PMComanchePeakPEm Resource

From: Monarque, Stephen
Sent: Wednesday, July 01, 2009 8:47 AM
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Cc: ComanchePeakCOL Resource; Kallan, Paul
Subject: Comanche Peak RCOL RAI 11 - Section 2.5.2
Attachments: RAI 1889 (RAI 11).doc

The NRC staff has identified that additional information is needed to continue its review of the combined license application. The staff's request for additional information (RAI) is contained in the attachment. Within five calendar days of the date of this letter, please indicate if you wish to have a conference call.

The response to this RAI is due within 35 calendar days of July 1, 2009.

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

thank you,

Stephen Monarque
U. S. Nuclear Regulatory Commission
NRO/DNRL/NMIP
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Hearing Identifier: ComanchePeak_COL_Public
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Request for Additional Information (RAI) No. 1889

RAI No. 11

7/1/2009

Comanche Peak Units 3 and 4
Luminant Generation Company, LLC.
Docket No. 52-034 and 52-035
SRP Section: 02.05.02 - Vibratory Ground Motion
Application Section: 2.5.2

QUESTIONS for Geosciences and Geotechnical Engineering Branch 1 (RGS1)

02.05.02-1

In FSAR Subsection 2.5.2.1.2 you stated that the updated earthquake catalog covers an area bounded by 28° N to 38° N and 93° W to 104° W. The update area does not completely cover all of the EPRI seismic sources used in your hazard calculations. Please justify the use of a limited spatial extent in your earthquake catalog update for the Comanche Peak site. Please describe how you account for any earthquakes occurring since 1985 within the EPRI sources, but outside of the area of your update that might potentially impact seismic source parameters used in hazard calculations at the Comanche Peak site.

02.05.02-2

In Tables 2.5.2.-202 through 2.5.2-207 you listed seismic sources that contribute more than 1% of the total hazard at the Comanche Peak site. It is not clear to the staff if these contributing sources are based on the results of the original EPRI PSHA study or they are based on the results of your own assessments conducted using the updated ground motion prediction models and the latest Comanche Peak earthquake catalog. If it is the former, please discuss in details why you concluded that change in ground motion prediction models and/or the updated catalog (e.g., Mmax updates) would not result in higher hazard contributions from these unused seismic sources.

02.05.02-3

In Subsection 2.5.2.4.2.1 you described the results of a sensitivity study to determine whether the original earthquake recurrence rates used in the 1989 EPRI study still apply to the seismic sources used in the Comanche Peak PSHA study. Your sensitivity study focused on two test zones rather than the actual EPRI seismic source geometries. Please explain why the conclusions reached by using these two test zones are applicable to all of the EPRI seismic sources used for the Comanche Peak site, especially considering that seismic sources, in general, are independent of each other.

02.05.02-4

In Subsection 2.5.2.1.3.1 you described your interpretation of the tectonic environment that produced the moderate-sized (M=5.8) earthquake of April 14, 1995 in Western Texas. In your PSHA analysis, rather than updating the EPRI M_{max} values of many of the seismic sources, you opted to create a new seismic source to accommodate any potential hazard that may result from an easterly extending Rio Grande Rift model. In your conclusions, you also stated that in your hazard calculations this new source resulted in less than 1% of the total hazard at the site and as a result, you did not incorporate it in your final PSHA calculations. Please provide further scientific evidence including a list of publications and reports that studied the April 14, 1995 earthquake and reached a conclusion that this earthquake is tectonically related to the Rio Grande Rift system. Please also provide further information on how the hazard calculated at the Comanche Peak site would be impacted if you were to update the EPRI source model parameters, such as M_{max} values to accommodate this 5.8 magnitude event, as it is normally done when EPRI source models are used as a starting point to calculate seismic hazard at a COLA site.

02.05.02-5

In Subsection 2.5.2.4.2.3.2.3 you stated that "Epistemic uncertainty in return periods for characteristics earthquakes on the Meers fault is implemented through return period branches on a logic tree." The FSAR does not include this logic tree. Please provide a copy of this logic tree.

02.05.02-6

In Subsection 2.5.2.4.2.3.3.2 you stated that rather than using areal sources to represent the Rio Grande Rift seismic source, you used a point source because it is more conservative. Please describe why this is a more conservative approach.

02.05.02-7

FSAR Subsection 2.5.2.5 states that "The average shear wave velocity of Layer C is greater than 6000 ft/sec". FSAR Figure 2.5.4-239 shows that the average velocity of layer C is less than 6000 ft/sec. Please assess the differences between the text and Figure 2.5.4-239 and provide any correction.

02.05.02-8

In FSAR Subsection 2.5.2.5 you stated “Velocity data for the deep profile was limited to only a few wells”. The FSAR does not provide the actual number and locations of these wells. Please provide additional information on the location and the geologic environment of these wells you used in estimating deeper velocities at the site. Also, provide further information on how projections were made to the site given the geology and the well locations relative to the site.

02.05.02-9

In FSAR Subsection 2.5.2.6.1.2 you stated that “The vertical DCD spectrum equals or does not exceed the horizontal DCD spectrum for frequencies above 3.5 Hz. The conclusion is that the vertical DCD spectrum will also exceed the vertical GMRS”.

a. Please further justify this conclusion.

b. Please explain why a qualitative argument is used to estimate the vertical GMRS rather than a quantitative methodology

02.05.02-10

In supplement to FSAR Subsection 2.5.2.6.1.2 you stated that “The Comanche Peak site is a deep, soft-rock site with shales and limestones near the surface having shear-wave velocities of about 2600 fps, and the V/H ratios for this site condition will be similar to those for hard rock sites”. Please provide further justification of this statement.

02.05.02-11

In FSAR Subsection 2.5.2.1.3.2, you stated that “Other historic events are discussed in the FSAR for CPNPP Units 1 and 2, but intensity observations and isoseismal maps published by Frolich and Davis suggest that these events were not likely to be felt at CPNPP Units 3 and 4.” Please further clarify this statement by describing the number, locations and characteristics of the other historic events, and their maximum modified Mercalli intensity values at or near the CPNPP site.

02.05.02-12

The Oklahoma aulacogen is an identified seismic source within the 200 mi of the CPNPP site and it is included in several of the EPRI/SOG source models as discussed in Subsection 2.5.2.2.1. The majority of these models, however, assign a low Probability of Activity (Pa) for the Oklahoma aulacogen (in the range of 0.08 to 0.6).

a. Please justify that these low probabilities still adequate for this source.

b. Does the recognition of the Meers fault, which marks the southern boundary of the Oklahoma aulocogen, as a Holocene fault with a Pa of 1.0, require a revision of the Pa values assigned for the Oklahoma aulocogen?

c. Does the pronounced seismicity observed within the seismic sources related to the Oklahoma aulocogen require increasing the Pa values and Mmax values for these sources?

02.05.02-13

In FSAR Subsections 2.5.2.4.2.2.1 and 2.5.2.4.2.2.2 you discussed how the Mmax distribution for EPRI source models was updated based on recent earthquake observations. The procedure used raises the lower bound on maximum magnitude to the magnitude of the largest observed earthquake. Please explain why the observed largest magnitude earthquake is suitable for Mmax determinations in seismic sources with limited observations and lower seismicity rates, such as the South Coastal Margin and the NM-Texas block. Please justify your assumption that the maximum observed earthquake magnitude should be used as the Mmax in these sources.

02.05.02-14

In FSAR Subsection 2.5.2.4.2.3.1 you stated that the treatment of the NMSZ in the PSHA calculations is essentially the same as what was done in Bellefonte and Clinton PSHA studies. However, the Bellefonte and Clinton PSHA studies used both time-dependent and time-independent source models. FSAR does not mention a time-dependent treatment of the NMSZ.

a. Is the time-dependent treatment of the NMSZ the same as that used in the Bellefonte FSAR? What basic renewal model is applied, Brownian passage time or some other model?

b. Please discuss the important parameters and their uncertainties used for the NMSZ. For example, mean recurrence interval, coefficient of variation, or alpha; time since last mainshock cluster to beginning of proposed plant operations, or t_0, and exposure time, $\Delta\tau$. Please define exposure time, e.g., time from beginning of commercial power generation to plant decommissioning or other appropriate end-time

02.05.02-15

In FSAR Subsection 2.5.2.4.2.3.2.2 you described the data used to determine the maximum magnitude for the Meers fault using source rupture length, source rupture area, and the maximum surface displacement data. The maximum surface displacement data produced an Mmax of 7. The staff is concerned about the lack of multiple displacement data along the Meers fault which makes it uncertain whether or not the two displacement values used are closer to the mean or the maximum displacement.

a. Please justify more fully using the limited surface displacement data available for the Meers fault with the maximum displacement regression equations of Wells and Coppersmith, rather than the average displacement regression equations of Wells and Coppersmith, which would yield a higher maximum magnitude.

b. Please further justify the use of uneven weights (0.2, 0.6, 0.2) for the three magnitude estimates in calculating the Meers fault's impact on the hazard curves.

02.05.02-16

The Meers fault is about 270 km from the CPNPP site with an Mmax distribution of 6.85±0.15 (Table 2.5.2-213) and a dominant recurrence interval of 1265 years. Considering these parameters, the staff is unclear why the Meers source's contribution to mean hazard is almost invisible in the 1 to 2.5 Hz deaggregations, and only a small contributor to the 5 to 10 Hz deaggregations of Figures 2.5.2-223 to 227. Please explain the near invisibility of the Meers source in FSAR Figures 2.5.2-223 to 227.

02.05.02-17

FSAR Subsection 2.5.2.4.2.3.3.1 states that the fault source characterization for Rio Grande Rift (RGR) faults is based on a simplification of the USGS National Seismic Hazards Maps. Some the RGR faults extend into Mexico near the Big Bend of the Rio Grande River. However, faults south of the USA/Mexico border are not considered in the National Seismic Hazards Maps and faults south of the border are not listed in Tables 2.5.2-214 and 215 of the FSAR.

a. Please explain if any attempt was made to characterize RGR seismic hazard from faults that extend into Mexico.

b. Please explain how you accounted for seismic hazard arising from other potential seismic sources located in Mexico.

02.05.02-18

In FSAR Subsection 2.5.2.4.4 you stated that “Anchoring the LF spectral shape to all frequencies was necessary because otherwise the LF spectral shape exceeded the HF spectral shape at high frequencies. This exceedance results from the contribution of extreme ground motions (ε >1, see for example Figure 2.5.2-224) at low spectral frequencies, and a resulting UHRS shape that differs for the median shape predicted in NUREG/CR-6728.” The staff is not clear on how these adjustments were made. Please describe further details by providing the low-frequency and high-frequency spectral shapes together and whether or not any higher ground motions, mentioned as “extreme ground motions” were disregarded by using the high-frequencies in low-frequency spectral matching.

02.05.02-19

FSAR Subsection 2.5.2.6.1.1. states that “Figure 2.5.2-234 shows the horizontal GMRS spectrum taken from Table 2.5.2-228,...”. However, the GMRS shown on the mentioned figure and the values provided in the table do not match. Please clarify why there is a difference. Please also explain the differences in the GMRS curves shown in Figure 2.5.2-234 of the FSAR and Figure 2.5.2-247 of the supplemental document.

02.05.02-20

Please provide the following data in digital format

a. Smooth Rock UHRS values for annual exceedance frequencies of 10^{-4}, 10^{-5}, and 10^{-6}

b. Geographic coordinates of all seismic source geometries used in the Comanche Peak PSHA study

c. Median Amplification Factors used in site response calculations for 10^{-4}, 10^{-5}, and 10^{-6} annual exceedance frequencies in digital format.

d. The shear wave velocity profile used in site response calculations in digital format.

e. Mean total hazard curves for 0.5, 1, 2.5, 5, 10, 25, and 100 Hz as well as the hazard curves of all individual seismic sources

f. Shear modulus and damping degradation curves shown in FSAR Figure 2.5.2-232

g. Soil UHRS curves electronically for 10^{-4}, 10^{-5}, and 10^{-6} annual exceedance frequencies

h. Updated earthquake catalog

02.05.02-21

1. The following is a list of editorial corrections that the staff has identified. Please provide an updated text that includes these corrections.

   a. FSAR Subsection 2.5.2.1.2, the southern Oklahoma aulacogen is not outlined on Figure 2.5.2-202 as suggested by the FSAR.

   b. FSAR Subsection 2.5.2.2.1.1 cites the wrong figure in the statement: "The Ouachita source zone extends from Arkansas into east Texas (Figure 2.5.2-233) and was defined to encompass the extent of the Ouachita fold belt within this region." Citation should read “2.5.2-203.”

   c. FSAR Subsection 2.5.2.4.1 refers to current COLA calculations in Tables 2.5.2-208 and 2.5.2-209 as 2007, but they are labeled as 2008 in the tables.

   d. In FSAR Subsection 2.5.2.4.2.3.2, the reference to Figure 2.5-211, should be to Figure 2.5.1-211.

   e. FSAR Subsection 2.5.2.4.2.3.3 uses the term “tensile stress regime.” Is the correct term “extensional stress regime”?

   f. FSAR Subsection 2.5.2.4.4 refers to the shaded cells in Table 2.5.2-220. There are no shaded cells in Table 2.5.2-220.

   g. In FSAR Subsection 2.5.2.6.2, Table 2.5.2-227, there are superscript numbers associated with particular values as if there were notes or footnotes (e.g. shallow site profile[1]). Are there corresponding notes?