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

August 12, 2015

Mr. Adam C. Heflin
President, Chief Executive Officer
and Chief Nuclear Officer
Wolf Creek Nuclear Operating
Corporation
P.O. Box 411
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION - 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 NO. MF3755)

Dear Mr. Heflin:

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, Wolf Creek Nuclear Operating Corporation (the licensee), responded to this request for Wolf Creek Generating Station (Wolf CreekWolf Creek).

The NRC staff has reviewed the information provided related to the reevaluated seismic hazard for Wolf Creek 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 the licensee'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 Wolf Creek, 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 No. 50-482

Enclosure:
Staff Assessment of Seismic
Hazard Evaluation and Screening Report

cc w/encl: Distribution via Listserv

STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO SEISMIC HAZARD AND SCREENING REPORT

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482

1.0 INTRODUCTION

By letter dated March 12, 2012 (NRC, 2012a), the U.S. Nuclear Regulatory Commission (NRC or 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 sites 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. A high-frequency evaluation (if necessary),

[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” (NRC, 2007), 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 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 ground motion model for use by CEUS plants in developing a plant-specific GMRS.

By letter dated April 9, 2013 (Pietrangelo, 2013), industry committed to following the SPID to develop the SHSR for existing nuclear power plants. By letter dated September 12, 2013 (Broschak, 2013), Wolf Creek Nuclear Operating Corporation (WCNOC, the licensee) submitted at least partial site response information for the Wolf Creek Generating Station (Wolf Creek). By letter dated March 31, 2014 (Smith, 2014), the licensee submitted its SHSR for Wolf Creek.

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." The 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) GMMss. 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 (Smith, 2014), the licensee provided the (SHSR) for Wolf Creek. The licensee's SHSR indicates that the site GMRS exceeds the SSE for Wolf Creek within the frequency range of 1 to 10 Hertz (Hz). As such, Wolf Creek screens-in to perform a seismic risk evaluation, as well as a SFP evaluation. The GMRS also exceeds the SSE at frequencies above 10 Hz and, as such, a high frequency evaluation will be performed. The licensee indicated that its plant risk evaluation would address the high frequency exceedance.

On May 9, 2014 (NRC, 2014), the staff issued a letter providing the outcome of its 30-day screening and prioritization evaluation. As indicated in the letter, the staff confirmed the licensee's screening results. The licensee's GMRS, as well as the confirmatory GMRS, developed by the staff, exceed the SSE for Wolf Creek over the frequency range of approximately 7 to 100 Hz. Therefore, a seismic risk evaluation, SFP evaluation, and a high frequency evaluation are merited for Wolf Creek.

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 licensees 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 from 20 to 33 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 3.1 of its SHSR, the licensee described its seismic design bases for Wolf Creek. The licensee stated that the SSE for Wolf Creek was conservatively defined as an earthquake of Modified Mercalli intensity (MMI) VIII occurring no closer than 75 miles [121 km] from the site generating a maximum ground motion of MMI VI at the site. The licensee estimated that resulting maximum horizontal ground motion at the site from the SSE would vary from 0.02 to 0.08 g. Wolf Creek has both a SSE defined for the powerblock and non-powerblock structures, both of which are Regulatory Guide 1.60 (NRC, 1974) response spectral shapes anchored at 0.20g and 0.15g, respectively. For the purposes of the screening evaluation, the licensee used the non-powerblock SSE anchored at 0.15g as a more conservative approach.

The licensee specified that the SSE control point is located in the free field at finished grade at Elevation 1,099.5 ft [335 m] National Geodetic Vertical Datum. The SSE control point is specified in the Wolf Creek updated Safety Analysis report (USAR). Based on a review of the Wolf Creek USAR, the staff confirmed that the SSE for Wolf Creek is a Regulatory Guide 1.60 response spectrum anchored at 0.20g and 0.15g. In addition, the staff concludes that the selection of the control point is consistent with guidance provided in Section 2.4.2 of the SPID to define the control point.

3.2 Probabilistic Seismic Hazard Analysis

In Section 2.2 of its 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). For its PSHA, the licensee used a minimum moment magnitude (M_w) of 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] and included the Meers, New Madrid Fault System 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_w >= 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 in SHSR Section 2.2.2 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 staff assessment.

As part of its confirmatory analysis of the licensee's GMRS, the NRC staff performed PSHA calculations for base rock conditions at the Wolf Creek site. As input, the staff used the CEUS-SSC model as documented in NUREG-2115 (NRC, 2012b) along with the updated EPRI GMM (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 Wolf Creek site. In addition, the staff included all of the RLME sources falling within a 620 mi [1,000 km] radius of the site, which includes the Meers, New Madrid Fault System and Wabash Valley RLME sources. For each of the CEUS-SSC sources used in the PSHA, the NRC staff used the mid-continent version of the updated EPRI GMM (EPRI, 2013). The NRC staff used the resulting base rock seismic hazard curves together with a confirmatory site response analysis, described in the next section, to develop control point seismic hazard curves and a GMRS for comparison with the licensee's results.

Based on its review of the SHSR, the NRC 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 generic or reference 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 the licensee 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

The licensee provided detailed site profile descriptions in Sections 2.3.1 and 2.3.2 of its SHSR, based on information provided in the Wolf Creek USAR (WCNOC, 2013, USAR) and supported by a more recent review of site parameter data. The licensee stated that the site is underlain by approximately 10 ft [3.0 m] of soil overlying 2,700 ft [823 m] of Pennsylvanian age sedimentary rock.

The licensee provided a brief description of the subsurface materials in terms of geologic units and thickness in its SHSR. Seismic shear wave velocities range from 300 to 400 feet per second (fps) [91 to 122 meters per second (m/s)] for the soil, and increase from 1,400 to 8,000 fps [427 to 2,440 m/s] for the firm sedimentary rock layers, which underlay the soil layer.

To characterize the subsurface geology, the licensee developed three site base case profiles. The middle, or best estimate, profile was developed using the specified shear wave velocities with a deepest velocity of 8,000 fps [2,438 m/s] and a gradient of 0.5 ft/s/ft, resulting in a base-case shear wave velocity of 9,075 fps [2,766 m/s] at a depth of 2,700 ft [823 m]. Upper and lower base case profiles were developed using a scale factor of 1.57 to reflect a natural log standard deviation of 0.35. Consistent with the SPID, to account for randomness in material properties across the plant site, the licensee stated that it randomized each of its three base case shear-wave velocity profiles. Figure 3.3-1 of this assessment shows the licensee's three base case shear-wave velocity profiles.

In Section 2.3.2.1 of its SHSR, the licensee assumed that the behavior of the upper 500 ft [152 m] of firm rock material at the site could be modeled as either nonlinear or linear in response to the input bedrock ground motions. Consistent with the SPID, the licensee used the EPRI rock curves (model M1) to model the nonlinear response and the Peninsular Range (PR) curves combined with a constant damping value of about 3 percent (model M2) to model the linear response of the rock.

The licensee also considered the impact of kappa, or small strain damping, on the site response. Kappa is measured in units of seconds (sec), and is the damping contributed by both intrinsic hysteretic damping, as well as scattering due to wave propagation in heterogeneous material. For Wolf Creek, with about 2,700 ft [823 m] of sedimentary rock below the SSE control point, the licensee estimated kappa based on the low-strain damping in the hysteretic damping curves over the upper 500 ft [152 m] plus a constant hysteretic damping of 1.25 for the remaining firm rock profile. The licensee also added a kappa value of 0.006s to account for the contribution from the underlying base rock. The resulting kappa for the three profiles are 0.020 sec, 0.029 sec, and 0.011 sec.

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 the cases analyzed. Amplification functions are shown for eleven input loading levels for the median reference (hard rock) peak acceleration (0.01g to 1.50g) for the middle base case profile (P1) with the EPRI rock curves.

In order to develop probabilistic site-specific control point hazard curves, as requested 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 (Section 2.3.7), 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 Wolf Creek site. The staff independently developed three base case shear-wave velocity profiles from the information provided in USAR. The staff developed three separate profiles in order to capture the epistemic uncertainty in the modeled profiles. The USAR for Wolf Creek provides detailed information on the dynamic properties of the shallow site formations collected from numerous geophysical surveys including refraction, uphole compressional wave, uphole and crosshole shear wave, surface waves and ambient vibrations. Most of the shear wave velocities listed in the USAR were calculated from the compression wave velocities estimated from the refraction surveys. The NRC staff's base case shear-wave velocity profiles are shown along with the licensee's base case profiles in Figure 3.3-1 of this assessment. The staff's

shear wave velocity profiles are almost identical to those submitted by the licensee due to the detailed information in the USAR which is also presented in Table 2.3.2-1 of the SHSR.

Similar to the approach used by the licensee, the NRC staff used the SPID guidance to characterize the dynamic material behavior of the base case profiles. The NRC staff assumed that the material in the upper 500 ft [152 m] could behave both linearly and non-linearly under a range of loading conditions. For the soil type material, the EPRI soil curves were used to model the non-linear response and the Peninsular curves were used to represent linear behavior. For materials considered to be rock, the NRC staff used the EPRI rock curves to represent non-linear response while the linear behavior was modeled using a damping value of about 3-percent. Below 500 ft [152 m], the NRC staff assumed only linear behavior for the rock with a constant damping value of 1.25 percent.

Using the guidance provided in the SPID for the determination of site kappa, the NRC staff used the small strain damping in the material curves for the upper 500 ft [152 m] of the profile along with constant 1.25-percent damping in the remaining profile to calculate site kappa values for the three base case velocity profiles. The kappa values resulting from the staff's three base case profiles are 0.015 sec, 0.019 sec and 0.014 sec. To account for aleatory variability in material properties across the plant site, the NRC staff randomized its base case shear-wave velocity profiles following the guidance provided in Appendix B of the SPID.

In order to calculate control point hazard curves for the Wolf Creek site, the staff developed median amplification functions for several different loading levels representing the possible hazard at the Wolf Creek site. The median site amplification and associated uncertainty for two separate loading levels are shown in Figure 3.3-2 of this assessment. A comparison of both the NRC staff's and licensee's site amplifications shows that they are similar in shape with minor differences at the higher frequency levels. These differences are due to small differences in the NRC staff's and licensee's velocity profiles in the rock layers and due to the wider range of uncertainty in kappa used by the NRC staff for its site response analysis. The licensee's and NRC staff's control point hazard curves resulting from the convolution of the site amplification with the PSHA rock hazard are shown in Figure 3.3-3 of this assessment. As shown in Figure 3.3-3, the licensee's and NRC staff's control point hazard curves are nearly identical.

In summary, the NRC staff concludes that the licensee's site response was conducted using present-day guidance and methodology, including the NRC-endorsed SPID. The NRC staff performed independent calculations which confirmed 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 Wolf Creek site.

3.4 Ground Motion Response Spectra

In Section 2.4 of its 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 NRC 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 NRC staff. As shown, the licensee's and NRC staff's GMRS are very similar.

The NRC 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 NRC staff performed both a PSHA and site response confirmatory analysis and achieved results consistent with the licensee's horizontal GMRS. As such, the NRC staff concludes that the GMRS determined by the licensee adequately characterizes the reevaluated hazard for the Wolf Creek 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 Wolf Creek site. Based on its review, the NRC 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 to 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, the NRC staff confirms the licensee's conclusion that the licensee's GMRS for the Wolf Creek site exceeds the SSE in the frequency range of approximately 7 to 100 Hz. As such, a seismic risk evaluation, SFP evaluation, and a high-frequency confirmation are merited. The licensee indicated that it would perform the high frequency confirmation as part of its seismic risk evaluation. The NRC staff review and acceptance of the WCNOC's seismic risk evaluation with the high frequency confirmation, interim ESEP evaluation, and SFP evaluation (i.e., Items (4), (6), (8), and (9)) for Wolf Creek will complete the Seismic Hazard Evaluation identified in Enclosure 1 of the 50.54(f) letter.

REFERENCES

Note: ADAMS Accession Nos. refers 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- 1Plot of Staff's and Licensee's Base Case Shear-Wave Velocity Profiles for the Wolf Creek site

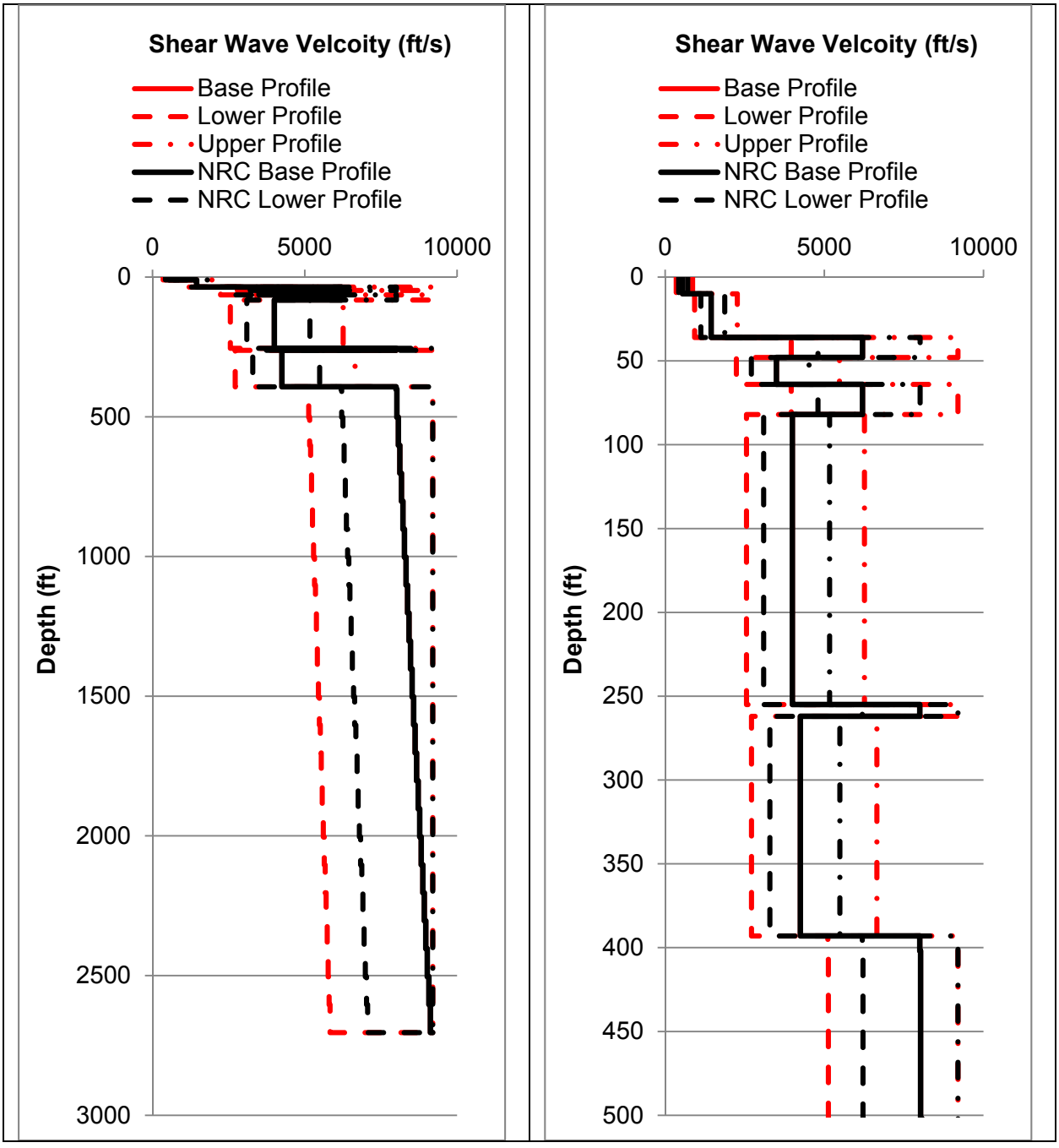


Figure 3.3- 2 Plot Comparing the Staff's and the License's Median Amplification Functions and Uncertainties for two input loading levels for the Wolf Creek site

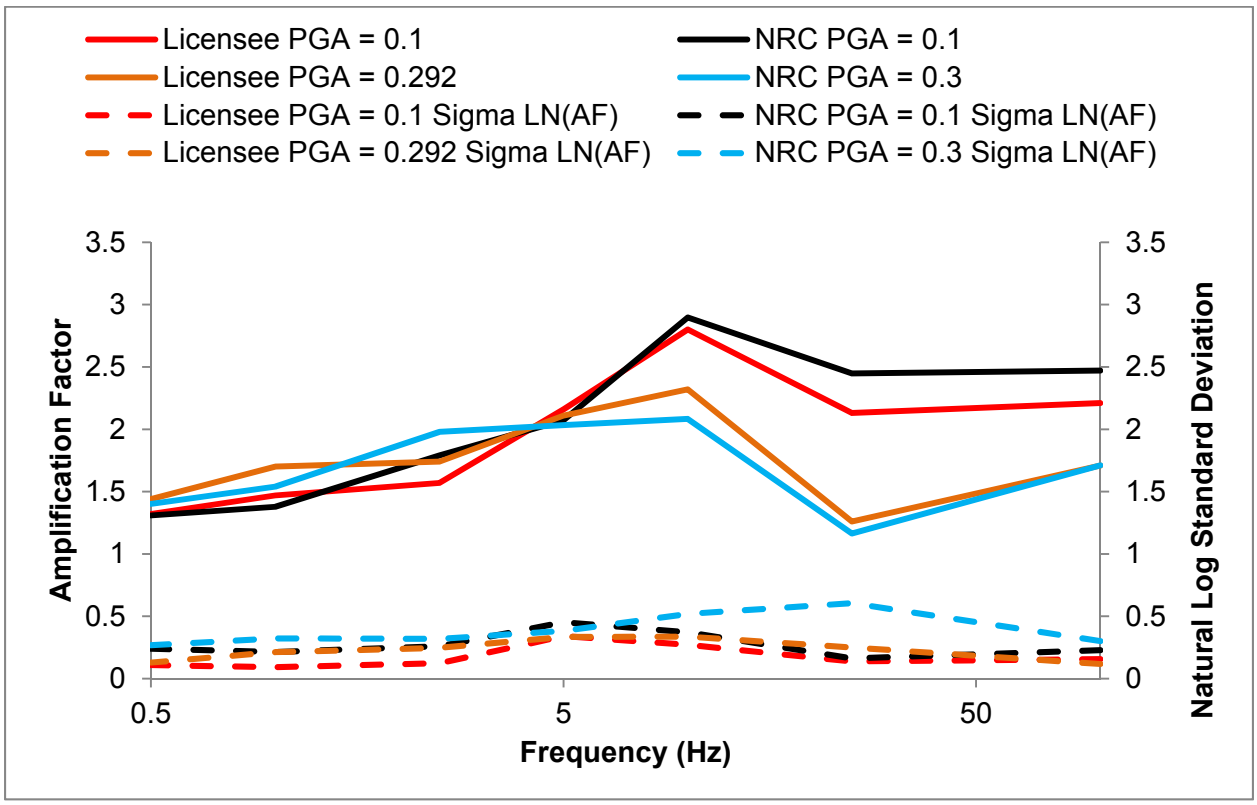


Figure 3.3-3 Plot Comparing the Staff's and the Licensee's Mean Control Point Hazard Curves at a Variety of Frequencies for the Wolf Creek site

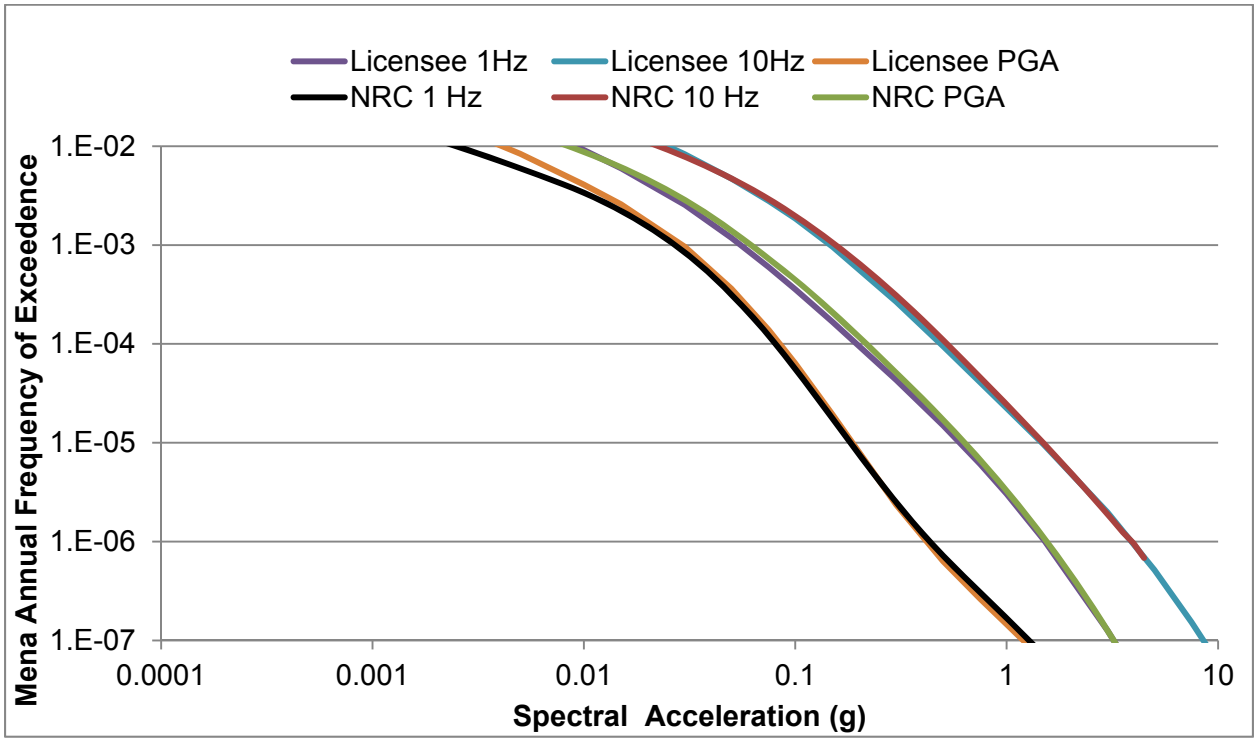
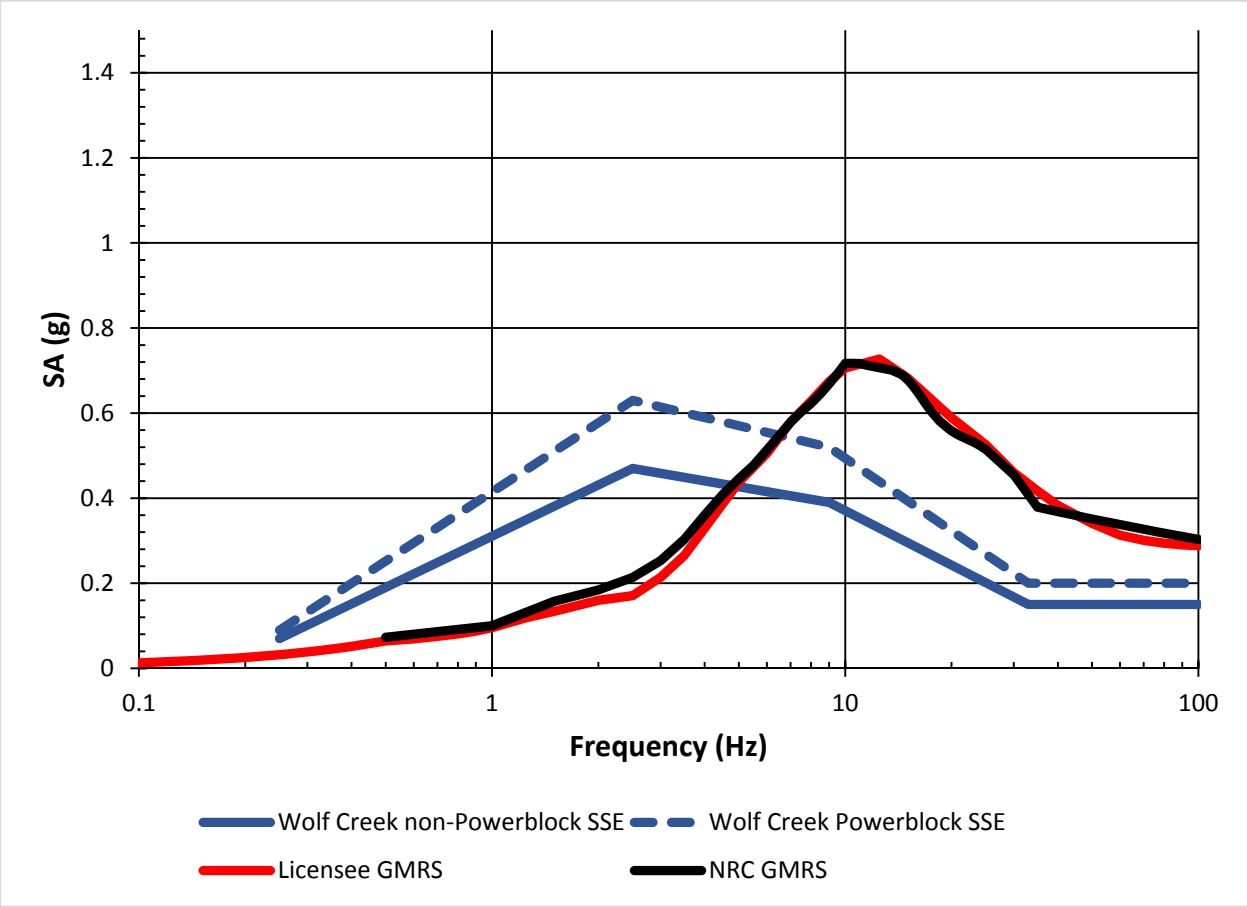


Figure 3.4-1 Comparison of the Staff's GMRS with Licensee's GMRS and the SSEs for the Wolf Creek Site (Powerblock and Non-Powerblock SSE (used for Screening))



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 No. 50-482

Enclosure:
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