



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

July 18, 2018

Mr. John Dent, Jr.  
Vice President-Nuclear and CNO  
Nebraska Public Power District  
Cooper Nuclear Station  
72676 648A Avenue  
P.O. Box 98  
Brownville, NE 68321

**SUBJECT: COOPER NUCLEAR STATION – STAFF REVIEW OF MITIGATION 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. MF7819; EPID L-2016-JLD-0006)**

Dear Mr. Dent:

The purpose of this letter is to provide the U.S. Nuclear Regulatory Commission's (NRC) assessment of the seismic hazard mitigation strategies assessment (MSA), as described in the August 24, 2017, letter (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17244A277) submitted by Nebraska Public Power District (NPPD, the licensee) for Cooper Nuclear Station (Cooper). The NRC staff evaluated the mitigation strategies developed under Order EA-12-049 and described in NPPD's Final Integrated Plan (FIP) for Cooper (ADAMS Accession No. ML17017A166). The staff's review of Cooper's mitigation strategies was documented in a safety evaluation dated September 20, 2017 (ADAMS Accession No. ML17226A032). 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 March 15, 2018. The results of the inspection are documented in Inspection Report 05000298/2018010, dated May 8, 2018 (ADAMS Accession No. ML18128A074). The following NRC staff review confirms that the licensee has adequately addressed the reevaluated seismic hazard within Cooper'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 seismic hazard or the most recent seismic hazard information, which may not have been 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 September 8, 2015 (ADAMS Accession No. ML15240A030), 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 Cooper from 5 hertz (Hz) to 100 Hz. As such, a seismic risk evaluation, high frequency (HF) confirmation and spent fuel pool (SFP) evaluation were merited. The NRC staff concluded that the GMRS determined by the licensee adequately characterizes the reevaluated hazard for the Cooper site and is suitable for use in subsequent evaluations and confirmations, as needed, for the response to the 50.54(f) letter. Cooper later screened out of the seismic risk evaluation based on additional information as documented in NRC letter dated October 27, 2015 (ADAMS Accession No. ML15194A015).

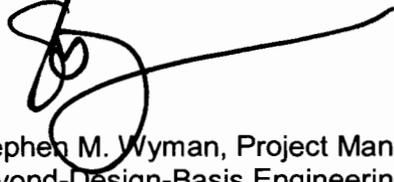
By letter dated August 24, 2017 (ADAMS Accession No. ML17244A277), NPPD submitted the seismic MSA report for Cooper. The licensee stated that the Cooper MSA was performed consistent with Appendix H of NEI 12-06, Revision 2 (ADAMS Accession No. ML16005A621). Appendix H of NEI 12-06, Revision 2, describes acceptable methods for demonstrating that the reevaluated seismic hazard is addressed within the Cooper mitigation strategies for beyond-design-basis external events. The NRC staff confirmed that the licensee's seismic hazard MSA is consistent with the guidance in Appendix H.4.4 of NEI 12-06, Revision 2, as endorsed, by JLD-ISG-2012-01, Revision 1. Therefore, the methodology used by the licensee is appropriate to perform an assessment of the mitigation strategies that addresses the reevaluated seismic hazard.

The NRC staff performed a checklist review of the seismic hazard MSA for Cooper. The checklist is provided as an enclosure to this letter. The NRC staff found that Cooper 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 Cooper 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,

A handwritten signature in black ink, appearing to be 'S. Wyman', with a long horizontal line extending to the right.

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

Docket No. 50-298

Enclosure:  
Technical Review Checklist

cc w/encl: Distribution via Listserv

**TECHNICAL REVIEW CHECKLIST**  
**BY THE OFFICE OF NUCLEAR REACTOR REGULATION**  
**RELATED TO PATH FOUR MITIGATION STRATEGY ASSESSMENT**  
**COOPER NUCLEAR STATION**  
**DOCKET NO. 50-298**

The NRC staff performed the following checklist review based on the Enclosure of the August 24, 2017, letter (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17244A277) for Cooper Nuclear Station (Cooper). 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)

<p>This section establishes basic background and assessment to MSSHI criteria in Nuclear Energy Institute (NEI) 12-06, Appendix H.</p>	
<p>Licensee approach to mitigation strategies assessment (MSA):</p>	
<p>Was the MSA conducted in accordance with NEI 12-06, Revision 4 as endorsed by the staff?</p>	<p>Yes / No</p>
<p>Was the MSA conducted using an alternate method?</p>	<p>Yes / No</p>
<p>Status of Order EA-12-049 Flexible Mitigation Strategy (FLEX) at the time of this review:</p>	
<p>Has the licensee submitted a Final Integrated Plan?</p>	<p>Yes / No</p>
<p>Has the NRC staff completed a safety evaluation for the mitigation strategy?</p>	<p>Yes / No</p>
<p>Has the NRC staff confirmed compliance with Order EA-12-049 by successfully completing the temporary instruction (TI)-191 inspection?</p>	<p>Yes / No</p>
<p>Status of MSSHI</p>	
<p>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?</p>	<p>Yes / No</p>

<p>Has the plant equipment relied on for FLEX strategies previously been evaluated as seismically robust to the plant safe shutdown earthquake (SSE) levels?</p> <p>Is the maximum ratio of GMRS/SSE in the range of 1-10 hertz (Hz) less than 2?</p> <p>Did the licensee meet the seismic evaluation criteria described in NEI 12-06, Section H.5?</p>	<p>Yes / No / NA</p> <p>Yes / No</p> <p>Yes / No</p>
<p>Notes from staff reviewer: The GMRS/SSE ratio is approximately 1.39. This meets the criteria of NEI 12-06, Appendix H.5.</p> <p>Deviation(s) or deficiency(ies) and Resolution: The NRC staff notes that the NEI 12-06 Revision 2 is an acceptable alternative to Revision 4 for the purpose of the mitigation strategies assessment.</p> <p>Consequence(s): None</p>	
<p>The NRC staff concludes:</p> <ul style="list-style-type: none"> <li>The licensee meets the background and assessment to MSSHI criteria in NEI 12-06, Appendix H.</li> </ul>	<p>Yes / No</p>

II. Expedited Seismic Evaluation Process (ESEP) Equipment

<p>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).</p> <p>Licensees may reference a previous ESEP submittal, submit a new or updated ESEP report, or provide other adequate justification or evaluation.</p> <p>Did the licensee previously perform an ESEP?</p> <p>Did the licensee provide a new or updated ESEP report with the MSA?</p>	<p></p> <p>Yes / No</p> <p>Yes / No</p>
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<p>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<sub>10%</sub> capacity criteria?</p> <p>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?</p>	<p>Yes / No / NA</p> <p>Yes / No / NA</p>
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Notes from staff reviewer: The licensee stated that FLEX items not included in the ESEP were evaluated for the Cooper MSSHI. Results of evaluations of components not on the expedited seismic equipment list (ESEL) were presented in Section 2.4 of the MSA submittal.

Deviation(s) or deficiency(ies) and Resolution: None

Consequence(s): None

<p>The NRC staff concludes:</p> <ul style="list-style-type: none"><li>• The licensee has evaluated the seismic adequacy of equipment used in support of FLEX strategy consistent with the NEI 12-06, Appendix H guidance.</li></ul>	<p>Yes / No</p>
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III. Inherently / Sufficiently Rugged Equipment

<p>Appendix H, Section 4.4 of NEI 12-06, Revision 2 documents the process and justification for inherently and sufficiently rugged SSCs.</p> <p>The licensee:</p> <p>Documented the inherently and sufficiently rugged SSCs consistent with the NEI 12-06 Appendix H guidance.</p>	<p>Yes / No</p>
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Notes from staff reviewer: The process to identify inherently rugged items is documented in Section 2.3 of the Cooper MSA report dated August 24, 2017. The NRC staff found the licensees assessment of inherently rugged equipment is consistent with the NEI 12-06, Revision 2, guidance.

Deviation(s) or deficiency(ies) and Resolution: None

Consequence(s): None	
<p>The NRC staff concludes:</p> <ul style="list-style-type: none"> <li>The licensee's assessment of inherently and sufficiently rugged SSCs met the intent of the NEI 12-06, Appendix H guidance.</li> </ul>	Yes / No

**IV. Evaluation of Components Not Covered by ESEP**

<p>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? :</p> <ul style="list-style-type: none"> <li>FLEX Storage Building</li> <li>Non-seismic CAT I structures</li> <li>Operator Pathways credited in FLEX strategy</li> <li>Tie down of FLEX portable equipment</li> <li>Seismic interactions <ul style="list-style-type: none"> <li>Masonry block wall</li> <li>Piping attached to tanks</li> <li>Flooding from non-seismically robust tanks</li> <li>Distributed systems (Piping/conduit/raceways/cable trays)</li> <li>Other potential areas of interaction</li> </ul> </li> <li>FLEX equipment haul paths</li> <li>Other equipment (list in Staff Reviewer Notes)</li> </ul> <p>Did the licensee provide adequate description/documentation of the evaluation?</p>	<p>Yes / No</p> <p>Yes / No / NA</p> <p>Yes / No</p> <p>Yes / No / NA</p> <p>Yes / No</p>
<p>Notes from staff reviewer: The licensee stated that Cooper constructed two identical and separate structures to store mitigation strategies equipment (FLEX storage buildings). The licensee stated that both were evaluated to have adequate capacities corresponding to the GMRS level. As outlined in "Nuclear Regulatory Commission Plan</p>	

For The Audit Of Mitigation Strategies Assessment Submittals Related To Order EA-12-049, 'Order To Modify Licenses With Regard To Requirements For Mitigation Strategies For Beyond-Design-Basis External Events,' (ADAMS Accession No. ML16259A189), the NRC staff reviewed, via the eportal, calculation NEDC 17-03, Revision 0, "NEI 12-06 Appendix H Path 4 Seismic Evaluations," as part of the Cooper mitigation strategies assessment staff evaluation. The NRC staff found that the licensee used comparative wind shear loading in determining adequate seismic capacity for the Cooper FLEX storage buildings. The licensee determined the base shear loading using the GMRS peak spectral acceleration of 0.486g @ 12.5Hz. The NRC staff found that wind shear loading for the Cooper FLEX storage building was more than 10 times the base shear loading. Because the GMRS/SSE increase in demand is less than two times, the FLEX building is expected to have sufficient capacity to withstand a seismic event up to the GMRS.

The licensee stated in Section 2.4.3 that a walkdown of tie downs of FLEX portable equipment identified a front loader as not being tied down. The licensee stated that tie downs have been added to the front loader to avoid any potential seismic interactions.

The NRC staff reviewed Section 2.4.4 of the MSA report and, via the eportal, licensee calculation NEDC17-03, Revision 0, Sections 5.8, 5.9, and 5.11, and found that the licensee used a scaled down Individual Plant Examination for External Events (IPEEE) High Confidence of Low Probability of Failure (HCLPF) Spectrum (IHS) for evaluation of Reactor Building (RB) reactor equipment cooling heat exchangers and RB FC recirculation fans. The NRC staff found in the Cooper reevaluated seismic hazard staff assessment (ADAMS Accession No. ML15240A030) that the Cooper IHS did not meet the criteria in Section 3.3 of the Screening, Prioritization and Implementation Details (SPID) guidance (ADAMS Accession No. ML12333A170). The NRC staff found that although the IHS was not approved for use in evaluations related to the 50.54(f) request for information, the practice of scaling is common in structural engineering and because the IHS was developed, in part, to include the reactor building, that its use is acceptable in this limited scope to provide reasonable assurance the components have adequate C<sub>10%</sub> seismic capacity to withstand an event up to the GMRS.

The NRC staff also reviewed the information provided regarding haul paths and operator pathways and found the licensee met the criteria in the NEI 12-06, Revision 2, guidance. The licensee did not identify any additional components under "Other Equipment".

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

<p>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.</p> <p>The licensee:</p> <ul style="list-style-type: none"> <li>• Clearly identified the SSCs and locations of the equipment that is part of the final FLEX SFP cooling strategy.</li> <li>• Clearly stated the seismic design basis (e.g. SSE) of the equipment used in the strategy.</li> <li>• 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.</li> </ul>	<p>Yes / No</p> <p>Yes / No</p> <p>Yes / No</p>
<p>Notes from staff reviewer: The licensee credited the alternate SFP cooling strategy that uses all portable equipment (diesel pump, hoses) to accomplish the SFP cooling strategy. The portable equipment was evaluated as adequately protected up to the GMRS in the FLEX storage buildings in Section IV above.</p> <p>Deviation(s) or deficiency(ies) and Resolution: None</p> <p>Consequence(s): None</p>	
<p>The NRC staff concludes:</p> <ul style="list-style-type: none"> <li>• The licensee followed the NEI 12-06, Appendix H guidance in evaluating SFP cooling.</li> </ul>	<p>Yes / No</p>

VI. High Frequency (HF)

<p>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.</p>	
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<p>The licensee:</p> <ul style="list-style-type: none"> <li>• GMRS exceeds the SSE above 10 Hz.</li> <li>• Provided a HF evaluation as described in NEI 12-06, Section H.4.2.</li> <li>• Appeared to follow the guidance for the HF evaluation.</li> <li>• Provided results of demand vs. capacity with identification of resolutions as needed.</li> </ul>	<p>Yes / No</p> <p>Yes / No / NA</p> <p>Yes / No / NA</p> <p>Yes / No / NA</p>
<p>Notes from staff reviewer: The NRC staff performed a checklist review of the 2.1 HF to confirm Cooper met the criteria of NEI 12-06, Section H.4.2 and EPRI report 3002004396. The NRC staff review checklist is publicly available in NRC letter dated June 26, 2018 (ADAMS Accession No. ML18171A237). The report stated that 89 of 136 components evaluated had adequate seismic capacity. Two components did not have adequate seismic capacity and were resolved through operator actions. The remaining 45 components did not impact the mitigation strategy. No component modifications or changes to the mitigation strategy were required.</p> <p>Deviation(s) or deficiency(ies) and Resolution: None</p> <p>Consequence(s): None</p>	
<p>The NRC staff concludes:</p> <ul style="list-style-type: none"> <li>• The licensee's component capacity evaluation met the intent of the HF guidance.</li> </ul>	<p>Yes / No</p>

VII. Conclusions:

The NRC staff assessed the licensee's implementation of the MSA guidance for Cooper. 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 mitigation 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 Cooper. 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: COOPER NUCLEAR STATION – STAFF REVIEW OF MITIGATION STRATEGIES ASSESSMENT REPORT OF THE IMPACT OF THE REEVALUATED SEISMIC HAZARD DEVELOPED IN RESPONSE TO THE MARCH 12, 2012, 50.54(f) LETTER DATED July 18, 2018

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**ADAMS Accession No.: ML18184A273**

**\* via e-mail**

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