NRR-DMPSPEm Resource

From: Galvin, Dennis
Sent: Thursday, September 20, 2018 12:48 PM
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Subject: Brunswick Draft RAIs – LAR to Allow Implementation of the Provisions 10 CFR 50.69 (EPID L 2018-LLA-0008)
Attachments: Brunswick 50.69 Draft RAIs L-2018-LLA-0008 2018-09-20.pdf

Mr. Zaremba,

By letter dated January 10, 2018 (Agencywide Documents Access and Management System Accession No. ML18010A344), Duke Energy Progress, LLC (the licensee) submitted a license amendment request (LAR) for Brunswick Steam Electric Plant Unit Nos. 1 and 2 (Brunswick). The proposed amendment would modify the licensing basis to allow for the implementation of the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.69, "Risk-informed categorization and treatment of structures, systems, and components for nuclear power plants," and provide the ability to use probabilistic risk assessment (PRA) models, namely the internal events PRA, internal flooding PRA (IFPRA), internal fire PRA (FPRA), high winds PRA (HW PRA), and external flooding PRA (XF PRA) for the proposed 10 CFR 50.69 categorization process.

To complete its review, the NRC staff has prepared the attached requests for additional information (RAIs) in DRAFT form. Please submit your response to these RAIs within 30 days of this email. If you need a clarification call for the attached draft RAIs, or if you need to change the due date for the RAI responses, please contact me at (301) 415-6256.

Respectfully,

Dennis Galvin
Project Manager
U.S Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Operating Reactor Licensing
Licensing Project Branch 2-2
301-415-6256

Docket No. 50-325, 50-324

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REQUESTS FOR ADDITIONAL INFORMATION

RELATED TO LICENSE AMENDMENT REQUEST TO ADOPT 10 CFR 50.69,

"RISK-INFORMED CATEGORIZATION AND TREATMENT OF STRUCTURES, SYSTEMS,

AND COMPONENTS FOR NUCLEAR POWER REACTORS"

DUKE ENERGY PROGRESS, LLC

BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2

DOCKET NOS. 50-325 AND 50-324

1.0 BACKGROUND

By letter dated January 10, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18010A344), Duke Energy Progress, LLC (Duke Energy, the licensee), submitted a license amendment request (LAR) for Brunswick Steam Electric Plant (BSEP), Units 1 and 2. The proposed amendment would modify the licensing basis to allow for the implementation of the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.69, "Risk-informed categorization and treatment of structures, systems, and components for nuclear power plants," and provide the ability to use probabilistic risk assessment (PRA) models, namely the internal events PRA, internal flooding PRA (IFPRA), internal fire PRA (FPRA), high winds PRA (HW PRA), and external flooding PRA (XF PRA) for the proposed 10 CFR 50.69 categorization process.

Regulatory Guide (RG) 1.201, Revision 1, "Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants According to their Safety Significance," May 2006 (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 [Structure, System, and Component] Categorization Guideline," July 2005 (ADAMS Accession No. ML052910035), as one acceptable method for use in 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," February 2004 (ADAMS Accession No. ML040630078), which endorses industry consensus PRA standards, as the basis against which peer reviews evaluate the technical acceptability of a PRA. Revision 2 of RG 1.200 issued March 2009 is available at ADAMS Accession No. ML090410014.

Section 3.1.1 of the LAR states that Duke Energy 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 U.S. Nuclear Regulatory Commission (NRC) staff to determine if the licensee has implemented the guidance appropriately in NEI 00-04, as endorsed by RG 1.201, as a means to demonstrate compliance with all of the requirements in 10 CFR 50.69, including technical adequacy of the PRA models. The NRC staff requests additional information (RAI) for the following areas in order to complete its assessment.

2.0 REQUEST FOR ADDITIONAL INFORMATION

PRA RAI 1 – Open/Partially Open Findings in the Process of Being Resolved

Section 4.2 of RG 1.200 states, in part, that the LAR should include:

A discussion of the resolution of the peer review facts and observations (F&Os) that are applicable to the parts of the PRA required for the application. This discussion should take the following forms:

- A discussion of how the PRA model has been changed, and

- A justification in the form of a sensitivity study that demonstrates the accident sequences or contributors significant to the application decision were not adversely impacted (remained the same) by the particular issue.

Attachment 3 of the LAR, "Disposition and Resolution of Open Peer Review Finding and Self-assessment Open Items," provides F&Os and self-assessment findings that are still open or partially resolved following the August 2017 F&O closure review. Also, F&O descriptions and their dispositions were previously provided to the NRC in the LAR dated December 21, 2015 (ADAMS Accession No. ML16004A249) to adopt Technical Specification Task Force (TSTF)-425, "Relocate Surveillance Frequencies to Licensee Control – Risk Informed Technical Specifications Task Force (RITSTF) Initiative 5b" (ADAMS Accession No, ML090850642), and in the LAR dated September 25, 2012 (ADAMS Accession No, ML12285A428) to adopt National Fire Protection Association Standard 805. For a number of F&O dispositions, there is insufficient information for NRC staff to conclude that the F&O is sufficiently resolved for this application.

a. Internal events F&O 1-19 pertaining to component failure data. This F&O description states that the component failure data values documented in BNP-PSA-049 were developed during a previous PRA update and that some values may need to be updated to be consistent with changes in the Level 1 PRA data. The licensee's disposition states that "[o]nly 4 events were found and all of them had either a [Fussell-Vesely (FV)] in the x10-3 range or a [Risk Achievement Worth (RAW)] of 1. Because of the small number of events that could have a need to be updated but were not, the relatively low value of FV for three of the retained events, and the relatively low RAW value on the remaining event, the effect on 50.69 applications is negligible." The response does not clarify how it was determined what events might need to be updated, only that there were four events identified. Furthermore, the SSC will be low safety significant (LSS) if the RAW<2 AND the FV< 0.005, but the conclusion that updates were not needed seems to be based on the argument the RAW OR the FV is low.

    1. Clarify how the check was performed to determine if any data needed to be updated including how the conclusion was reached that "only 4 events were found."

    2. Provide the RAW and FV of the four events, and some indication of the change in the failure likelihood expected from a data update. Based on the data provided, indicate the expected changes to the RAW and FV values.

    3. Alternatively, propose a mechanism that ensures F&O 1-19 will be resolved prior to implementation of the 10 CFR 50.69 categorization process. This mechanism should

also provide an explicit description of changes that will be made to the PRA model or documentation to resolve this issue.

b. Internal events F&O 3-6 pertaining to human reliability analysis (HRA). This F&O description notes a specific issue related to the HRA calculation for event OPER-DCDG, specifically, no execution failure probabilities were assigned to the tasks of starting and connecting the diesel generator (DG). Additionally, the calculation may not have considered all of the necessary breaker manipulations. The licensee's resolution states that the standard is met and this is an opportunity for enhancement to the documentation and does not affect the core damage frequency (CDF) or the risk metrics. However, the licensee's resolution did not directly address this specific issue, which does not appear to be just a documentation issue. Explain how the finding concerning OPER-DCDG was resolved and clarify if the model of record (MOR) has been updated to incorporate this resolution.

c. Internal flooding F&O IFSN-A8 pertaining to the effects of expansion joint failures. The F&O description notes that no propagation from gaskets or expansion joints was modeled in the IFPRA. The licensee's disposition states that the circulating expansion joints are not risk significant to the BSEP IFPRA risk as circulating water piping does not contribute a significant amount to CDF/large early release frequency (LERF) and circulating water expansion joint ruptures represent a small portion of the total rupture frequency for IFPRA. Although this modeling exclusion may have a small impact on the total risk, its inclusion could potentially increase the risk importance values for certain system components above the threshold criteria for determining high safety significance (HSS).

    1. Justify that the circulating expansion joint modeling exclusion cited above does not impact the results of the 10 CFR 50.69 categorization process.

    2. Alternatively, propose a mechanism that ensures F&O IFSN-A8 will be resolved prior to implementation of the 10 CFR 50.69 categorization process. This mechanism should also provide an explicit description of changes that will be made to the PRA model or documentation to resolve this issue.

d. Internal events F&O QU-C2-1 pertaining to human reliability analysis. The F&O description indicates that some joint human failure events (JHFEs) may be assigned a floor value of 1E-6, and suggested that these cutsets be evaluated to determine the appropriateness of this value. In contrast, the reported disposition states "in examining the top 95% cutsets, there were some cutsets with 5 and 6 human error probabilities (HEP) events that were not explicitly analyzed for dependencies." It is not clear whether "not explicitly analyzed" means the floor value was assigned, or there was no justification of a result that was less than a floor value.

    For performing HRA dependency analysis, NUREG-1921, "EPRI [Electric Power Research Institute]/NRC-RES Fire Human Reliability Analysis Guidelines - Final Report," July 2012 (ADAMS Accession No. ML12216A104), discusses the need to consider a minimum value for the joint probability of multiple HFEs, and refers to NUREG-1792, "Good Practices for Implementing Human Reliability Analysis (HRA)," April 2005 (ADAMS Accession No. ML051160213) (Table 2-1), which recommends joint human error probability (JHEP) values should not be below 1E-5. Table 4-3 of EPRI Technical Report 1021081, "Establishing Minimum Acceptable Values for Probabilities of Human Failure Events," October 2010, provides a lower limiting value of 1E-6 for sequences with a very low level of dependence. Therefore, the available guidance provides for assigning joint HEPs that are

less than a minimum value but only through assigning proper levels of dependency. Cutsets with JHEP values less than the minimum value should be individually reviewed for timing, cues, etc. to check the dependency between all the operator actions in the cutset.

Consistent with the guidance, please confirm that, for JHEP values below 1E-5 in the FPRA models, and for JHEP values below 1E-6 in the internal events PRA, the justification for these values have been documented.

e. Internal flooding F&O IFEV-A5 pertaining to internal flood pipe break frequencies. The F&O description states that a new methodology was applied to use pipe length, and flood and major flood frequency based on diameter and flow rate and that the analysis only applied major flood frequencies to large pipe, omitting flood frequency from large pipe which is the dominant frequency. In addition, the description notes that the break frequencies used in the calculation are applied incorrectly in the analysis. The licensee's disposition states that since the flooding frequency data in the calculation and the EPRI data have different pipe size breakpoints, the pipe size intervals were adjusted to match. The corresponding frequencies were then adjusted by the ratio of new EPRI flood and major flood frequency to existing major flood frequency. The appropriate multiplier was then applied to each scenario based on pipe size and fluid system type. The licensee disposition does not address the use of a new method or the incorrect application of the break frequencies.

   The ASME/ANS RA-Sa-2009 Standard defines PRA upgrade as the incorporation into a PRA model of a new methodology or significant changes in scope or capability that impact the significant accident sequences or the significant accident progression sequences. Section 1-5 of Part 1 of ASME/ANS RA-Sa-2009 states that upgrades of a PRA shall receive a peer review in accordance with the requirements specified in the peer review section of each respective part of this Standard. Provide the following:

   1. A description of the proposed methodology and basis for determining the internal flood scenario initiating event frequencies. Include in this discussion the reference(s) for the methodology. If the methodology is modified from that described in the reference(s), include a summary of how the information and values in the reference is modified into the values used in the PRA.

   2. A discussion about how the new method is expected to affect the repair and replacement categorization methodology (passive categorization) summarized in the LAR.

   3. A discussion on whether the methodology used 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 new method is expected to affect the passive categorization methodology and the use of the methodology is considered a PRA "upgrade," then propose a mechanism to ensure that a focused-scope peer review of the upgrade and the disposition of any resulting F&Os to meet Capability Category II will be completed prior to implementing the 10 CFR 50.69 categorization process.

f. Fire F&O 1-34 pertaining to fire barrier failure probabilities. The F&O description notes that a screening value for rated barrier probability of 1E-2 was applied in the PRA and that this value may not be bounding depending on the features of the barrier. The licensee's disposition states that the 0.1 barrier failure probability was inappropriately applied for certain fire compartment combinations where the partitioning element was open and that it is

expected to have no more than a minimal impact on the 50.69 application. Although this incorrect modeling may have a small impact on the total risk, it could potentially increase the risk importance values for certain system components above the threshold criteria for determining HSS. Provide the following:

1. A justification that use of the incorrect fire barrier failure probability exclusion cited above does not impact the results of the 10 CFR 50.69 categorization process.

2. Alternatively, propose a mechanism that ensures F&O 1-34 will be resolved prior to implementation of the 10 CFR 50.69 categorization process. This mechanism should also provide an explicit description of changes that will be made to the PRA model or documentation to resolve this issue.

g. Internal fire F&O 4-1 pertaining to fire severity factors. The licensee's disposition states that the treatment of motor control centers (MCCs) is not in accordance with FAQ 14-0009, "Treatment of Well Sealed MCC Electrical Panels Greater than 440V," October 2014 (ADAMS Accession No. ML15118A810), and that in lieu of an accepted generic method, BSEP used the analysis method piloted at HNP [Harris Nuclear Plant], but that the impact on the 50.69 application is expected to be small. However, though this modeling may have a small impact on the total risk, its inclusion could potentially increase the risk importance values for certain system components above the threshold criteria for determining HSS.

   1. Justify that the modeling of MCCs cited above as opposed to using the accepted FAQ 14-0009 modelling does not impact the results of the 10 CFR 50.69 categorization process.

   2. Alternatively, propose a mechanism that ensures F&O 4-1 will be resolved prior to implementation of the 10 CFR 50.69 categorization process. This mechanism should also provide an explicit description of changes that will be made to the PRA model or documentation to resolve this issue.

h. Internal fire F&O 6-4 pertaining to fire barrier failure for multi-compartment analysis. The F&O description describes issues with calculating failure probability of passive fire barriers in the multi-compartment analysis. The disposition is incomplete and, as a result, the NRC staff is unable to assess the disposition to this F&O and the licensee's conclusion that it has "no more than a minimal impact."

   1. Clarify the disposition of this F&O.

   2. If the disposition does not update the FPRA to resolve the F&O and meet Capability Category II for Supporting Requirement FSS-G4, provide justification that the resolution does not impact the results of the 10 CFR 50.69 categorization process. [The NRC staff notes that a small impact on the total risk could potentially increase the risk importance values for certain system components above the threshold criteria for determining HSS.]

   3. Alternatively, propose a mechanism that ensures F&O 6-4 will be resolved prior to implementation of the 10 CFR 50.69 categorization process. This mechanism should also provide an explicit description of changes that will be made to the PRA model or documentation to resolve this issue.

PRA RAI 2 – Qualitative Function Categorization

Table 3-1 of the LAR indicates that the evaluation of the seven qualitative criteria defined in Section 9.2 of NEI 00-04 is performed at the function level and prior to the Integrated Decision-making Panel (IDP). The LAR states that NEI 00-04 only requires the seven qualitative criteria to be completed for components/functions categorized as LSS. Table 3-1 of the LAR contains the entry "Allowable" at the intersection of the "IDP change HSS to LSS" column and "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/SSC against the remaining capability to perform the basic safety functions. Explain how the IDP will collectively assess the seven specific questions to identify a function/SSC as LSS as opposed to HSS including a clarification of the "Allowed" entry in LAR Table 3-1 and confirm that a negative answer to any of the seven questions would result in the function/SSC to be categorized as HSS.

PRA RAI 3 – Passive Component Categorization Process

Section 3.1.2 of the LAR states that passive components and the passive function of active components will be evaluated using 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 In-service Inspection Intervals," for Arkansas Nuclear One, Unit 2 (ANO-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.

This methodology has only 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 from Class 2 and Class 3 SSCs 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 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: (1) justification of the appropriateness of the numerical criteria for conditional core damage probability (CCDP) and conditional large early release probability (CLERP), used to assign used to assign 'High', 'Medium', and 'Low' safety significance to these loss-of-coolant initiating events; (2) identification and justification of the adequacy of the additional qualitative considerations to assign 'Medium' safety significance (based on the CCDP and CLERP) to 'High' safety significance; (3) justification for crediting operator actions for success and failure of pressure boundary; (4) guidelines and justification for selecting the appropriate break size (e.g., double-ended guillotine break or smaller break); and (5) include supporting examples of types of Class 1 SSCs that would be assigned low safety significance, etc.

As mentioned in the March 13, 2018, meeting summary for 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 dated December 17, 2014 (ADAMS Accession No. ML14237A034).

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.

PRA RAI 4 – Identifying Key Assumptions and Uncertainties that could Impact the Application

Section 3.2.7 of the LAR states that the detailed process of identifying, characterizing and qualitative screening of model uncertainties is found in Section 5.3 of NUREG-1855, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making," March 2009 (Revision 0) (ADAMS Accession No. ML090970525), and Section 3.1.1 of EPRI Technical Report (TR)-1016737. The NRC staff notes that one of these sources has been superseded by a revision (Revision 1 of NUREG-1855, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decisionmaking," March 2017 (ADAMS Accession No. ML17062A466), which references the updated EPRI guidance TR-1026511, "Practical Guidance on the Use of PRA in Risk-Informed Applications with a Focus on the Treatment of Uncertainty" (2012)).

Attachment 6 of the LAR, "Disposition of Key Assumptions/Sources of Uncertainty," contains nine assumptions/uncertainties from five PRA models, whereas industry guidance documents such as NUREG-1855, Revision 1, and EPRI TR-1026511 address a large number of potential assumptions and uncertainties. For example, one fire modeling assumption/uncertainty (page 56) in the LAR is provided as a source of uncertainty, compared to the 2012 EPRI document, which identifies 71 potential sources of uncertainty. There appear to be no uncertainties or assumptions associated with LERF and internal flooding, and one source that relates to both high winds and external flooding.

The LAR continues, "[t]he list of assumptions and sources of uncertainty were reviewed to identify those which would be significant for the evaluation of this application. Only those assumptions or sources of uncertainty that could significantly impact the risk calculations were considered key for this application."

The NRC staff notes that Stage F of NUREG-1855 (Revision 1) provides guidance on how to identify key sources of uncertainty relevant to the application.

Provide the following:

a. A summary of the process used to determine the nine sources of uncertainties and assumptions presented in Attachment 6 of the LAR. Include in this discussion an explanation of how the process is in accordance with NUREG-1855, Revision 1, or other NRC-accepted method. Also, include in the discussion a detailed description of how the final set of nine uncertainties and assumptions were developed from the initial comprehensive list of PRA model(s) uncertainties and assumptions.

b. If the process of identifying key sources of uncertainty or assumptions for these PRA models was not done in accordance with NUREG-1855, provide the results of an updated assessment of key sources of uncertainty or assumptions.

c. A description of the specific assumptions and sources of uncertainty key to this application for the entries in LAR Attachment 6 in enough detail that their impact on the application can be clearly understood and that a specific sensitivity could be defined to examine the risk significance of the issue. Include in this description for any new sources of uncertainty or assumptions identified in Part b.

PRA RAI 5 – Key Assumptions and Uncertainties that could Impact the Application

The licensee's dispositions for key assumptions and modeling uncertainties are presented in Attachment 6 of the LAR. Attachment 6 (page 56) of the LAR states that the GOTHIC analysis for switchgear HVAC requirements is not a bounding case and shows only one of eight HVAC fans needed for room cooling. However, in the disposition for this assumption/uncertainty, the licensee states that screening of HVAC for switchgear rooms needs to consider the level of detail in the GOTHIC analysis. The NRC staff is unclear if HVAC support has been screened from the model or the success criterion modeled is one of eight fans. Provide the following:

a. A clarification of the actual modeling of HVAC support of the switchgear rooms and specify the assumption/uncertainty related to this modeling choice.

b. Justification that the specific assumption/uncertainty does not impact the results of the 10 CFR 50.69 categorization process.

c. Alternatively, ensure that the assumption/uncertainty resolution is incorporated into the PRA prior to implementation of the 10 CFR 50.69 risk categorization process.

PRA RAI 6 –Feedback and Adjustment Process

Section 11.2, "Following Initial Implementation," of NEI 00-04 discusses that "a periodic update of the plant PRA may affect the results of the categorization process. If the results are affected, the licensee must make adjustments as necessary to either the categorization or treatment processes to maintain the validity of the processes." Specifically, NEI 00-04, Section 12.1 discusses cases for which, in some instances, an updated PRA model could result in new risk achievement worth (RAW) and Fussell-Vesley (FV) importance measures that are sufficiently different from those in the original categorization so as to suggest a potential change in the categorization. Provide the following:

a. Explain how this periodic review will be administered. At minimum, discuss the following:

    1. Participants involved in the review;

    2. Sources of material identified to be reviewed;

    3. Periodicity for when the review will be performed;

    4. Documentation of the review performed (e.g., corrective action program, engineering evaluation, etc.); and

b. Provide the criteria to be used to determine if the change being reviewed has any impact to a modeled PRA hazard(s) and/or any SSC categorized by the 50.69 process.

PRA RAI 7 – SSCs Categorization Based on Other External Hazards

Section 3.2.4 of the LAR states:

> As part of the categorization assessment of other external hazard risk, an evaluation is performed to determine if there are components being categorized that participate in screened scenarios and whose failure would result in an unscreened scenario. Consistent with the flow chart in Figure 5-6 in Section 5.4 of NEI 00-04, these components would be considered HSS.
>
> All remaining hazards were screened from applicability and considered insignificant for every SSC and, therefore, will not be considered during the categorization process.

The last sentence implies that the assessment has been completed and concludes that all other external hazards will never need evaluation during categorization. The individual plant examination of external events (IPEEE) screening process did not include the additional step illustrated in Figure 5-6 in Section 5.4 of NEI 00-04. Figure 5-6 and its associated text states that an evaluation is performed to determine if there are components being categorized that participate in screened external event scenarios whose failure would result in an unscreened scenario.

Please clarify how the screening criteria in LAR Attachment 5, "Progressive Screening Approach for Addressing External Hazards," satisfy the guidelines that HSS will be assigned to SSCs whose failure would cause a screened external event scenario to become unscreened.

PRA RAI 8 – Addition of FLEX to the PRA Model

In order to ensure efficiency in its reviews and prevent duplicate reviews of a licensee's PRA technical acceptability, the NRC staff may utilize PRA information from the licensee's previous risk-informed submittals. In the course of its review for this LAR, the staff utilized information from response to RAI 9 of the "Brunswick Steam Electric Plant, Unit Nos. 1 and 2 Request for Risk-Informed Exigent License Amendment - Technical Specification 3.8.1, AC Sources – Operating, One-Time Extension of Emergency Diesel Generator Completion Times and Suspension of Surveillance Requirements," dated December 6, 2017 (ADAMS Accession No. ML17340A457). The licensee indicated in the RAI response that FLEX diesel generators and other FLEX equipment, with associated operator actions, were credited in some of the PRA models used in the LAR evaluation.

There are several challenges to incorporating these new strategies into PRA models that need to be addressed. The NRC memorandum dated May 30, 2017, "Assessment of the Nuclear Energy Institute 16-06, 'Crediting Mitigating Strategies in Risk-Informed Decision Making,' Guidance for Risk-Informed Changes to Plants Licensing Basis" (ADAMS Accession No. ML17031A269), provides the NRC's staff assessment of challenges to incorporating FLEX equipment and strategies into a PRA model in support of risk-informed decision making in accordance with the guidance of RG 1.200.

Provide the following information in the context of both the internal and external hazard PRA models credited in the licensee's 10 CFR 50.69 application:

a. A discussion detailing the extent of incorporation, i.e. summarize the supplemental equipment and compensatory actions, including FLEX strategies that have been quantitatively credited for each of the PRA models used to support this application.

b. A discussion detailing the methodology used to assess the failure probabilities of any modeled equipment credited in the licensee's mitigating strategies (i.e., FLEX). The discussion should include a justification explaining the rational for parameter values, and whether the uncertainties associated with the parameter values are considered in accordance with the ASME/ANS PRA Standard as endorsed by RG 1.200.

c. A discussion detailing the methodology used to assess operator actions related to FLEX equipment and the licensee personnel that perform these actions. The discussion should include:

    1. A summary of how the licensee evaluated the impact of the plant-specific HEPs and associated scenario-specific performance shaping factors listed in (a)-(j) of supporting requirement HR-G3 of the ASME/ANS RA-Sa-2009 PRA standard.

    2. Whether maintenance procedures for the portable equipment were reviewed for possible pre-initiator human failures that renders the equipment unavailable during an event, and if the probabilities of the pre-initiator human failure events were assessed as described in HLR-HR-D of the ASME/ANS RA-Sa-2009 PRA standard.

    3. If the licensee's procedures governing the initiation or entry into mitigating strategies are ambiguous, vague, or not explicit, a discussion detailing the technical bases for probability of failure to initiate mitigating strategies.

d. The ASME/ANS RA-Sa-2009 Standard defines PRA upgrade as the incorporation into a PRA model of a new methodology or significant changes in scope or capability that impact the significant accident sequences or the significant accident progression sequences. Section 1-5 of Part 1 of ASME/ANS RA-Sa-2009 states that upgrades of a PRA shall receive a peer review in accordance with the requirements specified in the peer review section of each respective part of this Standard.

    1. Provide an evaluation of the model changes associated with incorporating mitigating strategies, which demonstrates that none of the following criteria is satisfied: (1) use of new methodology, (2) change in scope that impacts the significant accident sequences or the significant accident progression sequences, (3) change in capability that impacts the significant accident sequences or the significant accident progression sequences, OR

    2. Propose a mechanism to ensure that a focused-scope peer review is performed on the model changes associated with incorporating mitigating strategies, and associated F&Os are resolved to Capability Category II prior to implementation of the 10 CFR 50.69 categorization program.

PRA RAI 09 – Proposed License Condition

The guidance in NEI 00-04 allows licensees to implement different approaches, depending on the scope of their PRA (e.g., the approach if a seismic margins analyses is relied upon is different and more limiting than the approach if a seismic PRA is used). RG 1.201, Revision 1

states that “as part of the NRC's review and approval of a licensee's or applicant's application requesting to implement §50.69, the NRC staff intends to impose a license condition that will explicitly address the scope of the PRA and non- PRA methods used in the licensee's categorization approach.”

Section 2.3 of the LAR proposed the following License Condition:

> Duke Energy is approved to implement 10 CFR 50.69 using the processes for categorization of Risk-Informed Safety Class (RISC)-1, RISC-2, RISC-3, and RISC-4 SSCs specified in the license amendment request dated January 10, 2018. Prior NRC approval, under 10 CFR 50.90, is required for a change to the categorization process specified above (e.g., change from a seismic margins approach to a seismic probabilistic risk assessment approach).

The proposed license condition does not explicitly address the PRA and non-PRA methods that were used. Provide a license condition that explicitly address the approaches, e.g.:

> Duke Energy is approved to implement 10 CFR 50.69 using the processes for categorization of Risk Informed Safety Class (RISC)-1, RISC-2, RISC-3, and RISC-4 structures, systems, and components (SSCs) using: Probabilistic Risk Assessment (PRA) models to evaluate risk associated with internal events, including internal flooding, internal fire, external flooding, and high winds; the shutdown safety assessment process to assess shutdown risk; the Arkansas Nuclear One, Unit 2 (AN0-2) passive categorization method to assess passive component risk for Class 2 and Class 3 SSCs and their associated supports; and the results of non-PRA evaluations that are based on the IPEEE Screening Assessment for External Hazards, i.e., seismic margin analysis (SMA) to evaluate seismic risk, and a screening of other external hazards updated using the external hazard screening significance process identified in ASME/ANS PRA Standard RA-Sa-2009; as specified in Unit 1 and Unit 2 License Amendment No. [XXX] dated [DATE].
>
> Prior NRC approval, under 10 CFR 50.90, is required for a change to the categorization process specified above (e.g., change from a seismic margins approach to a seismic probabilistic risk assessment approach).

Note that if implementation items are identified, the license condition may need to be expanded to address them.

PRA RAI 10 – External Hazards Peer-Review Process

Section 10 CFR 50.69(c)(1)(i) requires that the 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. According to Section 3.3 of the Enclosure to the LAR, the BSEP HW PRA and XF PRA models were subject to a full-scope peer review in February 2012 against RG 1.200, Revision 2. Appendices B, C and D to RG 1.200, Revision 2, provide the NRC regulatory position on the peer review requirements in the peer review process in NEI 00-02, “Probabilistic Risk Assessment Peer Review Process Guidance” Revision 1, May 2006 (ADAMS Accession No. ML061510619), NEI 05-04, Process for Performing Internal Events PRA Peer Reviews Using the ASME/ANS PRA Standard," Revision 2, November, 2008 (ADAMS Accession No. ML083430462) and NEI 07-12, "Fire Probabilistic Risk Assessment (FPRA) Peer Review

Process Guidelines," Revision 1, June 2010 (ADAMS Accession No. ML 102230070). Section 2.2, “Industry Peer Review Program,” in RG 1.200, Revision 2, states that when “the staff’s regulatory positions contained in the appendices are taken into account, use of a peer review can be used to demonstrate that the PRA [with regard to an at-power Level 1/LERF PRA for internal events (excluding external hazards)] is adequate to support a risk-informed application.” Therefore, RG 1.200, Revision 2, does not endorse any peer review guidance for external hazards. Section 2.2 of RG 1.200, Revision 2, further states that “[a]n acceptable peer review approach is one that is performed according to an established process…” and the peer reviewers’ “technical expertise includes experience in performing (not just reviewing) the work in the element assigned for review.”

NEI 12-13, “External Hazards PRA Peer Review Process Guidelines” (ADAMS Accession No. ML12240A027), provides guidance for conducting and documenting peer-reviews of external hazard PRAs. The staff issued a letter accepting the use of NEI 12-13, as modified by the staff’s comments, in March 2018 (ADAMS Accession No. ML18025C025). Section 1.4 of NEI 12-13 states that the “on-site External Hazards PRA Peer Review is a one-week, tiered review” and that “[i]t is necessary to perform on-site walkdowns during an External Hazards PRA Peer Review to confirm the relationships between SSCs and the potential effects of an external hazard.” Section 2.2 of NEI 12-13, referring to the peer review team composition and qualifications, states that “[t]he intent is to ensure that there is more than one peer reviewer with experience in each key External Hazards PRA process” and “experience should have involved explicit development of the PRA technical area being reviewed.” The same section in NEI 12-13 also states that the peer review team “should have at least two utility participants” with specialized experience in the hazards being reviewed. Section 3.2 of NEI 12-13 describes the issues that should be identified by the review team as Unreviewed Analysis Methods (UAMs).

a. Provide details, including the source, for the peer review process and corresponding guidelines followed for the BSEP HW and XF PRA full-scope peer-reviews.

b. Discuss how the peer review, including the corresponding process and guidelines discussed in response to part (a), was consistent with NEI 12-13, as modified and accepted by the NRC, and justify deviations from that guidance. Features of the external hazards PRA peer review that should be discussed include the process and extent of walkdowns performed by the peer-review team, the duration of the on-site peer-review for each external hazard PRA, composition and qualification of the peer-review team as cited above from NEI 12-13, and identification of UAMs.

PRA RAI 11 – External Flooding Hazard Development – Storm Surge and Initiating Event Frequencies

RG 1.200, Revision 2, endorses, with staff clarifications and qualifications, the 2009 version of the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) PRA Standard (ASME/ANS RA-Sa-2009). High level requirement (HLRs) in Part 8 of the 2009 ASME/ANS PRA Standard, related to the external flooding technical element, specifically HLR-XFHA-A, calls for the use of site-specific probabilistic analysis to develop the hazard frequency and for the propagation of uncertainties in the model and parameter values to develop a family of hazard curves.

a. Discuss how the initiating event frequencies used in the XF PRA were developed. The discussion should include a description of (1) method(s) used, (2) input parameter selection such as precipitation events intensity and duration, storm surge flooding, stillwater levels,

wave runup, and other associated effects, (3) how data were selected for specific analysis including time periods and intensities, and (4) how parametric and modeling uncertainties were addressed to develop a family of hazard curves.

b. It appeared from the audit discussions that the method presented to support the technical acceptability of the flood hazard development for this application has not been peer-reviewed. Discuss and provide the results of a focused-scope peer-review, including the resolution of finding level Facts and Observations (F&Os) not closed using a NRC approved process, for the development of the initiating event frequencies that will be used in the XFPRA.

PRA RAI 12 – External Flood Hazard Development – Local Intense Precipitation and Screening

RG 1.200, Revision 2, endorses, with staff clarifications and qualifications, ASME/ANS RA-Sa-2009. Section 8-2 of the 2009 ASME/ANS PRA Standard indicates that certain flooding phenomena can be screened out using the screening methods in Part 6 of the cited PRA Standard. Part 6 of the 2009 ASME/ANS PRA Standard provides criteria for screening along with associated supporting requirements (SRs) and peer-review.

The summary of the staff's review of the licensee's reevaluated flood-causing mechanisms, included in the letter dated March 16, 2017 (ADAMS Accession No. ML17072A364), stated that the reevaluated flood hazard results for the local intense precipitation (LIP), streams and rivers, failure of dams and onsite water control/storage structures, storm surge, and tsunami flood-causing mechanisms were not bounded by the current design basis. Such flooding mechanisms may lead to flooding in excess of plant grade such that water impinges upon plant structures.

Further, use of the licensee's design basis to screen out certain flooding phenomena does not address the frequency of exposure to floods (including lower than the design basis flood) that may impinge upon SSCs and challenge plant safety, the impact of associated effects and the temporal characteristics of the event (e.g., the period of site inundation), and the risk associated with those floods.

a. In light of the above information, describe and justify the approach used for screening out any flooding mechanism from inclusion in the licensee's XF PRA. The descriptions should include justification for any credit taken for permanent, passive, or active flood protection features.

b. Describe, with justification, how LIP was considered in the licensee's XF PRA. Include discussion of precipitation event intensity and duration (with source of information), any hydrologic and hydraulic modeling, and elevations of LIP induced flooding that supported the consideration.

c. Identify and describe any topographic changes to the site that can invalidate prior analyses (e.g., Individual Plant Examination for External Events) for screening or mitigation of external flooding hazards.

PRA RAI 13 – High Winds Hazard Development

Discuss the approach followed for the development of hazard curves for the extreme winds, tornadoes, and hurricanes used in the BSEP HW PRA. For each hazard, the discussion should

include information on the (i) source(s) of data, (ii) the process used to develop the corresponding non-exceedance curves, (iii) consideration of uncertainties in parameter values, and (iv) the sources of model uncertainty and key assumptions.

PRA RAI 14 – Wind Generated Missile Hazard Development

Discuss the approach followed for the evaluation and development of wind-generated missile hazard for inclusion in the BSEP HW PRA. The discussion should include the approach used to (i) to identify and assess the number, type and location of potential missiles, and (ii) to determine the frequency of damage on individual SSCs from high-winds and tornado generated missiles. Justify any deviation(s) from NRC accepted methodology for determining the frequency of damage resulting from missiles generated by high-winds and tornadoes on individual SSCs and demonstrate the impact of identified deviation(s) on this application.

PRA RAI 15 – External Flood PRA Walkdowns

RG 1.200, Revision 2, endorses, with staff clarifications and qualifications, ASME/ANS RA-Sa-2009. Several SRs in Parts 7 (e.g. SR WFR-A1 and WPR-A10) and 8 (e.g. SR XFFR-A1, XFPR-A10, and XFPR-B1) of the 2009 ASME/ANS PRA Standard discuss the use of walkdowns in the development of the HW and XF PRAs.

Discuss the walkdowns performed to support the XF PRA including (i) composition of the walkdown team, (ii) approach taken to perform the walkdown citing any relevant guidance that was followed, (iii) whether any areas that could be impacted were not included in the walkdown based on flood protection features or barriers, and (iv) the salient results of the walkdown and their incorporation into the XF PRA.

PRA RAI 16 – Sufficient External Flooding Data Points to Capture Spectrum of Plant Response

RG 1.200, Revision 2, endorses, with staff clarifications and qualifications, ASME/ANS RA-Sa-2009. SR XFPR-B1 of the 2009 ASME/ANS PRA Standard calls for the assessment of accident sequences that are initiated by external flooding. Accident sequences in XF PRA models that are initiated by external flooding can vary depending on the flood elevation and the corresponding impact of SSCs and actions.

Describe how sufficient data points for the external flooding hazard were determined to capture the plant response at different flooding elevations.

PRA RAI 17 – External Flood and High Winds Key Assumptions and Sources of Uncertainty

Section 3.3.2, "Assessment of Assumptions and Approximations," of RG 1.200, Revision 2, states "[f]or each application that calls upon this regulatory guide, the applicant identifies the key assumptions and approximations relevant to that application. This will be used to identify sensitivity studies as input to the decision-making associated with the application." Further, Section 4.2, "Licensee Submittal Documentation," of RG 1.200, Revision 2, states that "[t]hese assessments provide information to the NRC staff in their determination of whether the use of these assumptions and approximations is appropriate for the application, or whether sensitivity studies performed to support the decision are appropriate." RG 1.200, Revision 2, defines the terms "key assumption" and "key source of uncertainty" in Section 3.3.2.

Section 3.2.7 of the Enclosure to the LAR cites certain references for the process of identifying model uncertainties but does not elaborate on the implementation by the licensee. The same section further states that key BSEP PRA model specific assumptions and sources of uncertainty for this application have been identified and dispositioned in Attachment 6 of the Enclosure. Item 9 in Attachment 6 of the Enclosure to the LAR states that the disposition for the uncertainty associated with the initiating event frequency of external events at extreme ranges "will be addressed as individual systems are categorized in this risk-informed application." The discussion for this item also states that "the Initiating Events for the very rare events is believe[d] to be assigned a frequency higher than actual."

a. Describe the approach used to identify and characterize the "key" assumptions and "key" sources of uncertainty in the licensee's HW and XF PRA models. The description should contain sufficient detail to identify: (i) whether assumptions and sources of uncertainty related to aspects of the hazard, fragility, and plant response analysis were evaluated to determine whether they were "key," and (ii) the criteria for determining whether the modeling assumptions and sources of uncertainty were considered "key."

b. Discuss how each key assumption and key source of uncertainty identified above was dispositioned for this application. If available, provide sensitivity studies that will be used to support the disposition for this application or use a qualitative discussion to justify why different reasonable alternative assumptions would not affect this application.

c. Provide clarification on the uncertainty associated with the initiating event frequency of external events at extreme ranges (Item 9 in Attachment 6 of the Enclosure) and describe how that uncertainty is dispositioned "as individual systems are categorized" for licensee's HW and XF PRA models.

d. Discuss why the licensee believes that the assigned frequencies are conservative (i.e., "higher than actual" as described by the LAR).

PRA RAI 18 – External Flooding PRA Finding Level Facts and Observations

Section 3.3 of the Enclosure to the LAR states that findings were reviewed and closed using the process documented in Appendix X to NEI 05-04, NEI 07-12, and NEI 12-13, "Close-out of Facts and Observations" as accepted by NRC by letter dated May 3, 2017 (ADAMS Accession No. ML17079A427). The licensee cites closure of findings for its internal events, internal flood, high winds, and fire PRA models.

a. Clarify whether the process cited above was applied to the licensee's XF PRA and discuss the results therefrom.

Attachment 3 of the Enclosure to the LAR provides the open peer review findings and their disposition by the licensee for this application. The following requests for information apply to the XF PRA F&Os and their corresponding resolutions in above mentioned attachment:

b. Finding XFPR-A11-1, related to SR XFPR-A11, stated that "there is no evaluation of the potential impact of external floods on system recoveries credited in the Level 1 PRA." The resolution discusses staging of personnel and re-evaluation of human reliability events and concludes that "changes made are enough to support…the 50.69 application." The discussion does not include sufficient detail to determine how environmental conditions and

flood protection failures were incorporated in the determination of HEPs and to support staff's review of the licensee's conclusion. Water, due to in-leakage from various doors, is expected at various locations and manipulations of electrical equipment under such conditions may prove dangerous or require guidance as well as availability of certain special equipment. Failure of credited flood protection features, such as sump pump(s), drain(s), and flood door(s), could prevent operators from performing their actions. Such considerations are expected to have an impact on the internal events HEPs via either execution time or other relevant performance shaping factors (PSFs).

In light of the above, discuss changes made to the XF PRA to resolve XFPR-A11-1 including discussion on consideration and inclusion of (i) the impacts of environmental conditions such as the presence or accumulation of water on the staged and unstaged operator actions, (ii) the flood protection or mitigation features credited in licensee's XF PRA, and (iii) the failures of flood protection or mitigation features that could prevent operators from performing their actions or achieve the desired level of protection.

c. Finding XFPR-A3-1, related to SRs XFPR-A3, -A5, -A8, and -A10, stated that assurance was needed that external flood-caused failures were modeled and that a systematic review of potential impacts of external flooding was performed. The resolution discusses documentation changes but does not provide information on the systematic review of the potential impacts of external flooding. External flood doors, internal drains, and sump pumps appear to be relied on to keep equipment from being inundated. It also is unclear whether random or flood induced failures of such features and components are considered in the licensee's XF PRA. Exclusion of such random or flood induced failures of credited flood protection features and components could underestimate the risk of external flooding events.

   Provide details of the systematic review performed including discussion on (i) the development of the list of SSCs or features required for external flood hazard mitigation, (ii) the selection of SSCs for inclusion in the XF PRA model, and (iii) the consideration of failures of flood protection features such as manually operated doors, water-tight doors, door seals, penetration seals, conduit seals, internal drainage systems, and sump pumps. Include discussion on how the licensee's resolution to the F&O addresses all the four SRs against which the finding is cited.

d. Finding XFPR-A7-1, related to SR XFPR-A7, called for the performance of an analysis of external hazard caused dependencies and correlations. The resolution states that the external flooding analysis does not model dependencies and correlations of equipment failure other than the effects from inundation and that the analysis has equipment failure correlated due to submergence. The resolution also cites inspections performed on the trash racks for debris accumulation. The note accompanying SR XFPR-A7 in the 2009 ASME/ANS PRA Standard indicates that it is vital to capture spatial and environmental dependencies among external flood caused failures and further states that external floods can affect multiple SSCs or a combination of SSCs at the same time. Further, Section 8-1.3 of the 2009 ASME/ANS PRA Standard mentions the importance of considering "rational probabilistic-based combinations" of external flooding phenomena. The resolution does not provide sufficient information to determine whether dependencies have been appropriately considered and included in the XF PRA model.

i. Provide details on and results from the approach used to identify, capture, or screen spatial and environmental dependencies that can affect multiple SSCs or a combination of SSCs in the XF PRA model.

ii. Discuss the approach used to consider probabilistic-based combinations of external flooding phenomena (e.g., wind driven LIP and wind driven storm surge) and their inclusion in the XF PRA model. Address any inconsistencies in modeling the failure of SSCs such as the Severe Accident Mitigation Alternatives (SAMA) diesel generator and the emergency diesel generator (EDG) exhaust between the licensee's XF and HW PRA models that are related to such combination of phenomena.

e. Finding XFPR-C2-1, related to SR XFPR-C2, stated that the documentation of the specific adaptions to the internal events PRA to produce the XF PRA was not performed. Since the documentation was unavailable at the time of the peer review, it appears that the peer reviewers did not have information necessary to determine whether the adaption of the internal events model was performed appropriately. Provide details of and basis for the specific adaptations that were made to the internal events model to develop the XF PRA.

PRA RAI 19 – High Winds PRA Initiating Event Identification

RG 1.200, Revision 2, endorses, with staff clarifications and qualifications, ASME/ANS RA-Sa-2009. SR WPR-A1 of the 2009 ASME/ANS PRA Standard calls for the inclusion of initiating events caused by high wind hazards that give rise to significant accident or accident progression sequences using a systematic process. The note accompanying the cited SR indicates the importance of thoroughly investigating site-specific wind-caused failure events including multiple-unit impacts and dependencies.

Describe the systematic process that was followed to determine the initiating events from the internal events model that would be included in the licensee's HW PRA. Include discussion on consideration of SSC failures that can result in initiators, spatial and environmental dependencies, multiple-unit impacts, and feedback from plant walkdowns as well as the outcome of the process.

PRA RAI 20 – Propagation of Changes in the Base Internal Events PRA to the High Winds and External Flooding PRAs

According to Sections 7-1.2 and 8-1.2 of the 2009 ASME/ANS PRA Standard it is assumed that a full-scope internal-events at-power Level 1, and Level 2 LERF, PRAs exist and that those PRAs are used as the basis for the HW and XF PRA. Therefore, the acceptability of the internal events PRA model used as the foundation for the XF and HW PRAs is an important consideration. Section 3.3 of the Enclosure to the LAR states that the internal events findings were reviewed and closed using the process documented in Appendix X to NEI 05-04, NEI 07-12, and NEI 12-13. However, the LAR does not provide information about the propagation of changes made to the internal events model for closing the finding level F&Os to the XF and HW PRAs.

a. Clarify whether changes made to the internal events model to resolve the corresponding finding level F&Os have been implemented in the XF and HW PRAs or justify not implementing the changes in the context of impact on this application.

b. Clarify and address any human actions or SSC functions credited in the internal events model that may have been included in the XF PRA but are incompatible with assumptions in the XF PRA. Examples include credit for control rod drive (CRD) injection and sump pumps, both of which rely on offsite power.

PRA RAI 21 – Inclusion of New Site-Specific Hazard and Plant Change Information in External Flooding and High Winds PRAs

Section 3.2.6 of the Enclosure to the LAR describes the licensee's PRA maintenance and update process and states that the process includes provisions for monitoring potential areas affecting the PRA models and for assessing the risk impact of unincorporated changes. Further, the licensee states that the assessment of the impact of the changes will be performed no longer than once every two refueling outages. The licensee's HW and XF PRAs use site-specific hazard information that can change during the implementation of the 10 CFR 50.69 program. The discussion of the licensee's PRA maintenance and update process does not include information about the consideration and inclusion of changes to the site-specific hazard information (e.g., occurrence frequencies).

a. Discuss how new information about the high winds and external flooding hazard will be identified, evaluated, and incorporated in the licensee's HW and XF PRAs that support this application during the implementation of the 10 CFR 50.69 program.

b. Discuss how plant changes will be evaluated for their impact on the licensee's HW and XF PRAs that support this application and subsequently incorporated in those PRAs during the implementation of the 10 CFR 50.69 program. Discuss whether the appropriate modeling inputs for the plant changes (e.g., high wind fragility) will be evaluated for inclusion in the XF and HW PRAs.

PRA RAI 22 – Importance Measure Calculation and Categorization of Non-Aligned Components

The categorization of SSCs using the licensee's HW and XF PRA models is expected to be based on importance measures and corresponding numerical criteria as described in Sections 5.1 and 5.3 of NEI 00-04. 10 CFR 50.69(c) provides requirements for the categorization process including determination of SSC functional importance. 10 CFR 50.69(1)(ii) states that "[t]he functions to be identified and considered include design bases functions and functions credited for mitigation and prevention of severe accidents." The discussion on "other external risks" in Section 1.5 of NEI 00-04 includes an example of the inclusion of importance measures arising specifically from the impact of an external hazard in the categorization process. Further, the discussion of integral importance measures in the same section states that "[e]ach risk contributor is initially evaluated separately…". Section 5.4 of NEI 00-04, while discussing the importance measure calculation for "other external hazards", states that "the risk importance process is slightly modified to consider the fact that plant components cannot initiate external events such a floods, tornadoes, and high winds" and does not exclude the impact of the external hazard from the importance measure development. Section 5.6 of NEI 00-04 discusses the "integral assessment" wherein the hazard specific importance measures are weighted by the individual hazard contribution to the plant risk.

a. Describe how the importance measures are determined from the HW and XF PRA models in the context of the 'binning' approach employed those models. Describe and justify how the

same basic events, which were discretized by binning during the development of the PRA, are then combined to develop representative importance measures. Further, discuss how they are compared to the numerical criteria, justify any impact on the categorization results, and describe how the approach is consistent with the guidance in NEI 00-04.

b. In the context of the "integral assessment" described in Section 5.6 of NEI 00-04, it is understood that importance evaluations performed in accordance with the process in NEI 00-04 are determined on a component basis. However, it is not apparent from the LAR and the NEI 00-04 guidance how the integrated importance measures are calculated for certain components where corresponding basic events, which represent different failure modes for a component, in the HW and XF PRA models may not align with basic events in other PRA models. Examples of such basic events include those that are specific to the HW and XF PRA model, including implicitly modeled components, or basic events that represent a subcomponent modeled within the boundary of an internal events PRA component.

   Provide details, with justification, of how the integrated importance measures will be calculated for HW and XF basic events that may not align directly with basic events in other PRA models. Include discussion on (i) any mapping that will be performed between HW and XF PRA basic events and those in other PRA models as well as cases where such mapping would be performed, and (ii) treatment of implicitly modeled components in the HW and XF PRA models in the categorization process.

PRA RAI 23 – Categorization Sensitivity Studies for High Winds and External Flooding PRAs

Section 5.4 of NEI 00-04 indicates that components can be identified as being safety significant following sensitivity studies. Section 5.4 also recommends the completion of several sensitivity studies, including any applicable sensitivity studies identified in the characterization of PRA acceptability.

a. Table 5-5 of NEI 00-04 identifies sensitivity studies for HW and XF PRAs and includes any applicable sensitivity studies identified in the characterization of PRA acceptability. Clarify whether the sensitivity analyses in Table 5-5 and those identified as part of PRA acceptability for HW and XF PRAs will be performed every time SSCs are categorized under 10 CFR 50.69.

b. The key assumptions and sources of uncertainties identified as part of the licensee's LAR may change as HW and XF PRA model updates could affect the significance of those assumptions for this application or create new key assumptions or sources of uncertainties. Describe how the licensee’s 10 CFR 50.69 program continues to evaluate assumptions and sources of uncertainty when the HW and XF PRA models are updated in the future and subsequently incorporates key assumptions and key sources of uncertainty in a sensitivity analysis that is performed consistent with the guidance in NEI 00-04.

PRA RAI 24 – Risk Sensitivity Study and Compliance with Requirements of 10 CFR 50.69(e)

The regulation 10 CFR 50.69(c)(1)(iv) requires that the categorization process includes evaluations that provide reasonable confidence that for SSCs categorized as RISC-3, any potential increase in CDF and LERF resulting from changes in treatment are small. The regulations 10 CFR 50.69(e)(2) and (3) require the licensee to monitor the performance of

RISC-1 and RISC-2 SSCs and consider the data collected for RISC-3 SSCs and make adjustments to the categorization or treatment processes so that the categorization process and results are maintained valid.

Section 8 of NEI 00-04 provides guidance on how to conduct risk sensitivity studies during the categorization process for all the preliminary LSS SSCs to confirm that the categorization process results in acceptably small increases to CDF and LERF. An example is provided in the guidance to increase the unreliability of all preliminary LSS SSCs by a factor of 3 to 5, which appears to address random failures. No explicit discussion of risk sensitivity studies for external hazard PRAs is provided in the guidance.

The categorization of SSCs using the external hazard PRAs is dominated by structural failure modes, which are dependent on the corresponding modeling inputs such as the 'dominant failure modes' and 'fragility curves'. These modeling inputs are derived using several parameters, including the SSC design, testing, and as-built installation, all of which can be impacted by alternative treatments.

Based on the preceding discussion,

a. Describe and justify how the required risk sensitivity study outlined in Section 8 of NEI 00-04 will be performed for categorization using the licensee's HW and XF PRA models to meet the requirements of 10 CFR 50.69(c)(1)(iv) and 10 CFR 50.69(b)(2)(iv).

b. Describe how it will be determined that the modeling inputs in the licensee's HW and XF PRA models and those used for the risk sensitivity study continue to remain valid to ensure compliance with the requirements of 10 CFR 50.69(e).