

**U.S. Nuclear Regulatory Commission Regulatory Audit of Seismic Hazard Software and
New Central and Eastern United States (CEUS) Seismic Source Characterization (SSC)
Model Implementation for Calvert Cliffs Unit 3 (CCNPP3)**

AUDIT SUMMARY

Audit Location: Paul C. Rizzo Associates, Inc.
500 Penn Center Boulevard
Penn Center East, Suite 100
Pittsburgh, PA 15235

Audit Dates: August 2-3, 2012

Audit Participants:

NRC	Rizzo (Contractor)	UniStar
Surinder Arora	Richard Quittmeyer	Wayne Massie
Tanya Ford	Mike Edwards	Antonio Hernandez
Dogan Seber	Arash Zandieh	
	Margaret Pelcher	
	Jongwong Lee	
	Jose Blanco	

Audit Purpose and Scope

The purpose of this regulatory audit was for NRC staff to audit distinct seismic hazard calculation software being used by the industry to respond to the Fukushima Near-Term Task Force (NTTF) Recommendation 2.1 seismic Request for Additional Information (RAI) submitted to all combined operating license (COL) applicants. The audit focused only on the seismic hazard software and examined the implementation of the new seismic source models described in NUREG-2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities." As a result of the audit, the NRC staff will be able to conduct its review of RAI 345, Question 02.05.02-24 more efficiently once it has been submitted by the applicant. The audit did not cover any potentially available preliminary hazard calculations performed for the site. The site-specific hazard results may be the subject of a separate audit at a later time.

Audit Activities

Rizzo staff made a presentation to the NRC staff providing details of its seismic hazard software methodology and model implementation for CCNPP3. The NRC staff reviewed software runs and performed a quality assurance review of Rizzo's documents. The following documents, including relevant calculation notes, were reviewed by the NRC staff during the audit:

- *Paul C. Rizzo Associates, Inc., "Quality Procedures Manual" Revision 11*
 - QP-3, Revision 3, "Personnel Qualifications," dated March 21, 2011
 - QP-7, Revision 4, "Control of Design and Analysis Software," dated April 5, 2011
 - QP-15, Revision 2, "Calculation Preparation," dated February 26, 2010
- *Paul C. Rizzo Associates, Inc., "Quality Assurance Manual" Revision 7*

- *Paul C. Rizzo Associates, Inc., binder containing the computer program verification and validation information for the Rizzo Hazard Software Code Version 1.1.*
- Calculation Notes:
 - Calculation Note 09-4179.24-F01, Revision 0, "Response to UNE RFI Number 12-027 – PSHA for Calvert Cliffs NPP Unit 3 Site Rock condition," dated May 24, 2012. (V&V Revision No. 8)
 - Calculation Note 09-4179.24-F02, Revision 0, "Response to UNE RFI Number 12-027 – Controlling Earthquakes for Calvert Cliffs NPP Unit 3 Site Rock condition," dated April 24, 2012. (V&V Revision No. 8)
[The NRC staff confirmed the Configuration Baseline Form (Form QP-7-4, Revision 5, 4/5/11) supports Calculation Number 09-4179.24-F102, Rev. 0, "Response to UNE RFI Number 12-027-Controlling Earthquakes for Calvert Cliffs NPP Unit 3 Site," dated April 24, 2012.]
 - Calculation Note 09-4179.24-F00, Revision 0, "PSHA Input for the Calvert Cliffs NPP Site," dated May 22, 2012. (This calculation did not use the RIZZO HAZARD software Version 1.1; therefore, validation is not needed.)

Audit Findings

The NRC staff was unable to compare the seven test sites' total seismic hazard curves provided in NUREG-2115 with those calculated using the Rizzo Hazard Software, as the applicant did not have the total seismic hazard curves calculated at these seven test sites. Therefore, the NRC staff was unable to fully examine the integrated performance of the Rizzo Hazard Software and could not evaluate the full results of the test sites.

The NRC staff discussed the methodologies employed in the Rizzo Hazard Software with regard to implementation of the Repeated Large Magnitude Earthquake (RLME) sources described in NUREG-2115. The NRC staff and the applicant agreed that the Rizzo Hazard Software's implementation of the RLME sources may include a certain degree of uncertainty when a potential site is close to one of these large RLME sources. This is an observation that the NRC staff wanted to highlight to prevent future problems if the software is ever used in these regions. However, this observation has no implications on the CCNPP3 site.

The NRC staff noted that the Rizzo Hazard Software included only the mid-continent Ground Motion Prediction Equation's (GMPEs) of the EPRI (2004) and (2006) models, and did not incorporate the Gulf Coast GMPEs into its seismic hazard software. This means that the current version of the software cannot be used for any site in the Gulf Coast. However, this observation has no implications on the CCNPP3 site.

The NRC staff noted that Procedure Form QP-7-2, Revision 5, was not available for Revision 8 of the software. This is noted as an observation. The Rizzo staff understands the NRC's issue and took note of the discrepancy.

During the audit exit meeting, the NRC staff reviewed each of the six items to be completed during the audit and provided feedback on each item as follows:

1. (Review seismic hazard software.) – **This task was completed and no further action is needed for this item.**
2. (Review details of the implementation of the new CEUS seismic source model in hazard calculations.) – **This task was completed and no further action is needed for this item.**
3. (Review input parameters and seismic source zones.) – **This task was completed and no further action is needed for this item.**
4. (Review new model computer code implementation by comparing seismic hazard calculations conducted at the seven test sites presented in NUREG-2115.) – **This task was not completed. The NRC staff asked Rizzo if they have justification for not doing this task or when Rizzo plans to complete this task. According to Rizzo, this task has not been identified as a requirement.**
5. (Review any additional test run calculations and conduct simplified test runs.) – **This task was completed and no further action is needed for this item.**
6. (Review application of the new cumulative absolute velocity (CAV) filter settings for removing effect of non-damaging earthquakes in seismic hazard calculations.) – **This task was not applicable and no further action is needed for this item.**

Conclusion

The NRC staff evaluated the implementation of the new seismic source models described in NUREG-2115 in support of the NTTF Recommendation 2.1 seismic RAI submitted to the COL applicant for CCNPP3 (RAI 345, Question 02.05.02-24). The NRC staff noted several observations as described above that may need to be addressed in the future. One item was identified as incomplete and will need to be discussed further potentially when the final RAI response is submitted. This information was provided to the applicant during the audit exit meeting. As a result of the audit, no new RAIs were identified; however, the staff will be better prepared to review the applicant's response to RAI 345, Question 02.05.02-24 when it is submitted.