PMSTPCOL PEmails

From: Tai, Tom
Sent: Tuesday, June 09, 2009 2:33 PM
To: John Price (jeprice@stpegs.com)
Cc: STPCOL
Subject: Draft RAI 2924 for Chapter 3.7.1
Attachments: RAI 2924 03.07.01-xx.doc

John,

Please review the attached RAI (03.07.01-xx) of Chapter 3.7.1 of the COL. If you need a conference call to clarify the requested information, please contact me. If a conference call is not needed, please send me an email and I will continue the formal process of issuing the RAI to STPNOC.

Regards

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Hearing Identifier: SouthTexas34Public_EX
Email Number: 1295

Mail Envelope Properties (C56E360E9D804F4B95BC673F886381E71FBA8B6B8D)

Subject: Draft RAI 2924 for Chapter 3.7.1
Sent Date: 6/9/2009 2:32:51 PM
Received Date: 6/9/2009 2:32:53 PM
From: Tai, Tom

Created By: Tom.Tai@nrc.gov

Recipients:
"STPCOL" <STP.COL@nrc.gov>
Tracking Status: None
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Tracking Status: None

Post Office: HQCLSTR02.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	394	6/9/2009 2:32:53 PM
RAI 2924 03.07.01-xx.doc	50170	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Request for Additional Information No. 2924 Revision 2

South Texas Project Units 3 and 4
South Texas Project Nuclear Operating Co
Docket No. 52-012 and 52-013
SRP Section: 03.07.01 - Seismic Design Parameters
Application Section: 03.07.01

QUESTIONS for Structural Engineering Branch 2 (ESBWR/ABWR Projects) (SEB2)

03.07.01-***

FSAR Section 3.7 “Seismic Design” specifically listed only two departures, STD DEP 1.8-1 and STD T1 2.15-1. The applicant is requested to provide justification for not listing STP Departure, STP DEP T1 5.0-1, under FSAR Section 3.7 regarding not meeting the DCD minimum shear wave velocity requirement at the site since shear wave velocity parameter is an input for Soil Structure Interaction (SSI) analysis.

03.07.01-***

10 CFR 50 Appendix S specifies that the Safe Shutdown Earthquake (SSE) Ground Motion for the site is characterized by both horizontal and vertical free-field ground motion response spectra at the free ground surface. As such, site-specific SSE ground motion should be established as free-field ground motion response spectra together with site-specific design time histories. Per guidance of SRP Acceptance Criteria 3.7.1 II.1.A & B, the applicant is requested to provide the following in the FSAR:

1. Site-specific SSE design response spectra for all applicable damping values (include specific figures) used for seismic reconciliation with the standard plant results as well as for site-specific seismic analysis and design of applicable site-specific structures (Ultimate Heat Sink, and Reactor Service Water (RSW) Piping Tunnel.)
2. Site-specific statistically independent three components of SSE design time histories and their bases that apply for the site-specific analysis
3. Site-specific Operating Basis Earthquake (OBE) to be used for setting up the seismic instrumentation (FSAR Section 3.7.4).

03.07.01-***
Section 3.7.1 states that a site-specific Soil Structure Interaction (SSI) analysis will be performed to confirm that standard plant results included in the ABWR DCD envelop the results of the site-specific SSI analysis. With regard to this seismic reconciliation analysis, the applicant is requested to address the following:

1. A comparison of site-specific SSE design response spectra with ABWR DCD Certified Seismic Design Response Spectra (CSDRS).

2. Consistent with the site-specific SSE design response spectra established for the site, the applicant is requested to provide in the FSAR a description of how were the Foundation Input Response Spectra (FIRS) in the free field at the foundation level were determined (including the soil model, soil properties, computer programs, and analysis assumptions)? Provide also FIRS in the free field at the foundation levels of all Category I structures that demonstrate meeting the requirement of 10 CFR 50 Appendix S (i.e. the horizontal component of the SSE ground motion in the free field at the foundation level of the structures must be an appropriate response spectrum with a peak ground acceleration of at least 0.1g.).

03.07.01-***

The applicant should describe in the FSAR in detail the confirmatory SSI analysis performed including the results. Provide a figure in the FSAR depicting the SSI model for the Reactor Building (RB) and the Control Building (CB) including the model of the supporting subgrade. In addition, the applicant is requested to provide the following information:

1. State whether or not embedment effects are considered in this analysis and, if not, what is the justification for not including them and what impact could this have on the analysis results?
2. Describe the properties of the structural backfill and how is the backfill material is modeled in the SSI analysis?
3. As the groundwater table is high, how are groundwater effects treated in the SSI confirmatory analysis?
4. For the applicable Category I structures covered by ABWR DCD, provide in the FSAR a comparison of the results (e.g., seismic displacements, accelerations, floor response spectra at the mat foundation, top of the building including some peripheral locations of the building, and major equipment locations, polar crane support, etc) of site-specific SSI analysis using the site-specific design SSE ground motion as input with the results documented in the ABWR DCD.

03.07.01-***

The shear wave velocity at the STP 3 & 4 varies both horizontally in a soil stratum and vertically with elevation and is lower than the 1000 ft/sec minimum stated in the DCD (STP DEP T1 5.0-1). In addressing the departure, STP has committed to perform a site-specific confirmatory Soil Structure Interaction (SSI) analysis. While this analysis would addresses the potential effect of SSI on the seismic response, it may not address the potential effect of structure-to-structure interaction due to STP DEP T1 5.0-1 unless the SSI model includes site-specific soil foundation model (including backfill material) combined with Reactor Building (RB), Control Building (CB), and Turbine Building (TB) models. As such, the applicant is requested to address how the effects of structure-to-structure interaction are considered in this confirmatory analysis and, if not, what is the justification for not including them and what impact could this have on the analysis results?

03.07.01-***

Per guidance in SRP acceptance criteria 3.7.1.II.3, the applicant is requested to provide the following information or provide reference to the appropriate subsections and figures in Section 3.7.1.4 of the FSAR. This includes the following information:

1. Description of supporting media for each Category I structures and dimensions of the structural foundation, and total structural height.

2. Depth of soil over bedrock, soil layering characteristics, ground water elevation, and soil properties such as shear wave velocity, shear modulus, Poisson's ratios, and density as a function of depth.
3. Since the minimum shear wave velocity parameter may be less than 1000 fps, quantitative results of additional studies performed which consider the actual site specific shear wave velocity (including its degree of variability) addressing potential impact on soil-structure interaction, settlement calculations, and design of foundation elements.

03.07.01-***

In the supplementary information provided in Section 3.7.1 under the heading Other Analysis, it is stated that:

"In the development of settlement estimates, the representative shear wave velocity value for intervals within a soil column is only one input used in the derivation of the elastic modulus for layers within that column. Since this derived elastic modulus value is first adjusted for strain and then weighted with estimated values derived from either SPT tests (for granular material) or undrained shear strength tests (for cohesive soils) the effect of variability of shear wave velocity upon settlement calculations is significantly attenuated. The foundation spring constants for mat design are based on settlement calculations and therefore the effect of shear wave velocity variation is similarly attenuated.

Based on above discussion, it is concluded that the shear wave velocities at the plant site do not impact the plant design."

However, note that while FSAR Appendix 3H Section 3H.1.5.2 listed shear wave velocity, unit weight, shear modulus, and Poisson's ratio as the basis of calculating the spring constants, it does not include elastic modulus as one of the soil parameters for calculating foundation soil springs. Accordingly, the applicant is requested to provide the following information:

(a) A comparison of estimated spring constant value (and its potential degree of variability) under the mat foundations of Category I structures for actual STP site conditions and the corresponding ABWR DCD parameter used in the certified design.
(b) Justify any differences between the calculated site-specific spring constant values and the ABWR DCD parameter as to their effect on mat design forces.

03.07.01-***

FSAR Appendix 3C lists the computer programs used in the design and analysis of seismic Category I structures. While the extent of application for SSDP-2D (3C.6) included Reactor Building (RB) and Control Building (CB), Ultimate Heat Sink (UHS) was not listed. As such, what computer program was used for section design of UHS? The applicant is requested to include in this Appendix appropriate computer programs used

for UHS analysis and design as well as list in this Appendix the computer programs used for analysis and design of Reactor Service Water (RSW) Piping Tunnel.

03.07.01-***

FSAR Appendix 3C Section 3C.7.1 states that a GE in-house version of NASTRAN was used for the static and Eigen value analysis of the concrete containment, RB, and CB. Please confirm that the program validation document available at MSC-Software Corporation includes the GE in-house version. The applicant is requested to include this confirmation in FSAR section 3C.7.2.

03.07.01-***

For seismic Category I site specific structures, the applicant is requested to provide in FSAR Appendix Section 3H.6.5.1.1.1, “Design Response Spectra,” the following information either directly or by reference to applicable Figures:

1. Two levels (SSE and OBE) of horizontal and vertical design earthquake ground motions response spectra for damping ratios of 2, 3, 4, 5, and 7% at the finished grade in the free field. Also specify the maximum vertical and horizontal SSE and OBE level ground accelerations.
2. Consistent with the site-specific SSE design response spectra established above, the applicant is requested to provide in this FSAR Section a description of how were the Foundation Input Response Spectra (FIRS) in the free field at the foundation levels of site-specific Category I structures (UHS basin, RSW Pump House, and RSW Piping Tunnels) were determined (including the soil model, soil properties, computer programs, and analysis assumptions)?
3. Demonstrate that FIRS in the free field at the foundation levels of site-specific Category I structures meet the requirement of 10 CFR 50 Appendix S (i.e. the horizontal component of the SSE ground motion in the free field at the foundation level of the structures must be an appropriate response spectrum with a peak ground acceleration of at least 0.1g.).

03.07.01-***

For seismic Category I site-specific structures, the applicant is requested to provide (per guidance of SRP Acceptance Criteria 3.7.1.II.1B) in FSAR Appendix Section 3H.6.5.1.1.2, “Design Time Histories,” the following information either directly or by reference to applicable Figures:

1. Design ground motion time histories for three orthogonal directions that comply with the design response spectra (see SRP acceptance criteria 3.7.1.II.1B for guidance)
2. Demonstrate that each pair of time histories are statistically independent

3. Demonstrate that design time histories have adequate strong motion duration and appropriate V/A and AD/V^2 ratios consistent with characteristic values for the magnitude and distance of the controlling seismic events defining the uniform hazard.

03.07.01-***

The applicant is requested to provide in FSAR Appendix 3H.6.5.1.2 the following information:

1. A Table containing the percentages of critical damping values used in the seismic analysis of site-specific Category I structures, systems, and components (SSCs).
2. Justifications, if any exceptions were taken from RG 1.61
3. A plant-specific technical basis (see regulatory position C1.2 of RG 1.61) for use of damping values higher than the OBE damping values specified in Table 2 of RG 1.61, but not greater than the SSE damping values specified in Table 1 of RG 1.61, in the generation of In-Structure Response Spectra (ISRS).
4. The material soil damping value used in the analysis

03.07.01-***

FSAR Appendix 3H.6.5.1.3 states that soil conditions at the STP 3 & 4 site are described in Subsection 2.5S.4. The applicant is requested to provide the information per guidance of SRP Acceptance Criteria 3.7.1.II.3 either in this Section or by specific reference to specific Tables or Figures for all site-specific Category I structures (including UHS and RSW Piping Tunnel).