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**To:** <mls3@nrc.gov>  
**Date:** 1/31/05 8:56AM  
**Subject:** Dominion Response to DSER Open Item 2.5-1

Mike,

Attached is the pdf version of Dominion's January 25, 2005 response to DSER Open Item 2.5-1.

Joe H.

(See attached file: 012505 D Response to Open Item 2.5-1.pdf)

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**Creation Date:** 1/31/05 8:56AM  
**From:** <Joseph\_Hegner@dom.com>

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012505 D Response to Open Item 2.5-1.pdf

Mime.822

**Size**

171

412800

**Date & Time**

01/31/05 08:56AM

300440

**Options**

**Expiration Date:** None

**Priority:** Standard

**Reply Requested:** No

**Return Notification:** None

**Concealed Subject:** No

**Security:** Standard



January 25, 2005

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555

Serial No. 04-785  
ESP/JDH  
Docket No. 52-008

**DOMINION NUCLEAR NORTH ANNA, LLC**  
**NORTH ANNA EARLY SITE PERMIT APPLICATION**  
**RESPONSE TO DRAFT SAFETY EVALUATION REPORT OPEN ITEM 2.5-1**

On December 20, 2004, the NRC issued its Draft Safety Evaluation Report (DSER) for Dominion Nuclear North Anna, LLC's North Anna Early Site Permit application. The DSER contained open items for which NRC requested a response by March 3, 2005 to support the review schedule. This letter forwards our response to the open item listed below. The remaining open items will be addressed in separate correspondence.

- Open Item 2.5-1

No update to the North Anna ESP application is required as a result of this response.

If you have any questions or require additional information, please contact Mr. Joseph D. Hegner at 804-273-2770.

Very truly yours,

A handwritten signature in black ink, appearing to read "Eugene S. Grecheck".

Eugene S. Grecheck  
Vice President-Nuclear Support Services

- Enclosures:
1. Response to DSER Open Item 2.5-1
  2. EPRI CEUS Ground Motion Project Final Report (Hard copy and CD-ROM), December 2004. The CD-ROM contains the following files:
    - 1009684.pdf; 46,612 KB, publicly available
    - EPRI CEUS\_GM\_Plotter\_TR\_1009684.xls, 832 KB, publicly available
    - Read Me to Use Plotter.doc, 28 KB, publicly available

Commitments made in this letter: None

cc w/Enclosure 1 only:

U. S. Nuclear Regulatory Commission, Region II  
Sam Nunn Atlanta Federal Center  
61 Forsyth Street, SW  
Suite 23T85  
Atlanta, Georgia 30303

Mr. Mike Scott  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Mr. M. S. King  
NRC Senior Resident Inspector  
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Mr. Jack Cushing  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Ms. L. Sandell  
EPRI  
3412 Hillview Avenue  
Palo Alto, CA 9430

COMMONWEALTH OF VIRGINIA

COUNTY OF HENRICO

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Eugene S. Grecheck, who is Vice President-Nuclear Support Services, of Dominion Nuclear North Anna, LLC. He has affirmed before me that he is duly authorized to execute and file the foregoing document on behalf of Dominion Nuclear North Anna, LLC, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 25<sup>th</sup> day of January, 2005

My Commission expires May 31, 2006

Vicki L. Hull  
Notary Public

(SEAL)

**Enclosure 1**

**Response to DSER Open Item 2.5-1**

**DSER Open Item 2.5-1 (DSER pages 2-165 and 2-166)**

**Response**

On DSER pages 2-165 and 2-166, the NRC staff posed three distinct questions related to Dominion's ground motion evaluation. The three questions were collectively identified as Open Item 2.5-1. Dominion's response to each of three questions is provided below.

**Part 1 of DSER Open Item 2.5-1**

In RAI 2.5.2-2, the staff asked the applicant to provide additional details on the 2003 EPRI ground motion evaluation that it used for the ESP PSHA. To update PSHAs in the CEUS, EPRI sponsored a Senior Seismic Hazard Advisory Committee Level 3 analysis. NUREG/CR-6372 provides the guidelines for performing this analysis. The EPRI ground motion study used 13 different ground motion attenuation relationships grouped into four clusters. In RAI 2.5.2-2(c), the staff asked the applicant to provide the weight assigned to each of the 13 ground-motion relationships within their respective cluster. For cluster 1, EPRI gave the highest weight (0.90) to the three attenuation relationships reported by Silva et al. The staff inferred from this higher weight that these relationships must have fit the data much better than other relationships. However, the applicant did not provide plots or tables of the residuals as a function of attenuation relation, magnitude, distance, and frequency. Therefore, the staff was unable to evaluate the weighting EPRI selected for cluster 1. Similarly, for clusters 2 and 3, the ground motion experts applied higher weights to different attenuation relationships within each cluster. Neither the EPRI 2003 ground motion report or the applicant's response to RAI 2.5.2-2 provided the rationale for these weights.

**Response to Part 1**

- EPRI has published a December 2004 final version of the CEUS Ground Motion Report. The December 2004 version of the report contains significantly more detail on this subject than the August 2003 version currently referenced in SSAR Section 2.5. A copy of the December 2004 report is enclosed for your review. Please note that the report is published in both hard copy and electronic formats.
- Table 3-5, "Ground Motion Attenuation Model Weights in Each Cluster," of EPRI (2004) provides the intracluster weights. These intracluster weights are the same as identified in our July 8, 2004 response to RAI 2.5.2-2(c).
- Section 3.4.2, "Representing Ground Motion Model Clusters" of EPRI (2004) provides a detailed description of the rationale and process for developing the intracluster weights.

- Appendix A.3, "Model and Data Comparisons" of EPRI (2004) describes the direct statistical comparisons made with each of the median ground motion models and the strong-motion database. These detailed comparisons include explicit formulas and an example of the evaluations for the Atkinson and Boore attenuation relation.
- Statistics tables and residual plots for the Silva et al. Cluster 1 models, similar in format to those presented in Appendix A.3 of EPRI (2004) for the Atkinson and Boore model, were available to the Expert Panel during their evaluations of ground motion attenuation relationships.
- The process for developing the ground motion attenuation relationships in Clusters 2 and 3 is the same as that described for Cluster 1.

#### **Part 2 of DSER Open Item 2.5-1**

In RAI 2.5.2-2(b), the staff asked the applicant to provide additional information on the Silva et al. Cluster 1 attenuation relationships. In response, the applicant provided additional documentation on these attenuation relationships. The Silva et al. Cluster 1 relationships use an expression for the seismic attenuation parameter,  $Q$ , that is frequency dependent. This frequency-dependent  $Q$  value was derived from an inversion of the data from the 1988 Saguenay earthquake. This inversion solves for  $Q$ , as well as the local site attenuation parameter  $\kappa$  and the stress drop, which is the difference between the initial stress before and earthquake and the final stress. The staff was unable to determine how the recordings from a single earthquake can provide well-resolved values of both crustal  $Q$  and site  $\kappa$ . In addition, the  $Q$  value of 317 at 1 Hz is much lower than values found in other studies of eastern North American earthquakes. In addition, other studies have found less frequency dependence of  $Q$  in the east than in the west, which is contrary to the findings of Silva et al.

#### **Response to Part 2**

- The EPRI (2004) ground motion model was developed by implementing a SSHAC Level 3 assessment process. The intent of the SSHAC process is to consider the suite of viable models, as may be developed from a range of parameterizations, which properly represents the epistemic uncertainty of the technical community. To this end, presentation and critique of the various models occurred during the EPRI project workshops conducted as an integral part of the SSHAC process. The Expert Panel identified the Silva et al. (2002) relationships, among several others, as viable relationships that should be included in the assessment and evaluated.



All ground motion relationships identified as viable by the Expert Panel were evaluated using the same criteria following the SSHAC Level 3 process. The weight assessed for each viable ground motion relationship reflects its credibility assessed against the criteria and its relative weight for establishing the EPRI (2004) ground motion model. Once the assessment and evaluation by the Expert Panel and integration by the Technical Integrator is performed, specific critique of a constituent model or its parametric composition is not procedurally appropriate. This would undermine not only the integrity of the SSHAC process but also its end product.

- However, in response to this part of the DSER open item, several items should be noted with respect to the Silva, et al model parameter development:
  - EPRI (2004) used  $Q(f)=351f^{0.84}$  as referenced in the Silva et al., 2002 paper and not  $Q(f)=317f^{0.86}$  from the Brookhaven report. The  $f^{0.81}$  in Table 4-3 of the EPRI (2004) report is a typographical error and was not used in any EPRI (2004) calculations.
  - A direct comparison of the Silva, et al inversions with other Q models is difficult because of the interdependence of Q and other model parameters such as geometrical attenuation.
  - During the SSHAC workshops, the experts extensively discussed the Silva, et al attenuation models and the differences with other models were explicitly accepted as representative of epistemic uncertainty.
  - The Silva et al. model form was selected as the best representative of Cluster 1 models because it fit the data the best (see also the response to Part 1).

### **Part 3 of DSER Open Item 2.5-1**

In RAI 2.5.2-2(d), the staff asked the applicant to explain the weights given to each of the four clusters. In response to RAI 2.5.2-2, the applicant stated that the expert panel members, convened for the EPRI ground motion study, were asked to subjectively evaluate how well the alternative ground motion models relied on seismological principles. The staff considers the applicant's response to of RAI 2.5.2-2(d) to be somewhat indirect. The applicant has provided additional information, but the details still remain abstract in terms of specific "seismological principles." The response emphasizes the ranking of model clusters and the judgments involved in balancing data consistency and adherence to seismological principles. However, the applicant provided only abstract and very general references to these seismological principles. As a result, the staff was unable to evaluate the criteria or the weights applied to the four clusters.

**Response to Part 3**

- The December 2004 version of the EPRI CEUS GM Report (enclosed) contains significantly more detail on this subject than the August 2003 version currently referenced in SSAR Section 2.5.
- Section 3.5, "Evaluation of Cluster Median Ground Motion Models," of EPRI (2004) provides a discussion of seismological principles.
- Appendix C, "Ground Motion Project Workshop Summaries," of EPRI (2004) describes the assessment by the Expert Panel of the use of seismological principles by the various ground motion models.
- Specific definition of "seismological principles" was presented in the Ground Motion Expert Survey, which was the basis of our July 8, 2004 response to RAI 2.5.2-2(d). The results of the survey are summarized in Appendix D of EPRI (2004). Elements of incorporation of seismological principles into the intercluster weighting scheme reflect the reasoned judgments of the expert panelists. Expert panel judgment is an integral, appropriate, and NRC-approved element of the SSHAC process.
- Section 3.5 of EPRI (2004) also details the development of the intercluster weights, including the use of seismological principles—one of three criteria—as their assessment is utilized through an evaluation matrix to derive the intercluster weights.

**Application Revision**

None

**Enclosure 2**

**EPRI  
CEUS Ground Motion Project Final Report  
Technical Report No. 1009684  
December 2004**