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

August 29, 2018

Mr. Mano Nazar
President and Chief Nuclear Officer
Nuclear Division
NextEra Energy Seabrook, LLC
Mail Stop: EX/JB
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Juno Beach, FL 33408

SUBJECT: SEABROOK, UNIT 1 – 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. MF7875; EPID L-2016-JLD-0006)

Dear Mr. Nazar:

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 28, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17241A140), letter submitted by NextEra Energy Seabrook, LLC (NextEra, the licensee) for Seabrook, Unit 1 (Seabrook). The NRC staff evaluated the Seabrook mitigation strategies developed under Order EA-12-049 and described in NextEra's Final Integrated Plan (FIP) for Seabrook (ADAMS Accession No. ML16214A244). The staff's review of Seabrook's mitigation strategies was documented in a safety evaluation dated December 1, 2016 (ADAMS Accession No. ML16321A418). 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 documented in an NRC report dated June 27, 2017 (ADAMS Accession No. ML17180A060). The following NRC staff review confirms that the licensee has adequately addressed the reevaluated seismic hazard within Seabrook'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 12, 2016 (ADAMS Accession No. ML16354B416), the Nuclear Energy Institute (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 Japan Lessons-Learned Division (JLD) Interim Staff Guidance (ISG) 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 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 *Federal Register* Notice 83 FR 18089.

MITIGATION STRATEGIES ASSESSMENT

By letter dated August 12, 2015 (ADAMS Accession No. ML15208A049), 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 Seabrook from approximately 8 Hertz (Hz) to 100 Hz. As such, Seabrook screened in to perform a seismic risk evaluation, high frequency confirmation (HF) and spent fuel pool (SFP) evaluation. Seabrook 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 Seabrook 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 28, 2017 (ADAMS Accession No. ML17241A140), NextEra submitted the seismic MSA report for Seabrook. The licensee stated that the Seabrook MSA was performed consistent with Appendix H of NEI 12-06, Revision 4 (ADAMS Accession No. ML16354B421). Appendix H of NEI 12-06, Revision 4, describes acceptable methods for demonstrating that the reevaluated seismic hazard is addressed within the Seabrook 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 4, as endorsed, by JLD-ISG-2012-01, Revision 2. 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 and associated HF confirmation for Seabrook. The checklist is provided as an enclosure to this letter. The NRC staff found that Seabrook 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 Seabrook 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. 50-443

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

SEABROOK, UNIT 1

DOCKET NO. 50-443

The NRC staff performed the following checklist review based on Enclosure 1 of the August 28, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17241A140), letter for Seabrook, Unit 1 (Seabrook). 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 mitigation 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~~

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 1.30 based on the Seabrook SSE and the GMRS. 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 flexible mitigation strategies (FLEX) 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 two times the SSE?	~~Yes / No~~ / NA
Notes from staff reviewer: The licensee stated, in part, that FLEX items not included in the ESEP were added to the MSA and evaluated for the Seabrook MSSHI. Deviation(s) or deficiency(ies) and Resolution: None Consequence(s): None	
The NRC staff concludes: The licensee has evaluated the seismic adequacy of equipment used in support of FLEX mitigation strategies 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,, 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 Seabrook MSA. 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	Yes / ~~No~~
o Piping attached to tanks	Yes / ~~No~~
o Flooding from non-seismically robust tanks	Yes / ~~No~~

○ Distributed systems (Piping/conduit/raceways/cable trays)	Yes / ~~No~~
○ Other potential areas of interaction	Yes / ~~No~~
• FLEX equipment haul paths	Yes / ~~No~~
• Other equipment (list in Staff Reviewer Notes)	~~Yes / No /~~ NA
Did the licensee provide adequate description/documentation of the evaluation?	Yes / ~~No~~

Notes from staff reviewer: Among the list of components evaluated as part of the MSA that were not previously evaluated as part of the ESEP, the licensee identified three components that do not have adequate $C_{10\%}$ seismic capacity to meet the Seabrook GMRS demand based on the original calculations. The weld capacity of the 'B' diesel generator fuel storage tank and valves 1-SI-V-32 and 1-SI-V-47 were reevaluated using more rigorous methods. As outlined in "Nuclear Regulatory Commission Plan 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 Acceession No. ML16259A189), the NRC staff reviewed, via the eportal, NextEra documents FP101168, "Seismic Capacity for Miscellaneous Tanks," and FP101213, "Seismic Evaluation of SI-V-32 and SI-V-47," to confirm the reevaluated seismic capacity for these components. The NRC staff found the seismic evaluations were acceptable and consistent with the guidance.

The licensee stated that the Service Water Pump House is the primary FLEX storage location and that the Control Building, Primary-Aux Building, and the Emergency Feedwater Pump Building are also used to store some FLEX related equipment. All of the buildings are reinforced concrete seismic Category I structures. The NRC staff found that, in accordance with the NEI 12-06 guidance, these structures are judged to have adequate seismic capacity to withstand a seismic event up to the GMRS.

The licensee stated in its MSA report that two non-seismic Category I structures, the Turbine Building and the Main Steam and Feedwater Pipe Bridge, could impact the operator pathways, equipment haul paths, and deployment pathways at the GMRS level. The licensee sated that the structures both met the $C_{10\%}$ criteria defined in Section H.5 of the NEI 12-06 guidance based on original design criteria and the $C_{10\%}/C_{1\%}$ ratio given in Table H.1 of NEI 12-06. The NRC staff reviewed on the e-portal, as part of the audit process mentioned above, the NextEra document FP101170, "Seismic Evaluation for Deployment and Operator Pathways." The NRC reviewed the calculation and walkdown results and found the licensees evaluation was performed consistent with the guidance.

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 MSA was previously evaluated to the SSE for Seabrook. The preferred cooling method noted in the Final Integrated Plan (FIP) is the SFP cooling system powered by supplemental emergency power system (SEPS). However, the SFP cooling equipment was not evaluated to the MSSHI and the SEPS may not be available because of wind driven missile susceptibility. As stated in the MSA, the credited SFP cooling method is the refueling water storage tank, gravity-fed through valves 1-CBS-V-35 and 1-CBS-V-61 to the SFP. The MSA also credits the Unit 2 circulating water piping cistern as a water source using portable FLEX low pressure pump or submersible low pressure pump via flexible hose routed to the refueling floor. Protection of portable FLEX equipment was previously reviewed in Section IV above. The licensee also performed calculations (FP101171) to demonstrate the Unit 2 circ water piping and cistern and the SFP level instrumentation have adequate seismic capacity to withstand the MSSHI. To confirm the MSA statements, the NRC staff reviewed on the e-portal, as part of the audt process mentioned above, licensee documents FP101171, "Seismic Capacity Evaluation for Miscellaneous Components," FP101173, "Screened List of SSCs for Seismic Mitigating Strategies Assessment," and SBK-L-14229, "Seabrook Expedited Seismic Equipment List." The NRC staff noted that the valves in the RWST sourced SFP cooling strategy are manual valves and screen out of further seismic evaluation in accordance with the NEI 12-06 Appendix H guidance, Section H.4.4, on inherently rugged components. The NRC staff found that the Seabrook SFP evaluation met the criteria of NEI 12-06, Appendix H guidance.

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.	Yes / ~~No~~
• Provided a HF evaluation as described in NEI 12-06, Section H.4.2.	Yes ~~/ No / NA~~
• Appeared to follow the guidance for the HF evaluation.	Yes / ~~No / NA~~
• Provided results of demand vs. capacity with identification of resolutions as needed.	~~Yes / No~~ / NA

Notes from staff reviewer: The licensee provided a high frequency review in Attachment A of the MSA. In Section 4 of its MSA, the licensee stated that Seabrook completed the HF evaluation in accordance with NEI 12-06, Appendix H, and the high frequency guidance, EPRI 3002004396. The licensee stated, in part, that the MSA HF review did not identify any components for seismic evaluation that had not already been reviewed as part of the 2.1 HF confirmation review. The NRC staff assessment for Seabrook's 2.1 Seismic HF confirmation report is documented in an NRC letter dated June 5, 2018 (ADAMS Accession No. ML18138A451).

The NRC staff reviewed the MSA HF review in Attachment A of the Seabrook MSA and found that it is consistent with the guidance in NEI 12-06, Appendix H, and EPRI 3002004396. The NRC staff identified NA for "provided results" in the checklist above because no additional components were evaluated for the MSA HF scope. The NRC also notes that the SEPS system is a preferred, but not relied upon system because of wind driven missile protection susceptibility. The NRC staff, therefore, did not confirm licensee statements related to the SEPS system in Section 1.5, Attachment A, of the MSA.

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 Seabrook. 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 mitigation strategy.

In summary, the NRC staff has reviewed the seismic hazard MSA for Seabrook. 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: SEABROOK, UNIT 1 – 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 August 29, 2018

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ADAMS Accession No.: ML18236A191 *** via e-mail**

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