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July 19, 2011

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555
ATTN: David B. Matthews, Director
Division of New Reactor Licensing

SUBJECT: COMANCHE PEAK NUCLEAR POWER PLANT, UNITS 3 AND 4
DOCKET NUMBERS 52-034 AND 52-035
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION NO. 5789
(SECTION 3.7.1)

Dear Sir:

Luminant Generation Company LLC (Luminant) submits herein the response to Request for Additional Information (RAI) No. 5789 (CP RAI #222) for the Combined License Application for Comanche Peak Nuclear Power Plant Units 3 and 4. The RAI addresses the site-specific seismic response.

Should you have any questions regarding this response, please contact Don Woodlan (254-897-6887, Donald.Woodlan@luminant.com) or me.

There are no commitments in this letter.

I state under penalty of perjury that the foregoing is true and correct.

Executed on July 19, 2011.

Sincerely,

Luminant Generation Company LLC

Donald R. Woodlan for

Rafael Flores

Attachment: Response to Request for Additional Information No. 5789 (CP RAI #222)

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NRO

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RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 5789 (CP RAI #222)

SRP SECTION: 03.07.01 - Seismic Design Parameters

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

DATE OF RAI ISSUE: 6/3/2011

QUESTION NO.: 03.07.01-9

This is a follow-up to RAI 3.7.1-8 (RAI 5609, RAI Letter Number 209).

The staff reviewed the information the applicant provided in response to RAI 3.7.1-8, which included a record from the Los Angeles (LA) University Hospital made during the 1994 Northridge, CA earthquake. The applicant explained that the magnitude of the earthquake (M6.7) is representative of the magnitudes of earthquakes dominating the high-frequency ground motion for the Comanche Peak site. However, the applicant did not describe or explain how the distance of the earthquake to the LA University Hospital compares to the distance of the Probabilistic Safety Hazard Analysis (PSHA) controlling earthquake to the Comanche Peak Site. Additional information that demonstrates the appropriateness of the selected time histories for the Comanche Peak site and how these represent the site-specific seismic response are needed in order for the staff to complete its safety review. Please provide the following information:

1- The distance from the LA University Hospital to the 1994 Northridge Earthquake and how this distance compares to the distance between the Comanche Peak site and the controlling earthquakes defined in FSAR 2.5.2.

2- If the distance between the LA University Hospital and the 1994 Northridge earthquake does not compare to the distance between the Comanche Peak site and the FSAR 2.5.2 controlling earthquakes, provide the technical basis for the selection of the LA University time history.

3- Explain how the use of a different time history (different magnitude and/or distance from the PSHA controlling earthquakes) could affect the soil structure interaction (SSI) results and overall design of the seismic category I structures of Comanche Peak Units 3 and 4.

ANSWER:

1. The closest distance from the LA University Hospital ground motion record to the fault rupture associated with the 1994 Northridge earthquake is 34.6 km, as documented in Table B-1 of Ref.1.

Distances between the Comanche Peak site and controlling earthquakes are given in FSAR Table 2.5.2-220 as follows:

	High-frequency ground motion	Low-frequency ground motion
10^{-4} motion	300 km	570 km
10^{-5} motion	180 km	630 km
10^{-6} motion	46 km	680 km

2. The first technical basis for selection of the LA University Hospital ground motion record as a starting point for spectral matching of time histories is that this is a rock record generated by an earthquake with moment magnitude M 6.7, and the three time histories of the record (two horizontals and one vertical) have broad frequency content and reasonable duration. The purpose of selecting the record was as a starting point to match a DCD spectrum (Ref. 5) that is anchored at 0.1g PGA and has broad frequency content. The purpose was not to match a spectrum of a controlling earthquake. The DCD spectrum envelops the FIRS spectra and thus represents stronger ground motion (e.g., FSAR Figure 2.5.2-239). The stronger ground motion implies a closer distance than the distances of the controlling earthquakes.

   Secondly, several studies have concluded that earthquake distance is not an influential parameter on the characteristics of strong ground motion for the purposes of calculating inelastic spectral response and nonlinear soil response. Examples are as follows:

   (A) Tuthong and Cornell (Ref. 2) examined the influence of ground motion parameters on inelastic spectral displacement by looking at the ratio of inelastic to elastic spectral displacement as a function of those parameters. They concluded that dependence on distance to earthquake rupture was small and is "...of negligible practical importance..." (Ref. 2, page 2161).

   (B) Bazzurro and Cornell (Ref. 3) examined the influence of ground motion parameters on nonlinear soil response and concluded that the site amplification factor at frequency *f*, conditioned on rock input motion, "...is virtually independent on *M* and *R*." (Ref. 3, page 2112.) This led the same authors to conclude, regarding site amplification, that "...it is not critical to select with great precision the records representing the scenario events (i.e. *M* and *R* pairs) dominating the site hazard." (Ref.6, page 2106). These authors further concluded that "These statistical properties are also valid for the extreme case of a linear soil column." (Ref.6, page 2106).

   (C) Regarding soil response, Risk Engineering, Inc. (Ref. 4) concluded that "...soil response is governed primarily by the level of rock motion and the magnitude of the event; given these two variables, distance does not have a significant effect." (Ref. 4, page 6-4).

   These separate studies of inelastic spectral response and soil response provide a strong second technical basis for concluding that the distance between an earthquake source and a strong motion instrument is not critical, when selecting a recorded ground motion to represent rock motion.

3. As described in Parts 1 and 2 above, the use of the Northridge records for formulating soil-structure interaction (SSI) analyses inputs is not intended to imply a physical relationship between the geographic location of Los Angeles versus the geographic locations of those earthquakes in FSAR Subsection 2.5.2 that contribute to an earthquake at Comanche Peak Units 3 and 4. The time histories used as input for SSI analyses and design, obtained using the Northridge records, meet the guidance provided in SRP 3.7.1 for a minimum 0.1 g earthquake, which exceeds the PSHA controlling earthquakes defined in FSAR Subsection 2.5.2. The time histories development and use as input for SSI analyses and design is described in FSAR Subsection 3.7.1 and Appendix 3NN Section 3NN.2, and the site-specific SSE spectra corresponding to the time histories are shown in

FSAR Figures 3.7-201, 3.7-202, and 3.7-203. Because the time histories used exceed the PSHA controlling earthquakes described in FSAR Subsection 2.5.2, there is no impact on the SSI analyses results or the overall design of the seismic category I structures at Comanche Peak Units 3 and 4. The time histories used as input for SSI analyses and design are not "different" but instead provide an "envelope" for SSI analyses and design, and therefore there is no impact on SSI results or overall seismic/structural design.

References

1. Risk Engineering, Inc (2001). Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk-consistent Ground Motion Spectra Guidelines, NUREG/CR-6728, Oct.
2. Tuthong, Polsak., and C.A. Cornell (2006). "An Empirical Ground-Motion Attenuation Relation for Inelastic Spectral Displacement," Bull. Seism. Soc. Am., 96, 6, 2146-2164, Dec.
3. Bazzurro, Paolo, and C.A. Cornell (2004). "Nonlinear Soil-Site Effects in Probabilistic Seismic Hazard Analysis," Bull. Seism. Soc. Am., 94, 6, 2110-2123, Dec.
4. Risk Engineering, Inc (2002). Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Development of Hazard- and Risk-Consistent Seismic Spectra for Two Sites, NUREG/CR-6769, Apr.
5. Mitsubishi Heavy Industries, Ltd (2009). Design Control Document for the US APWR, Chapter 3, Design of Structures, Systems, Components, and Equipment, Rev. 2, Oct (ML093070252).
6. Bazzurro, Paolo, and C.A. Cornell (2004). "Ground-Motion Amplification in Nonlinear Soil Sites with Uncertain Properties," Bull. Seism. Soc. Am., 94, 6, 2090-2109, Dec.

Impact on R-COLA

None.

Impact on S-COLA

None; this response is site-specific.

Impact on DCD

None.