UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 8, 2015

Mr. George H. Gellrich
Vice President
Exelon Generation Company, LLC.
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
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SUBJECT: CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS. 1 AND 2 - STAFF ASSESSMENT OF INFORMATION PROVIDED PURSUANT TO TITLE 10 OF THE *CODE OF FEDERAL REGULATIONS* PART 50, SECTION 50.54(f), SEISMIC HAZARD REEVALUATIONS FOR RECOMMENDATION 2.1 OF THE NEAR-TERM TASK FORCE REVIEW OF INSIGHTS FROM THE FUKUSHIMA DAI-ICHI ACCIDENT (TAC NOS. MF3970 AND MF3971)

Dear Mr. Gellrich:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued a request for information pursuant to Title 10 of the *Code of Federal Regulations*, Part 50, Section 50.54(f) (hereafter referred to as the 50.54(f) letter). The purpose of that request was to gather information concerning, in part, seismic hazards at each operating reactor site and to enable the NRC staff, using present-day NRC requirements and guidance, to determine whether licenses should be modified, suspended, or revoked.

By letter dated March 31, 2014, Exelon Generation Company, LLC (Exelon), previously as Constellation Energy Nuclear Group, LLC, responded to this request for Calvert Cliffs Nuclear Power Plant Units, 1 and 2 (Calvert Cliffs).

The NRC staff has reviewed the information provided related to the reevaluated seismic hazard for Calvert Cliffs and, as documented in the enclosed staff assessment, determined that you provided sufficient information in response to Enclosure 1, Items (1) – (3), (5), (7) and the comparison portion of Item (4) of the 50.54(f) letter. Further, the staff concludes that the licensee's reevaluated seismic hazard is suitable for other actions associated with Near-Term Task Force Recommendation 2.1, "Seismic".

Contingent upon the NRC staff's review and acceptance of Exelon's expedited seismic evaluation process and seismic risk evaluation including the high frequency confirmation and spent fuel pool evaluation (i.e., Items (4), (6), (8), and (9)) for Calvert Cliffs, the Seismic Hazard Evaluation identified in Enclosure 1 of the 50.54(f) letter will be completed.

If you have any questions, please contact me at (301) 415-1617 or at Frankie.Vega@nrc.gov.

Sincerely,

Frankie G. Vega, Project Manager
Hazards Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket Nos. 50-317 and 50-318

Enclosure:
Staff Assessment of Seismic
Hazard Evaluation and Screening Report

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STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO SEISMIC HAZARD AND SCREENING REPORT

CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2

DOCKET NO. 50-317 AND 50-318

1.0 INTRODUCTION

By letter dated March 12, 2012 (NRC, 2012a), the U.S. Nuclear Regulatory Commission (NRC or the Commission) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f) "Conditions of license" (hereafter referred to as the "50.54(f) letter"). The request and other regulatory actions were issued in connection with implementing lessons-learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as documented in the "Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident" (NRC, 2011b).[1] In particular, the NRC Near-Term Task Force (NTTF) Recommendation 2.1, and subsequent Staff Requirements Memoranda (SRM) associated with Commission Papers SECY-11-0124 (NRC, 2011c) and SECY-11-0137 (NRC, 2011d), instructed the NRC staff to issue requests for information to licensees pursuant to 10 CFR 50.54(f).

Enclosure 1 to the 50.54(f) letter requests that addressees perform a reevaluation of the seismic hazards at their site(s) using present-day NRC requirements and guidance to develop a ground motion response spectrum (GMRS).

The required response section of Enclosure 1 requests that each addressee provide the following information:

(1) Site-specific hazard curves (common fractiles and mean) over a range of spectral frequencies and annual exceedance frequencies,

(2) Site-specific, performance-based GMRS developed from the new site-specific seismic hazard curves at the control point elevation,

(3) Safe Shutdown Earthquake (SSE) ground motion values including specification of the control point elevation,

(4) Comparison of the GMRS and SSE. High-frequency evaluation (if necessary),

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[1] Issued as an enclosure to Commission Paper SECY-11-0093 (NRC, 2011a).

(5) Additional information such as insights from NTTF Recommendation 2.3 walkdown and estimates of plant seismic capacity developed from previous risk assessments to inform NRC screening and prioritization,

(6) Interim evaluation and actions taken or planned to address the higher seismic hazard relative to the design basis, as appropriate, prior to completion of the risk evaluation (if necessary),

(7) Statement if a seismic risk evaluation is necessary,

(8) Seismic risk evaluation (if necessary), and

(9) Spent fuel pool (SFP) evaluation (if necessary).

Present-day NRC requirements and guidance with respect to characterizing seismic hazards use a probabilistic approach in order to develop a risk-informed performance-based GMRS for the site. Regulatory Guide (RG) 1.208, A Performance-based Approach to Define the Site-Specific Earthquake Ground Motion, describes this approach. As described in the 50.54(f) letter, if the reevaluated seismic hazard, as characterized by the GMRS, is not bounded by the current plant design-basis SSE, further seismic risk evaluation of the plant is merited.

By letter dated November 27, 2012 (Keithline, 2012), the Nuclear Energy Institute (NEI) submitted Electric Power Research Institute (EPRI) report "Seismic Evaluation Guidance: Screening, Prioritization, and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1 Seismic" (EPRI, 2012), hereafter called the SPID. The SPID supplements the 50.54(f) letter with guidance necessary to perform seismic reevaluations and report the results to NRC in a manner that will address the Requested Information Items in Enclosure 1 of the 50.54(f) letter. By letter dated February 15, 2013 (NRC, 2013b), the staff endorsed the SPID.

The required response section of Enclosure 1 to the 50.54(f) letter specifies that Central and Eastern United States (CEUS) licensees provide their Seismic Hazard and Screening Report (SHSR) by 1.5 years after issuance of the 50.54(f) letter. However, in order to complete its update of the EPRI seismic ground motion models (GMM) for the CEUS (EPRI, 2013), industry proposed a six-month extension to March 31, 2014, for submitting the SHSR. Industry also proposed that licensees perform an expedited assessment, referred to as the Augmented Approach, for addressing the requested interim evaluation (Item 6 above), which would use a simplified assessment to demonstrate that certain key pieces of plant equipment for core cooling and containment functions, given a loss of all alternating current power, would be able to withstand a seismic hazard up to two times the design basis. Attachment 2 to the April 9, 2013, letter (Pietrangelo, 2013) provides a revised schedule for plants needing to perform (1) the Augmented Approach by implementing the Expedited Seismic Evaluation Process (ESEP) and (2) a seismic risk evaluation. By letter dated May 7, 2013 (NRC, 2013a), the NRC determined that the modified schedule was acceptable and by letter dated August 28, 2013 (NRC, 2013c), the NRC determined that the updated GMM (EPRI, 2013) is an acceptable GMM for use by CEUS plants in developing a plant-specific GMRS.

By letter dated April 9, 2013 (Pietrangelo, 2013), industry committed to follow the SPID to develop the SHSR for existing nuclear power plants. By letter dated September 12, 2013 (Spina, 2013), Exelon Generation Company, LLC (Exelon, the licensee), previously as Constellation Energy Nuclear Group, LLC, submitted at least partial site response information to this request for Calvert Cliffs Nuclear Power Plant Units, 1 and 2 (Calvert Cliffs, CCNPP). By letter dated March 31, 2014 (Korsnick, 2014), Exelon submitted its SHSR for CCNPP.

2.0 REGULATORY BACKGROUND

The structures, systems, and components (SSCs) important to safety in operating nuclear power plants are designed either in accordance with, or meet the intent of Appendix A to 10 CFR Part 50, General Design Criteria (GDC) 2: "Design Bases for Protection Against Natural Phenomena;" and Appendix A to 10 CFR Part 100, "Reactor Site Criteria." GDC 2 states that SSCs important to safety at nuclear power plants shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions.

For initial licensing, each licensee was required to develop and maintain design bases that, as defined by 10 CFR 50.2, identify the specific functions that an SSC of a facility must perform, and the specific values or ranges of values chosen for controlling parameters as reference bounds for the design. The design bases for the SSCs reflect appropriate consideration of the most severe natural phenomena that had been historically reported for the site and surrounding area. The design bases also considered limited accuracy, quantity, and period of time in which the historical data have been accumulated.

The seismic design bases for currently operating nuclear power plants were either developed in accordance with, or meet the intent of GDC 2 and 10 CFR Part 100, Appendix A. Although the regulatory requirements in Appendix A to 10 CFR Part 100 are fundamentally deterministic, the NRC process for determining the seismic design basis ground motions for new reactor applications after January 10, 1997, as described in 10 CFR 100.23, requires that uncertainties be addressed through an appropriate analysis such as a probabilistic seismic hazard analysis (PSHA).

Section 50.54(f) of 10 CFR states that a licensee shall at any time before expiration of its license, upon request of the Commission, submit written statements, signed under oath or affirmation, to enable the Commission to determine whether or not the license should be modified, suspended, or revoked. On March 12, 2012, the NRC staff issued requests for licensees to reevaluate the seismic hazards at their sites using present-day NRC requirements and guidance, and identify actions planned to address plant-specific vulnerabilities associated with the updated seismic hazards.

Attachment 1 to Enclosure 1 of the 50.54(f) letter describes an acceptable approach for performing the seismic hazard reevaluation for plants located in the CEUS. Licensees are expected to use the CEUS Seismic Source Characterization (CEUS-SSC) model in NUREG-2115 (NRC, 2012b) along with the appropriate EPRI (2004, 2006) GMMs. The SPID provides further guidance regarding the appropriate use of GMMs for the CEUS. Specifically, Section 2.3 of the SPID recommends the use of the updated GMM (EPRI, 2013) and, as such, licensees used the NRC-endorsed updated EPRI GMM instead of the older EPRI (2004, 2006) GMM to

develop PSHA base rock hazard curves. Finally, Attachment 1 requested that licensees conduct an evaluation of the local site response in order to develop site-specific hazard curves and GMRS for comparison with the plant SSE.

2.1 Screening Evaluation Results

By letter dated March 31, 2014 (Korsnick, 2014), Exelon provided the SHSR for Calvert Cliffs. The licensee's SHSR indicated that the site GMRS exceeds the SSE in the frequency range of 1 to 10 Hertz (Hz). Further, the licensee indicated that the GMRS also exceeds the SSE above 10 Hz. However, the licensee stated that because the site GMRS is bounded by the Individual Plant Examination of External Events (IPEEE) High Confidence Low Probability of Failure (HCLPF) Spectrum (IHS), that neither a seismic risk evaluation nor high-frequency confirmation is necessary for CCNPP, Units 1 and 2. The licensee provided additional justification in its SHSR to demonstrate that its IPEEE met the SPID criteria necessary to use the IHS for its screening evaluation rather than the SSE. As such, the licensee concluded that only a SFP evaluation was merited for the CCNPP, Units 1 and 2 because the SFP was not included in the IPEEE program.

On May 9, 2014 (NRC, 2014), the staff issued a letter providing the outcome of its 30-day screening and prioritization evaluation. In the letter, the staff characterized the site as screened in. This was based on the staff determination that the CCNPP IPEEE program did not meet the IPEEE program screening criteria described in the SPID. The licensee's GMRS, as well as the confirmatory GMRS developed by the staff, exceed the SSE in the frequency range of 1 to 10 Hz, as well as above 10 Hz. Therefore, a plant seismic risk evaluation, high-frequency evaluation, and SFP evaluation are merited for CCNPP, Units 1 and 2.

3.0 TECHNICAL EVALUATION

The NRC staff evaluated the licensee's submittal to determine if the provided information responded appropriately to Enclosure 1 of the 50.54(f) letter with respect to characterizing the reevaluated seismic hazard.

3.1 Plant Seismic Design Basis

Enclosure 1 of the 50.54(f) letter requests that the licensee provide the SSE ground motion values, as well as the specification of the control point elevation(s) for comparison to the GMRS. For operating reactors licensed before 1997, the SSE is the plant licensing basis earthquake and is characterized by (1) a peak ground acceleration (PGA) value which anchors the response spectra at high frequencies (typically at 20 to 30 Hz for the existing fleet of nuclear power plants); (2) a response spectrum shape which depicts the amplified response at all frequencies below the PGA; and (3) a control point where the SSE is defined.

In Section 3.0 of the SHSR, the licensee described its seismic design-basis. The licensee stated that the design-basis earthquake for CCNPP is based on the occurrence of a Modified Mercalli Intensity VII event, which would result in a horizontal PGA of 0.15 g. The licensee defined the SSE control point at the foundation level within the Chesapeake cemented sand layer at an elevation of -1 foot (ft) (-0.30 meters (m)).

The staff reviewed the licensee's description of the SSE for CCNPP and confirms that it is consistent with the information provided in the CCNPP updated final analysis report (UFSAR). Furthermore, the staff confirms that the licensee's SSE control point elevation determination is consistent with the information provided in the CCNPP UFSAR, as well the guidance provided in the SPID.

3.2 Probabilistic Seismic Hazard Analysis

In Section 2.2 of the SHSR, the licensee stated that, in accordance with the 50.54(f) letter and the SPID, it performed a PSHA using the CEUS-SSC model and the updated EPRI GMM for the CEUS (EPRI, 2013). The licensee used a minimum moment magnitude of **M** 5.0, as specified in the 50.54(f) letter. The licensee further stated that it included the CEUS-SSC background sources out to a distance of 400 miles (640 km) around the site and included the Charleston and Wabash Valley repeated large magnitude earthquake (RLME) sources, which lie within 620 miles (1,000 km) of the site. The RLME sources are those source areas or faults for which more than one large magnitude (**M** ≥ 6.5) earthquake has occurred in the historical or paleo-earthquake (geologic evidence for prehistoric seismicity) record. The licensee used the mid-continent version of the updated EPRI GMM (EPRI, 2013) for each of the CEUS-SSC sources. Consistent with the SPID, the licensee did not provide base rock seismic hazard curves because it performed a site response analysis to determine the control point seismic hazard curves. The licensee provided its control point seismic hazard curves in Section 2.3.7 of its SHSR. The staff's review of the licensee's control point seismic hazard curves is provided in Section 3.3 of this assessment.

As part of its confirmatory analysis of the licensee's GMRS, the staff performed PSHA calculations for base rock site conditions at the CCNPP site. As input, the staff used the CEUS-SSC model, as documented in NUREG-2115 (NRC, 2012b), along with the updated EPRI GMM model (EPRI, 2013). Consistent with the guidance provided in the SPID, the staff included all CEUS-SSC background seismic sources within a 310 mi (500 km) radius of the CCNPP site. In addition, the staff also included the Wabash Valley, and Charleston RLMEs sources. For each of the CEUS-SSC sources used in the PSHA, the staff used the mid-continent version of the updated EPRI GMM (EPRI, 2013).

Based on review of the SHSR, the staff concludes that the licensee appropriately followed the guidance provided in the SPID for selecting the PSHA input models and parameters for the site. This includes the licensee's use and implementation of the CEUS-SSC model and the updated EPRI GMM.

3.3 Site Response Evaluation

After completing PSHA calculations for reference rock site conditions, Attachment 1 to Enclosure 1 of the 50.54(f) letter requests that the licensee provide a GMRS developed from the site-specific seismic hazard curves at the control point elevation. In addition, the 50.54(f) letter specifies that the subsurface site response model, for both soil and rock sites, should extend to sufficient depth to reach the reference or base rock conditions as defined in the GMMs used in the PSHA. To develop site-specific hazard curves at the control point elevation, Attachment 1 requests that licensees perform a site response analysis.

Detailed site response analyses were not typically performed for many of the older operating plants; therefore, Appendix B of the SPID provides detailed guidance on the development of site-specific amplification factors (including the treatment of uncertainty) for sites that do not have detailed, measured soil and rock parameters to extensive depths. The purpose of the site response analysis is to determine the site amplification that will occur as a result of bedrock ground motions propagating upwards through the soil/rock column to the surface. The critical parameters that determine what frequencies of ground motion are affected by the upward propagation of bedrock motions are the layering of soil and/or soft rock, the thicknesses of these layers, the shear-wave velocities and low-strain damping of the layers, and the degree to which the shear modulus and damping change with increasing input bedrock amplitude.

3.3.1 Site Base Case Profiles

In its SHSR, the licensee indicated that it performed a site response analysis for CCNPP, Units 1 and 2. According to the licensee, the site consists of approximately 245 ft (74.7 m) of dense sand and clay/silt of the Chesapeake Formation atop 2,200 ft (671 m) of Eocene and older sands with deeper soil transition layers overlying approximately 20 ft (6 m) of a bedrock transition zone. In Table 2.3.1-1 of its SHSR, the licensee provided a brief description of the subsurface materials in terms of the geologic units and layer thicknesses. SHSR Table 2.3.2-1 also provides the shear wave velocities which range from 800 feet per second (fps) (244 meters per second (m/s)) in the upmost 17 ft (5.2 m) to 9,200 fps (2,800 m/s) in the bedrock at a depth of 2,511 ft (765 m). The licensee stated that the SSE control point is at elevation -1 ft (-0.3 m), corresponding to firm cemented sands of the Chesapeake Formation with an average shear wave velocity of 1,600 fps (488 m/s).

The licensee used the shear-wave velocities, the information on the regional geologic profile (summarized in SHSR Table 2.3.1-1), and the guidance in Appendix B of the SPID to develop three base-case shear-wave velocities for the CCNPP site using a scale factor of 1.0 for the top 20 ft (6 m) of the Chesapeake sands and a factor of 1.57 for the deeper layers. The licensee noted that a scale factor of 1.57 reflects a natural log standard deviation of about 0.35. The licensee specified the shear-wave velocities taken as the mean or best estimate base-case profile with lower and upper range base-case profiles. All profiles were extended to a depth of 2,465 ft (751 m). Table 2.3.2-1 and Figure 2.3.2-1 of the SHSR provide the licensee's shear-wave velocity profile for each of the three base cases.

The licensee stated that no site-specific dynamic material properties were determined in the initial siting of CCNPP. Therefore, the licensee stated that it selected the EPRI soil and the Peninsular Range curves to represent the nonlinear response in the site materials for the initial 500 ft (152 m). For deeper layers, the licensee used a constant Q value of 40 to account for the linear damping. Using Appendix B-5.1.3.1 of the SPID, the licensee also estimated base-case kappa for a shallow soil CEUS site. For the CCNPP site the licensee calculated a kappa value of 0.051s, which exceeds the largest value recommended in the SPID. As such, the licensee capped the base kappa value at 0.04 s.

The licensee described the development of its random velocity profiles in Section 2.3.3 of the SHSR and stated that its approach is consistent with Appendix B of the SPID guidance. To account for randomness in material properties across the plant site, the licensee randomized its base case shear-wave velocity profiles. The licensee described the development of its

randomized velocity profiles in Section 2.3.3 of its SHSR and stated that its approach is consistent with Appendix B of the SPID guidance. In addition, the licensee randomized the depth to bedrock by about ±740 ft (± 225 m), which corresponds to about 30-percent of the total profile thickness.

3.3.2 Site Response Method and Results

In Section 2.3.4 of its SHSR, the licensee stated that it followed the guidance in Appendix B of the SPID to develop input ground motions for the site response analysis and in Section 2.3.5, the licensee described its implementation of the random vibration theory (RVT) approach to perform its site response calculations. Finally, Section 2.3.6 of the SHSR shows the resulting amplification functions and associated uncertainties for two of the eleven input loading levels for the base case profile and EPRI soil and rock shear modulus and damping curves.

In order to develop probabilistic site-specific control point hazard curves, as stated in Requested Information Item 1 of the 50.54(f) letter, the licensee used Method 3, described in Appendix B-6.0 of the SPID. The licensee's use of Method 3 involved computing the site-specific control point elevation hazard curves for a broad range of spectral accelerations by combining the site-specific bedrock hazard curves, determined from the initial PSHA discussed in Section 3.2 of this assessment, and the amplification functions and their associated uncertainties, determined from the site response analysis.

3.3.3 Staff Confirmatory Analysis

To confirm the licensee's site response analysis, the staff performed site response calculations for the CCNPP site. The staff independently developed a shear-wave velocity profile, damping values, and modeled the potential nonlinear behavior of the rocks. For its site response calculations, the staff employed the RVT approach and developed input ground motions in accordance with Appendix B of the SPID. The staff's shear wave velocity profile was primarily adapted from the Calvert Cliffs, Unit 3 Combined Operating License (COL) FSAR. The operating plant is close to the COL site; the distance is on the order of several hundred meters. However, because it is likely that the shear wave velocities differ somewhat between the COL site and the operating plant site, the staff developed upper and lower velocity models in addition to the median case using a natural log sigma of 0.1. To capture the uncertainty in the depth to base rock beneath the site, the staff also used a natural log sigma of 0.1, resulting in a basement uncertainty of about ± 250 feet. Figure 3.3-1 of this assessment shows the staff's velocity profile compared to the three base-case profiles developed by the licensee. The staff's control point is on top of the Chesapeake group, which is the same location as the licensee's control point.

Overall, the staff's velocity profiles are similar to those developed by the licensee. Similar to the licensee, the staff also used the SPID guidance in developing the appropriate dynamic properties by using the appropriate EPRI soil and Peninsular curves. The staff's model, however, assumed a linear response below a depth of 360 ft [110 meters] whereas the licensee assume a linear response below a depth of 500 ft [152 meters]. For the site kappa values, the staff also estimated a value above 0.04 s and therefore, used a kappa value 0.04 s to be consistent with the SPID guidance.

Figure 3.3-2 of this assessment shows a comparison of the staff's and licensee's median site amplification functions and uncertainties (±1 standard deviation) for two of the eleven input loading levels. Even though there are some variations in site amplifications due to differing input model parameters, as shown in Figure 3.3-3 of this assessment, these differences do not impact the final control point hazard curves. Appendix B of the SPID provides guidance for performing site response analyses, including capturing the uncertainty for sites with less subsurface data; however, the guidance is neither entirely prescriptive nor comprehensive. As such, various approaches in performing site response analyses, including the modeling of uncertainty, are acceptable for this application.

In summary, the staff concludes that the licensee's site response was conducted using present-day guidance and methodology, including the NRC-endorsed SPID. The staff performed independent calculations which confirm that the licensee's amplification factors and control point hazard curves adequately characterize the site response, including the uncertainty associated with the subsurface material properties, for the CCNPP site.

3.4 Ground Motion Response Spectra

In Section 2.4 of the SHSR, the licensee stated that it used the control point hazard curves, described in SHSR Section 2.3.7, to develop the 10^{-4} and 10^{-5} (mean annual frequency of exceedance) uniform hazard response spectra (UHRS) and then computed the GMRS using the criteria in RG 1.208.

The staff independently calculated the 10^{-4} and 10^{-5} UHRS using the results of its confirmatory PSHA and site response analyses, as described in Sections 3.2 and 3.3 of this staff assessment, respectively. Figure 3.4-1 of this assessment shows a comparison of the GMRS determined by the licensee to that determined by the staff. As shown in Figure 3.4-1, the NRC's GMRS shape is generally similar to the licensee's GMRS across the entire frequency range.

The staff confirms that the licensee used the present-day guidance and methodology outlined in RG 1.208 and the SPID to calculate the horizontal GMRS, as requested in the 50.54(f) letter. The staff performed both a PSHA and site response confirmatory analysis and achieved results consistent with the licensee's horizontal GMRS. As such, the staff concludes that the GMRS determined by the licensee adequately characterizes the reevaluated hazard for the CCNPP site. Therefore, this GMRS is suitable for use in subsequent evaluations and confirmations, as needed, for the response to the 50.54(f) letter.

4.0 CONCLUSION

The NRC staff reviewed the information provided by the licensee for the reevaluated seismic hazard for the CCNPP site. Based on its review, the staff concludes that the licensee conducted the hazard reevaluation using present-day methodologies and regulatory guidance, it appropriately characterized the site given the information available, and met the intent of the guidance for determining the reevaluated seismic hazard. Based upon the preceding analysis, the NRC staff concludes that the licensee provided an acceptable response to Requested Information Items (1) – (3), (5), (7) and the comparison portion of Item (4), identified in Enclosure 1 of the 50.54(f) letter. Further, the licensee's reevaluated seismic hazard is acceptable to address other actions associated with NTTF Recommendation 2.1, "Seismic".

In reaching this determination, staff confirmed the licensee's conclusion that the licensee's GMRS exceeds the SSE for CCNPP, Units 1 and 2 over the frequency range of approximately 6 to 40 Hz. The staff also determined that the CCNPP IPEEE program did not meet the IPEEE program screening criteria described in the SPID. As such, a seismic risk evaluation, a high-frequency confirmation and SFP evaluation are merited. NRC review and acceptance of the seismic risk evaluation, high-frequency confirmation, ESEP interim evaluation and SFP evaluation (i.e., Items (4), (6), (8), and (9)) for CCNPP, Units 1 and 2 will complete the Seismic Hazard Evaluation identified in Enclosure 1 of the 50.54(f) letter.

REFERENCES

Note: ADAMS Accession Nos. refer to documents available through NRC's Agencywide Documents Access and Management System (ADAMS). Publicly-available ADAMS documents may be accessed through http://www.nrc.gov/reading-rm/adams.html.

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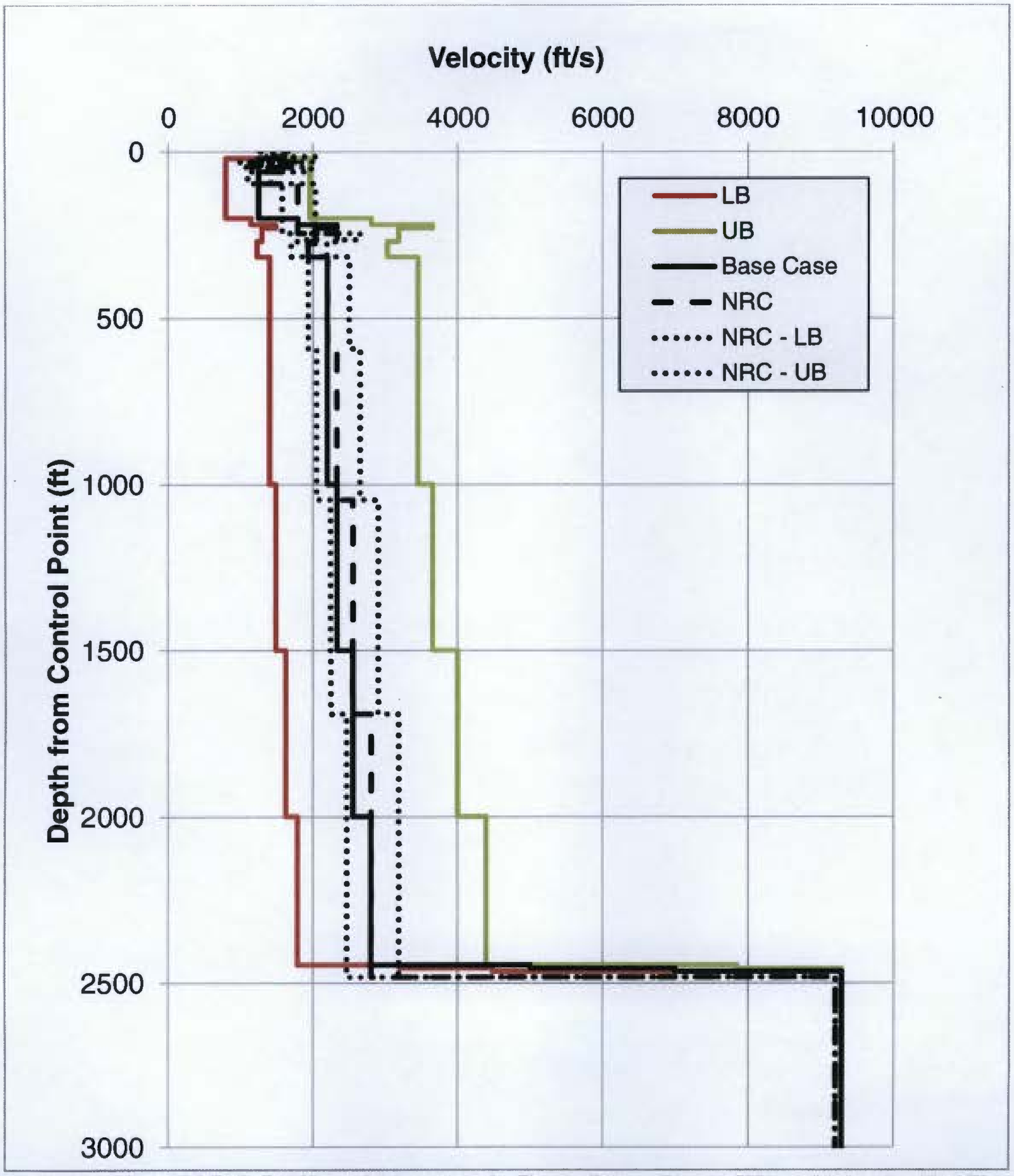

Figure 3.3-1 Plot of NRC Staff and Licensee's Base Case Shear-Wave Velocity Profiles for the Calvert Cliffs site

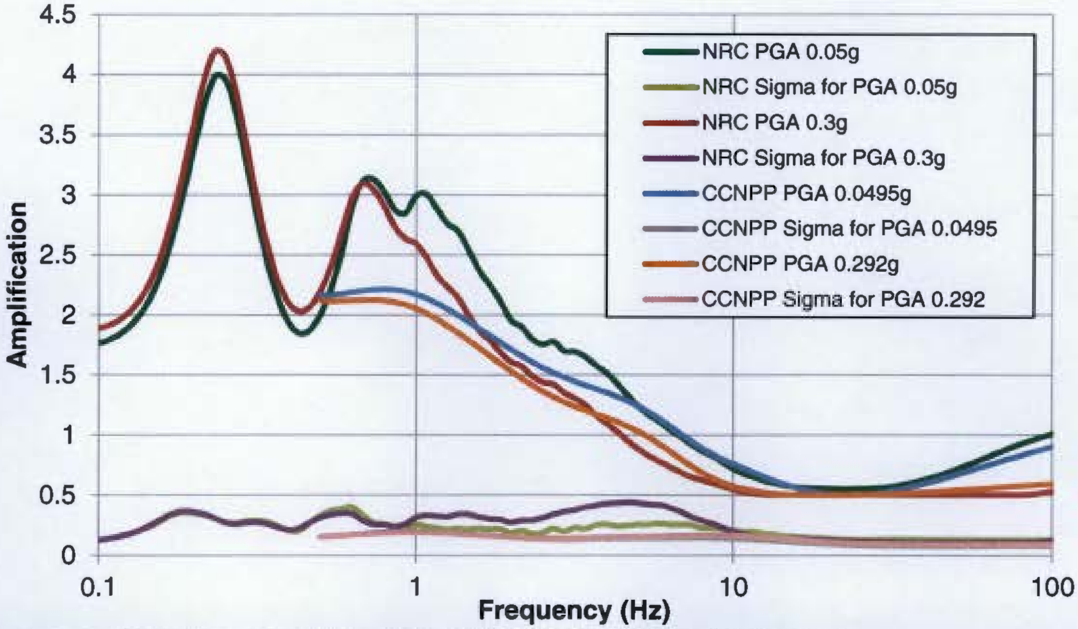

Figure 3.3-2 Plot Comparison of the NRC Staff and the Licensee's Median Amplification Functions and Uncertainties for the Calvert Cliffs site

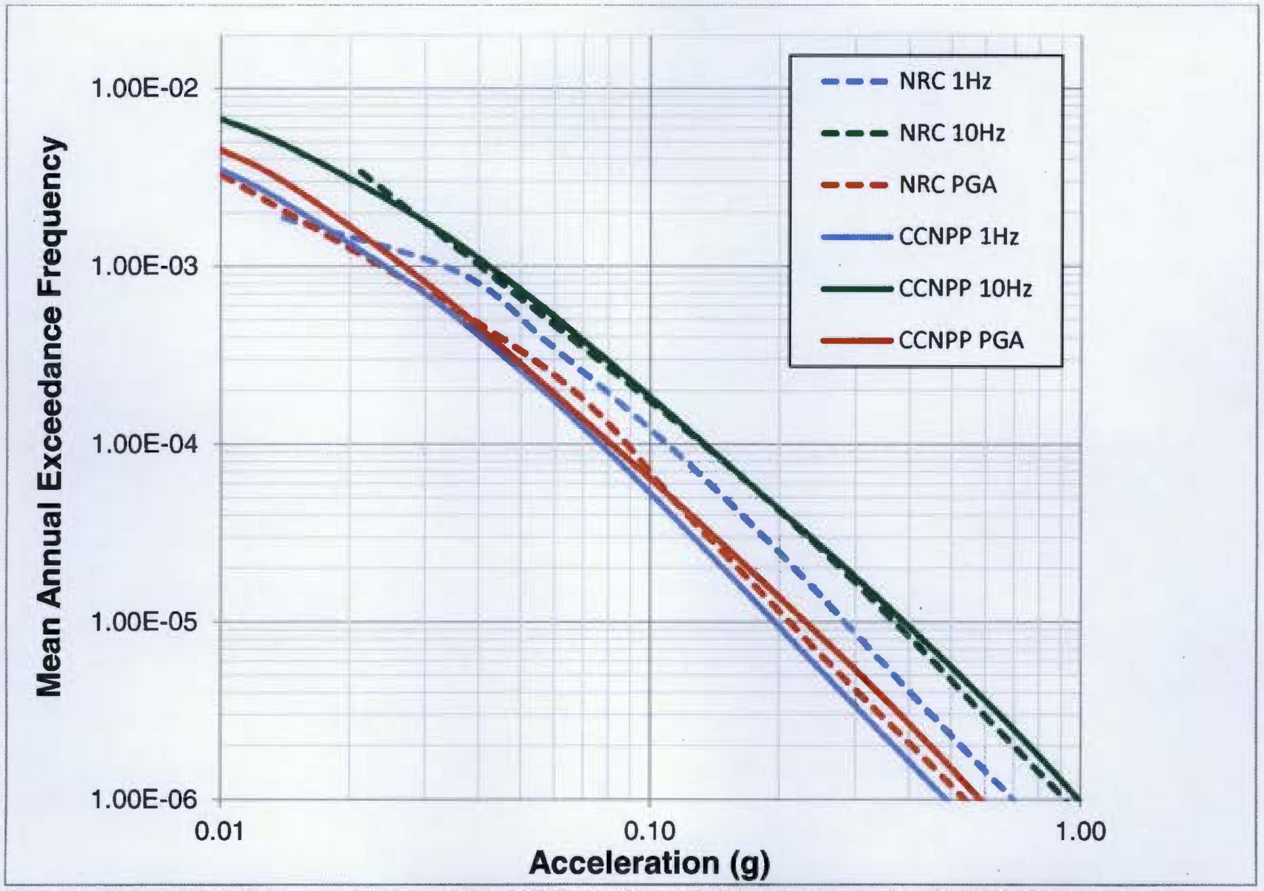

Figure 3.3-3 Plot Comparison of the NRC staff and the Licensee's Mean Control Point Hazard Curves at a Variety of Frequencies for the Calvert Cliffs site

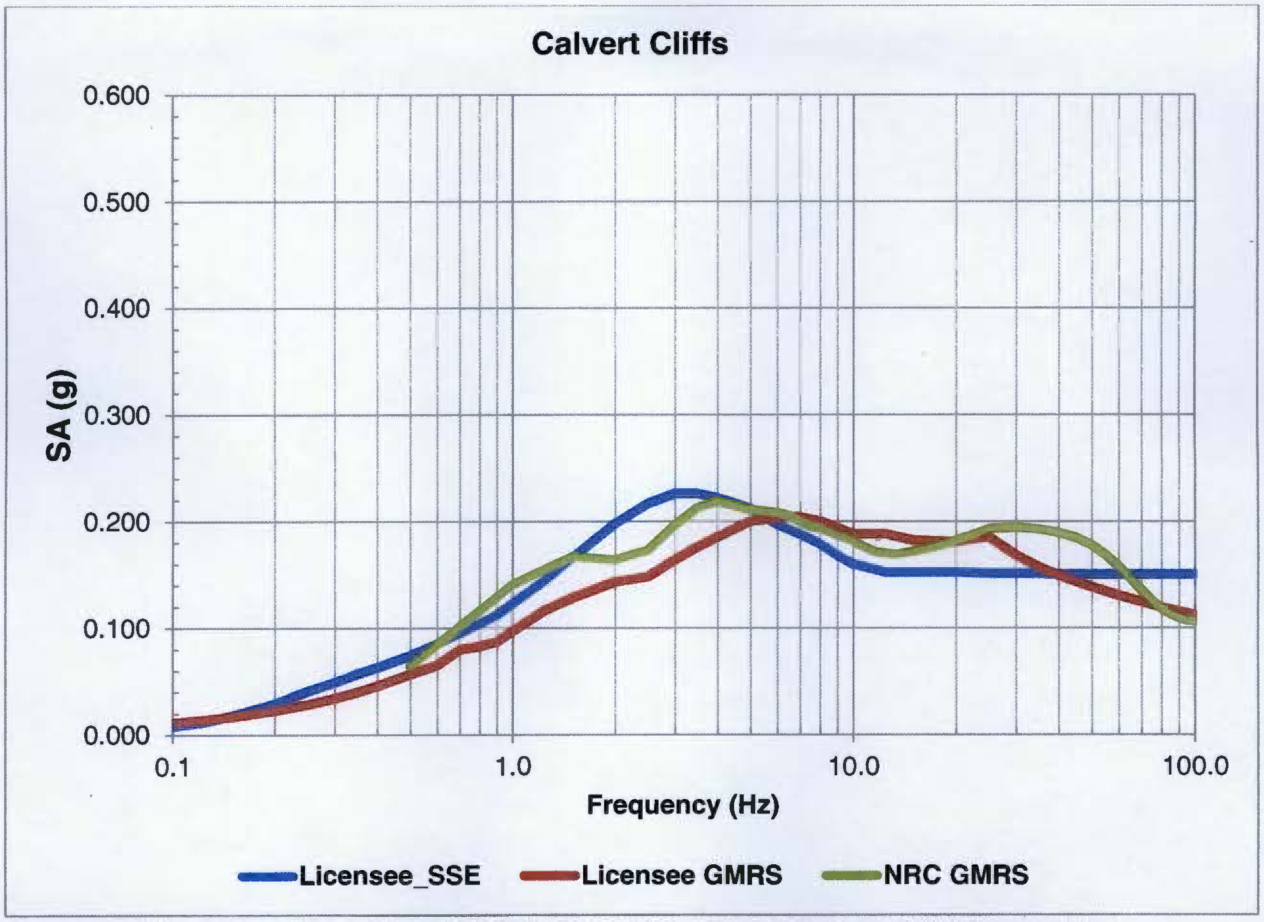

Figure 3.4-1 Comparison of the NRC staff GMRS with Licensee's GMRS and the Unit Nos. 1 and 2 SSE for the Calvert Cliffs site

If you have any questions, please contact me at (301) 415-1617 or at Frankie.Vega@nrc.gov.

Sincerely,

/RA/

Frankie G. Vega, Project Manager
Hazards Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket Nos. 50-317 and 50-318

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Hazard Evaluation and Screening Report

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