



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

August 14, 2018

Mr. Bryan C. Hanson
Senior Vice President
Exelon Generation Company, LLC
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Rd
Warrenville, IL 60555

SUBJECT: LASALLE COUNTY STATION, UNITS 1 & 2 – 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 NOS. MF7839 AND MF7840; EPID NO. L-2016-JLD-0006)

Dear Mr. Hanson:

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 22, 2017, letter (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17234A470), submitted by Exelon Generation Company, LLC (Exelon, the licensee) for LaSalle County Station, Units 1 & 2 (LaSalle). The NRC staff evaluated the LaSalle strategies developed under Order EA-12-049 and described in Exelon's Final Integrated Plan (FIP) for LaSalle (ADAMS Accession No. ML18130A750). The staff's review of LaSalle's mitigating strategies will be documented in a safety evaluation scheduled to be completed in September 2018. 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 will be conducted at a date to be determined. The following NRC staff review confirms that the licensee has adequately addressed the reevaluated seismic hazard within LaSalle'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 April 21, 2015 (ADAMS Accession No. ML15013A132), 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 LaSalle in the 1 to 10 hertz (Hz) range, as well as above 10 Hz. As such, LaSalle screened in to perform a seismic risk evaluation, high frequency confirmation (HF) and spent fuel pool (SFP) evaluation. LaSalle 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 LaSalle 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 22, 2017 (ADAMS Accession No. ML17234A470), Exelon submitted the seismic MSA report for LaSalle. The licensee stated that the LaSalle 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 LaSalle. The checklist is provided as an enclosure to this letter. The NRC staff found that LaSalle 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 LaSalle 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 read 'S. Wyman', with a long horizontal flourish extending to the right.

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

Docket Nos. 50-373 and 50-374

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
LASALLE COUNTY STATION, UNITS 1 & 2
DOCKET NOS. 50-373 AND 50-374

The U.S. Nuclear Regulatory Commission (NRC) staff performed the following checklist review based on the Enclosure of the August 22, 2017, letter (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17234A470) for LaSalle County Station, Units 1 & 2 (LaSalle). 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)

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| <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 mitigating 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 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> |

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| <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 1.83. This meets the criteria of NEI 12-06, Appendix H.5.</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"> The licensee meets the background and assessment to MSSHI criteria in NEI 12-06, Appendix H. | <p>Yes / No</p> |

II. Expedited Seismic Evaluation Process (ESEP) Equipment

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| <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>Yes / No</p> |
| <p>Did the licensee provide a new or updated ESEP report with the MSA?</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_{10%} 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> |
| <p>Notes from staff reviewer: The licensee stated that FLEX items not included in the ESEP were evaluated for the LaSalle MSSHI. Results of the evaluations of components not included in the ESEP were presented in Section 2.4 of the MSA submittal.</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"> The licensee has evaluated seismic adequacy of equipment used in support of FLEX strategy consistent with the NEI 12-06, Appendix H guidance. | <p>Yes / No</p> |

III. Inherently / Sufficiently Rugged Equipment

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| <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> |
| <p>Notes from staff reviewer: The process to identify inherently rugged items is documented in Section 2.3 of the LaSalle MSA report dated August 22, 2017.</p> <p>Deviation(s) or deficiency(ies) and Resolution: None</p> <p>Consequence(s): None</p> | |

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| <p>The NRC staff concludes:</p> <ul style="list-style-type: none"> The licensee's assessment of inherently and sufficiently rugged SSCs met the intent of the NEI 12-06, Appendix H guidance. | <p>Yes / No</p> |
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IV. Evaluation of Components Not Covered by ESEP

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| <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"> FLEX Storage Building | <p>Yes / No</p> |
| <ul style="list-style-type: none"> Non-seismic CAT I structures | <p>Yes / No / NA</p> |
| <ul style="list-style-type: none"> Operator Pathways credited in FLEX strategy | <p>Yes / No</p> |
| <ul style="list-style-type: none"> Tie down of FLEX portable equipment | <p>Yes / No</p> |
| <ul style="list-style-type: none"> Seismic interactions <ul style="list-style-type: none"> Masonry block wall Piping attached to tanks Flooding from non-seismically robust tanks Distributed systems (Piping/conduit/raceways/cable trays) Other potential areas of interaction | <p>Yes / No Yes / No Yes / No Yes / No</p> |
| <ul style="list-style-type: none"> FLEX equipment haul paths | <p>Yes / No</p> |
| <ul style="list-style-type: none"> Other equipment (listed in Staff Reviewer Notes) | <p>Yes / No / NA</p> |
| <p>Did the licensee provide adequate description/documentation of the evaluation?</p> | <p>Yes / No</p> |

Notes from staff reviewer: The LaSalle FLEX Equipment Storage Buildings consist of 1'-9" thick reinforced concrete slab floors, walls and roofs. The roof slabs are supported by composite beams and girders. In Section 2.4.1 of its MSA, the licensee provided the

results from an analysis that demonstrated adequate seismic capacity. The licensee's analysis is based on a comparison of the ratio of the American Society of Civil Engineers (ASCE) 7-10 minimum seismic design criteria and the actual design criteria used for the FLEX Storage Building (i.e. available seismic capacity) versus the ratio of the increase in peak spectral accelerations of the GMRS to SSE (i.e. increase in seismic demand). Ultimately, the available seismic capacity of the building exceeds the increase in seismic demand. Additionally, the licensee identified that the lower bound $C_{10\%}/C_{1\%}$ ratio, in accordance with NEI 12-06, Appendix H, Section H.5, Table H.1, is also greater than the increase in seismic demand. The NRC staff reviewed the analysis and determined it met the criteria of NEI 12-06, Appendix H.

In Section 2.4.1 of its MSA, the licensee stated, in part, that mitigation-strategies-related, non-seismic category I structures, Hardened Hose Station (HHS) #1 and HHS #2 are designed based on a seismic scaling factor of 1.83. The staff noted that the GMRS/SSE ratio of 1.83 is the maximum demand increase from SSE to GMRS between 1 Hz and 10 Hz. 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 Accession No. ML16259A189), the NRC staff reviewed, via the eportal, Exelon report number EXLS014-REPT-001, Revision 0, "MSA Seismic Path 4 Evaluation For LaSalle County Station Units 1 & 2 (EC 619279)". The HHS evaluation in the Exelon report states that all interaction coefficients associated with the HHS structures remain less than one (1) after applying the 1.83 scaling factor. The NRC staff determined, based on that report, that it is reasonable to assume the HHS structures have adequate seismic capacity to withstand the GMRS.

The NRC staff also reviewed the MSA submittal for operator pathways, haul paths, tie down of portable equipment, and additional seismic interactions. As a part of the audit process described above, the NRC staff viewed Exelon report number EXLS014-REPT-001, Revision 0. The NRC staff confirmed the MSA submittal statements and reviewed the walkdown report to confirm the licensee's seismic interactions conclusion. The NRC staff determined the licensee's assessment of the operator pathways, haul paths, tie down of portable equipment, and additional seismic interactions is consistent with the NEI 12-06, Appendix H guidance.

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

Consequence(s): None

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| The NRC staff concludes: <ul style="list-style-type: none">• The licensee followed the NEI 12-06, Appendix H guidance in evaluating SSCs not deemed inherently rugged. | Yes / No |
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V. Spent Fuel Pool (SFP) Cooling

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| <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"> • Clearly identified the SSCs and locations of the equipment that is part of the final FLEX SFP cooling strategy. • Clearly stated the seismic design basis (e.g. SSE) of the equipment used in the strategy. • 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. | <p>Yes / No</p> <p>Yes / No</p> <p>Yes / No</p> |
| <p>Notes from staff reviewer: The NRC staff confirmed that the SFP cooling equipment described in the licensee's FIP was previously evaluated to the SSE for LaSalle. The strategy consists of fixed piping in the reactor building, flexible hoses, and portable diesel driven pumps, as described in the LaSalle FIP. The NRC staff reviewed LaSalle's Spent Fuel Pool Evaluation Report (ADAMS Accession No. ML16244A802) 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.</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"> • The licensee followed the NEI 12-06, Appendix H guidance in evaluating SFP cooling. | <p>Yes / No</p> |

VI. High Frequency (HF)

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| <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> <p>The licensee:</p> <ul style="list-style-type: none"> • 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. | <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 previously performed a checklist review of the HF confirmation to confirm LaSalle met the criteria of NEI 12-06, Section H.4.2 and EPRI report 3002004396 (ADAMS Accession No. ML17031A425). The report stated that 360 of 363 evaluated components had seismic capacity greater than demand and that 3 components were resolved through operator action.</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"> • The licensee's component capacity evaluation met the intent of the HF guidance. | <p>Yes / No</p> |

VII. Conclusions:

The NRC staff assessed the licensee's implementation of the MSA guidance for LaSalle. 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 LaSalle. 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: LASALLE COUNTY STATION, UNITS 1 & 2 – 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 August 14, 2018

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