structure in its fixed-base condition are computed ignoring the surrounding soil, and then the response spectra analysis is performed, which does not seem to have a valid technical basis. The applicant is requested to provide the technical justification for this approach used in the analyses.

(b) Provide the technical information that shows how the natural frequencies were calculated from the transfer functions for the SASSI model. Provide plots for these transfer functions. Is the surrounding soil included in the SASSI model? What criteria are used to confirm the adequacy of the coarser mesh SASSI model?

03.08.04-41

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” section 3LL.3, “Seismic Analysis Results,” the second paragraph (Page 3LL-3) states that “The maximum accelerations have been obtained by combining cross-directional contributions in accordance with RG 1.92 (Reference 3LL-5) using the square root sum of the squares (SRSS) method.” The third paragraph (CP FSAR Page 3LL-3) states that “Tables 3LL-9, 3LL-10, and 3LL-11 present the maximum seismic design forces and moments that represent the envelope of the results for all considered site conditions. The forces and moments are obtained by combination of the three orthogonal directions used in the model by the Newmark 100%-40%-40% method. The seismic design forces are applied to the ANSYS model for structural design of members and components.”

The applicant is requested to:

(a) Explain what “cross-directional contributions” means in the first quoted sentence above.

(b) Provide a rationale on why SRSS is used for combining accelerations; whereas, the Newmark 100%-40%-40% method is used for combining forces and moments.

(c) Provide a description for the ANSYS model. If the mesh of ANSYS model is different from that of SASSI model, provide a detailed description that shows how the seismic design forces obtained from the SASSI model are mapped to the ANSYS model.

03.08.04-42

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” Table 3LL-1, “ESWPT Segment 1 FE Model Component Properties,” there are two notes, 1 and 2, presented at the bottom of the table. The first note is referred in the fifth column. The second note, however, is not referred in the Table. The applicant is requested to correct this oversight.

03.08.04-43

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” Table 3LL-5, “SASSI Results for ESWPT Seismic Response” (Page 3LL-9), the first sentence under “Backfill” states, “The properties of the backfill determine the overall response of the buried ESWPT structure.” Later, the backfill soil frequency ranges are provided.

The applicant is requested to provide a description of the material properties required for the engineered backfill used for the ESWPT. This discussion should address current industry activities evaluating backfill properties issues under the direction of the Nuclear Energy Institute (NEI), and possible implications on seismic analyses performed on the ESWPT and as-built properties of the engineered backfill.

03.08.04-44

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” Table 3LL-7, “ESWPT Segment 2 SASSI FE Model Component Peak Accelerations” (Page 3LL-11), the third note at the bottom of the table states that “For structural design using the loads and load combinations in Section 3.8, design accelerations are determined separately using a response spectra analysis of the Segment 2 ANSYS FE model using as input the enveloped accelerations shown above, and a dynamic soil pressure.”

The applicant is requested to:

a. Provide details that show how the response spectra analysis mentioned in the above quoted paragraph was performed.

b. Show how the accelerations in the table are used as inputs.

c. Describe the locations of “a dynamic soil pressure” and discuss how it is used as input for the response spectra analysis.

03.08.04-45

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.1, "ESWPT", which references Appendix 3LL. In Appendix 3LL, “Model Properties and Seismic Analysis Results for ESWPT,” Table 3LL-13, “Bearing Pressures Below ESWPT (ksf)” (Page 3LL-17).

The applicant is requested to provide the allowable soil bearing pressure in the table.

03.08.04-46

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.3, "PSFSVs", which references Appendix 3MM. In Appendix 3MM, “Model Properties and Seismic Analysis Results for PSFSVs,” Section 3MM.1, “Introduction,” the second paragraph (Page 3MM-1) states that “The SASSI model results including seismic soil pressures are used as input to the ANSYS models for performing the detailed structural design including loads and load combinations in accordance with the requirements of Section 3.8.”

The applicant is requested to:

(a) Provide the detailed technical information that shows how the SASSI results, including seismic soil pressure, are used as input to the ANSYS models. Is the SASSI result at every node used as input?

(b) Provide descriptions for the ANSYS models. How many ANSYS models are there? Why use more than one model?

03.08.04-47

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.3, "PSFSVs", which references Appendix 3MM. In Appendix 3MM, “Model Properties and Seismic Analysis Results for power source fuel storage vaults (PSFSVs),” Section 3MM.2, “Model Description and Analysis Approach,” the second paragraph (Page 3MM-1) states that “Shell elements are used for the roof, interior and exterior walls, brick elements are used for the base mat, and beam elements are used to represent the emergency power fuel oil tanks and their supports, which are connected to the basemat.”

Provide the technical justification for using beam elements to model the fuel oil tank and their supports. Is the case of the tanks not filled with fuel oil included in the analyses? If yes, provide a description how it is modeled. If not, provide the rationale for not considering this case.

03.08.04-48

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.3, "PSFSVs", which references Appendix 3MM. In Appendix 3MM, “Model Properties and Seismic Analysis Results for PSFSVs,” Section 3MM.2, “Model Description and Analysis Approach,” the second paragraph on Page 3MM-3 states that, “The backfill separation is modeled by reducing the shear wave velocity by a factor of 10 for those layers of backfill that are determined to be separated. The potential for separation of backfill is determined using an iterative approach that compares the peak envelope soil pressure results to the at-rest soil pressure.”

The applicant is requested to:

(a) Provide justification for using a factor of 10 to reduce the shear wave velocity for those layers of backfill that are to be separated.

(b) Provide a detailed description for the iterative approach used while running the SASSI program. If the shear wave velocity of a layer is reduced by 10, would that layer stay with the reduced shear wave velocity, or would it go back to the original shear wave velocity once the dynamic soil pressure is less than the at-rest soil pressure?

03.08.04-49

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.3, "PSFSVs", which references Appendix 3MM. In Appendix 3MM, “Model Properties and Seismic Analysis Results for PSFSVs,” Section 3MM.3, “Seismic Analysis Results,” the second paragraph (Page 3MM-3) states that “The total adjusted wall shear forces used for design are presented in Figure 3MM-2.”

The applicant is requested to explain why these shear forces presented in Figure 3MM-2 are not symmetric? Seismic may come in any direction. Provide a rationale for not using symmetric forces in the design.

03.08.04-50

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsection 3.8.4.4.3.3, "PSFSVs", which references Appendix 3MM. In Appendix 3MM, “Model Properties and Seismic Analysis Results for PSFSVs,” Section 3MM.4, “In-Structure Response Spectra (ISRS),” the paragraph (Page 3MM-4) states that “The spectra can be used for the design of seismic category I and II subsystems and components housed within or mounted to the PSFSV.”

The applicant is requested to address the issue: Are the emergency power fuel oil tanks and their supports designed by making use of these ISRS? Where is this design presented?

03.08.04-51

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsections 3.8.4.4.3.1, "ESWPT", 3.8.4.4.3.2, "UHSRS", and 3.8.4.4.3.3, "PSFSVs", which reference Appendices 3LL, 3KK, and 3MM, respectively. Each of these appendices reference Appendix 3NN, “Model Properties and Seismic Analysis Results R/B-PCCV-Containment Internal Structure”.

In Appendix 3NN, Section 3NN.2 (Page 3NN-1), the 1st paragraph states “The R/B-PCCV-containment internal structure of Units 3 and 4 will be constructed on a rock subgrade by removing the native soil above the top of the limestone layer with shear wave velocity exceeding 5000 fps that is located at nominal elevation of 782 ft. A thin layer of fill concrete will be placed on the top of the limestone to level the surface below the building basemat established at nominal elevation of 783 ft.-2 in. Fill concrete will be also placed below the surface mat located at the north-east corner of the FH/A [fuel handling area] under the central portion of the mat underneath the PCCV. The foundation will be backfilled with a 40 ft. thick layer of engineered fill material to establish the nominal elevation of the plant ground surface at 822 ft.”

The applicant is requested to address the following issues:

(a) The 3rd sentence in the above quote is not clear. It is not clear where the fill concrete is placed. (Is there an "and" missing between "the FH/A" and "under the central portion of the mat under the PCCV"?) For example, information given in the US-APWR DCD shows that the bottom of the common basemat below the R/B PCCV and containment internal structure (CIS) is not at one elevation or level. Rather, it varies, as for example, below the FH/A. It also varies below the PCCV, wherein the bottom of the central circular portion of the basemat below the PCCV is at a much higher elevation than the bottom of the concrete slabs under the prestressing tendon gallery. Is fill concrete also placed under this central region of the basemat under the PCCV? The staff suggests that a figure be included in the CPNPP COL FSAR that clearly indicates the extent of the concrete fill, both in plan view and in cross section.

(b) The quoted paragraph suggests that the intent of the CPNPP design is to have a concrete fill below the central region of the basemat under the PCCV. Describe the design of this fill, including how and when it is placed between the tendon gallery foundation slab, and how it joins with the structural concrete of the tendon gallery. This description should also address any special precautions to be taken when placing thick sections of concrete.

(c) If there is fill concrete below the PCCV slab, describe how the design of the concrete common basemat under the R/B, PCCV, and containment internal structures is treated in the region where the ASME Code governs the design (i.e., under the PCCV). Describe the design of the basemat at the juncture between regions designed to the requirements of the ASME Code and regions governed by the ACI-349 code.

(d) Does this concrete fill have any steel reinforcement?

03.08.04-52

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsections 3.8.4.4.3.1, "ESWPT", 3.8.4.4.3.2, "UHSRS", and 3.8.4.4.3.3, "PSFSVs", which reference Appendices 3LL, 3KK, and 3MM, respectively. Each of these appendices reference Appendix 3NN, "Model Properties and Seismic Analysis Results R/B-PCCV-Containment Internal Structure".

In Appendix 3NN, Section 3NN.2, "Seismological and Geotechnical Considerations," the second paragraph (Page 3NN-2) states, in part, that "The profiles address the possibility of stiffer backfill, and the project specifications limit the minimum shear wave velocity of the backfill material to 600 ft/s for 0 to 3 ft. depth, 720 ft/s for 3 to 20 ft. depth, and 900 ft/s for 20 to 40 ft. depth. Table 3NN-1 presents the COV on shear modulus used for development of different soil profiles."

The applicant is requested to address the following issues:

(a) Explain how the project specification limit (i.e., the minimum shear wave velocity of the backfill material to be 600 ft/s for 0 to 3 ft. depth, 720 ft/s for 3 to 20 ft. depth, and 900 ft/s for 20 to 40 ft. depth) is enforced during the construction.

(b) Correct typo in the third column heading of Table 3NN-1. The abbreviation for Upper Bound should be UB not LB.

03.08.04-53

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsections 3.8.4.4.3.1, "ESWPT", 3.8.4.4.3.2, "UHSRS", and 3.8.4.4.3.3, "PSFSVs", which reference Appendices 3LL, 3KK, and 3MM, respectively. Each of these appendices reference Appendix 3NN, “Model Properties and Seismic Analysis Results R/B-PCCV-Containment Internal Structure”.

In Appendix 3NN, Section 3NN.2, “Seismological and Geotechnical Considerations,” the fourth paragraph (Page 3NN-2) states that “The compression or P-wave velocity is developed for the rock and the backfill from the strain-compatible shear or S-wave velocity (Vs) and the measured value of the Poisson’s ratio. The SSI analyses use identical values for the shear S-wave and compression P-wave velocity damping. Figure 3NN-1, Figure 3NN-2 and Figure 3NN-3 present, respectively, the rock subgrade LB, BE and UB profiles for shear (S) wave velocity (Vs), compression (P) wave velocity (Vp) and material damping. Figure 3NN-4, Figure 3NN-5 and Figure 3NN-6 present in solid lines the results of the site response analyses for the profiles of strain-compatible backfill properties. The plots also show with dashed lines the backfill profiles that were modified to match the geometry of the mesh of the SASSI basement model. The presented input S and P wave profiles are modified using the equal arrival time averaging method.”

The applicant is requested to provide:

(a) Plots for soil shear modulus and damping as a function of soil strain used in the above analysis.

(b) Technical information for “the equal arrival time averaging method.”

03.08.04-54

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsections 3.8.4.4.3.1, "ESWPT", 3.8.4.4.3.2, "UHSRS", and 3.8.4.4.3.3, "PSFSVs", which reference Appendices 3LL, 3KK, and 3MM, respectively. Each of these appendices reference Appendix 3NN,

“Model Properties and Seismic Analysis Results R/B-PCCV-Containment Internal Structure”.

In Appendix 3NN, Section 3NN.2, “Seismological and Geotechnical Considerations,” the last paragraph (Page 3NN-3) states that “The site response analyses convert the design motion that is defined as outcrop motion (or motion at the free surface) to within-layer (or base motion) that depends on the properties of the backfill above the rock surface. The site response analyses provide for each considered backfill profile, two horizontal acceleration time histories of the design motion within the top limestone rock layer that are used as input in the SASSI analyses of embedded foundation. The outcrop horizontal time histories are used as input for the SASSI analyses of surface foundations.”

The above quoted paragraph is confusing. The applicant is requested to explain and/or rewrite. Does the paragraph imply that the site response analysis is needed only for the embedded foundation?

03.08.04-55

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsections 3.8.4.4.3.1, "ESWPT", 3.8.4.4.3.2, "UHSRS", and 3.8.4.4.3.3, "PSFSVs", which reference Appendices 3LL, 3KK, and 3MM, respectively. Each of these appendices reference Appendix 3NN, “Model Properties and Seismic Analysis Results R/B-PCCV-Containment Internal Structure”.

In Appendix 3NN, Section 3NN.2, “Seismological and Geotechnical Considerations,” the last paragraph (Page 3NN-3) states that “The time history of the vertical outcrop accelerations serves as input for both surface and embedded foundations. The time step of the acceleration time histories used as input for the SASSI analysis is 0.005 sec.”

The applicant is requested to address the issue, “What is the cutoff frequency specified in the SASSI runs?”

03.08.04-56

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsections 3.8.4.4.3.1, "ESWPT", 3.8.4.4.3.2, "UHSRS", and 3.8.4.4.3.3, "PSFSVs", which reference Appendices 3LL, 3KK, and 3MM, respectively. Each of these appendices reference Appendix 3NN, “Model Properties and Seismic Analysis Results R/B-PCCV-Containment Internal Structure”.

In Appendix 3NN, Section 3NN.3, “SASSI Model Description and Analysis Approach,” the first paragraph (Page 3NN-3) states that “The SASSI structural model uses lumped-

mass-stick models of the PCCV, containment internal structure, and R/B to represent the stiffness and mass inertia properties of the building above the ground elevation."

The applicant is requested to provide data to show that the lumped-mass-stick models adequately match the dominant frequencies, related mode shapes, and participation factors of the 3D ANSYS model used in the detailed design.

03.08.04-57

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsections 3.8.4.4.3.1, "ESWPT", 3.8.4.4.3.2, "UHSRS", and 3.8.4.4.3.3, "PSFSVs", which reference Appendices 3LL, 3KK, and 3MM, respectively. Each of these appendices reference Appendix 3NN, "Model Properties and Seismic Analysis Results R/B-PCCV-Containment Internal Structure".

In Appendix 3NN, Section 3NN.3, "SASSI Model Description and Analysis Approach," the third paragraph (Page 3NN-3) states that "All of the modeling characteristics present in the standard plant lumped mass stick models for the R/B-PCCV-containment internal structure are the same as for the SASSI model, with the exception of minor adjustments for compatibility with SASSI, described as follows. The rigid links in the lumped mass stick models that connect different nodal points at the same floor elevation are replaced with SASSI 3D beam elements with high stiffness properties."

The applicant is requested to provide the rationale for replacing the rigid links with the 3D beam elements with high stiffness properties. Isn't that like using the 3D beam elements with high stiffness in trying to simulate the rigid link behavior?

03.08.04-58

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsections 3.8.4.4.3.1, "ESWPT", 3.8.4.4.3.2, "UHSRS", and 3.8.4.4.3.3, "PSFSVs", which reference Appendices 3LL, 3KK, and 3MM, respectively. Each of these appendices reference Appendix 3NN, "Model Properties and Seismic Analysis Results R/B-PCCV-Containment Internal Structure".

In Appendix 3NN, Section 3NN.3, "SASSI Model Description and Analysis Approach," the fourth paragraph (Page 3NN-3) states that "Table 3NN-6 presents the types of SASSI finite elements used to model the different structural members in the basement model. The table also presents the stiffness and mass inertia properties assigned to each group of finite elements."

The applicant is requested to provide the following information:

(a) The data in Table 3NN-6 indicate that shell elements are used for walls and solid elements are used for basemat and fill concrete. Explain how the shell elements are connected to the solid elements. The shell element has six degrees of freedom per node; whereas, the solid element has three degrees of-freedom per node.

(b) The second sentence of the above quoted paragraph states that Table 3NN-6 also presents the stiffness and mass inertia properties assigned to each group of finite elements. One example in the table is the data presented under NS Exterior Walls. The entries for “Mass” and “Stiffness” in the table are “Concrete (adjusted)” and “Concrete fc=4000 psi (adjusted),” respectively. This information is confusing. Concrete fc=4000 psi is the 28-day concrete compression strength, not the stiffness. Provide the actual data used in the model for “Mass” and “Stiffness.”

03.08.04-59

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of General Design Criteria (GDC) 2.

CP COL 3.8(29) in CPNPP COL FSAR inserts subsections 3.8.4.4.3.1, "ESWPT", 3.8.4.4.3.2, "UHSRS", and 3.8.4.4.3.3, "PSFSVs", which reference Appendices 3LL, 3KK, and 3MM, respectively. Each of these appendices reference Appendix 3NN, “Model Properties and Seismic Analysis Results R/B-PCCV-Containment Internal Structure”.

In Appendix 3NN, Section 3NN.4, “Seismic Analysis Results,” the third paragraph (Page 3NN-6) states that “Table 3NN-12, Table 3NN-13, and Table 3NN-14 present maximum absolute accelerations (zero period acceleration values) at lumped-mass locations of the R/B-PCCV-containment internal structure in NS, EW, and vertical direction, respectively. The results obtained from each set of SASSI analysis are listed together with the enveloped value from all of the considered site conditions.”

The applicant is requested to provide, in these tables, the corresponding values of the maximum absolute accelerations of the analysis in the US-APWR DCD.

03.08.04-60

Appendix 3NN lists CP COL 3.7(3), CP COL 3.7(26), and CP COL 3.8(29) on its title page. However, the appendix is referenced by only CP COL 3.7(20), CP COL 3.7(23), and CP COL 3.7(25). This appears to be a carryover from the title pages of the three previous appendices.

Additionally, CP COL 3.8(29) lists Appendix 3NN, when it should list Appendix 3MM.

The Chapter 3 Table of Contents and the title page of Appendix 3NN lists the title as "Model Properties and Seismic Analysis Results for R/B-PCCV-Containment Internal Structure." The Table of Contents for the Appendix adds "SASSI" to this title.

Please confirm that these are typographical errors and correct them as appropriate.