

PMTurkeyCOLPEm Resource

From: Comar, Manny
Sent: Tuesday, September 20, 2011 11:32 AM
To: orthen, Richard; Raymond Burski; Steve Franzone; STEVEN.HAMRICK; TurkeyCOL Resource; William Maher
Subject: Draft RAI 5896 related to SRP Section 02.05.02 - Vibratory Ground Motion for the Turkey Point Units 6 and 7 combined license application.
Attachments: draft RAI 5896_TPN.doc

To All,

Attached is the draft of RAI No:5896, regarding section 02. 05.02 Vibratory Ground motion for the Turkey Point Units 6 and 7 combined license application.

If you need a conference call to discuss the question(s) of the draft RAIs please contact me at 301-415-3863. Unless you request additional clarification we will normally issue the RAI as final within 3 to 5 days, from today.

Thanks

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Request for Additional Information No. 5896

Turkey Point Units 6 and 7
Florida P and L
Docket No. 52-040 and 52-041
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-***

FSAR Subsection 2.5.2.4.5 describes new ground motion prediction equations (GMPEs) that the applicant developed for Caribbean region seismic sources. The basis of the new GMPEs is a scientific study conducted by Motazedian and Atkinson (2005) in the Puerto Rico area. In accordance with NUREG-0800, Standard Review Plan, Chapter 2.5.2, "Vibratory Ground Motion," and Regulatory Guide (RG) 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion":

- a. Please explain why ground motion prediction models developed by Motazedian and Atkinson (2005) for the Puerto Rico region, which is primarily a subduction zone, provide an adequate basis for the larger Caribbean region, especially for the region between Cuba and Florida.
- b. Please provide the complete Senior Seismic Hazard Analysis Committee (SSHAC) documentation for the Level 2 study conducted to develop the Caribbean GMPEs for the staff to specifically evaluate the makeup of the Technical Integrator (TI) team, the peer review panel, how the experts' opinions were integrated into the development of the final GMPE, whether any conflicting opinions among the experts were dealt with, and how the final GMPEs represent the consensus of the informed community.
- c. Please provide copies of the following supporting calculations: Report #: 25409-000-K0C-0000-00009, Report#: 25409-000-K0C-0000-00024, Report #: 25409-000-K0C-0000-00034 to enable the staff to evaluate the technical details of the final GMPEs.
- d. In order for the staff to be able to compare the new Caribbean GMPEs with the 2004/2006 EPRI mid-continent GMPEs, please provide plots showing both ground motion models for earthquake magnitudes of 6.0, 7.0, and 8.0 in the distance range of 200 km to 1000 km at all seven frequencies defined in the EPRI 2004 and 2006 GMPEs.
- e. Discuss evidence, if any, that seismic source scaling varies regionally and/or between source types in the Caribbean. For example, is there any evidence that stress parameter varies systematically between the northern Hispaniola sources, the Caribbean plate-boundary transform fault sources, and the Cuba sources? If so, what are the implications for the attenuation models and hazard calculated at TPNPP?

02.05.02-***

FSAR Subsection 2.5.2.4.4.3.1 describes summary information related to the SSHAC Level 2 study on new seismic source models for the Cuba and northern Caribbean region,. In accordance with NUREG-0800, Standard Review Plan, Chapter 2.5.2, "Vibratory Ground Motion", and Regulatory Guide (RG) 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion," please provide the complete SSHAC documentation detailing specifically:

- a. Procedures and any assumptions made in developing the Caribbean seismic sources,
- b. The questionnaire used in obtaining expert opinions,
- c. The TI any advisory groups and/or peer reviewers used,
- d. How the experts' opinions were integrated into the development of the final models. Discuss expert opinions and/or suggestions that were left out of the final model and justifications for doing so,
- e. How conflicting opinions among the experts were dealt with,
- f. How the final models represent the consensus of the informed community

02.05.02-***

FSAR Subsection 2.5.1.1.1.3.2.4 describes that due to lack of knowledge about individual faults' characteristics, the applicant used an areal source zone to model the seismic hazard from the Cuban seismic sources. In accordance with NUREG-0800, Standard Review Plan, Chapter 2.5.2, "Vibratory Ground Motion," and Regulatory Guide (RG) 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion," please provide the following:

- a. Rationale for the exclusive use of an areal source rather than multiple areal sources or a combination of fault sources and areal sources. Given the uncertainties, does the use of a single areal source result in a more conservative representation of the hazard from the Cuba seismic sources?
- b. Details of the PSHA implementation for the Cuba areal source zone. Specifically, is Cuba seismicity modeled using the EPRI approach, using a uniform source zone, or using some other methodology?
- c. A description of how well the seismic source model parameters represent the observed spatial patterns and concentrations of seismicity. Is a uniform seismic source zone justified considering FSAR Figure 2.5.1-267, which shows prominent clusters of seismicity? Discuss evidence, if any, that frequency-magnitude behavior is different for the subset of earthquakes concentrated in western and northern Cuba than for the entire zone.
- d. Details on the earthquake catalog completeness, methodology used to compute the *a* and *b* values, the computed *a* and *b* values and rates of earthquakes equal to or greater than moment magnitude 5. If used, please also discuss smoothing operators applied to the *a* and *b* values.
- e. A detailed description of the PSHA implementation for the Cuba seismicity model. Are large earthquakes modeled as finite faults? If so, can they

extend outside the zone boundary, and is there a preferred azimuth? If so, what is their closest distance of approach to the TPNPP site?

02.05.02-***

FSAR Subsection 2.5.2.1.3.1 states that M_w was used as the uniform magnitude measure in Phase II (Caribbean region) earthquake catalog development efforts. Phase I earthquake catalog (EPRI updates), on the other hand, uses m_b as the uniform magnitude measure. In accordance with NUREG-0800, Standard Review Plan, Chapter 2.5.2, "Vibratory Ground Motion," and Regulatory Guide (RG) 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion", please explain the rationale for selecting M_w as the uniform magnitude measure for the Caribbean earthquake catalog rather than m_b . Discuss what impact, if any, this choice had on the number of earthquakes listed in the Caribbean earthquake catalog. Were there any earthquakes with m_b of 3.0 (or perhaps larger) that did not make the $M_w \geq 3.0$ cut used in Phase II catalog development?

02.05.02-***

FSAR Subsection 2.5.2.2.1 describes that among the six EPRI-SOG earth science teams only one team identified more than one seismic source within the site region. In accordance with NUREG-0800, Standard Review Plan, Chapter 2.5.2, "Vibratory Ground Motion," and Regulatory Guide (RG) 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion", please explain:

- a. Whether any attempt has been made to identify potential EPRI seismic sources that are outside the site region, but might contribute to the site hazard above the 1% of the total hazard.
- b. Whether the use of the updated EPRI (2004, 2006) GMPEs significantly increases the hazard contributions of any of the EPRI seismic sources that are outside the site region to justify their use in the TPNPP PSHA calculations?

02.05.02-***

FSAR Subsection 2.5.2.3 discusses the correlation of seismicity with only the EPRI seismic source models. In accordance with NUREG-0800, Standard Review Plan, Chapter 2.5.2, "Vibratory Ground Motion," please provide a thorough, detailed, description in the FSAR that discusses the correlation of seismicity with all of the seismic sources used in the Turkey Point PSHA study.

02.05.02-***

FSAR Subsection 2.5.2.4.6 lists the Cuba areal source as one of the major contributing seismic sources to the total hazard. However, the deaggregation results shown in FSAR Figure 2.5.2-226 indicate only a minor contribution from the distance range of the Cuba areal source. In accordance with NUREG-0800, Standard Review Plan, Chapter 2.5.2, "Vibratory Ground Motion," and Regulatory Guide (RG) 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion", please explain this apparent discrepancy. What is the percentage of the Cuba areal source's hazard contribution to the total site hazard at all seven frequencies defined by the EPRI 2004 and 2006 GMPEs? Are these consistent with the deaggregation results?

02.05.02-***

FSAR Subsection 2.5.2.5.1 states that P-wave velocities from eight deep wells were used to develop the deeper (>636 ft) sections of the site response model. The wells that provide the P-wave velocity information are approximately 100km to 180km away from the site. In accordance with Regulatory Guide (RG) 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion", please provide:

- a. additional information on the applicability of seismic velocity information obtained at such great distances to the Turkey Point site. How was the variation in geology considered in these projections?
- b. individual velocity profiles for each of the eight wells used in estimating the average profile shown in FSAR Figure 2.5.4-211
- c. further details on how larger uncertainties in deeper layers' thicknesses/depths are taken into account in the randomization of the site profile

02.05.02-***

FSAR Subsection 2.5.2.1.2 describes the updated Phase 1 and Phase 2 earthquake catalogs. Of the 34 source earthquake catalogs listed on pages 2.5.2-3 through 2.5.2-5 for Phase 1 updates, 15 cite Reference 307, which is the USGS NEIC "Earthquake Search" website. A similar situation exists for the Phase 2 catalog update. In accordance with Regulatory Guide (RG) 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion", please clarify the relationship between Reference 307 and the corresponding 15 source catalogs used in the Phase 1 seismicity update. Specifically, how is the contribution from each sub-catalog identified?

02.05.02-***

FSAR Subsection 2.5.2.4.4.1 describes the supplemental source zones which are developed to extend the original EPRI zones to cover the entire site region. The FSAR discusses that updated *a* and *b* values are borrowed from peninsular Florida for the supplemental zones, but the parameters are not provided. In accordance with NUREG-0800, Standard Review Plan, Chapter 2.5.2, "Vibratory Ground Motion," and Regulatory Guide (RG) 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion" please provide the *a* and *b* parameters for each supplemental zone.

02.05.02-***

FSAR Subsection 2.5.2.4.4.3.2 discusses the existence of several large, but very distant seismic sources. Regarding these sources the FSAR states that: "... these tectonic features would not significantly contribute" to the hazard at TPNPP. In accordance with NUREG-0800, Standard Review Plan, Chapter 2.5.2, "Vibratory Ground Motion," and Regulatory Guide (RG) 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion," please explain whether this assessment is based on preliminary sensitivity calculations showing very small hazard contributions from these sources or simply on best judgment. If best judgment, please further elaborate on the rationale used.

02.05.02-***

The FSAR does not list the USGS national seismic hazard map project as a potential source for EPRI seismic source model updates. The USGS regularly updates its own national seismic hazard maps using the most recent data and information. Within the last decade, the USGS published two comprehensive national seismic hazard reports in 2002 and 2008. RG 1.208 indicates that existing seismic source models should be evaluated in light of more recent data and evolving knowledge. Please discuss why the USGS national seismic hazard maps and model parameters are not discussed as potential studies to be considered in updating the existing EPRI seismic source geometries and/or model parameters.