PMComanchePeakPEm Resource

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Sent: Friday, October 02, 2009 12:23 PM
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Cc: Ward, William; ComanchePeakCOL Resource
Subject: Comanche Peak RCOLA, Section 3.8.4 - RAI # 108
Attachments: RAI 2994 (RAI 108).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 2, 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. 2994

RAI # 108

10/2/2009

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)

03.08.04-1

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(19) in Comanche Peak Nuclear Power Plant (CPNPP) COL FSAR, Subsection 3.8.4.1.3.1, "ESWPT" (Page 3.8-5), the first paragraph states that "The ESWPT [essential service water pipe tunnel] is an underground reinforced concrete structure. Figure 3.8-203 shows the typical section of the ESWPT…The tunnel is divided into two sections by an interior concrete wall to provide separation of piping trains. Each section contains both ESWS [essential service water system] supply and return lines."

The applicant is requested to provide the following information:

(a) In CPNPP COL FSAR Figure 3.8-202, the top of concrete for ESWPT is at EL 810.25 ft, whereas in Figure 3.8-203, it is at EL 809.75 ft. Explain this discrepancy.

(b) In Figure 3.8-202, the thickness of the top slab of ESWPT is 2 ft-6 in., whereas, in Figure 3.8-203, it is 2 ft-0 in. Explain this discrepancy.

(c) In Figure 3.8-202, call out the rebar size and quantity, and indicate on the drawing which pipe is the supply line and which one is the return line.

(d) In the right cross section of Figure 3.8-202, the remark under the shear key of the base slab states that "SHEAR KEY – SEE DETAIL THIS DRAWING," but there is no detail given in the drawing. Provide this detail.

(e) In the right drawing of CP COL Figure 3.8-202, the remark at right states "UHS BASIN FOR REINF. SEE FIGURE 3.8-210." However, no rebar information is given in Figure 3.8-210. Call out rebar size and quantity in Figure 3.8-210.

03.08.04-2

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(19) in CPNPP COL FSAR, Subsection 3.8.4.1.3.2, the second paragraph (Page 3.8-6) states that each basin of the ultimate heat sink related structures (UHSRS) is separated from the adjacent basin by a minimum 4-inch expansion joint.

The applicant is requested to provide the following information:

(a) What is the material used for the 4-inch (minimum) expansion joints? How do the physical properties of these joints vary with aging over the 60-year life of the plant?

(b) How are the expansion joints modeled in the seismic structural analyses?

03.08.04-3

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(19) in CPNPP COL FSAR, Subsection 3.8.4.1.3.2, "UHSRS," the paragraph at the top of Page 3.8-7 states that "Air intakes are located at the north and south faces of the enclosure and configured to protect the safety-related substructures and components from tornado missiles. The north side air intake is an integral part of the cooling tower enclosure, whereas the south side air intake is an integral part of the ESWPT."

The applicant is requested to:

(a) List the safety-related substructures and components that are protected from tornado missiles.

(b) Referring to Figure 3.8-210, where it shows the air intake, explain how objects are prevented from falling into and blocking the air intake.

03.08.04-4

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(19) in CPNPP COL FSAR, Subsection 3.8.4.1.3.3, "PSFSVs," the 1st paragraph (Page 3.8-7) describes the reinforced-concrete underground vaults used to house the safety-related and non-safety-related fuel oil tanks.

The applicant is requested to address whether seismic analysis has been performed with varying levels of fuel oil in the fuel oil storage tanks. Provide a description of such

an analysis. If there is no analysis, provide the rationale as to why this condition is not important to the seismic analyses.

03.08.04-5

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

CP COL 3.8(19) in CPNPP COL FSAR, Subsection 3.8.4.1.3.4, “Other Site-Specific Structures,” states “Site-specific seismic category I yard piping and conduits are routed within reinforced concrete duct banks (solid) or reinforced concrete chases (hollow). The duct banks and chases have shallow embedments and are buried partially or wholly below grade within structurally engineered and compacted backfill that extends down to top of limestone at nominal elevation 782 ft. The duct banks and pipe chases are constructed in segments, which are separated from each other and other structures by expansion joints. The expansion joints accommodate all anticipated differential settlement and movement (due to seismic and other loading) at support points, penetrations, and entry points into other structures.”

The description of the buried piping and conduits is fairly general and lacks specific descriptions of the details of the design. The applicant is requested to:

(a) Provide details on the concrete enclosures, including cross-section views that show steel reinforcing.

(b) Provide details on the analyses performed to assure the safety-related function of the buried piping and conduits under all loadings, including seismic loads.

(c) Provide a detailed description of the expansion joints used between the segments of the buried ducts and banks, and explain how the structural adequacy of the reinforced ducts and banks is assured at these joints.

(d) Assuming that the analyses were based on beams on elastic foundations, describe how the foundation modulus for beams on the elastic foundations was calculated or otherwise obtained.

(e) Procedures for the design of restrained underground piping of American Society of Mechanical Engineers (ASME) B31.1 provide guidance for the thermal loading of the buried ducts and banks. Address whether this guidance was used for the design of buried utilities for the CPNPP. If not, explain the rationale for not following the ASME B31.1 guidance.

(f) Describe the properties of the engineered backfill and how the reconciliation of the as-built properties with the design values is to be accomplished.

03.08.04-6

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(20) in CPNPP COL FSAR, Subsection 3.8.4.3, “Loads and Load Combinations” (Page 3.8-8), the applicant is requested to provide the following information:

(a) Describe the safe-shutdown earthquake (SSE) response spectra used in the design.

(b) Provide a table comparing the loads considered in CPNPP that are different from those considered in US-APWR DCD (such as rain, snow, etc).

(c) Provide information on loads due to tornado-generated missiles, or, if not considered, the rationale for not including these loads.

03.08.04-7

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(29) in CPNPP COL FSAR, Subsection 3.8.4.4.3.1, “ESWPT,” the first paragraph (Page 3.8-8) states that “The ESWPT is designed to withstand the loads specified in Subsection 3.8.4.3.”

ESWPT is an underground structure. The applicant is requested to address the issue, “Is there any surcharge pressure on the ground surface considered in the design?” If yes, specify the surcharge pressure. If not, explain why, and describe what measures or safeguards are taken to avoid any surcharge loading.

03.08.04-8

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(29) in CPNPP COL FSAR, Subsection 3.8.4.4.3.1, “ESWPT,” the second paragraph (Page 3.8-9) states that “The stiffness of the subgrade springs under different sections of the ESWPT is calculated using the methodology in ASCE [American Society of Civil Engineers]-4 Section 3.3.4.2 (Reference 3.8-34), for vibration of a rectangular foundation resting on an elastic half space. Since the support below the structure (fill concrete and rock) will not exhibit long-term settlement effects, the subgrade stiffness calculated from ASCE-4 Section 3.3.4.2 is used for analysis of both static and seismic loads.”

The applicant is requested to provide the following information:

(a) ESWPT is an underground structure. The dynamic response of an underground structure subjected to earthquake excitation is different from that of a surface supported structure. The soil springs presented in ASCE-4 Section 3.3.4.2 are the impedance functions for rigid rectangular foundations on the ground surface for surface supported structures, not for underground structures. Provide the rationale and technical basis for using these springs for ESWPT. How is the soil on the sides and on the top of ESWPT considered in the analyses?

(b) Provide the technical basis and rationale for the statement that “the support below the structure will not exhibit long-term settlement effects” is a prerequisite for using the subgrade stiffness calculated from ASCE-4 Section 3.3.4.2 for both static and seismic loads.

03.08.04-9

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(29) in CPNPP COL FSAR, Subsection 3.8.4.4.3.1, “ESWPT,” the fourth paragraph (Page 3.8-9) states that “Where axial force in the roof and mat slabs are not balanced by an equal and opposite force from the other side of the tunnel, the roof and mat slabs work with the walls as a moment frame to resist the unbalanced lateral forces.”

The applicant is requested to explain the direction of the “axial force” mentioned in the above quoted sentence. Is it in the direction of the central axis of the tunnel?

03.08.04-10

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(29) in CPNPP COL FSAR, Subsection 3.8.4.4.3.1, “ESWPT,” the fifth paragraph (Page 3.8-9) states that “Lateral forces that are not balanced by an equal and opposite force on the other side of the tunnel are transferred to the concrete fill below the tunnel by friction, and where a shear key is present, by friction and lateral bearing of the shear key on the fill concrete. Lateral forces in the fill are then transferred to bedrock by friction, and where required, by lateral bearing of another shear key that extends into bedrock.”

The friction mentioned in the above quoted paragraph includes friction between the tunnel and the concrete fill and friction between the concrete fill and the bedrock. The applicant is requested to address the issue, “What are the coefficients of friction used in these friction calculations, and what is the rationale for assuming these values?”

03.08.04-11

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(29) in CPNPP COL FSAR, Subsection 3.8.4.4.3.1, “ESWPT,” the sixth paragraph (Page 3.8-9) states that “For dynamic forces oriented parallel to the length of the tunnel segment, the roof slab acts as a diaphragm that transfers loads to the outer and interior walls. The walls act as shear walls that transfer the forces to the mat slab. The exterior walls are also designed for static and dynamic soil pressure in accordance with ASCE 4-98 (Reference 3.8-34).”

The applicant is requested to provide the following information:

(a) The first sentence of the above quoted paragraph discussed only the dynamic forces oriented parallel to the length of the tunnel segment. Provide a similar description for dynamic forces perpendicular to the length of the tunnel segment.

(b) Provide detailed information that shows how the static and dynamic soil pressure is calculated in accordance with ASCE 4-98.

03.08.04-12

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(29) in CPNPP COL FSAR, Subsection 3.8.4.4.3.2, "UHSRS," the second paragraph (Page 3.8-9) states that "ANSYS analyses are performed on the model placed on soil springs at the bottom of the base slab, with the springs representing the stiffness of the rock subgrade. To address the sensitivity of the structural response on the subgrade stiffness, an additional set of analyses simulating a fixed base condition is performed on the model. The stiffness of the subgrade springs is calculated using the methodology in ASCE-4 Section 3.3.4.2 (Reference 3.8-34) for vibration of a rectangular foundation resting on an elastic half space. The evaluation of subgrade stiffness considers the best estimate properties of the layers above elevation 393 ft."

The applicant is requested to provide the following information:

(a) The soil springs presented in ASCE-4 Section 3.3.4.2 are for the foundations resting on the surface of elastic half space. Provide technical justification for neglecting the embedment effect.

(b) Provide a rationale for only considering the best estimate properties of the soil layers for the ANSYS analysis; whereas, the SASSI analysis for UHSRS presented in Appendix 3KK considers the best estimate, the lower bound, the upper bound, and the high bound properties of the soil layers.

(c) Provide a summary of the results of the "additional set of analyses" performed.

03.08.04-13

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(29) in CPNPP COL FSAR, Subsection 3.8.4.4.3.2, "UHSRS," the fourth paragraph (Page 3.8-10) states that "Above grade walls loaded laterally by seismic forces …"

The applicant is requested to provide detailed information for how the seismic forces are applied. Are these seismic forces applied dynamically or statically?

03.08.04-14

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(29), CPNPP COL FSAR, Subsection 3.8.4.4.3.3, "PSFSVs," the second paragraph (Page 3.8-10) states that "The ANSYS analyses are performed on the model placed on soil springs at the bottom of the concrete fill / top of limestone level representing the stiffness provided by the rock subgrade. The stiffness of the subgrade springs is calculated using the methodology in ASCE-4 Section 3.3.4.2 (Reference 3.8-34) for vibration of a rectangular foundation resting on an elastic half space. The evaluation of subgrade stiffness considers the best estimate properties of the layers above elevation 215 ft."

The applicant is requested to provide the following information:

(a) Soil springs in ASCE-4 Section 3.3.4.2 are for surface foundations. Provide the technical justification for using these springs for the PSFSVs, which have an embedment depth of 40 ft. The equivalent radius of the PSFSV foundation is about 45 ft. The depth-to-equivalent-radius ratio is about 0.9. According to ASCE4-98, the maximum depth-to-equivalent-radius is 0.3 for neglecting the effect of embedment.

(b) Provide a rationale for only considering the best estimate properties of the soil layers for the ANSYS analysis; whereas, the SASSI analysis for PSFSVs presented in Appendix 3MM considers the best estimate, the lower bound, the upper bound, and the high bound properties of the soil layers.

03.08.04-15

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(29) in CPNPP COL FSAR, Subsections 3.8.4.4.3.1, 3.8.4.4.3.2, and 3.8.4.4.3.3 (Pages 3.8-8 through 3.8-10), the applicant states that the static analyses of ESWPT, UHSRS, and PSFSV are performed on the ANSYS models placed on the soil springs calculated using the methodology in ASCE-4 Section 3.3.4.2.

The applicant is requested to provide technical details that show how the soil springs for horizontal, rocking, vertical, and torsion motions were calculated, and how they are connected to the ANSYS finite element models.

03.08.04-16

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(29) in CPNPP COL FSAR, Subsection 3.8.4.4.3.3, “PSFSVs,” the third paragraph (Page 3.8-11) states that “The roof acts as a two-way slab with a single span in the north-south direction and a 3-span continuous slab with two-way action in the east-west direction. The vertical wall loads are transmitted to the mat slab and into the bedrock. The exterior walls are also designed for static and dynamic soil pressure in accordance with ASCE 4-98 (Reference 3.8-34).”

The applicant is requested to provide the following information:

(a) CPNPP COL FSAR Figure 3.8-213 shows that the roof of the PSFSV is steel decking with concrete slabs supported on steel I beams. Steel deck is a one-way structure. Justify the above quoted paragraph which states that “The roof acts as a two-way slab”.

(b) How are the static and dynamic soil pressures calculated in accordance with ASCE 4-98?

03.08.04-17

This Request for Additional Information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR 50.55a, and General Design Criteria (GDC) 1, 2, 4, and 5.

In CP COL 3.8(28) in CPNPP COL FSAR, Subsection 3.8.4.6.1.1, “Concrete” (Page 3.8-11), the applicant is requested to specify the strength of concrete fill.