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March 18, 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
RESPONSES TO REQUEST FOR ADDITIONAL INFORMATION NO. 5317 (SECTION 3.7.1), NO. 5411 (SECTION 6.4), AND NO. 5465 (SECTION 2.3.1)

Dear Sir:

Luminant Generation Company LLC (Luminant) submits herein responses to Request for Additional Information No. 5317 (CP RAI #205), No. 5411 (CP RAI #202), and No. 5465 (CP RAI #204) for the Combined License Application for Comanche Peak Nuclear Power Plant Units 3 and 4. The responses address seismic response spectra, compliance with ASHRAE Standard 15-207, and the 100-year return period non-coincident site wet bulb temperature, respectively.

Should you have any questions regarding these supplemental responses, 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 March 18, 2011.

Sincerely,

Luminant Generation Company LLC

Donald R. Woodlan for

Rafael Flores

Attachments: 1. Response to Request for Additional Information No. 5317 (CP RAI #205)
2. Response to Request for Additional Information No. 5411 (CP RAI #202)
3. Response to Request for Additional Information No. 5465 (CP RAI #204)

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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.: 5317 (CP RAI #205)

SRP SECTION: 03.07.01 - Seismic Design Parameters

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

DATE OF RAI ISSUE: 2/15/2011

QUESTION NO.: 03.07.01-7

This is a follow-up to RAI 3.7.1-3.

In response to RAI 3.7.1-3 Luminant has stated that the development of foundation input response spectra (FIRS) 1, FIRS 2, and FIRS 3 is consistent with the recommendations of NEI (2009) *Consistent Site-Response/Soil-Structure Interaction Analysis and Evaluation* for embedded structures that are analyzed as surface structures. To date, the soil-structure interaction (SSI) analysis performed in support of the US-APWR Standard Plant has treated embedded structures as surface structures. In contrast, in the SSI analysis of the CPNPP structures, embedded structures are analyzed as embedded structures, not surface structures.

Consequently, FIRS 1, FIRS 2, and FIRS 3 that were developed for treating embedded structures as surface structures will not generally be the same FIRS for analyzing embedded structures as embedded structures. Section 3.2.3 of NEI gives a multi-step process for developing FIRS to be used when analyzing embedded structures as embedded structures. Provide justification for using FIRS 1, FIRS 2, and FIRS 3 as the basis of comparison for determining the proper seismic input to the CPNPP structures and describe how the current approach does or does not meet the guidelines of DC/COL Interim Staff Guidance-017 (which adopts the methodology of NEI [2009]).

ANSWER:

The minimum design spectra, tied to the shapes of the certified seismic design response spectra (CSDRS) and anchored at 0.1g, define the safe-shutdown earthquake (SSE) design motion for the site-specific seismic design and analysis of category I structures. GMRS/FIRS1 and FIRS 2 and 3 motions developed in FSAR Subsection 2.5.2 were not used as SSI input for the structural and seismic design and evaluations for CPNPP Units 3 and 4 because they are all below the federally mandated 0.1 g SSE (10 CFR 50 Appendix S). FSAR Figure 3.7-201 shows why the 0.1 g SSE from the CSDRS is used as SSI input motion for the design and analysis in lieu of the spectra developed in FSAR Subsection 2.5.2. FSAR Section 3.7.1.1 defines the SSE and contains summary descriptions of FIRS1, FIRS2, FIRS3 and

FIRS4 shown in Figure 3.7-201. The response to related CP RAI 167 Question 03.08.04-64 (ML102240246) discusses how the site-specific SSE is defined.

The SSI analyses of the seismic category I structures documented in FSAR Chapter 3 and its related appendices consider both surface and embedded conditions, with limited exceptions. One such exception is the analysis of the segments 1 and 3 of the ESWPT, which considers only embedded conditions in the SSI analyses since those tunnel segments are buried.

The development of the SSE ground motion used as the basis for the site-specific SSI analyses of the standard plant is described in FSAR Subsection 3.7.1.1 and Section 3NN.2 of Appendix 3NN. FSAR Appendices 3KK, 3LL, and 3MM for the seismic analyses of site-specific structures utilize the same approach for the development of the SSI ground input motion and cross-reference to the explanations in FSAR Subsection 3.7.1.1 and Section 3NN.2. Please note that the discussion in Section 3NN.2 has been revised to correct a cross-reference to Subsection 2.5.2.

Two statistically independent time histories H1 and H2 are developed compatible to the horizontal 0.1 g CSDRS design basis input spectrum, and a vertical acceleration time history V is developed compatible to the vertical 0.1 g CSDRS design spectrum. These time histories are referred to herein as 0.1 g CSDRS motions.

Analyses of structures as surface structures were performed using 0.1 g CSDRS motions directly as input at the surface level, which is equal to the foundation level for the SASSI analyses.

Analyses of structures as embedded structures were also performed using 0.1 g CSDRS time histories as outcrop motion input at the bottom of foundation level at the top of limestone. The SASSI SSI analysis requires the object motion to be defined as in-layer motion. Therefore, the analyses of embedded foundations use horizontal in-layer motion input time histories that are numerically equivalent to the outcrop motions. These in-layer motions are obtained from a set of site response analyses, separate from those documented in FSAR Subsection 2.5.2, that are performed on a soil column consisting of the rock subgrade and backfill strain-compatible profiles identical to those used in the SSI analyses with no iteration on soil properties. The 0.1 g CSDRS motions are applied to the soil column as outcrop motion at the top of limestone/foundation interface elevation in order to calculate the in-layer motion at the same location. This procedure is the same as used in NEI White Paper Section 3.2.3 Step 3. These site response analyses provide two horizontal acceleration time histories (East-West and North-South) within the top limestone rock layer that are used as input in the SASSI analyses of embedded foundations. A different set of time history motions is developed for each considered soil profile. The 0.1 g CSDRS motions are applied directly to SASSI as in-layer motions for embedded foundations.

Figure 1 shows the horizontal ground motion acceleration response spectra (ARS) calculated in the site response analyses. The figure shows the 0.1 g CSDRS and surface ARS calculated for each of the four soil cases: lower bound (LB), best-estimate (BE), upper bound (UB) and high bound (HB) as indicated. The 0.1 g CDSRS motion was input as outcrop motion at the foundation level at top of limestone. The resulting ground surface ARS are significantly higher than the outcrop motions input at rock level.

ISG-017 and the associated NEI document require the motions applied to exceed the performance-based spectra developed at foundation level (FIRS) and at surface level (PBSRS). The performance based surface response spectra (PBSRS) corresponds to FIRS3 or FIRS4 identified in FSAR Figure 3.7-201. The input motion applied exceeds the FIRS3 and FIRS4 values by a significant margin at all frequencies. None of the spectra in FSAR Figure 3.7-201 directly represent outcrop FIRS response for embedded structures, however based on Figure 1, surface spectra are higher than the foundation level outcrop motion for this soil column. Therefore, the performance-based FIRS will be lower than FIRS3 and FIRS4 motions in FSAR Figure 3.7-201 which are lower than the 0.1 CSDRS used as input motion. Therefore, the motions applied exceed the ISG-017 required FIRS and PBSRS input requirements.

Because the design was developed prior to issuance of ISG-017, the exact procedures used for the SSI analysis may not match verbatim what is described in ISG-017. However, the motions used are conservative relative to the procedure advocated in ISG-017 as follows:

For vertical motions, the 0.1 g CSDRS motions were applied in SASSI as in-layer motion even though these motions represent outcrop motions. This approach is conservative since in-layer motions are lower than outcrop motions for this profile across the range of key frequencies as seen in Figure 2. The vertical motions envelope those required by ISG-017 because vertical motions are developed from the horizontal using a site-specific V/H ratio, which is the same for all motions.

The consequence of SSI analysis approach used is that the design based on the SSI input motion is conservative because the SSI input motion envelopes surface and embedded conditions of the ISG-017 guidelines. Because the design was developed prior to issuance of ISG-017, the exact procedures used for the SSI analysis may not match verbatim what is described in ISG-017. However, despite the differences, the resulting structural and seismic design is as conservative, or more so, than what would be achieved with ISG-017 procedures.

Reference:

NEI White Paper, "Consistent Site-Response/Soil Structure Interaction and Evaluation," NEI, June 12, 2009.

Attachments:

Figure 1 – Site Response Soil Column Analysis Results Showing Ground Surface Acceleration Response Spectra for Four Soil Profiles due to Rock Outcrop Motion Applied at Foundation Level

Figure 2 - Site Response Soil Column Analysis Results Showing Foundation Level in-Layer Acceleration Response Spectra for Four Soil Profiles due to Rock Outcrop Motion Applied at Foundation Level

Impact on R-COLA

See attached marked-up FSAR Revision 1 page 3NN-4.

Impact on S-COLA

None; this response is site-specific.

Impact on DCD

None.

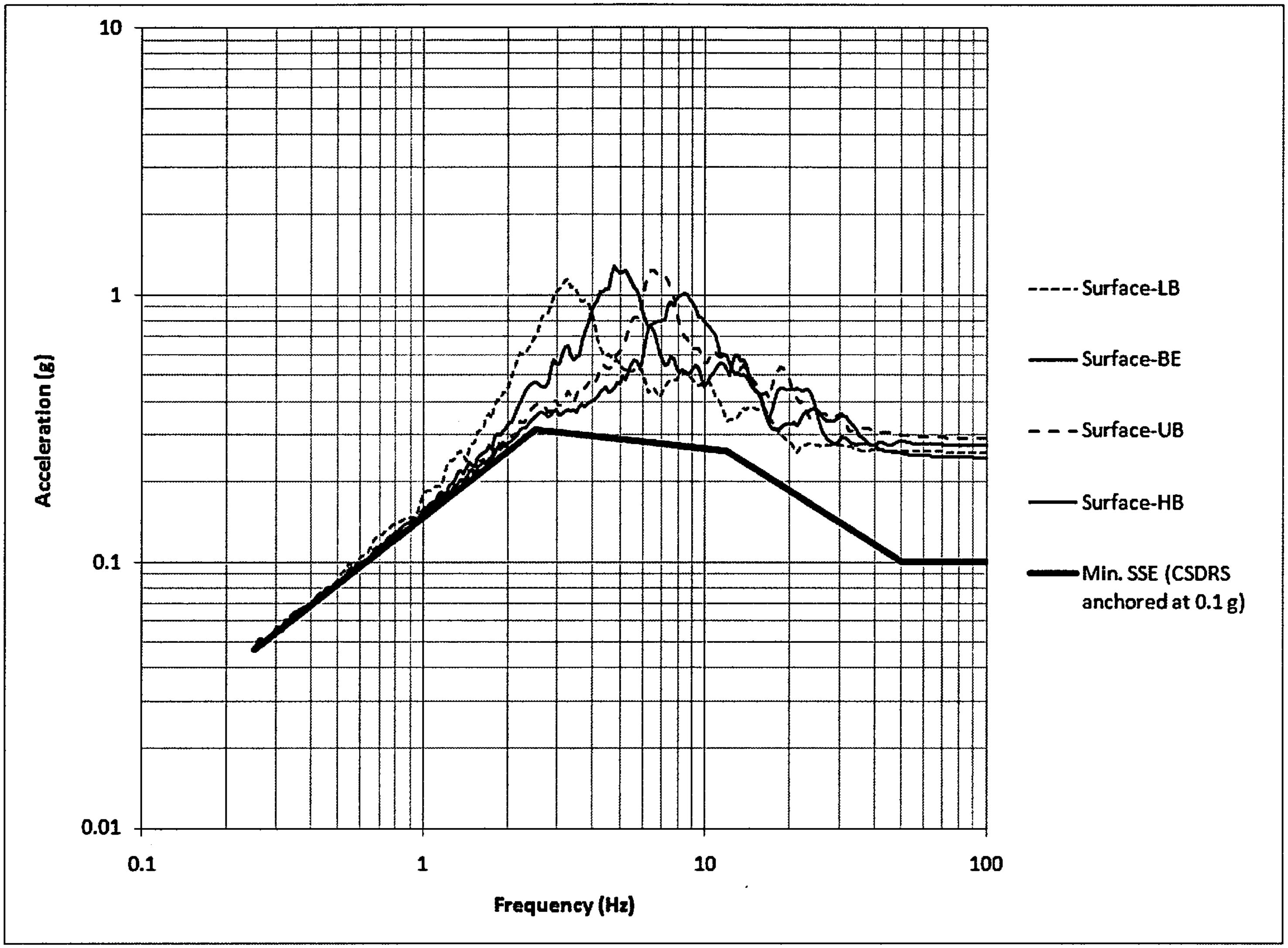

Figure 1 – Site Response Soil Column Analysis Results Showing Ground Surface Acceleration Response Spectra for Four Soil Profiles due to Rock Outcrop Motion Applied at Foundation Level

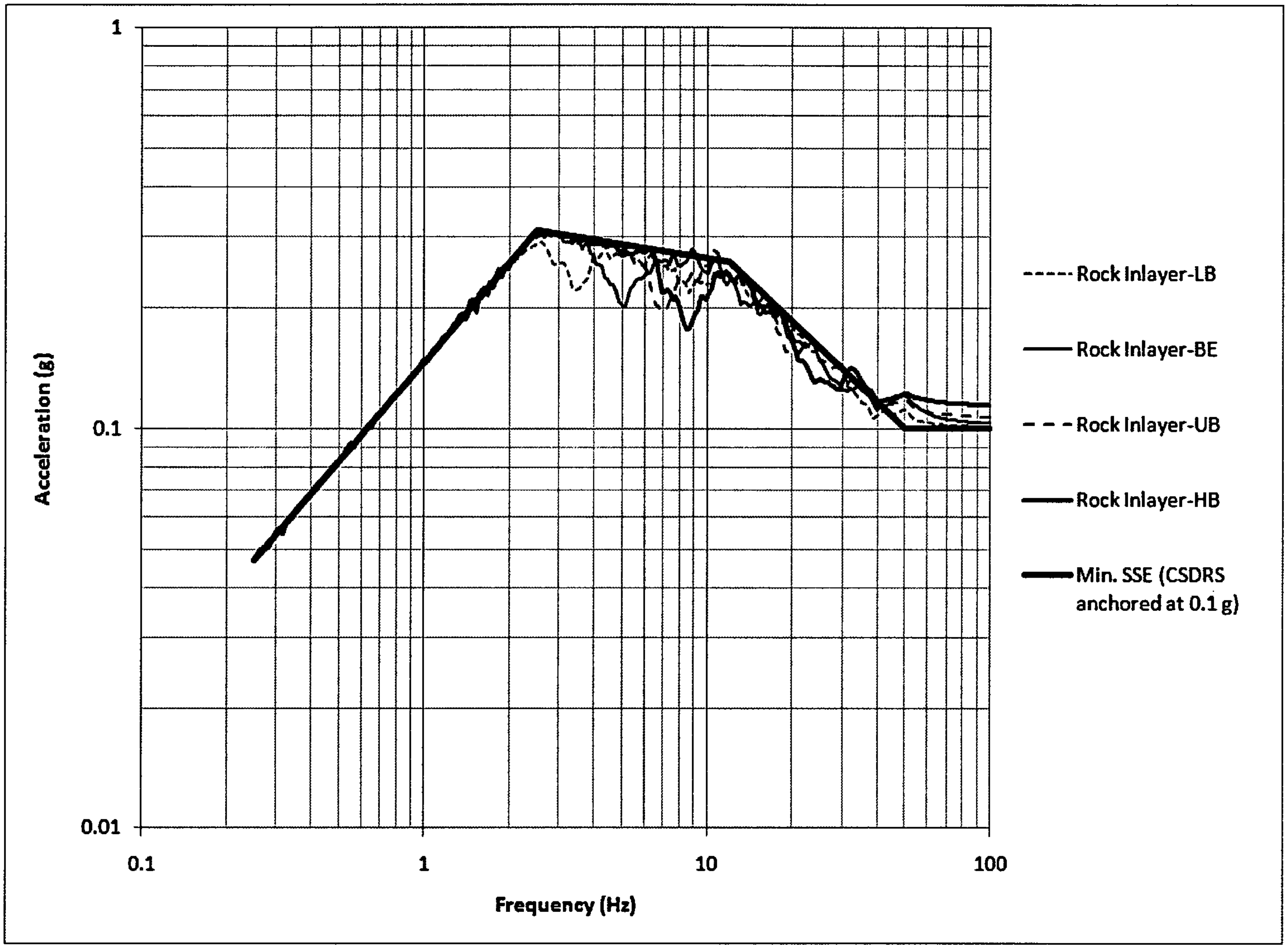

Figure 2 – Site Response Soil Column Analysis Results Showing Foundation Level in-Layer Acceleration Response Spectra for Four Soil Profiles due to Rock Outcrop Motion Applied at Foundation Level

~~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 outcrop horizontal time histories are used directly as input for the SASSI analyses of surface foundations applied at the FIRS bottom of foundation elevation. The analyses of embedded foundation use "within" motion input time histories that are also applied at the FIRS input elevation. The "within" motions are obtained from a set of site response analyses, separate from these documented in Subsection 2.5.2, that are performed on a soil column consisting of the rock subgrade and the backfill, for purposes of embedded foundation SSI analysis. The design motion is applied to the soil column as layer outcrop motion at the FIRS elevation in order to calculate the within-layer motion. These site response analyses provides for each considered backfill profile, two horizontal acceleration time histories (East-West and North-South) of the design motion within the top limestone rock layer that are used as input in the SASSI analyses of embedded foundations. 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.~~ RCOL2_03.08.04-54 RCOL2_03.07.01-7

3NN.3 SASSI Model Description and Analysis Approach

Figure 3NN-7 shows the three-dimensional SASSI FE model used for site-specific seismic analysis of the US-APWR R/B-PCCV-containment internal structure of Units 3 and 4. 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. A three-dimensional (3D) FE model, presented in Figure 3NN-8, represents the building basement and the floor slabs at ground elevation.

The model is established with reference to the Cartesian coordinate system with origin established 2 ft.-7 in. below the ground surface elevation at the center of the PCCV foundation. The origin location corresponds to the location of the coordinate system used as reference for the seismic analysis of the standard plant presented in Section 3.7. The orientation of the Z-axis is upward. The orientation of the standard plant model is modified such that the positive X-axis is oriented northward and the Y-axis is oriented westward.

The geometry and the properties of the lumped-mass-stick models representing the above ground portion of the building are identical to those of the lumped mass stick model used for the R/B-PCCV-containment internal structure seismic analysis, as addressed in Appendix 3H. SASSI 3D beam and spring elements with cross sectional properties identical to those of the standard plant models represent stiffness properties. 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. Because SASSI does not have rigid link capability, ~~T~~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 3D beam elements RCOL2_03.08.04-57 RCOL2_03.08.04-57

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.: 5411 (CP RAI #202)

SRP SECTION: 06.04 - Control Room Habitability System

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)

DATE OF RAI ISSUE: 2/11/2011

QUESTION NO.: 06.04-12

This is a follow-up RAI for USAPWR DCD RAI No. 49 Question No. 06.04-19 and RAI 338-2325, Question No. 06.04-6 (ADAMS Accession Number ML091700682); RAI No. 559-4387; Question No. 06.04-13 (ADAMS Accession Number ML101450224) (NRC ID 4387, Question number 16732), and for Comanche Peak R-COLA RAI No. 3968, Question No. 06.04-7 (ADAMS Accession Number ML100550345), and RAI No. 4678, Question No. 06.04-11 (ADAMS Accession Number ML102810224). Due to the expected plant design impact of the resolution of the issues associated with this RAI, it is being issued simultaneously to both the DCD applicant and the R-COL applicant.

In response to Question No. 06.04-13, **OPEN ITEM** - Follow-up RAI (NRC ID 4387, Question Number 16732), dated May 20, 2010, the COL FSAR was revised in a confusing and potentially ambiguous manner. Specifically, the FSAR commits to design the enclosure and chillers in accordance with ANSI/ASHRAE Standard 15-2007. The NRC staff can accept essential and non-essential chillers located in proximity of other important equipment if they are designed in accordance with a robust consensus standard like ANSI/ASHRAE Standard 15. Unfortunately, compliance with the standard was made ambiguous with the recent revision to the COL FSAR. The specific or detailed design of the chillers has not been finalized and it is not possible at this time to demonstrate compliance with STD 15. It is also not possible to conclude whether a dedicated ventilation for each machinery room is necessary to comply with STD 15. The recent COL FSAR revision has precluded the use of dedicated ventilation and instead indicated that the auxiliary building ventilation would be used. STD 15 clearly requires dedicated ventilation under certain conditions. Specifically, STD 15, Section 8.11.4 reads, *"Air and supply and exhaust ducts to the machinery room shall serve no other area."*

Please justify why a dedicated ventilation and the other requirements of STD 15 Sections 8.11.and 8.12 are not necessary for compliance with STD 15 for all possible chiller configurations permitted by the FSAR. If additional design commitments for the chillers (size, refrigerant type, refrigerant volume, refrigerant amount ....) are necessary to justify this assertion please include these design commitments in the FSAR.

ANSWER:

The design of the essential chilled water system (ECWS), non-ECWS chillers, and chiller equipment rooms is within the scope of the standard plant contained in the US-APWR Design Control Document (DCD). The applicable sections of the DCD related to ECWS, non-ECWS chillers, and chiller equipment rooms are incorporated by reference into the FSAR.

DCD RAI 691-5410, Question 06.04-14 requested additional information about the design of the ECWS, non-ECWS chillers, and chiller equipment rooms, and compliance with ANSI/ASHRAE Standard 15. MHI responded to RAI 691-5410 in letter UAP-HF-11061 on March 9, 2011. The letter is not yet available in ADAMS.

<u>Impact on R-COLA</u>

None.

<u>Impact on S-COLA</u>

None.

<u>Impact on DCD</u>

None.

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.: 5465 (CP RAI #204)

SRP SECTION: 02.03.01 - Regional Climatology

QUESTIONS for Siting and Accident Conseq Branch (RSAC)

DATE OF RAI ISSUE: 2/14/2011

QUESTION NO.: 02.03.01-12

10 CFR 52.79(a)(1)(iii) states that the COL FSAR shall include "the seismic, meteorological, hydrologic, and geologic characteristics of the proposed site with appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area and with sufficient margin for the limited accuracy, quantity, and time in which the historical data have been accumulated." The US-APWR DCD states that the 0% exceedance ambient design temperature site parameters are based on the EPRI Advanced Light Water Reactor Utility Requirements Document and conservative estimates of historical high and low values for potential US-APWR sites. The staff considers temperatures based on a 100-year return period to provide sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated as required by the regulation. This is why SRP 2.3.1 states that 100-year return period ambient temperature and humidity statistics should be identified as site characteristics. Thus, the staff believes the higher of either the maximum recorded dry-bulb value or the maximum 100-year dry-bulb value should be listed as the Comanche Peak Nuclear Power Plant (CPNPP) site characteristic value to be compared to the US-APWR 0% exceedance maximum dry-bulb site parameter value. Similarly, a comparison should be provided between the 100-year non-coincident wet-bulb value and the US-APWR DCD 0% exceedance maximum non-coincident wet-bulb value.

In response to RAI 02.03.01-11, CPNPP COL FSAR Table 2.0-1R was updated to include comparisons between the site characteristic 100-year return period temperatures for the maximum dry bulb temperature with coincident wet bulb temperature as well as the minimum dry bulb temperature. These values, as presented, are acceptable to the staff. However, the updated table did not include a comparison between the site parameter 0% exceedance non-coincident wet bulb temperature and the 100-year return period non-coincident wet bulb temperature.

Please update CPNPP COL FSAR Table 2.0-1R to include a comparison between the 100-year return period non-coincident wet bulb temperature site characteristic value and the US-APWR DCD 0% exceedance maximum non-coincident wet bulb temperature value or provide a statement as to why this information should be omitted.

ANSWER:

The 100-year return period maximum dry bulb temperature and the coincident wet bulb temperature are used to calculate the capacity of safety related HVAC system cooling coils. The safety related HVAC system cooling coil design is based on the enthalpy of the cooling coil inlet and outlet air flow. The cooling coil inlet air enthalpy is determined from the 100-year return period dry bulb temperature and the coincident wet bulb temperature.

The non-coincident wet bulb temperature is generally used in the cooling tower design as the inlet air temperature; however the non-coincident wet bulb temperature is not used in the US-APWR design and is therefore not relevant to safety analyses.

Table 2.0-1R summarizes the typical DCD design conditions and the site conditions and Regulatory Guide 1.206 section C.I.2 states that the purpose of meteorological information in the COLA is to "demonstrate that the applicant has accurately described the site characteristics and appropriately used them in the plant design and operating criteria". The 100-year return period maximum non-coincident wet bulb temperature was not used in the US-APWR design, however the FSAR has been revised to compare the 100-year return maximum non-coincident wet bulb values to the DCD 0% exceedance non-coincident wet bulb values.

The ASHRAE Fundamentals Handbook gives an accepted methodology for calculating 100-year return values for dry bulb temperature. The ASHRAE discussion of the methodology used to calculate an n-year return period Extreme Annual Design Conditions specifically uses dry bulb temperature as the example. The handbook bases the dry bulb temperature return period calculation on the assumption that the annual maxima and minima temperatures are distributed according to the Gumbel Type 1 extreme value distribution. Assuming that the wet bulb temperature follows the same Type 1 Gumbel distribution as the dry bulb temperature results in a site-specific 100-year return non-coincident wet bulb temperature of 86°F (30°C) using 30 years (1977-2006) of meteorological data from the Dallas/Fort Worth Airport. For comparison, the maximum wet bulb temperature was also calculated to be 86°F using a methodology from the Statistical Engineering Division of NIST. This value is equal to the 0% annual exceedance maximum (historical limit excluding peaks <2 hr) non-coincident wet bulb temperature of 86°F given in the US-APWR DCD.

<u>Impact on R-COLA</u>

See attached marked-up FSAR Revision 1 page 2.0-3

<u>Impact on S-COLA</u>

None; this response is site-specific

<u>Impact on DCD</u>

None.

Table 2.0-1R (Sheet 2 of 15)
Key Site Parameters

	Extreme wind speed (other than in tornado)	155 mph for 3-second gusts at 33 ft aboveground level based on 100-year return period, with importance factor of 1.15 for seismic category I/II structures	~~90~~96 mph for-3-second gust wind speed at 33-ft aboveground	RCOL2_02 .03.01-9
CP COL 2.1(1) CP COL 2.2(1) CP COL 2.3(1) CP COL 2.3(2)	Ambient design air temperature ~~(1% exceedance maximum)~~ ~~Ambient design air temperature (0% exceedance maximum)~~	1% exceedance maximum: 100°F dry bulb, 77°F coincident wet bulb, 81°F non-coincident wet bulb	1% exceedance maximum: 99°F dry bulb, 75°F coincident wet bulb, 78°F non-coincident wet bulb	RCOL2_02 .03.01-11
		0% exceedance maximum: 115°F dry bulb, 80°F coincident wet bulb, 86°F non-coincident wet bulb, historical limit excluding peaks <2 hr	0% exceedance maximum: 112°F dry bulb, 78°F coincident wet bulb, 83°F non-coincident wet bulb, historical limit excluding peaks <2 hr 100-year return period maximum: 115°F dry bulb, 78°F coincident wet bulb 86°F non-coincident wet bulb	RCOL2_02 .03.01-11 RCOL2_02 .03.01-6 S01 RCOL2_02.3.01-12 RCOL2_02 .03.01-6 S02
CP COL 2.3(3) CP COL 2.4(1) CP COL 2.5(1)	Ambient design air temperature ~~(1% exceedance minimum)~~ ~~Ambient design air temperature (0% exceedance minimum)~~	1% exceedance minimum: -10°F dry bulb	1% exceedance minimum: 25°F dry bulb	RCOL2_02 .03.01-11
		0% exceedance minimum: -40°F dry bulb, historical limit excluding peaks <2 hr	0% exceedance minimum: -0.5°F dry bulb, historical limit excluding peaks <2 hr 100-year return period minimum: -5°F dry bulb	RCOL2_02 .03.01-6 S01 RCOL2_02 .03.01-6 S02
	Atmospheric dispersion factors (χ/Q values) for on-site locations:			