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

September 27, 2018

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 REVIEW OF MITIGATING STRATEGIES ASSESSMENT REPORT OF THE IMPACT OF THE REEVALUATED SEISMIC HAZARD DEVELOPED IN RESPONSE TO THE MARCH 12, 2012, 50.54(f) LETTER (CAC NO. MF7893; EPID NO. L-2016-JLD-0006)

Dear Mr. Heflin:

The purpose of this letter is to provide the U.S. Nuclear Regulatory Commission's (NRC) assessment of the seismic hazard mitigating strategies assessment (MSA), as described in the August 1, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17220A061), letter, submitted by Wolf Creek Nuclear Operating Corporation (WCNOC, the licensee) for Wolf Creek Generating Station (Wolf Creek). The NRC staff evaluated the Wolf Creek strategies developed under Order EA-12-049 and described in WCNOC's Final Integrated Plan (FIP) for Wolf Creek (ADAMS Accession No. ML17026A194). The staff's review of Wolf Creek's mitigating strategies is documented in a safety evaluation dated August 2, 2017 (ADAMS Accession No. ML17144A009). The purpose of the safety evaluation is to ensure that the licensee has developed guidance and proposed designs which, if implemented appropriately, should adequately address the requirements of Order EA-12-049. An inspection to confirm compliance with the order was conducted during the week of January 22, 2018, and is documented in Inspection Report 05000482/2018008 (ADAMS Accession No. ML18082A107). The following NRC staff review confirms that the licensee has adequately addressed the reevaluated seismic hazard within Wolf Creek's mitigation strategies for beyond-design-basis external events.

BACKGROUND

By letter dated March 12, 2012 (ADAMS Accession No. ML12053A340), the NRC issued a request for information pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f) (hereafter referred to as the 50.54(f) letter). The 50.54(f) letter was issued as part of implementing lessons-learned from the accident at the Fukushima Dai-ichi nuclear power plant. Enclosure 1 to the 50.54(f) letter requested that licensees reevaluate the seismic hazard using present-day methodologies and guidance.

Concurrent with the reevaluation of seismic hazards, the NRC issued Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML12054A736). The order

requires holders of operating power reactor licenses and construction permits issued under 10 CFR Part 50 to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling following a beyond-design-basis external event. In order to proceed with the implementation of Order EA-12-049, licensees used the current design basis flood and seismic hazard or the most recent flood and seismic hazard information, which may not be based on present-day methodologies and guidance, in developing their mitigation strategies.

On December 10, 2015 (ADAMS Accession No. ML16005A621), the Nuclear Energy Institute (NEI) submitted Revision 2 to NEI 12-06, including guidance for conducting MSAs using the reevaluated hazard information. The NRC subsequently endorsed NEI 12-06, Revision 2, with exceptions, clarifications, and additions, in Japan Lessons-Learned Division (JLD) interim staff guidance (ISG) JLD-ISG-2012-01, Revision 1, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events" (ADAMS Accession No. ML15357A163).

On December 12, 2016 (ADAMS Accession No. ML16354B416), NEI submitted Revision 4 to NEI 12-06, including guidance for conducting MSAs using the reevaluated hazard information. In a letter to the NEI dated February 8, 2017 (ADAMS Accession No. ML17034A286), the NRC staff stated that JLD-ISG-2012-01, Revision 2 (ADAMS Accession No. ML17005A182) had been issued and had been made publicly available. This ISG revision endorsed NEI 12-06, Revision 4, with exceptions, clarifications and additions. However, the NRC letter to the NEI also cautioned that JLD-ISG-2012-01, Revision 2, was not intended to be referenced by licensees in submittals to the NRC, and that the NRC staff would not make use of this ISG revision until all applicable Congressional Review Act (CRA) requirements had been met. The CRA requirements were met and JLD-ISG-2012-01, Revision 2, was officially issued on April 25, 2018, in the *Federal Register* (83 FR 18089).

MITIGATION STRATEGIES ASSESSMENT

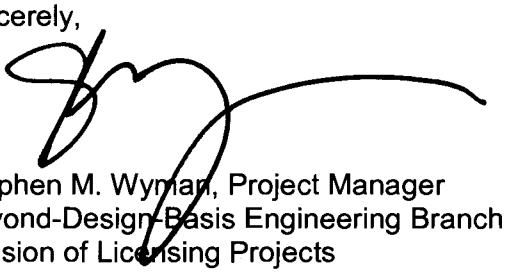
By letter dated August 12, 2015 (ADAMS Accession No. ML15216A320), the NRC staff documented its review of the licensee's reevaluated seismic hazard, also referred to as the mitigation strategies seismic hazard information (MSSHI). The NRC staff confirmed that the licensee's ground motion response spectra (GMRS) exceeds the safe shutdown earthquake (SSE) for Wolf Creek above 7 Hertz. As such, Wolf Creek screened in to perform a seismic risk evaluation, high frequency confirmation (HF) and spent fuel pool (SFP) evaluation. Wolf Creek was later screened out of the seismic risk evaluation, as documented in NRC letter dated October 27, 2015 (ADAMS Accession No. ML15194A015). The NRC staff concluded that the GMRS determined by the licensee adequately characterizes the reevaluated hazard for the Wolf Creek site and is suitable for use in subsequent evaluations and confirmations, as needed, for the response to the 50.54(f) letter.

By letter dated August 1, 2017 (ADAMS Accession No. ML17220A061), WCNOC submitted the seismic MSA report for Wolf Creek. The licensee stated that the Wolf Creek MSA was performed consistent with Appendix H of NEI 12-06, Revision 4 (ADAMS Accession No. ML16354B421). The NRC staff performed a checklist review of the seismic hazard MSA for Wolf Creek. The checklist is provided as an enclosure to this letter. The NRC staff found that Wolf Creek met the intent of the guidance. The staff did not identify any deficiencies. All evaluated components demonstrated adequate seismic capacity and no component modifications were required.

The NRC staff completed its review of the seismic hazard MSA for Wolf Creek and concluded that sufficient information has been provided to demonstrate that the licensee's plans for the development and implementation of guidance and strategies under Order EA-12-049 appropriately address the reevaluated seismic hazard information stemming from the 50.54(f) letter.

If you have any questions, please contact me at (301) 415-3041 or via e-mail at Stephen.Wyman@nrc.gov.

Sincerely,



Stephen M. Wyman, Project Manager
Beyond-Design-Basis Engineering Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosure:
Technical Review Checklist

cc w/encl: Distribution via Listserv

TECHNICAL REVIEW CHECKLIST
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO PATH FOUR MITIGATING STRATEGY ASSESSMENT
WOLF CREEK GENERATING STATION
DOCKET NO. 50-482

The U.S. Nuclear Regulatory Commission (NRC) staff performed the following checklist review based on the Enclosure of the August 1, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17220A061), letter, for Wolf Creek Generating Station (Wolf Creek). Deviations, deficiencies, and conclusions are noted at the end of each section and an overall conclusion is provided at the end of the checklist.

I. Background and Assessment to Mitigation Strategies Seismic Hazard Information (MSSHI)

This section establishes basic background and assessment to MSSHI criteria in Nuclear Energy Institute (NEI) 12-06, Appendix H.	
Licensee approach to mitigating strategies assessment (MSA):	
Was the MSA conducted in accordance with NEI 12-06, Revision 4 as endorsed by the staff?	Yes / ~~No~~
Was the MSA conducted using an alternate method?	~~Yes~~ / No
Status of Order EA-12-049 Flexible Mitigation Strategy at the time of this review:	
Has the licensee submitted a Final Integrated Plan?	Yes / ~~No~~
Has the NRC staff completed a safety evaluation for the mitigation strategy?	Yes / ~~No~~
Has the NRC staff confirmed compliance with Order EA-12-049 by successfully completing the temporary instruction (TI)-191 inspection?	Yes / ~~No~~
Status of MSSHI	
Did the licensee use the Ground Motion Response Spectra (GMRS) and Uniform Hazard Response Spectra (UHRS) as submitted in response to the 50.54(f) request for information and reviewed by the NRC staff?	Yes / ~~No~~

Enclosure

Has the plant equipment relied on for FLEX strategies previously been evaluated as seismically robust to the plant safe shutdown earthquake (SSE) levels?	Yes / ~~No / NA~~
Is the maximum ratio of GMRS/SSE in the range of 1-10 Hertz (Hz) less than 2?	Yes / ~~No~~
Did the licensee meet the seismic evaluation criteria described in NEI 12-06, Section H.5?	Yes / ~~No~~
Notes from staff reviewer: The GMRS/SSE ratio is approximately 1.47. This meets the criteria of NEI 12-06. Deviation(s) or deficiency(ies) and Resolution: None Consequence(s): None	
The NRC staff concludes: • The licensee meets the background and assessment to MSSHI criteria in NEI 12-06, Appendix H.	Yes / ~~No~~

II. Expedited Seismic Evaluation Process (ESEP) Equipment

Equipment used in support of the FLEX strategies has been evaluated to demonstrate seismic adequacy following the guidance in Section 5 of NEI 12-06. As stated in Appendix H of NEI 12-06, previous seismic evaluations should be credited to the extent that they apply for the assessment of the MSSHI, including the ESEP evaluations performed in accordance with Electric Power Research Institute (EPRI) Report 3002000704. "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic." (ADAMS Accession No. ML13102A142). Licensees may reference a previous ESEP submittal, submit a new or updated ESEP report, or provide other adequate justification or evaluation.	
Did the licensee previously perform an ESEP?	Yes / ~~No~~
Did the licensee provide a new or updated ESEP report with the MSA?	~~Yes~~ / No

If the licensee did not perform ESEP, did they provide adequate justification that the expedited seismic equipment list structures, systems, and components (SSCs) are acceptable in accordance with the original guidance and in accordance with NEI 12-06 Section H.5 $C_{10\%}$ capacity criteria?	~~Yes / No~~ / NA
If the licensee did not perform the ESEP, did they perform an evaluation consistent with the guidance in NEI 12-06, Section H.4.4, Steps 2 and 3, including the evaluation of FLEX components that were not previously evaluated to GMRS or 2 times the SSE?	~~Yes / No~~ / NA
Notes from staff reviewer: The licensee stated that FLEX items not included in the ESEP were evaluated for the Wolf Creek MSSHI. Results of the evaluations of components not included in the ESEP were presented in Section 2.4 of the MSA submittal. Deviation(s) or deficiency(ies) and Resolution: None Consequence(s): None	
The NRC staff concludes: • The licensee has evaluated seismic adequacy of equipment used in support of FLEX strategy consistent with the NEI 12-06, Appendix H guidance.	Yes / ~~No~~

III. Inherently / Sufficiently Rugged Equipment

Appendix H, Section 4.4 of NEI 12-06, Revision 2 documents the process and justification for inherently and sufficiently rugged SSCs. The licensee: Documented the inherently and sufficiently rugged SSCs consistent with the NEI 12-06 Appendix H guidance.	Yes / ~~No~~
Notes from staff reviewer: The process to identify inherently rugged items is documented in Section 2.3 of the Wolf Creek MSA report dated August 1, 2017. Deviation(s) or deficiency(ies) and Resolution: None Consequence(s): None	

The NRC staff concludes: • The licensee's assessment of inherently and sufficiently rugged SSCs met the intent of the NEI 12-06, Appendix H guidance.	Yes / ~~No~~

IV. Evaluation of Components Not Covered by ESEP

The ESEP specifically excluded the evaluation of certain components of the FLEX strategy in an effort to provide stakeholders with near-term confidence in a plant's seismic capacity. However, licensees will be required to complete those evaluations as part of the Path 4 MSA to demonstrate compliance with the impending rule. Were the following components, not evaluated in the ESEP, evaluated as part of the MSA? :	
• FLEX Storage Building	Yes / ~~No~~
• Non-seismic CAT I structures	Yes / ~~No / NA~~
• Operator Pathways credited in FLEX strategy	Yes / ~~No~~
• Tie down of FLEX portable equipment	Yes / ~~No~~
• Seismic interactions o Masonry block wall o Piping attached to tanks o Flooding from non-seismically robust tanks o Distributed systems (Piping/conduit/raceways/cable trays) o Other potential areas of interaction	 Yes / ~~No~~ Yes / ~~No~~ Yes / ~~No~~ Yes / ~~No~~ Yes / ~~No~~
• FLEX equipment haul paths	Yes / ~~No~~
• Other equipment (listed in Staff Reviewer Notes)	~~Yes / No /~~ NA
Did the licensee provide adequate description/documentation of the evaluation?	Yes / ~~No~~

Notes from staff reviewer: The Wolf Creek 60' x 120' FLEX Equipment Storage Buildings use steel moment-resisting frame construction with concrete walls and a 4" slab concrete ceiling. The licensee stated that it evaluated the FLEX storage buildings

against the GMRS and identified the mid-span steel columns on the long side as the most critical structural components. The licensee's analysis showed the maximum compressive, bending, and combined stresses in these columns were less than the allowable column stresses. The licensee identified the Turbine Building (TB) as the only non-seismic Category I structure that could impact implementation of the FLEX strategies. Collapse of the TB could impact operator pathways. The licensee stated that it calculated a non-collapse high confidence-low probability of failure (HCLPF) value that exceeds the 10^{-5} UHRS which envelopes the GMRS. The licensee evaluated the potential impact of a post-seismic failure of the Demineralized Water Storage Tank (DWST) on the nearby FLEX pump staging area. The licensee determined that water depleted from the DWST would recede before FLEX Phase 2 implementation and that the existing FLEX debris removal equipment is adequate to clear the staging area. The licensee identified a potential seismic interaction in the Aux Building elevation 1974'. A cabinet was moved to prevent potential seismic interaction with the FLEX Reactor Coolant System Makeup pump control board. Deviation(s) or deficiency(ies) and Resolution: None Consequence(s): None	
The NRC staff concludes: • The licensee followed the NEI 12-06, Appendix H guidance in evaluating SSCs not deemed inherently rugged.	Yes / ~~No~~

V. Spent Fuel Pool (SFP) Cooling

Per NEI 12-06, Appendix H, Section 4.4, licensees need to evaluate the adequacy of SFP cooling equipment to the GMRS. Most plants include the Order EA-12-051 SFP Level Instrument as part of the strategy. The licensee:	
• Clearly identified the SSCs and locations of the equipment that is part of the final FLEX SFP cooling strategy.	Yes / ~~No~~
• Clearly stated the seismic design basis (e.g. SSE) of the equipment used in the strategy.	Yes / ~~No~~

• Provided adequate description or documentation of the SFP cooling equipment's evaluation to the GMRS. Portable equipment and flexible hoses do not need to be evaluated.	Yes / ~~No~~
Notes from staff reviewer: The NRC staff confirmed that the SFP cooling equipment described in the licensee's Final Integrated Plan (FIP) was previously evaluated to the SSE for Wolf Creek. The strategy consists of fixed piping in the fuel building, flexible hoses, and portable diesel driven pumps, as described in the Wolf Creek FIP. The NRC staff reviewed Wolf Creek's Spent Fuel Pool Evaluation Report (ADAMS Accession No. ML16335A371) to confirm the non-structural components (piping) were evaluated, consistent with NEI 12-06, Appendix H guidance. The remaining components of the SFP cooling strategy are portable equipment (diesel driven pumps, hoses) that are stored in the FLEX Equipment Storage Buildings which the NRC staff reviewed for adequate seismic capacity to the GMRS in Section IV above. Deviation(s) or deficiency(ies) and Resolution: None Consequence(s): None	
The NRC staff concludes: • The licensee followed the NEI 12-06, Appendix H guidance in evaluating SFP cooling.	Yes / ~~No~~

VI. High Frequency (HF)

Per NEI 12-06, Appendix H, Section 4.4, licensees with GMRS exceedance of the SSE above 10 Hz need to evaluate bi-stable components such as relays using the methodology described in NEI 12-06, Section H.4.2. The HF evaluation may have been submitted under separate letter or may be sent as an attachment to the MSA Report. The staff review checklist is included as an attachment to this report. The licensee: • GMRS exceeds the SSE above 10 Hz. • Provided a HF evaluation as described in NEI 12-06, Section H.4.2. • Appeared to follow the guidance for the HF evaluation. • Provided results of demand vs. capacity with identification of resolutions as needed.	 Yes / ~~No~~ Yes / ~~No / NA~~ Yes / ~~No / NA~~ Yes ~~/ No / NA~~
Notes from staff reviewer: The licensee provided a separate HF confirmation specific to the MSA scope. The licensee reported that it did not identify any components that required evaluation. The NRC staff previously performed a checklist review of the Recommendation 2.1 Seismic HF confirmation to confirm Wolf Creek met the criteria of NEI 12-06, Section H.4.2 and EPRI report 3002004396 (ADAMS Accession No. ML18012A506). The report stated that 452 of 527 evaluated components had seismic capacity greater than demand. Thirty-seven components were removed from consideration through additional detailed functional screening and the remaining 38 components were resolved through operator action. Deviation(s) or deficiency(ies) and Resolution: None Consequence(s): None	
The NRC staff concludes: • The licensee's component capacity evaluation met the intent of the HF guidance.	Yes ~~/ No~~

VII. Conclusions:

The NRC staff assessed the licensee's implementation of the MSA guidance for Wolf Creek. Based on its review, the NRC staff concludes that the licensee's implementation of the MSA meets the intent of the guidance. The staff concludes that through the implementation of the MSA guidance, the licensee identified and evaluated the seismic capacity of the mitigating strategies equipment to ensure functionality will be maintained following a seismic event up to the GMRS. As noted in the review checklist, the staff did not identify any deviations or exceptions taken from the guidance and the licensee did not identify any necessary equipment modifications or changes to the strategy.

In summary, the NRC staff has reviewed the seismic hazard MSA for Wolf Creek. The NRC staff concludes that sufficient information has been provided to demonstrate that the licensee's plans for the development and implementation of guidance and strategies under Order EA-12-049 appropriately address the reevaluated seismic hazard information stemming from the 50.54(f) letter.

SUBJECT: WOLF CREEK GENERATING STATION – STAFF REVIEW OF MITIGATING STRATEGIES ASSESSMENT REPORT OF THE IMPACT OF THE REEVALUATED SEISMIC HAZARD DEVELOPED IN RESPONSE TO THE MARCH 12, 2012, 50.54(f) LETTER DATED: September 27, 2018

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ADAMS Accession No.: ML18262A415 ***concurrence via e-mail**

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NAME	SWyman	SLent	BTitus	SWyman
DATE	9/25/18	9/20/18	9/26/18	9/27/18

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