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Subject: LIMERICK UNITS 1 AND 2: SECOND REQUEST FOR ADDITIONAL INFORMATION APPLICATION TO ADOPT 10 CFR 50.69 RISK-INFORMED CATEGORIZATION
Date: Monday, March 26, 2018 11:42:00 AM
Attachments: [Round2LimerickRAIsFinaltoDORLrevised.docx](#)

In a letter dated June 28, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17179A161), as supplemented by a letter dated August 14, 2017 (ADAMS Accession No. ML17336A336), Exelon Generation Company, LLC (Exelon) requested an amendment to the facility operating license for Limerick Generating Station (Limerick), Units 1 and 2, to adopt Title 10 of the *Code of Federal Regulations* (CFR) 50.69 for Risk-informed Categorization and Treatment of Structures, Systems and Components. In an e-mail dated December 6, 2017 (ADAMS Accession No. ML17341A250), the U.S. Nuclear Regulatory Commission (NRC) staff requested that the licensee provide additional information. In a letter dated January 19, 2018 (ADAMS Accession No. ML18019A091), the licensee replied to the NRC staff's request. Based on the information provided by the licensee, the NRC staff has several additional requests. Licensee had an opportunity to review the draft RAI provided on March 12, 2018. A clarification call was held on March 22, 2018.

During the clarification call, NRC offered to support a public technical discussion with the licensee regarding RAI 05.01-Qualitative Function Categorization (see enclosed attachment) before the licensee submits its response to this RAI.

Please provide the responses by April 27, 2018. If you have any additional questions, please contact the Project Manager by e-mail V.Sreenivas@nrc.gov or call 301-415-2597.

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SECOND REQUEST FOR ADDITIONAL INFORMATION
APPLICATION TO ADOPT 10 CFR 50.69 RISK-INFORMED CATEGORIZATION OF
STRUCTURES, SYSTEMS, AND COMPONENTS
EXELON GENERATION COMPANY, LLC
LIMERICK GENERATING STATION UNITS 1 AND 2
DOCKET NOS. 50-352 AND 50-353

In a letter dated June 28, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17179A161), as supplemented by a letter dated August 14, 2017 (ADAMS Accession No. ML17336A336), Exelon Generation Company, LLC (Exelon) requested an amendment to the facility operating license for Limerick Generating Station (Limerick), Units 1 and 2, to adopt Title 10 of the *Code of Federal Regulations* (CFR) 50.69 for Risk-informed Categorization and Treatment of Structures, Systems and Components. In an e-mail dated December 6, 2017 (ADAMS Accession No. ML17341A250), the U.S. Nuclear Regulatory Commission (NRC) staff requested that the licensee provide additional information. In a letter dated January 19, 2018 (ADAMS Accession No. ML18019A091), the licensee replied to the NRC staff's request. Based on the information provided by the licensee, the NRC staff has several additional requests. A clarification call was held on March 22, 2018.

PRA 02.01 – Modeling Undesired Operator Actions in the Fire PRA

The response to request for additional information (RAI) 02.c states that potential undesired operator actions resulting from spurious indications from fire-induced damage of an instrument were identified. It further states that the impact from undesired operator actions will be incorporated into the fire probabilistic risk assessment (FPRA) but provides no additional explanation. The NRC notes that NUREG-1921, "EPRI/NRC-RES Fire Human Reliability Analysis Guidelines," July 2012 (ADAMS Accession No. ML12216A104) provides guidance on how the complexities associated with identifying and modeling undesired operator actions will be addressed. In light of this:

- a. Confirm that the methodology in NUREG-1921 will be applied, or
- b. Describe in detail the method to be used including:
 - i. How Limerick will ensure that the range of possible erroneous indications caused by fire damage are identified and considered.
 - ii. How Limerick will ensure that the range of possible undesired operator actions are identified given possible erroneous indications. Include discussion of the possibility of undesired actuation of a pump as well the undesired shutdown of a pump. Also, include discussion of the potential for undesired flow diversion as well as flow isolation.

- iii. How the failure probabilities for these human error events will be determined and provide a basis for that determination supported by NRC or industry guidance.

PRA 02.02 – Sensitivity Study on THIEF Input Parameters

The response to RAI 02.g provided two findings and observations (F&Os) that resulted from the focused-scope peer review on the implementation of the thermally-induced electrical failure (THIEF) fire modeling tool. In disposition to one of the F&Os, FSS-H5-1, the licensee states that sensitivity studies were performed to address the uncertainties of the input parameters used for THIEF, and that the results of sensitivity studies indicate that the THIEF parameter inputs have a negligible impact on the FPRA and therefore the F&O has no impact on the 10 CFR 50.69 application. Summarize the sensitivity studies conducted on the THIEF parameter inputs and provide their results demonstrating the negligible impact on the 10 CFR 50.69 categorization.

PRA 04.01 – Implementation Items

The response to RAI 04 presents changes to the licensing basis that relate to completing items listed in the response to RAI 04 prior to implementing 10 CFR 50.69 categorization process. The response to RAI 04 refers generally to: (1) addressing PRA F&Os cited in RAI 01 and RAI 02, (2) performing focused-scope peer reviews on the two PRA upgrades identified in the response to RAI 03, and (3) future actions discussed in the license amendment request (LAR) supplement dated August 14, 2017 to perform PRA updates to address uncertainties. The response to RAI 04 does not explicitly list the PRA updates that are required prior to implementation of the 10 CFR 50.69 categorization process as requested in RAI 04.

The NRC staff identified the following items that should be completed prior to implementation of the 10 CFR 50.69 categorization process:

- i. Update the HRA pre-initiators in the internal events PRA model to meet Capability Category II of the ASME/ANS RA-Sa-2009 as endorsed by RG 1.200 Revision 2, conduct a focused-scope peer review of the pre-initiator analysis, and resolve any resulting F&Os as indicated in response to RAI 01.a.
- ii. Remove credit for recovery of instrument air from the internal events PRA model, as indicated in response to RAI 01.d.
- iii. Update the success criteria for main steam isolation valve (MSIV) spurious opening, as indicated in response to RAI 02.a.
- iv. Modeling undesired operator actions in the FPRA, conduct a focused-scope peer review, and resolve any F&Os as indicated in response to RAI 02.c, subject to follow up RAI 02.01 above.
- v. Update the FPRA model to model junction box fires consistent with frequently asked question (FAQ) 13-0006, as indicated in response to RAI 2.e.
- vi. Update the FPRA model to incorporate transient fires in the multi-compartment analysis, as indicated in response to RAI 2.f.
- vii. Update the pipe rupture frequencies in the internal flooding PRA to the most recent EPRI pipe rupture frequencies, as indicated on page 7 of supplement dated August 14, 2017.

- viii. Remove credit for core melt arrest in-vessel at high reactor pressure vessel (RPV) pressure conditions from the internal events PRA model, as indicated on page 7 of supplement dated August 14, 2017.
- ix. Update the PRA model to account for load shedding when crediting serial operation of high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) in loss of offsite power (LOOP) and station blackout (SBO) scenarios, as indicated on page 6 of the supplement dated August 14, 2017.

To fully address the above issues provide the following:

- a. For each of the nine issues above, please indicate how the issue will be addressed. If the issue has been addressed please state the issue has been addressed. A table of “implementation items” has been used in previous risk-informed licensing actions to formally identify issues requiring resolution before implementation of the amendment.
- b. Please provide a method to assure that all issues will be addressed and any associated changes will be made, that focused-scope peer reviews will be performed on changes that are PRA upgrades as defined in the PRA standard, and that any findings will be resolved and reflected in the PRA prior to implementation of the 10 CFR 50.69 categorization process (for example, a license condition that all applicable implementation items will be completed prior to categorization).

RAI 05.01 – Qualitative Function Categorization

Figure 5-1 provided in the response to RAI 5 show that the evaluation of the seven qualitative criteria in Section 9.2 of Nuclear Energy Institute (NEI) 00-04 is performed at the function level and prior to the Integrated Decision-making Panel (IDP). The response also states that “NEI 00-04 only requires [the seven criteria] to be completed for components/functions categorized as LSS.” Table 1 in the RAI 5 response has a column “IDP change HSS to LSS” and has the entry “[a]llowable” in the qualitative criteria row, which appears to contradict the premise that the seven criteria are only applied to LSS functions. The guidance in NEI 00-04 states that the IDP “should consider the impact of loss of the function/structure, system, and component (SSC) against the remaining capability to perform the basic safety functions.” Please clarify the guidance that will be provided to assess the safety significance of a function when there is an impact on, or even loss of, the capability described in each of the seven criteria (e.g., is a single false response sufficient to assign the function HSS).

RAI 06.01 – SSCs that Participate in Screened Scenarios

The response to RAI 06e for extreme wind and tornadoes states that “[t]he screening process followed the guidance in Figure 5-6 of NEI 00-04. The screening process includes an evaluation of whether SSCs participate in screened scenarios; and also considers whether, if credit for SSCs were removed relative to the hazard being evaluated, the hazard would then become Unscreened.” However, the discussion in 6e then simply states that “[t]he design basis tornado was reviewed against Table 6-1 of, “Tornado Climatology of the Contiguous United States,” NUREG/CR-4461, Rev. 2, and was found to be bounding. Therefore, no additional considerations were necessary.” The Updated Final Safety Analysis Report (UFSAR) indicates design rotational wind speed of 223.5 miles per hour (mph) at the 1E-7/year frequency, not significantly below the wind speed of 202 mph indicated in Table 6-1 of NUREG/CR-4461, Rev. 2 at the 1E-7/year frequency. Further, Table 3.3-2 in the UFSAR identifies “Tornado Protected

Systems and Tornado-Resistant Enclosures.” The RAI response does not appear to address high straight winds.

- a. Provide the expected frequency of the wind hazard (e.g. straight line winds, tornadoes, hurricanes, etc.) which could cause damage from wind effect or wind-borne missiles to SSCs credited for safe shutdown to demonstrate that this frequency is sufficiently low that the hazard can be screened out without credit for mitigating SSCs, or
- b. Confirm that during categorization SSCs will be evaluated to determine if they participate in screened hazard scenarios and to determine whether their failures would result in an unscreened scenario, or
- c. Provide an alternative evaluation of the risk from high winds and tornado hazards, demonstrating how the guidance in NEI 00-04 Section 5.4 is met.

PRA 08.01 Passive Component Categorization

LAR Section 3.1.2 stated that for the categorization of passive components and the passive function of active components, Limerick will use the method for risk-informed repair/replacement activities consistent with the safety evaluation issued by the Office of Nuclear Reactor Regulation, “Request for Alternative ANO2-R&R-004, Revision 1, Request to Use Risk-informed Safety Classification and Treatment for Repair/Replacement Activities in Class 2 and 3 Moderate and High Energy Systems, Third and Fourth 10-Year Inservice Inspection Intervals,” for Arkansas Nuclear One, Unit 2 (ANO-2), dated April 22, 2009 (ADAMS Accession No. ML090930246).

The NRC staff notes that this methodology has been approved for Class 2 and Class 3 SSCs. Because Class 1 SSCs constitute principal fission product barriers as part of the reactor coolant system or containment, the consequence of pressure boundary failure for Class 1 SSCs may be different than for Class 2 and Class 3, and therefore the criteria in the ANO-2 methodology cannot automatically be generalized to Class 1 SSCs without further justification. Therefore, in RAI 08 the NRC staff asked the licensee to confirm that this methodology will be applied to Class 2 and Class 3 SSCs or to justify how the methodology will be modified to include Class 1 SSCs.

The justification provided in the response to RAI 08 does not justify how the ANO-2 methodology can be applied to Class 1 SSCs and how sufficient defense in depth and safety margins are maintained. A technical justification for Class 1 SSCs should address how the methodology is sufficiently robust to assess the safety significance of Class 1 SSCs, including, but not limited to: justification of the appropriateness of the conditional core damage probability (CCDP) numerical criteria used to assign ‘High’, ‘Medium’ and ‘Low’ safety significance to these loss of coolant initiating events; identification and justification of the adequacy of the additional qualitative considerations to assign ‘Medium’ safety significance (based on the CCDP) to ‘High’ safety significance; justification for crediting operator actions for success and failure of pressure boundary; guidelines and justification for selecting the appropriate break size (e.g. double ended guillotine break or smaller break); and include supporting examples of types of Class 1 SSCs that would be assigned low safety significance, etc.

As mentioned in the meeting summary from the February 20, 2018, Risk-Informed Steering Committee (RISC) meeting (ADAMS Accession No. ML18072A301), the NRC staff understands that the industry is planning to limit the scope to Class 2 and Class 3 SSCs, consistent with the pilot Vogtle Electric Generating Plant, Units 1 and 2 license amendment (ADAMS Accession No. ML14237A034).

Please provide the requested technical justification or confirm the intent to apply the ANO-2 passive categorization methodology only to Class 2 and Class 3 equipment.