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

March 22, 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: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3 – 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. MF7825 AND MF7826; EPID 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 31, 2017, letter (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17243A113), submitted by Exelon Generation Company, LLC (Exelon, the licensee) for Dresden Nuclear Power Station, Units 2 and 3 (Dresden). The NRC staff evaluated the Dresden strategies developed under Order EA-12-049 and described in Exelon's Final Integrated Plan (FIP) for Dresden (ADAMS Accession No. ML16230A487). The staff's review of Dresden's mitigating strategies was documented in a safety evaluation dated February 16, 2017 (ADAMS Accession No. ML17037C929). 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 confirmed compliance with the order and was documented in a report dated January 2, 2018 (ADAMS Accession No. ML18002A344). The following NRC staff review confirms that the licensee has adequately addressed the reevaluated seismic hazard within Dresden'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).

MITIGATION STRATEGIES ASSESSMENT

By letter dated April 27, 2015 (ADAMS Accession No. ML15097A519), 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 Dresden, Units 2 and 3, in the 1 to 10 hertz (Hz) range as well as above 10 Hz. As such, a seismic risk evaluation, a high frequency confirmation (HF) and spent fuel pool (SFP) evaluation are merited. Further, the NRC staff concluded that the GMRS determined by the licensee adequately characterizes the reevaluated hazard for the Dresden 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 31, 2017 (ADAMS Accession No. ML17243A113), Exelon submitted the seismic MSA report for Dresden. The licensee stated that the Dresden MSA was performed consistent with Appendix H of NEI 12-06, Revision 4 (ADAMS Accession No. ML16354B421). 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, is 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 have been met. Currently, the CRA requirements for JLD-ISG-2012-01, Revision 2 have not been met.

Regarding NEI 12-06, Revision 4, the NRC staff conducted a thorough review, with numerous stakeholder interactions, that ultimately resulted in the exceptions, clarifications and additions discussed in the NRC's letter dated February 8, 2017. Based on that review, the NRC staff concludes that following the provisions of NEI 12-06, Revision 4, with the exceptions, clarifications, and additions contained in JLD-ISG-2012-01, Revision 2, is an acceptable alternative to NEI 12-06, Revision 2. Therefore, the methodology used by the licensee is acceptable to perform an assessment of the mitigation strategies that addresses the reevaluated seismic hazard.

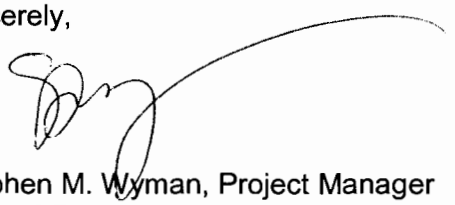
The NRC staff performed checklist reviews of the seismic hazard MSA and associated HF confirmation for Dresden. The checklists are provided as enclosures to this letter.

The NRC staff found that Dresden 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 Dresden 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 electronic mail at Stephen.Wyman@nrc.gov.

Sincerely,



Stephen M. Wyman, Project Manager
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Division of Licensing Projects
Office of Nuclear Reactor Regulation

Docket Nos. 50-237 and 50-249

Enclosures:
1. Technical Review Checklist
2. HF Checklist

cc w/encls: Distribution via Listserv

TECHNICAL REVIEW CHECKLIST
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO PATH FOUR MITIGATING STRATEGY ASSESSMENT
DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3
DOCKET NOS. 50-237 AND 50-249

The NRC staff performed the following checklist review based on the Enclosure of the August 31, 2017, letter (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17243A113) for Dresden Nuclear Power Station, Units 2 and 3 (Dresden). 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 2 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 1.78. This meets the criteria of NEI 12-06, Appendix H.5. Deviation(s) or deficiency(ies) and Resolution: Licensee performed assessment using NEI 12-06 Revision 4. The NRC staff found that following the provisions of NEI 12-06, Revision 4, with the exceptions, clarifications, and additions contained in JLD-ISG-2012-01, Revision 2, is an acceptable alternative to NEI 12-06, Revision 2 at Dresden. NRC staff evaluated using provisions of alternative guidance in NEI 12-06 Revision 4. 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 DRESDEN MSSHI. The licensee performed an analysis in accordance with NEI 12-06 Section H.5 and concluded that these items have adequate capacity. The NRC staff reviewed list of FLEX SSCs in Appendix B of Exelon document EXDR027-RPT-001 Rev 1. 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 Dresden MSA report dated August 31, 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 (list in Staff Reviewer Notes)	~~Yes / No /~~ NA

Did the licensee provide adequate description/documentation of the evaluation?	Yes / ~~No~~
Notes from staff reviewer: The licensee stated piping to buried tanks for FLEX reviewed during ESEP. The licensee stated no slope stability or liquefaction concerns for haul paths. NRC staff audited Block Wall Walk Down Report in Appendix E of Exelon document EXDR027-RPT-001 Rev 1 and found it was acceptable. 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 FIP was previously evaluated to the SSE for Dresden. The NRC staff reviewed Enercon Report No. EXDR027-RPT-001 Rev 1 via eportal to confirm the seismic qualifications statements made in the Dresden MSA. Specifically, the staff reviewed Section 6.4.7 to confirm the permanently mounted SFP pumps were qualified to the GMRS. The staff found the finite element model used the SSE times 1.78 (GMRS/SSE ratio) times a multi-mode factor of 1.5.	

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 NRC staff performed a checklist review of the MSA HF to confirm Dresden met the criteria of NEI 12-06, Section H.4.2 and EPRI report 3002004396. Staff notes that results table was only supplied via the eportal. All 328 components had capacity greater than demand. 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 Dresden. 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 identified one deviation and no 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 Dresden. 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.

TECHNICAL REVIEW CHECKLIST
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO HIGH FREQUENCY CONFIRMATION
IMPLEMENTING NEAR-TERM TASK FORCE RECOMMENDATION 2.1 SEISMIC
DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3
DOCKET NOS. 50-237 AND 50-249

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) 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) (hereafter referred to as the 50.54(f) letter). Enclosure 1 of the 50.54(f) letter requests addressees to reevaluate the seismic hazard at their site using present-day methods and guidance for licensing new nuclear power plants. Item 4 in Enclosure 1 to the 50.54(f) letter requests addressees to provide information related to high frequency (HF) sensitive structures, systems, and components (SSCs) for plants whose ground motion response spectra (GMRS) exceeds the safe shutdown earthquake (SSE) only at higher frequencies.

Additionally, by letter dated July 30, 2015 (ADAMS Accession No. ML15223A095), the Nuclear Energy Institute (NEI) submitted Electric Power Research Institute (EPRI) report EPRI 3002004396, "High Frequency Program: Application Guidance for Functional Confirmation and Fragility Evaluation" (hereafter referred to as the HF guidance). The HF guidance proposes methods for applying HF seismic testing results to support plant-specific analyses of potential HF effects. Specific guidance is given for plants performing a limited-scope HF confirmation to address the information requested in Item 4 in Enclosure 1 of the 50.54(f) letter. The limited-scope HF confirmation is a simplified seismic capacity evaluation focusing on the potential impacts of HF motion on key plant functions following a seismic event. By letter dated September 17, 2015 (ADAMS Accession No. ML15218A569), the NRC staff endorsed the HF guidance. Licensees with a reevaluated seismic hazard exceeding the SSE above 10 Hertz (Hz) and not performing a seismic probabilistic risk assessment (SPRA) were to submit a HF confirmation report in accordance with the schedule in the NRC letter dated October 27, 2015 (ADAMS Accession No. ML15194A015).

The NRC staff performed the following checklist review based on the High Frequency Attachment of the August 31, 2017, letter (ADAMS Accession No. ML17243A113) for Dresden Nuclear Power Station, Units 2 and 3 (Dresden). 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. Component Selection (EPRI 3002004396 Section 4.2)

The objective of the HF confirmation is to determine if the HF ground motion resulting from a seismic event could impact key plant safety functions that are critical following a plant trip/scram. Section 2 of the guidance summarizes EPRI's research on the impact of HF seismic activity which concludes that bi-stables (relays) in seal-in or lock-out (SILO) circuits could impact plant response. Component selection should identify any SILO-related relays that could directly impact critical functions following a trip. Licensees should provide sufficient description to clarify the potential impact in each of five major areas that encompass plant response: reactor (Rx) trip/scram, Rx vessel inventory control, Rx vessel pressure control, core cooling and alternating current/direct current (ac/dc) power systems.	
The licensee provided adequate description of the function with reasonable justification to support component selection in each of the following five functional areas:	
• Rx trip/scram	Yes / ~~No / NA~~
• Rx vessel inventory control	Yes / ~~No / NA~~
• Rx vessel pressure control	Yes / ~~No / NA~~
• core cooling	Yes / ~~No / NA~~
• ac/dc power systems	Yes / ~~No / NA~~
The licensee identified-SILO related circuits within the equipment scope.	Yes / ~~No / NA~~
The licensee identified the applicable contact configurations for SILO related circuits.	Yes / ~~No / NA~~
The licensee identified the locations of components (i.e., buildings and cabinets).	Yes / ~~No / NA~~

Notes from staff reviewer: The NRC staff reviewed the HF Report Summary in Attachment 1 of the Dresden MSA Report. The NRC staff also reviewed via eportal Exelon document EXLNDRE-00069, Rev. 0, "Dresden High Frequency Contact Chatter Assessment". The licensee identified 328 components for confirmation. Deviation(s) or deficiency(ies) and Resolution: None	
The NRC staff concludes: • The licensee's definition of the equipment list meets the HF guidance.	Yes / ~~No~~

II. Horizontal Seismic Demand (EPRI 3002004396 Sections 3.2 and 3.3)

For each equipment location, the licensee:	
• used the GMRS from the Seismic Hazard and Screening Report (SHSR).	Yes / ~~No~~
• developed a Foundation Input Response Spectra (FIRS).	~~Yes~~ / No
• provided justification for not providing FIRS.	~~Yes / No / NA~~
Notes from staff reviewer: The licensee stated in EXLNDRE-00069, Rev. 0 that the GMRS from Dresesden Seismic Hazard and Screening Report was used for the HF evaluation. The licensee did not develop a FIRS for Dresden. Deviation(s) or deficiency(ies) and Resolution: None	
The NRC staff concludes: • The licensee's definition of the horizontal seismic demand is acceptable for use in the HF confirmation.	Yes / ~~No~~

III. Component Horizontal Seismic Demand (EPRI 3002004396 Sections 4.3, 4.4, and 4.5)

For each component location, the licensee must apply amplification factors to the peak horizontal GMRS between 15 Hz and 40 Hz to determine the horizontal demand for each component. The structural amplification factor (AF) is given by Figure 4-3 in the guidance based on height above foundation. The cabinet AF is based on cabinet construction per EPRI NP-7148.	

The licensee: • identified the peak horizontal acceleration. • used structural amplification factors based on height above foundation from Figure 4-3 in the HF guidance (Section 4.3.2). • provided justification for selection of low, medium or high cabinet amplification factor based on cabinet construction consistent with EPRI NP-7148. • estimated the conservative deterministic failure margin mounting point demand in accordance with Section 4.5.1.	 Yes / ~~No~~ Yes / ~~No~~ Yes / ~~No~~ Yes / ~~No~~
Notes from staff reviewer: The NRC staff reviewed the evaluation presented in Appendix D of EXLNDRE-00069, Rev. 0 on the eportal. Deviation(s) or deficiency(ies) and Resolution: None	
The NRC staff concludes: • The licensee's development of component horizontal demand for the items on the equipment list met the HF guidance.	Yes / ~~No~~

IV. Vertical Ground Motion Response Spectrum (EPRI 3002004396 Section 3.2)

The HF guidance Section 3.2 describes the method for developing the vertical GMRS (VGMRS) from the horizontal GMRS and site soil conditions. The licensee: • used the horizontal GMRS and soil mean shear wave velocity vs. depth profile as given in the SHSR. • calculated the 30m shear wave velocity (Vs30) per the methodology in Section 3.5 of the HF guidance. • selected soil class from Table 3-1 in the HF guidance based on Peak Ground Acceleration and Vs30. • used correct V/H ratios from Table 3-2 in the HF guidance based on soil class. • provided a table and plot of the VGMRS.	Yes / ~~No~~ Yes / ~~No~~ Yes / ~~No~~ Yes / ~~No~~ Yes / ~~No~~
Notes from staff reviewer: The NRC staff reviewed the evaluation presented in Appendix D of EXLNDRE-00069, Rev. 0 on the eportal. Deviation(s) or deficiency(ies) and Resolution: None	
The NRC staff concludes: • The licensee followed the HF guidance in calculating VGMRS for use in HF confirmation.	Yes / ~~No~~

V. Component Vertical Seismic Demand (EPRI 3002004396 Sections 4.3 and 4.4)

For each component location, the licensee must apply amplification factors to the peak vertical GMRS between 15 Hz and 40 Hz to determine the vertical demand for each component. The structural AF is given by Figure 4-4 in the guidance based on height above foundation. The cabinet AF is 4.7 for all cabinets based on the calculation in Appendix C of the HF guidance. The licensee: • identified the peak vertical acceleration. • used Figure 4-4 from the guidance to determine the structural amplification factor. • used the cabinet amplification factor of 4.7 per Appendix C of the HF guidance.	 Yes / ~~No~~ Yes / ~~No~~ Yes / ~~No~~
Notes from staff reviewer: The licensee stated in Attachment 1 of the MSA that they followed the guidance of EPRI 3002004396. The NRC staff confirmed that statement by reviewing the calculations in Appendix D of EXLNDRE-00069, Rev. 0 on the eportal. Deviation(s) or deficiency(ies) and Resolution: None	
The NRC staff concludes: • The licensee's development of the vertical demand for the items on the equipment list met the guidance.	Yes / ~~No~~

VI. Component Capacity Evaluation and Comparison with Demand (EPRI 3002004396 Sections 4.5 and 4.6)

The licensee: • used the maximum of the pair of demand values for the mounting point demand as described in Section 4.5.1 of the HF guidance. • selected the correct knockdown factor per Section 4.5.2 of the guidance and Table 4-2. • selected/justified the correct single axis correction factor.	 Yes / ~~No / NA~~ Yes / ~~No / NA~~ Yes / ~~No / NA~~

• clearly indicated component capacity demand ratio for each component (in the sample evaluations). • results of demand vs. capacity are provided with identification of potential resolutions as needed.	Yes / ~~No / NA~~ Yes / ~~No / NA~~
Notes from staff reviewer: Items reviewed from calculations in Appendix D of EXLNDRE-00069, Rev. 0 on the eportal. Deviation(s) or deficiency(ies) and Resolution: None	
The NRC staff concludes: • The licensee's component capacity evaluation met the HF guidance.	Yes /~~No~~

VII. Resolution Options and High Frequency Report Requirements (EPRI 3002004396 Sections 4.6 and 4.7)

To resolve any relays not meeting the component capacity screening criteria, the licensee: • proposed an adequate resolution for each item on the component list that has a capacity vs. demand ratio less than one (outliers).	~~Yes / No /~~ NA
For plants that identified relays not meeting the component capacity screening criteria, the licensee used one or more of the following resolutions outlined in the guidance: • identified additional component testing as a resolution.	~~Yes / No /~~ NA
• identified refined mounting point seismic demand estimates as a resolution.	~~Yes / No /~~ NA
• identified operator actions as a resolution.	~~Yes / No /~~ NA
• identified plant modifications as a resolution.	~~Yes / No /~~ NA
The HF confirmation report included these required elements not previously identified in this checklist:	

• provided a component resolutions schedule. • provided representative calculations.	Yes ~~/ No / NA~~ Yes / ~~No / NA~~
Notes from staff reviewer: All 328 components evaluated had capacity greater than demand. Deviation(s) or deficiency(ies) and Resolution: None	
The NRC staff concludes: • The licensee's proposed component resolution and report content met the HF guidance.	Yes / ~~No~~

VIII. Conclusions:

The NRC staff concludes that through the implementation of the HF guidance, the licensee identified and evaluated the HF seismic capacity of certain key installed plant equipment to ensure critical functions will be maintained following a seismic event up to the GMRS. As noted in the review checklist, the staff did not identify deviations or exceptions taken from the guidance and the licensee did not identify any necessary equipment modifications. The application of this staff review is limited to the HF confirmation as part of the MSA.

SUBJECT: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3 – 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 March 22, 2018

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