PMComanchePeakPEm Resource

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Cc: ComanchePeakCOL Resource; Ward, William
Subject: Comanche Peak RCOL- Section 3.3.2 - RAI # 66
Attachments: RAI 2819 (RAI 66).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 43 calendar days of September 20, 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

Hearing Identifier: ComanchePeak_COL_Public
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Request for Additional Information (RAI) No. 2819

RAI # 66

9/20/2009

Comanche Peak Units 3 and 4
Luminant Generation Company, LLC.
Docket No. 52-034 and 52-035
SRP Section: 03.03.02 - Tornado Loads
Application Section: 3.3.2 Tornado Loads

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

03.03.02-1

RAI-2819, Question 11372

In order for the NRC staff to verify that the site-specific tornado characteristics for the Comanche Peak Nuclear Power Plant (CPNPP) are enveloped by the maximum design-basis tornado characteristics listed in Table 1 of Regulatory Guide 1.76, 'Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants,' Revision 1 (March 2007) for Region 1, a comparison of the two sets of tornado characteristics is requested to demonstrate compliance with General Design Criterion (GDC)-2 in 10 CFR 50, Appendix A.

The maximum tornado wind speed listed in Table 1 of Regulatory Guide 1.76, Revision 1, for Region 1 was reduced from 360 mph, as specified in the original version of Regulatory Guide 1.76 (Revision 0, 1974), to 230 mph in the current version. This change was based on the enhanced Fujita (EF)-scale approach that was used to replace the Fujita (F)-scale approach to project and update the design-basis tornado characteristic in Regulatory Guide 1.76. However, the following summary describes considerations involved in determining the maximum tornado wind speed.

(1) The EF-Scale was initially based on the need to correlate the actual damage intensity of structures related to tornados, instead of investigating the maximum tornado wind speeds. In addition, members of the Fujita-Scale Forum insisted that the historical tornado database be preserved. These considerations resulted in the 0.6246 correlation factor (or reduction factor) between the F-scale and EF-Scale, where the EF-Scale equals 0.6246 times the F-Scale.

(2) The Bridge Creek tornado that occurred on May 3, 1999 in the Oklahoma City area is a good example of a recent maximum tornado event. During this tornado, researchers from the University of Oklahoma used "Doppler on Wheels" (DOW) to measure a tornado wind speed of 318 mph near Bridge Creek, Oklahoma. The data obtained by the DOW team was subjected to scientific peer review, and results of this review suggest that the maximum speed actually may be less than 318 mph, but still in the 300 mph range.

Because research tools such as DOW are being developed and used to measure tornado wind speed, the 230 mph value used by the COL applicant may not envelope the maximum tornado wind speed that could occur during a severe tornado event at the CPNPP site.

Therefore, the COL applicant is requested to provide an analysis that compares the maximum design-basis tornado characteristics listed in Table 1 of Regulatory Guide 1.76, Revision 1 for Region 1 and the tornado characteristics for the CPNPP site in northern Texas. This information is needed to allow the NRC staff to verify that the site-specific tornado characteristics for the CPNPP are enveloped by the maximum design-basis tornado characteristics listed in Table 1 of the Regulatory Guide 1.76, Revision 1 for Region 1.

03.03.02-2

RAI-2819, Question 11383

In order for the NRC staff to verify compliance with requirements in GDC-2 in 10 CFR 50, Appendix A, the COL applicant is requested to provide information on potential tornado-generated missile impact effects that are more severe than those produced by the missiles included in the missile spectrum defined in Table 2 of Regulatory Guide 1.76, Rev. 1.

[I] The design-basis tornado missile spectrum and maximum horizontal speeds that are acceptable to the NRC staff are defined in Table 2 of Regulatory Guide 1.76, Rev. 1. The three types of missiles included in the spectrum are (1) a schedule 40 pipe, (2) an automobile, and (3) a solid steel sphere. According to Section 3.3.2.2.3 of the USAPWR design control document (DCD), which was incorporated by reference into the COL application, the COL applicant states:

> Overall effects of missile impact are designed for flexural, shear, and buckling effects on structural members using the equivalent static load obtained from the evaluation of structural response. The impact is assumed to be plastic, and is determined as outlined in “Impact Effect of Fragments Striking Structural Elements” (Reference 3.3-6).”

Provide a description of the fragment spectrum considered in Reference 3.3-6 of the US-APWR DCD and identify the missiles included in the fragment spectrum, if any, which are capable of producing tornado missile impact effects that are more severe than those produced by the missiles included in the missile spectrum defined in Table 2 of Regulatory Guide 1.76, Rev. 1. Reference 3.3-6 is R.A. Williamson and R R Alvy, 'Impact Effect of Fragments Striking Structural Elements,' Holmes and Narver, Inc. Publishers, November 1973.

[II]. Compliance with GDC 2 requires that nuclear power plant structures systems and components (SSCs) are designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their intended safety functions. The design-basis tornado-generated missile spectrum in Table 2 of Regulatory Guide 1.76, Rev. 1 is generally acceptable to the NRC staff for the design of nuclear power plants. However, other possible types of missiles that could adversely affect SSCs by reducing their capability to perform their intended safety functions should be analyzed by the applicant to ensure compliance with GDC 2 requirements.

Provide information on any potential tornado-generated missiles and fragments identified by the COL applicant that could produce tornado-generated missile impact effects more severe than those produced by the missiles included in the missile spectrum defined in Table 2 of Regulatory Guide 1.76, Rev. 1.

03.03.02-3

RAI-2819, Question 11385

In order for the NRC staff to demonstrate compliance with GDC-2 in 10 CFR 50, Appendix A, additional information about the response characteristics of the Ultimate Heat Sink Related Structures (UHSRS) to wind effects is requested. Specifically, NRC staff needs additional information to determine whether Method 2 can be used to determine the design wind loads for the UHSRS in accordance with ASCE/SEI 7-05, Section 6.5 requirements.

Design wind loads for buildings and other structures, including the Main Wind-Force Resisting Systems (MWFRS) and components, may be determined using one of three procedures defined in ASCE/SEI 7-05, Section 6.1.2. The applicant selected Method 2 – Analytical Procedure described in ASCE/SEI 7-05, Section 6.5 to determine design wind loads for the UHSRS. According to this procedure, Method 2 can only be used to design the MWFRS for buildings that satisfy the two conditions defined in ASCE/SEI 7-05, Section 6.5.1. Condition 2 for Method 2 states that the building does not have response characteristics making it subject to across wind loading, vortex shedding, instability due to galloping or flutter; and does not have a site location from which channeling effects or buffeting in the wake of upwind obstructions warrant special consideration.

The COL applicant used Method 2 – Analytical Procedure described in ASCE/SEI 7-05 to transform wind speed into pressure-induced forces applied to the UHSRS in the CPNPP. According to ASCE/SEI 7-05, Section 6.5, Method 2 can be used for the design of MWFRS for the UHSRS provided they satisfy both of the conditions in Section 6.5.1. The COL applicant is requested to provide information on the geometrical shapes of the buildings and the response characteristics of the buildings due to tornado-generated wind to verify that the UHSRS comply with both Condition 1 and 2 for Method 2.

03.03.02-4

RAI-2819, Question 11386

Design wind loads for buildings and other structures, including the Main Wind-Force Resisting Systems (MWFRS) and components, may be determined using one of three procedures defined in ASCE/SEI 7-05, Section 6.1.2. In order for the NRC staff to determine whether Method 1, 2, or 3 can be used to determine the design wind loads for the site-specific Seismic Category I yard piping and conduits in accordance with ASCE/SEI 7-05, additional information about the response characteristics of the site-specific Seismic Category I yard piping and conduits to tornado-generated wind effects is requested to demonstrate compliance with GDC-2 in 10 CFR 50, Appendix A.

The CPNPP includes site-specific Seismic Category I yard piping and conduits that 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 the top of the limestone at nominal elevation 782 ft. Therefore, the COL applicant is requested to submit the following information for the site-specific Seismic Category I yard piping and conduits.

- The method defined in ASCE/SEI 7-05, Section 6.1.2 that was used to transform wind speed into pressure-induced forces applied to each of these site-specific Seismic Category I structures.
- Design details about each of these site-specific, Seismic Category I structures that can be used to evaluate compliance with the conditions for Method 1, 2 or 3 defined in ASCE/SEI 7-05, Section 6.4.1.1, 6.5.1, or 6.6.2, as applicable.
- A structural assessment of atmospheric pressure change effects, if any, for each of these site-specific Seismic Category I structures due to venting.
- An assessment of tornado missile impact effects, if any, for each of these site-specific Seismic Category I structures.
- A description of the methodology used to determine the maximum tornado wind load effects for each of these site-specific Seismic Category I structures.

03.03.02-5

RAI-2819, Question 11387

Guidance for determining the combination of tornado-generated wind effects, atmospheric pressure change effects, and missile impact effects that produce the most adverse total tornado effect is provided in NUREG-0800, 'Standard Review Plan,' (SRP) Section 3.3.2. Understanding the procedures used to transform tornado parameters into effective loads on structures is key to verifying that the most adverse combination of total tornado effects are identified and considered. This is necessary to demonstrate compliance with GDC-2 in 10 CFR 50, Appendix A

The COL applicant is requested to provide additional information on the procedures used to determine the most adverse combination of total tornado effects on the Essential Service Water Pipe Tunnel (ESWPT) and Power Source Fuel Storage Vaults (PSFSVs) so the NRC staff can verify that the individual loads were combined in a manner that will produce the most adverse total tornado effect on structures.

The requested information should include the approach used for determining the most adverse combination of total tornado effects on the ESWPT and PSFSVs and the analytical techniques used to ensure that the combination of tornado effects for the ESWPT and PSFSVs are established in a conservative manner. In addition, information about the analytical techniques used by the COL applicant is requested to verify that the most adverse combination of tornado wind load effects, atmospheric pressure change effects, and tornado missile impact effects are identified and considered.

03.03.02-6

RAI-2819, Question 11388

The COL applicant designed the Ultimate Heat Sink Related Structures (UHSRS), which have vents or large openings, as vented structures. For venting to be effective in equalizing the internal and external atmospheric pressures on the UHSRS resulting from passage of a tornado, the vents or openings must permit air movement and allow sufficient air flow through the openings and vents to accommodate depressurization.

In order for the NRC staff to evaluate the effectiveness of the vents and openings in equalizing the internal and external pressures on the UHSRS, the COL applicant is requested to provide additional information on the depressurization model used to analyze air flow patterns and characteristics through the vents and openings in the UHSRS. In addition, the COL applicant is requested to provide additional information about the procedures used to determine the most adverse combination of total tornado effects on the UHSRS so the NRC staff can verify that the individual loads were combined in a manner that will produce the most adverse total tornado effect on structures.

Furthermore, the COL applicant is requested to provide a description of the analytical techniques used to verify that the most adverse combination of tornado wind load effects, atmospheric pressure change effects, and tornado missile impact effects on the UHSRS are identified and considered. This information is needed by the NRC staff to evaluate atmospheric pressure change effects and combined tornado load effects in accordance with guidance provided in SRP Section 3.3.2, Subsection II, Item C and to demonstrate compliance with GDC-2 in 10 CFR 50, Appendix A.

03.03.02-7

RAI-2819, Question 11389

Design wind loads for buildings and other structures, including the Main Wind-Force Resisting Systems (MWFRS) and components, may be determined using one of three procedures defined in ASCE/SEI 7-05, Section 6.1.2. In order for the NRC staff to determine whether Method 1, 2, or 3 can be used to determine the design wind loads for the site-specific Seismic Category II structures in accordance with ASCE/SEI 7-05 and to evaluate impacts on the function and integrity of safety-related SSCs, additional information about the response characteristics of the site-specific Seismic Category II structures to tornado-generated wind effects is requested to demonstrate compliance with GDC-2 in 10 CFR 50, Appendix A.

According to the DCD for the US-APWR standard design, the COL applicant is responsible for identifying the wind load design method and importance factor for site-specific Seismic Category I and II buildings and structures. In addition, Seismic Category II structures and components are required to be designed for the same tornado wind loads as Seismic Category I structures, in order to preclude impact on the function and integrity of safety-related SSCs. In order for the NRC staff to evaluate compliance with these requirements, the following information for the site-specific Seismic Category II structures is requested.

- The method defined in ASCE/SEI 7-05, Section 6.1.2 that was used to transform wind speed into wind forces applied to each site-specific Seismic Category II structure.
- The importance factor for each site-specific Seismic Category II structure.
- Design details about each site-specific Seismic Category II structure that can be used to evaluate compliance with the conditions for Method 1, 2 or 3 defined in ASCE/SEI 7-05, Section 6.4.1.1, 6.5.1, or 6.6.2, as applicable.