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To: [Helker, David P:\(GenCo-Nuc\)](#)
Cc: [Gropp Jr, Richard W:\(GenCo-Nuc\)](#)
Subject: Peach Bottom Units 2 and 3 - Request for Additional Information - Adopt 50.69 License Amendment (EPID L-2017-LLA-0281)
Date: Friday, April 06, 2018 3:02:00 PM
Attachments: [APLA Peach Bottom 50-69 Final RAIs.docx](#)

Dear Mr. Helker,

By letter dated August 30, 2017 (Accession No. ML17243A014), as supplemented by letter dated October 24, 2017 (ADAMS Accession No. ML17297B521), Exelon Generation Company, LLC requested an amendment to the facility operating license for Peach Bottom Atomic Power Station Units 2 and 3 to adopt 10 CFR 50.69 for Risk-informed Categorization and Treatment of Structures, Systems and Components.

The Nuclear Regulatory Commission's (NRC) staff is reviewing your submittal and has determined that additional information is needed to complete its review. The specific request for additional information (RAI) questions are provided below. The RAI questions were provided in draft form to you via e-mail on March 21, 2018. The draft questions were sent to ensure that the questions were understandable, the regulatory basis for the questions was clear, and to determine if the information was previously docketed. The finalized questions are both attached and below for your convenience.

In a clarification phone call on April 6, 2018, staff discussed the draft RAI questions and determined that minor clarifications to RAI-08 would aid in the understanding and response. Mr. Gropp confirmed that Exelon would provide a response to the RAI questions within 30 days of receipt (by May 7, 2018).

If you have any questions, please contact me at (301) 415-2328. A copy of this e-mail will be made publicly available in ADAMS.

Thanks,
Jenny

REQUEST FOR ADDITIONAL INFORMATION
APPLICATION TO ADOPT 10 CFR 50.69 RISK-INFORMED CATEGORIZATION OF
STRUCTURES, SYSTEMS, AND COMPONENTS
EXELON GENERATION COMPANY
PEACH BOTTOM ATOMIC POWER STATION (PBAPS), UNITS 2 AND 3
DOCKET NOS. 50-277 AND 50-278

Title 10, of the Code of Federal Regulations, Part 50, Section 69 (10 CFR 50.69), "Risk-informed categorization and treatment of structures, systems, and components for nuclear power reactors," allows licensees to use a risk-informed process to categorize systems, structures, and components (SSCs) according to their safety significance in order to remove SSCs of low safety significance from the scope of certain identified special

treatment requirements. Regulatory Guide (RG) 1.201, Revision 1, "Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants According to their Safety Significance" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML061090627) endorses, with regulatory positions and clarifications, the Nuclear Energy Institute (NEI) guidance document NEI 00-04, Revision 0 "10 CFR 50.69 SSC Categorization Guideline", (ADAMS Accession No. ML052910035) as one acceptable method for complying with the requirements in 10 CFR 50.69. Both RG 1.201 and NEI 00-04 cite RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," (revision 1 is available at ADAMS Accession No. ML040630078) which endorses industry consensus probabilistic risk assessment (PRA) standards (i.e., American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications" available at ADAMS Accession No. ML092870592), as the basis against which peer reviews evaluate the technical adequacy of a PRA. Revision 2 of RG 1.200 is available at ADAMS Accession No. ML090410014.

By letter dated August 30, 2017 (ADAMS Accession No. ML17243A014), as supplemented by letter dated October 24, 2017 (ADAMS Accession No. ML17297B521), Exelon Generation Company, LLC (Exelon, the licensee) submitted a license amendment request (LAR) to adopt the regulation in 10 CFR 50.69 at the Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. Section 3.1.1 of the LAR states that Exelon will implement the risk categorization process of 10 CFR 50.69 in accordance with NEI 00-04, Revision 0, as endorsed by RG 1.201. However, the licensee's LAR does not contain enough information for the Nuclear Regulatory Commission (NRC) staff to determine if the licensee has implemented the guidance in NEI 00-04, as endorsed by RG 1.201, appropriately as a means to demonstrate compliance with all of the requirements in 10 CFR 50.69. The following requests for additional information (RAIs) outline the specific issues and information needed to complete the NRC staff's review:

RAI 01 – Scope and Quality of PRA Self-Assessments and Peer Reviews

Section 50.69(c)(i) of 10 CFR requires that a licensee's PRA must be of sufficient quality and level of detail to support the categorization process, and must be subjected to a peer review process assessed against a standard or set of acceptance criteria that is endorsed by the NRC. Section 3.3 of the LAR states that the licensee conducted a self-assessment and a full-scope peer review for its internal events PRA (IEPRA) and fire PRA (FPRA) in November 2010 and 2011, respectively. However, the licensee did not indicate what standard the PRAs were reviewed against or whether internal flooding was included in the scope of review. Address the following:

- a) Describe the scope and reason for the self-assessments and peer reviews performed for the IEPRA and FPRA, and confirm they were performed against the guidance in RG 1.200, Revision 2.
- b) Confirm that the IEPRA full-scope peer review included internal flooding or otherwise provide the history of peer reviews for the internal flooding PRA.
- c) Identify which findings presented in Attachment 3 of the LAR were self-assessment findings and which were full-scope peer review findings.

RAI 02 – PRA Upgrades

Section 50.69(b)(2)(iii) of 10 CFR requires that the results of the peer review process conducted to meet 10 CFR 50.69 (c)(1)(i) criteria be submitted as part of the LAR. During a peer review, the documentation of differences or deficiencies between the licensee's PRA model and the NRC endorsed PRA standard are labeled as facts and observations (F&Os). In the supplement dated October 24, 2017, the licensee stated that the F&O closure review team performed an assessment of whether each finding resolution constitutes a PRA "upgrade" and identified one upgrade. In addition, the licensee stated that the independent peer review team did consider whether any other of the finding resolutions should have been considered an upgrade and that the review team concurred with the assessment that there were no other upgrades. However, the licensee did not discuss what the upgrade was or how review of the upgrade was completed.

Describe the change identified as an "upgrade," provide a description of the focused-scope peer review performed on the upgrade, and include all resulting F&Os with complete disposition for the application.

RAI 03 – Open F&Os in the Process of Being Resolved

Section 50.69(c)(i) of 10 CFR requires that a licensee's PRA must be of sufficient quality and level of detail to support the categorization process, and must be subjected to a peer review process assessed against a standard or set of acceptance criteria that is endorsed by the NRC. Section 50.69(b)(2)(iii) of 10 CFR requires that the results of the peer review process conducted to meet 10 CFR 50.69 (c)(1)(i) criteria be submitted as part of the application. During a peer review, the documentation of differences or deficiencies between the licensee's PRA model and the NRC endorsed PRA standard are labeled as F&Os. Attachment 3 of the LAR provides F&Os and self-assessment findings that are still open or partially resolved following the F&O closure review. The dispositions for several of these F&Os do not contain sufficient information to justify the licensee's conclusion that the open F&O has minimal or no impact on the application. The specific F&Os and requested information are as follows:

- a) Internal events F&Os 2011-3-1, 3-4, 3-6, and 5-8 pertaining to modeling of pre-initiators. These F&Os and their corresponding dispositions state that the licensee did not derive the currently modeled pre-initiators from a formal review of procedures and practices at the plant. The licensee stated that a resolution of these F&Os would have a minimal impact on this application, and are therefore not necessary. Provide the following:
 - i. A justification clearly showing why not resolving F&Os 2011-3-1, 3-4, 3-6, and 5-8 has no impact on the 10 CFR 50.69 categorization results, or
 - ii. A mechanism that ensures a review of the procedures and practices at the plant is conducted, and that any pre-initiators identified from the review are included in the PRA models prior to implementing the 10 CFR 50.69 categorization process.
- b) Fire F&O 2012-1-33 pertaining to adjustments to floor-area-ratios. This F&O and

the corresponding disposition states that the licensee did not consider correctly the treatment of obstructed floor space and consideration of maintenance practice when determining the floor-area-ratios (FARs) used to allocate the transient ignition frequency across a Physical Analysis Unit (PAU). The F&O indicates that the licensee did not remove the area-obstructed locations from the denominator in the FARs equations. In addition, the disposition indicates that the licensee did not use maintenance practice to inform the likelihood of transient locations. The disposition states that the licensee will resolve the resulting adjustment to the transient fire scenario frequencies in the current model update and that the resolution has minimal impact on this application. Provide the following:

- i. A justification clearly showing why not resolving F&O 2012-1-33 prior to implementing the 10 CFR 50.69 categorization process has no impact on the 10 CFR 50.69 categorization results or,
 - ii. A mechanism that ensures the FARs are adjusted as discussed in the F&O resolution prior to implementing the 10 CFR 50.69 categorization process.
- c) Fire F&O 2012-1-40 pertaining to lack of detailed fire modeling (FM). The F&O cites oversimplified FM in risk significant scenarios. The disposition states that the F&O closure team found that the licensee did perform detailed FM for risk significant scenarios in the modeling update, with some exceptions. Accordingly, the F&O closure team recommended that the licensee apply the detailed two-point FM approach to those exceptions as described in NUREG-6850, "Electric Power Research Institute (EPRI)/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," (ADAMS Accession Nos. ML052580075, ML052580118, and ML103090242) in which models are developed at the 98th and 75th percentiles. The disposition states that the licensee will perform the recommended two-point FM and that the resolution has minimal impact on this application. Provide the following:
- i. A justification clearly showing why not resolving F&O 2012-1-40 prior to implementing the 10 CFR 50.69 categorization process has no impact on the 10 CFR 50.69 categorization results or,
 - ii. A mechanism that ensures the two-point FM is applied to the risk-significant fire scenarios prior to implementing the 10 CFR 50.69 categorization process.
- d) Fire F&O 2012-3-17 pertaining to credit for fire wrapping. The disposition to this F&O states that the FPRA currently credits fire wrap for protecting enclosed cables though there may be locations potentially vulnerable to mechanical damage. Accordingly, the disposition states that the licensee will conduct a review of potentially vulnerable fire wrap configurations and, if vulnerabilities are confirmed, then the licensee will remove credit for the fire wrap from the FPRA. Provide the following:
- i. A justification clearly showing why not resolving F&O 2012-3-17 prior to implementing the 10 CFR 50.69 categorization process has no impact on the 10 CFR 50.69 categorization results or,

- ii. A mechanism that ensures a review is conducted of potentially vulnerable fire wrap configurations and credit removed from the PRA for any fire wrap susceptible to mechanical damage prior to implementing the 10 CFR 50.69 categorization process.
- e) Fire F&O 2012-3-37 pertaining to review of excluded electrical panels. The F&O states that the licensee did not consider failure of electrical panels and all targets terminating at the panel for all non-propagating electrical panel fires that are modeled in the FPRA. The disposition states that the licensee will confirm that the excluded panels lead to a single failure, and that the licensee will incorporate any excluded panels into the FPRA if the licensee determines that multiple failures from an excluded panel fire are possible. The licensee states that this F&O is being resolved in the current model update and has minimal impact on this application. In addition, this resolution does not appear to be consistent with the NRC guidance in NUREG/CR-6850, "Electric Power Research Institute (EPRI)/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," (ADAMS Accession Nos. ML052580075, ML052580118, and ML103090242), for excluding electrical cabinets from being counted if they are simple wall-mounted panels with less than four switches or they are well-sealed and robustly secured cabinets containing circuits below 440 V.

Explain how the resolution to F&O 2012-3-37 is consistent with the guidance contained in NUREG/CR-6850, or provide a description and justification for the proposed resolution.

- f) Fire F&O 2012-6-1 pertaining to resolution of internal events findings. The disposition to this F&O states that internal events F&O 6-11 (regarding supporting requirement (SR) DA-C11) and F&O 3-6 (regarding SR HR-A1 and HR-A2) remained open for the FPRA. The F&O states for internal events F&O FPIE 6-11 (mistakenly referred to as F&O 6-1 in PB-PRA-021.01 and the FPIE PR report) that validation is needed for use of maintenance rule unavailability data in the PRA. Internal events F&O 3-6 pertaining to identification of pre-initiators is already addressed in this question in part (a). The licensee states that F&O 2012-6-1 has not been resolved but has minimal impact on the 10 CFR 50.69 categorization process.
- i. Confirm that the internal events F&O 6-11 cited in Fire F&O 2012-6-1 was closed by the 2016 F&O Closure process, or alternatively provide description of the F&O and its resolution or disposition for the 10 CFR 50.69 application.
 - ii. Provide a justification clearly showing why not resolving F&O 2012-6-1 has no impact on the 10 CFR 50.69 categorization results.

RAI 04 – Open/Partially Open Findings Resolved Using Sensitivity Studies

Section 50.69(c)(i) of 10 CFR requires that a licensee's PRA must be of sufficient quality and level of detail to support the categorization process, and must be subjected to a peer review process assessed against a standard or set of acceptance criteria that is endorsed

by the NRC. Section 50.69(b)(2)(iii) of 10 CFR requires that the results of the peer review process conducted to meet 10 CFR 50.69 (c)(1)(i) criteria be submitted as part of the application. During a peer review, the documentation of differences or deficiencies between the licensee's PRA model and the NRC endorsed PRA standard are labeled as F&Os. The resolutions to a number of F&Os presented in Attachment 3 of the LAR involve sensitivity studies that the licensee will perform to validate the treatments used in the PRA. The dispositions for these cases do not explain how the licensee will resolve the F&Os if the sensitivity study results do not validate that the F&O has only a minimal impact on the application. The specific F&Os and requested information are as follows:

- a) Fire F&O 2012-5-6 pertaining to the uncertainty of FM parameters. The disposition for this F&O states that to resolve this F&O the licensee will evaluate FM parameter uncertainties for risk significant scenarios and that the licensee will perform sensitivity studies for parameters identified to be key sources of uncertainty. The licensee states that this F&O is being resolved in the current model update and has minimal impact on this application. Provide the results of the sensitivity studies on the FM parameters to demonstrate no impact on the 10 CFR 50.69 categorization results, or if any impact is identified, describe the actions that will be taken to address it.
- b) Fire F&O 2016-1-1 pertaining to the assumption that control cables would be the critical target cable in most scenarios. The disposition states that to resolve the F&O the licensee will use the weighted average of cable parameters in a PAU for thermally-induced electrical failure (THIEF) calculations (in some cases specific target parameters were used). The disposition states that the licensee is performing sensitivity studies by using the upper and lower bounds of these cable parameters as input to THIEF (for calculating critical time to cable insulation failure) to compare to the results of running THIEF using the mean parameters. The licensee states that this F&O is being resolved in the current model update and has minimal impact on this application. Provide the results of the sensitivity studies on the cable parameters to demonstrate no impact on the 10 CFR 50.69 categorization results, or if any impact is identified, describe the actions that will be taken to address it.
- c) Fire F&O 2016-1-2 pertaining to the radial increments used in THIEF. The disposition to this F&O states that to resolve this F&O the licensee will perform a sensitivity study on the "radial increment" used in the THIEF modeling, which is larger than the radial increment recommended in NUREG/CR-6931, Volume 3, "Cable Response to Live Fire (CAROLFIRE) Volume 3: Thermally-Induced Electrical Failure (THIEF) Model," (ADAMS Accession No. ML081190261) to demonstrate that the increment used yields a reasonable but conservative result. In addition, the licensee states that this F&O is being resolved in the current model update and has minimal impact on this application. Provide the results of the sensitivity studies on the radial increments to demonstrate no impact on the 10 CFR 50.69 categorization results, or if any impact is identified, describe the actions that will be taken to address it.
- d) Fire F&O 2016-1-6 pertaining to the assumed flame spread over horizontal cable trays (FLASH-CAT) and THIEF modeling parameters. The disposition to this F&O states that the licensee will perform sensitivity studies that vary the parameters used in FLASH-CAT and THIEF between reasonable upper and lower bounds in order to

determine the impact on analysis. The licensee states that this F&O is being resolved in the current model update and has minimal impact on this application. Provide the results of the sensitivity studies on the fire modeling parameters (both FLASH-CAT and THIEF) to demonstrate no impact on the 10 CFR 50.69 categorization results, or if any impact is identified, describe the actions that will be taken to address it.

RAI 05 – Open F&Os with Incomplete Dispositions

Section 50.69(c)(i) of 10 CFR requires that a licensee's PRA must be of sufficient quality and level of detail to support the categorization process, and must be subjected to a peer review process assessed against a standard or set of acceptance criteria that is endorsed by the NRC. Section 50.69(b)(2)(iii) of 10 CFR requires that the results of the peer review process conducted to meet 10 CFR 50.69 (c)(1)(i) criteria be submitted as part of the application. During a peer review, the documentation of differences or deficiencies between the licensee's PRA model and the NRC endorsed PRA standard are labeled as F&Os. The following dispositions for open or partially resolved F&Os presented in Attachment 3 of the LAR seemed incomplete and require further justification and/or information:

a) Undesired Operator Actions in FPRA

The dispositions for F&Os 2012-2-6 and 2012-2-7, pertaining to undesired operator actions, state that the licensee will perform a procedure-by-procedure review to justify why consideration of instrumentation that could potentially mislead operators or cause them to perform a harmful action did not need to be modelled in the FPRA. The licensee states that if a justification cannot be provided, then the licensee will incorporate the undesired operator actions into the PRA models as applicable. However, the disposition does not explain how the licensee will incorporate these undesired operator actions, which could propagate errors of commission and errors of omission into the PRA model. In addition, the disposition does not indicate whether this update would meet the criteria for a PRA "upgrade" as defined in the PRA Standard (i.e., American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications"), as endorsed by RG 1.200. Provide the following:

- i. A detailed discussion describing how the licensee will incorporate any applicable undesired operator actions into the PRA model. The discussion should include a description of the modeling of failures to respond to fire-induced damage of PRA modeled components (i.e., failure of omission), and undesired actions that could lead to undesired equipment actuations (i.e., errors of commission).
- ii. A discussion of whether the PRA model update to include any applicable undesired operator actions constitutes a PRA "upgrade" as defined in the PRA Standard (i.e., ASME/ANS RA-Sa-2009), as endorsed by RG 1.200. If the update is considered a PRA "upgrade", then propose a mechanism

that ensures a focused-scope peer review of the upgrade is performed and all resulting F&Os are resolved prior to implementing the 10 CFR 50.69 categorization process.

b) Uncoordinated Breakers in FPRA

The disposition for F&O 2012-5-1 states that circuits modeled in the FPRA determined to be uncoordinated will be modeled as “non-coordinated” in the FPRA. However, the disposition does not describe how the licensee will model the non-coordinated circuits. Failures caused by these inadequate circuits could represent a new kind of failure not currently modeled in the FPRA. The disposition does not indicate whether this update would meet the criteria for a PRA “upgrade” as defined in the PRA Standard (i.e., ASME/ANS RA-Sa-2009), as endorsed in RG 1.200. Provide the following:

- i. A discussion of the non-coordinated circuits and the extent of the modeling necessary to address this F&O.
- ii. A detailed discussion describing how the licensee will incorporate any non-coordinated circuits in the PRA model. The discussion should include a description of any modeled component failures associated with the uncoordinated circuit, including failures that could occur upstream and downstream of possible fault locations along the circuit.
- iii. A discussion of whether the PRA model update to include non-coordinated circuits constitutes a PRA “upgrade” as defined in the PRA Standard (i.e., ASME/ANS RA-Sa-2009), as endorsed by RG 1.200. If the update is considered a PRA “upgrade”, then provide a mechanism that ensures a focused-scope peer review of the upgrade is performed and all resulting F&Os are resolved prior to implementing the 10 CFR 50.69 categorization process.

RAI 06 – Open/Partially Open F&Os Associated with Fire Modeling Codes

Section 50.69(c)(i) of 10 CFR requires that a licensee’s PRA must be of sufficient quality and level of detail to support the categorization process, and must be subjected to a peer review process assessed against a standard or set of acceptance criteria that is endorsed by the NRC. Section 50.69(b)(2)(iii) of 10 CFR requires that the results of the peer review process conducted to meet 10 CFR 50.69 (c)(1)(i) criteria be submitted as part of the application. During a peer review, the documentation of differences or deficiencies between the licensee’s PRA model and the NRC endorsed PRA standard are labeled as F&Os. The dispositions to F&Os 2016-1-3, 2016-1-4, and 2016-1-9, indicate that the findings will be resolved by showing that the THIEF, FLASH-CAT, and Time-to-Automatic-Detection models and related model parameters have been applied within their known limits of applicability. Provide demonstration that the THIEF, FLASH-CAT, and Time-to-Automatic-Detection models and related model parameters have been used within known limits of their applicability. For each of the F&Os 2016-1-3, 2016-1-4, and 2016-1-9, provide a complete description of the F&O, and a discussion of its resolution.

RAI 07 – Implementation Items

Section 50.69(b)(2)(ii) requires that a licensee's application contain a description of the measures taken to assure that the quality and level of detail of the systematic processes that evaluate the plant for internal and external events during normal operation, low power, and shutdown are adequate for the categorization of SSCs. Attachment 6 of the LAR presents dispositions for assumptions and modeling uncertainties that include planned updates to the PRA models after the NRC approves the 10 CFR 50.69 implementation amendment request but before the licensee implements its 10 CFR 50.69 categorization program. These updates include updating the internal flooding pipe break frequencies, and removing credit for core melt arrest in vessel. However, the licensee did not discuss whether these future updates can have an impact on the 10 CFR 50.69 categorization process.

- a) Justify why the updates included in Attachment 6 of the LAR (i.e., updating the internal flooding pipe break frequencies, and removing credit for core melt arrest in vessel) have no impact on the 10 CFR 50.69 categorization results or include them in response to item b. below.
- b) Provide a list of activities and PRA modeling changes including any items that will not be completed prior to issuing the amendment but must be completed prior to implementing the 10 CFR 50.69 categorization process. Propose a mechanism that ensures these activities and changes will be completed and appropriately reviewed and any issues resolved prior to implementing the 10 CFR 50.69 categorization process (for example, a license condition that includes all applicable implementation items and a statement that they will be completed prior to implementation of the 10 CFR 50.69 categorization process).

RAI 08 – Key Assumptions and Uncertainties that could Impact the Application

Sections 50.69(c)(1)(i) and (ii) require that a licensee's PRA be of sufficient quality and level of detail to support the SSC categorization process, and that all aspects of the integrated, systematic process used to characterize SSC importance must reasonably reflect the current plant configuration and operating practices, and applicable plant and industry operational experience. The dispositions presented in Attachment 6 of the LAR for key assumptions and modeling uncertainties state in each case that they do not represent a key source of uncertainty and will not be an issue for the 10 CFR 50.69 categorization. However, in a number of instances the licensee did not provide sufficient information for NRC to conclude that the uncertainty will not impact the 10 CFR 50.69 categorization results. The specific F&Os and requested information are as follows:

a) Diesel Generator Cooling Fan Success Criteria

- Attachment 6 (page 71) of the LAR states that the outdoor air temperature at the plant does not often exceed the design basis temperature for the diesel generators (DG) (i.e., >80° F) which would require two DG cooling fans. The licensee states that it assumes just one-of-two DG cooling fans to be an adequate success criterion in the PRA for the entire year. Based on publically available information, the average high temperatures at the plant location appears to be above 80° F in the summer months. Provide the following:

- i. A basis for the adequacy of the assumed one-out-of-two DG cooling fans success criteria in the summer months, or
- ii. Justify quantitatively that the 10 CFR 50.69 categorization results are not sensitive to the assumption that one-of-two DG cooling fans provide adequate cooling when the temperature at the plant exceeds the design basis temperature (i.e., >80° F), or
- iii. A mechanism that ensures the model is adjusted to account for higher summer temperatures prior to implementing the 10 CFR 50.69 categorization process.

b) Low Pressure Injection after Core Damage

Attachment 6 (page 74) of the LAR indicates that the licensee takes credit in the PRA for “timely” low pressure injection after core damage to avoid a large early release. The disposition states that this assumption provides a reasonable best-estimate approach. However, the licensee does not provide a basis for the assumption. Provide the following:

- i. A discussion which describes the thermohydraulic basis or rationale supporting the validity of the assumption that injection of low pressure cooling after core damage can prevent a large early release. The discussion should include a description of the term “timely low pressure injection.”
- ii. Alternatively, justify quantitatively that the 10 CFR 50.69 categorization results are not sensitive to this assumption.

c) Safety Relief Valve (SRV) Success Criteria after Passing Liquid

Attachment 6 (page 75) of the LAR states that although the SRVs are designed to pass water, and 10 CFR Part 50, Appendix R, “Fire protection program for nuclear power facilities operating prior to January 1, 1979,” models the RPV being flooded with water returning to the suppression pool via the SRVs, the SRVs are never tested in this fashion. The disposition also states that the licensee assigns a nominal failure probability to the SRVs for failure to **open** following flooding of the steam lines that causes liquid to pass through the SRVs. However, the NRC staff notes that the NUREG/CR-6928, “Industry Average Performance for Components and Initiating Events at U.S. Commercial Nuclear Power Plants,” (ADAMS Accession No. ML070650650) Component Reliability 2010 update provides a probability estimate for an SRV to fail to **close** (passing liquid) of 0.1. Provide the following:

- i. Confirm that the nominal failure probability used for the SRVs to fail to open is consistent with the 2010 update of NUREG/CR-6928 or justify the nominal failure probability used, including a justification for assuming the SRVs will work absent of testing.
- ii. Given that the licensee has identified a scenario where SRVs could potentially pass liquid following steam-line flooding, discuss how the licensee

addresses the failure of the SRVs to close after passing liquid. The discussion should include consequences of the failure, how/if the failure is modeled, and a justification for the failure to close probabilities used, including a justification for the assumption that the SRVs will work absent of testing, or

- iii. As an alternative to ii., justify, quantitatively, that the 10 CFR 50.69 categorization results are not sensitive to the assumption or SRV failure modes addressed in items i and ii above.

d) Turbine success while passing liquid

- Attachment 6 (page 76) of the LAR states that a steam turbine similar to the reactor core isolation cooling (RCIC) and high-pressure coolant injection (HPCI) turbines was tested with a slug of water and found to run successfully. The LAR states that based on this information, the licensee assigned a nominal failure to provide a slight conservative bias for this failure mode. However, the licensee does not provide a justification showing why a single test on another turbine is sufficient to support the assumption that RCIC and HPCI turbines may continue running after passing liquid. In addition, the licensee does not provide information describing what nominal failure probability value the licensee assigned to this failure mode and why the licensee considered the nominal probability to be conservative. Provide the following:

- i. A discussion describing whether the RCIC and HPCI turbines were designed to continue running after passing liquid. If the RCIC and HPCI turbines were designed to continue running while and after passing liquid, then discuss whether these conditions encompass the conditions that would occur in the accident scenarios for which these turbines were credited (which appears to include instances in which there is continuous flow of water for the scenario).
- ii. A justification for the nominal failure probability assigned to the failure of the RCIC and HPCI turbines to run after passing liquid, or
- iii. As an alternative to ii., if the RCIC and HPCI turbines were not designed to continue running while and after passing liquid for the conditions that would occur in the accident scenarios they were credited for in the PRA, quantitatively justify that the 10 CFR 50.69 categorization results are not sensitive to this assumption.

e) Loss of Net Positive Suction Head (NPSH)

- Attachment 6 (page 77) of the LAR states that loss of NPSH during certain events (e.g. loss-of-coolant accidents (LOCAs)) leads to the loss of the suppression pool as a cooling inventory source. The LAR explains, however, that this inventory is only needed if the residual heat removal (RHR) system cross-tie fails. The LAR also explains that the licensee assigned a nominal failure probability to provide a slight conservative bias. However, the licensee does not provide information describing the RHR cross-tie or the specific failure mode of the cross-tie. In addition, the licensee does not provide information describing what nominal failure

probability value is assigned to this failure mode and why the licensee considered the nominal probability to be conservative. Provide the following:

- i. A discussion describing how the RHR is cross-tied to provide a cooling option given loss of the suppression pool as a source of cooling inventory. Identify the specific failure mode that was assigned a nominal failure probability.
- ii. A justification for the nominal failure probability value, and why this value is valid for this failure mode, or
- iii. As an alternative to ii., justify, quantitatively, that the 10 CFR 50.69 categorization results are not sensitive to this assumption.

f) Low Intake Pond Level

- Attachment 6 (page 78) of the LAR states that in the unlikely event of low intake pond level, risk can be averted by reducing power levels prior to a plant trip or by tripping the circulating water pumps following a plant trip. The LAR states that nominal failure probabilities are assigned to derive the overall likelihood that the precursor events (based on plant experience) proceed to a totally unrecoverable type of event. Provide the following:

- i. Description and justification on how the nominal failure probabilities are derived, and the specific failure mode associated with the assigned probabilities.
- ii. Confirmation and description of the two operator actions cited above are proceduralized steps required to be taken when the intake pond level is low enough to fail this inventory source, or
- iii. As an alternative to ii., justify, quantitatively, that the 10 CFR 50.69 categorization results are not sensitive to this assumption.

g) HEP Dependency Analysis

- Attachment 6 (page 80) of the LAR identifies dependent Human Error Probability (HEP) values as a source of uncertainty and cites the sensitivity study on HEPs performed in accordance with Section 5 of NEI 00-04 as the disposition. Clarify how the sensitivity studies performed for HEPs will address HEP dependency uncertainty.

h) Pipe Rupture due to Water Hammer

- Attachment 6 (page 82) of the LAR states that there is uncertainty associated with the success of RHR when the reactor is in suppression pool cooling mode because of the potential for a pipe rupture following a water hammer. The LAR states that the water hammer events and values utilized provide a reasonable approach. However the licensee does not describe nor justify the approach. Provide the following:

- i. A description of and a basis for the approach used to model the potential for pipe rupture in the RHR system following a water hammer while in suppression pool cooling mode or,
- ii. Justify, quantitatively, that the 10 CFR 50.69 categorization results are not sensitive to this treatment.

RAI 09 – Overall Categorization Process

Section 50.69(b)(2)(i) requires that a licensee's application contain a description of the process for SSC categorization. The discussion in Section 3.1.1 of the LAR does not provide enough information for the NRC staff to clearly understand the sequence of evaluations in the categorization process, what information the licensee will develop and use, and what guidance the licensee will follow for the Integrated Decision-making Panel (IDP) decision-making process during the categorization of each system. Information on the training and expertise of the IDP team is provided in the LAR and need not be repeated in response to this RAI. Provide the following:

- a) Summarize, in the order they will be performed, the sequence of elements or steps that the licensee will follow for each system that will be categorized. A flow chart, such as that provided in the September 6, 2017 public meeting with Nuclear Energy Institute (NEI) (ADAMS Accession No. ML17249A072) regarding 10 CFR 50.69 License Amendment Requests may be provided instead of a description. The public meeting summary is available at ADAMS Accession No. ML17265A020. The steps should include:
 - i. The input from all PRA evaluations such as use of the results from the IEPRA, internal flooding, and FPRAs;
 - ii. The input from non-PRA approaches (seismic, other external events, and shutdown);
 - iii. The input from the responses to the seven qualitative questions in Section 9.2 of NEI 00-04;
 - iv. The input from the defense-in-depth (DID) matrix;
 - v. The input from the passive categorization methodology.
- b) In description to item (a) above, please clarify the difference between "preliminary high-safety significance (HSS)" and "assigned HSS" and identify which inputs can, and which cannot, be changed from preliminary HSS to low-safety significance (LSS) by the IDP. Confirm that the proposed approach is consistent with the guidance in NEI 00-04, as endorsed by RG 1.201.
- c) In description to item (a) above, please clarify which steps of the process are performed at the function level and which steps are performed at the component level. Describe how the categorization of the component impacts the categorization of the function, and vice-versa. Describe instances in which the final safety significance of the function would differ from the safety significance of

the component(s) that support the function, and confirm that the proposed approach is consistent with the guidance in NEI 00-04 as endorsed by RG 1.201.

- d) Section 7 of NEI 00-04 states that if any SSC is safety significant, from either the PRA-based component safety significance assessment (Section 5) or the DID assessment (Section 6), then the associated system function is of preliminary safety significance. The cited guidance applies to all aspects identified in Sections 5 and 6 of NEI 00-04, including Section 5.3 through 5.5 dedicated to seismic, external hazards, and shutdown risk. If the licensee's categorization process differs from the guidance in Section 7 of NEI 00-04 cited above, where functions supported by any HSS component(s) will be assigned HSS, describe and justify the approach.
- e) The industry flow chart presented by NEI at the September 6, 2017 public meeting shows that the passive categorization would be undertaken separately from the active categorization.
 - i. Explain how the results from the passive categorization will be integrated with the overall categorization results.
 - ii. If the results from the passive categorization can be changed by the IDP, explain and justify the proposed approach.

RAI 10 – SSCs Categorization based on External Hazards

Sections 50.69(c)(1)(i) and (ii) require that a licensee's SSC categorization process consider results and insights from a plant-specific PRA that is of sufficient quality and level of detail to support the SSC categorization process, as well as determine SSC functional importance using an integrated, systematic process for addressing initiating events (internal and external), SSCs, and plant operating modes, including those not modeled in the plant-specific PRA. The guidance in NEI 00-04 provides one acceptable method for including external events in the categorization of each SSC. The information provided in the LAR is not sufficient for the NRC to determine if the licensee's proposed categorization process is consistent with the guidance in NEI 00-04. The specific hazards and requested information are as follows:

a) "Other" External Hazards

Section 3.2.4 of the LAR states that the categorization process will use screening results from the Individual Plant Evaluation of External Events (IPEEE), performed in response to GL 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities," for evaluation of safety significance related to the other external hazards and that all SSCs credited in other IPEEE external hazards are considered HSS. The use of "other" instead of a more precise description does not allow the NRC staff to compare the license's proposed process with the guidance in NEI 00-04. Provide the following:

- i. Identify the external hazards that will be evaluated according to the flow chart in Figure 5-6 of NEI 00-04.
- ii. Identify which hazards will have all SSCs credited and considered HSS instead of using the flow chart.

- iii. A description of, and justification for, any additional method(s) different from (i) or (ii) above that the licensee will use to evaluate individual SSCs against “other” external hazards and identify the hazards that the licensee will evaluate with these methods.
- iv. Confirm that all hazards not included in the categorization process in response to (i), (ii), or (iii) above will be considered insignificant for every SSC and therefore will not be considered during the categorization process.

b) External Flooding

Figure 5-6 of NEI 00-04 shows that if a component is included in a screened scenario, then in order for that component to be considered a candidate LSS, the licensee has to show that if the component was removed, the screened scenario would not become unscreened. Attachment 4 of the LAR indicates that the licensee screens external flooding hazards out of the 10 CFR 50.69 process. The LAR states that flooding from rivers and streams (precipitation based), and dam failure are bounded by the current licensing basis (CLB) and do not pose a challenge to the plant, and that flooding from local intense precipitation is not bounded by the current licensing basis. However, the licensee does not provide any information describing SSCs, if any, that are included in the screening. Provide the following:

- i. A discussion identifying SSCs, if any, that are credited in the screening of external flooding, including passive and/or active components
- ii. A discussion explaining how the licensee will apply the guidance in Figure 5-6 of NEI 00-04 to any SSCs that are credited for screening of external flooding.

c) High Winds

Figure 5-6 of NEI 00-04 shows that if a component is included in a screened scenario, then in order for that component to be considered a candidate LSS, the licensee has to show that if the component was removed, the screened scenario would not become unscreened. Attachment 4 of the LAR states that the licensee screens out the extreme wind or tornado hazard on the basis that the frequency of damage to the exposed components is estimated to be less than 1E-6/year. However, the licensee does not provide any information describing the SSCs, if any, that are included in the screening. Provide the following:

- i. A discussion identifying the SSCs, if any, that are credited in the screening of extreme wind and tornados, including passive and/or active components.
- ii. A discussion explaining how the licensee will apply the guidance in Figure 5-6 of NEI 00-04 to any SSCs that are credited for screening of extreme wind and tornados.
- iii. Explain how the discussion in items (i) and (ii) above would be impacted by the current effort to assess tornado missile protection hazard in response to RIS 2015-06 “Tornado Missile Protection,” (ADAMS Accession No. ML15020A419).

RAI 11 – Shutdown Risk

Section 50.69(c)(1)(ii) requires that a licensee's SSC categorization process determine SSC functional importance using an integrated, systematic process for addressing initiating events (internal and external), SSCs, and plant operating modes, including those not modeled in the plant-specific PRA. Section 3.2.5 of the LAR states that the 10 CFR 50.69 categorization process will use the shutdown safety management plan described in NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," (ADAMS Accession No. ML14365A203), for categorization of safety significance related to low power and shutdown conditions. However, the LAR does not cite the other categorization criteria listed in NEI 00-04 Section 5.5 pertaining to shutdown events (e.g., DID attributes, failures that would initiate a shutdown event). Clarify and provide a basis for how the categorization of SSCs will be performed for shutdown events, and how it is consistent with the guidance in NEI 00-04, as endorsed by RG 1.201.

RAI 12 – Qualitative Assessments

When classifying SSCs according to risk significance, 10 CFR 50.69(c)(1)(ii) states that a licensee must determine SSC functional importance using an integrated, systematic process for addressing initiating events (internal and external), SSCs, and plant operating modes, including those not modeled in the plant-specific PRA. The functions to be identified and considered include design bases functions and functions credited for mitigation and prevention of severe accidents. The systematic process outlined in NEI 00-04 includes qualitative assessment questions to assist the IDP in determining whether functions/SSCs identified as candidate LSS that are implicitly depended upon to maintain safe shutdown capability, prevention of core damage and maintenance of containment integrity. The staff notes that, unlike the DID assessment outlined in Section 6 of NEI 00-04, the qualitative questions for the IDP in Section 9 are not limited to design-basis events.

To address the requirements in 10 CFR 50.69(c)(1)(ii), describe and justify, with an example, such as FLEX functions, how the severe accident functions will be considered during the categorization process, including discussion on how each of the seven qualitative questions in Section 9 of NEI 00-04 would be applied to those functions.

RAI 13 – Interfacing SSCs

On January 31, 2018, the NRC staff observed the deliberations of the IDP for the RHR System. The staff observed that the RHR categorization process appeared to categorize RHR functions/SSCs that interfaced with other systems that have not yet been categorized, such as the Automatic Depressurization System (ADS) and Core Spray System. The guidance in Section 4 of NEI 00-04 states that a candidate LSS SSC that supports an interfacing system should remain uncategorized until all interfacing systems are categorized.

- a. Confirm that the guidance in NEI 00-04 will be followed and that any functions/SSCs that serve as an interface between two or more systems will not be categorized until the categorization for all of the systems that they support is completed, or otherwise justify your proposed approach.

- b. Confirm that the item in a. above will be captured in the 50.69 categorization procedures.

RAI 14 – F&O Closeout Process

- Section 50.69(b)(2)(iii) of 10 CFR requires that the results of the peer review process conducted to meet 10 CFR 50.69 (c)(1)(i) criteria be submitted as part of the LAR. On January 31 and February 1, 2018, the NRC staff performed an audit of the 50.69 categorization process, including a review of the revised F&O Closure Review Report and the revised PRA Technical Adequacy Evaluation Report. The staff noticed several inconsistencies between the information provided in the revised F&O closure report and the revised PRA technical adequacy evaluation, as compared to the information provided in the LAR and LAR supplement. Examples of the discrepancies include 1) Peer review F&Os not included in the LAR that were not addressed in the F&O closure report, and 2) open F&Os listed in the F&O closure report that were not provided in the LAR.

Provide the following:

- a. An explanation of how the F&Os were selected for the F&O closure process and how/why that differs from those provided in the LAR.
- b. Because the scope of the 10 CFR 50.69 categorization process is so broad, all open F&Os may potentially be relevant to this LAR and could have an impact on the 10 CFR 50.69 categorization results. Provide any outstanding F&Os that have not been closed by the F&O closure review and have not been provided in the LAR. For each F&O include:
 - i. The complete F&O description, the peer review team recommendation, the licensee's resolution, or disposition for the application, and the F&O closure team assessment, if applicable.
 - ii. The licensee's documented justification supporting the classification of each F&O finding resolution for open F&Os as either a PRA "upgrade" or PRA "maintenance update", as defined in the ASME/ANS RA-Sa-2009 PRA Standard endorsed by RG 1.200, Revision 2.

RAI 15 – Passive Component Categorization

LAR Section 3.1.2 stated that for the categorization of passive components and the passive function of active components, the licensee 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, dated April 22, 2009 (ADAMS Accession No. ML090930246). The LAR further states that this methodology will be

applied to determine the safety significance of Class 1 SSCs.

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.

The LAR does not justify how the ANO-2 methodology can be applied to Class 1 SSCs and how sufficient DID 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 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.

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