NRR-DMPSPEm Resource

From: Galvin, Dennis
Sent: Friday, December 21, 2018 3:05 PM
To: Arthur.Zaremba@duke-energy.com
Cc: Grzeck, Lee (Lee.Grzeck@duke-energy.com); Vaughan, Jordan L
Subject: Brunswick Draft 2nd Round RAIs – LAR to Allow Implementation of the Provisions 10 CFR 50.69 (EPID L 2018-LLA-0008)
Attachments: Brunswick 50.69 Draft 2nd Round RAIs L-2018-LLA-0008 2018-12-21.pdf

Mr. Zaremba,

By letter dated January 10, 2018 (Agencywide Documents Access and Management System Accession No. ML18010A344) as supplemented by letter dated November 2, 2018 (ADAMS Accession No ML18306A523), 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 2nd round requests for additional information (RAIs) in DRAFT form. Please submit your response to these RAIs by January 31, 2019. To arrange a clarification call for the attached draft RAIs and to discuss 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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Created By: Dennis.Galvin@nrc.gov

Recipients:
"Grzeck, Lee (Lee.Grzeck@duke-energy.com)" <Lee.Grzeck@duke-energy.com>
Tracking Status: None
"Vaughan, Jordan L" <Jordan.Vaughan@duke-energy.com>
Tracking Status: None
"Arthur.Zaremba@duke-energy.com" <Arthur.Zaremba@duke-energy.com>
Tracking Status: None

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SECOND ROUND 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), as supplemented by letter dated November 2, 2018 (ADAMS Accession No ML18306A523), 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 as supplemented 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 has developed the following requests for additional information (RAIs) in order to complete its assessment.

2.0 REQUEST FOR ADDITIONAL INFORMATION

PRA RAI 8-1 – Addition of FLEX to the PRA Model

The response to PRA RAI 8 confirmed that FLEX equipment, specifically diesel generators, cooling pumps, and instrument air compressors are incorporated in the PRA models to be used for the 10 CFR 50.69 SSC categorization process. The response identified that the failure rates for these components use the generic NUREG/CR-6928 (ADAMS Accession No. ML070650650) data for other components, that each component requires operator action(s) to meet its functional requirement, and that the failure rates for the associated actions are calculated using the Electric Power Research Institute (EPRI) human reliability analysis (HRA) calculator. In addition, the licensee stated that the addition of FLEX modeling moved the station blackout (SBO) accident sequence from the risk-significant category (top 95% contributor to core damage) to the non-risk significant category.

As noted in PRA RAI 8, 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 into a PRA model used for risk-informed applications. This memorandum provides specific guidance related to FLEX equipment failure rates, operator action probability calculations, and PRA upgrades when used for risk-informed applications.

Please address following:

a. Regarding component failure data the November 2, 2018, response states that NUREG/CR-6928 generic parameter estimates were used for the FLEX diesel generators (FLEX-DGs), FLEX pumps, and FLEX air compressors since plant-specific data is limited. For the FLEX-DGs, the response states that these components use the failure rates of the safety-related emergency diesel generators (EDGs) since, "they are expected to be as reliable as the EDGs."

   The ASME/ANS PRA Standard Capability Category II (CC-II) for supporting requirement (SR) DA-D2 that "if neither plant-specific data nor generic parameter estimates are available for the parameter associated with a specific basic event, USE data or estimates for the most similar equipment available, adjusting if necessary to account for differences. Alternatively, USE expert judgment and document the rationale behind the choice of parameter values." The NRC staff notes EDGs conduct several test runs in a year and operate for several hours with substantial electrical load to verify their reliability. It is unclear if the FLEX-DGs conduct the same rigorous testing as the EDGs to verify their reliability and therefore it is unknown whether the FLEX-DGs are sufficiently similar to EDGs to warrant uses of EDG generic data. If it cannot be demonstrated in the response to PRA RAI 8-1, subpart c, below, that the uncertainty associated with crediting the flex equipment is not expected to impact the categorization, provide the following:

   i. A justification that the failure rates for safety-related diesel generators can be used for the FLEX-DGs. Include in this discussion the similarities between EDGs and FLEX-DGs regarding installation, training, operation, maintenance, environmental controls, and testing, and how each of these items impact the reliability of the diesel generator.

ii. Develop a failure rate estimate that meets the requirements of the ASME/ANS PRA Standard (e.g., SR DA-D2). Include in this discussion any adjustments made to the generic failure rates due to differences and the rationale used to base those adjustments (provide actual FLEX component failure rates used in the PRA model).

iii. Alternatively to part i and ii, propose a mechanism to develop the FLEX component failure rates in accordance with the ASME/ANS PRA Standard and incorporate them into the PRA models used for the 10 CFR 50.69 SSC categorization process, provide a sensitivity study as part of the suite of sensitivity studies that are included in the categorization process described in NEI 00-04 (e.g., Table 5-2) that can address this uncertainty, or remove credit for the FLEX DGs in the PRA model used for the 10 CFR 50.69 categorization.

b. Regarding the methodology used to determine the human failure event (HFE) probabilities the, November 2, 2018, response stated that they were evaluated per ASME/ANS PRA Standard SR HR-G3. The licensee stated that the EPRI HRA Calculator was used to quantify the events, explicitly addressing all performance shaping factors identified in HR-G3. However, the EPRI HRA calculator has no directly applicable options explicitly to cover actions like transportation of equipment, or installation of portable hoses and cables. The NRC staff notes that using surrogates for specific actions or engineering judgment to estimate the failure probability does not adequately address the elements needed for a technically acceptable human reliability analysis described in the ASME/ANS PRA Standard. Until gaps in the human reliability analysis methodologies are addressed by improved industry guidance, human error probabilities (HEPs) associated with actions for which the existing approaches are not explicitly applicable should be submitted to the NRC for review. If it cannot be demonstrated in the response to PRA RAI 8-1, subpart c, below, that the uncertainty associated with crediting the flex equipment is not expected to impact the categorization, provide the following:

i. The HEP analysis for the operator actions related to the employment of FLEX equipment. Include in this discussion how each HFE was adjusted to address the gaps in the methodology and the rationale for each judgement, and a discussion of how the FLEX HFE probabilities compare to similar operator actions performed outside the main control room with the same number of execution steps.

ii. Alternatively to part i, propose a mechanism to develop the FLEX operator HEP values that reflect the gap in methodology and incorporate them into the PRA models used for the 10 CFR 50.69 SSC categorization process, provide a sensitivity study as part of the suite of sensitivity studies that are included in the categorization process described in NEI 00-04 (e.g., Table 5-2) that can address this uncertainty, or remove credit for FLEX operator HEPs in the PRA model used for 10 CFR 50.69 categorization

c. Regarding the impact of FLEX to the risk insights the November 2, 2018, response stated that the inclusion of FLEX in the PRA model moved the SBO sequence from the risk-significant category to the non-risk significant category. In order for any new risk-informed application that has incorporated mitigating strategies (FLEX) to meet the guidance of RG 1.200, the licensee should either perform a focused-scope peer review of the PRA model or demonstrate that none of the following criteria is satisfied:

(1) Use of a new methodology,
(2) Change in scope that impacts the significant accident sequences or the significant accident progression sequences, or
(3) Change in capability that impacts the significant accident sequences or the significant accident progression sequences.

The addition of mitigating strategies into a PRA model is considered a change in scope/capability. Based on the licensee's response to PRA RAI 8, subpart d, the addition of mitigating strategies to the Brunswick internal events PRA impacted a significant accident sequence (SBO drops out of top 95% contributor and would no longer be considered a significant accident sequence) and therefore would be considered an upgrade in accordance with the ASME/ANS PRA standard as endorsed by RG 1.200. Provide the following:

i. Clarify how including FLEX in the PRA is expected to impact the categorization. Specifically, whether and how including FLEX will change the risk-significance of non-FLEX SSCs and whether the FLEX SSCs will be categorized as parts of other systems or as a stand-alone system.

ii. If a significant impact is expected and the FLEX models are retained in the PRA, propose a mechanism to ensure that a focused-scope peer review is performed on the model changes associated with incorporating mitigating strategies, and associated facts and observations (F&Os) are resolved to Capability Category II prior to implementation of the 10 CFR 50.69 SSC categorization process. The peer review should address the issues raised in parts (a) and (b) of this RAI.

iii. Alternatively, remove credit for FLEX equipment and strategies in the PRA models used for the 10 CFR 50.69 SSC categorization process.

PRA RAI 14-1 – Wind Generated Missile Hazard Development

The licensee's response to PRA RAI 14 provides information justifying not using a plant-specific methodology for determining the frequency of damage resulting from missiles generated by high-winds and tornadoes. The response explains that "about 60% of the variance in missile hit probability is explained" by the licensee's approach. Item 3a in the response to PRA RAI 17.a states that the licensee's approach is "assumed to provide reasonable estimates of missile fragilities." The response to PRA RAI 14 states that the assumption is considered "key" per NUREG-1855, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decisionmaking", Revision 1 (ADAMS Accession No. ML17062A466). Further, the response to PRA RAI 14 states that the use of the sensitivity study required by Section 8.1 of NEI 00-04, "10 CFR 50.69 SSC Categorization Guideline" (ADAMS Accession No. ML052910035), and performance monitoring of low safety significant (LSS) SSCs as required by 10 CFR 50.69(e)(3), as discussed in the response to PRA RAI 17.b, is appropriate to address the "key" assumption of using the non-site-specific high wind missile analysis methodology. The licensee's response to PRA RAI 24.a states that the sensitivity will be performed by increasing the random failure probability of all LSS components by a factor of 3 in the HW PRA model and that "probability of the wind-induced failure events associated with the LSS components" will not be increased. Consequently, no changes to the missile impact failure probability will be included as part of the risk sensitivity study and that failure mode will not be part of the risk sensitivity study. Therefore, it is unclear how the proposed approach (i.e., increasing random failures in the HW PRA model by a factor of 3) will address the "key"

assumption associated with the use of the licensee's non-plant-specific high wind missile analysis methodology.

Justify how changes to the random failure probability of LSS components will address the "key" assumption of using the non-plant-specific high wind missile analysis methodology in the context of this application. Alternately, propose an approach that will directly address the cited "key" assumption.

PRA RAI 17-1 – External Flood and High Winds Key Assumptions and Sources of Uncertainty

The licensee's response to PRA RAI 17.a includes an external flooding (XF) event associated with the 23 feet (ft.) still water flood as an assumption for the licensee's XF PRA and the response to PRA RAI 17.b considers it to be a "key" assumption. The response to PRA RAI 17.b discusses the use of the sensitivity study discussed in Section 8.1 of NEI 00-04 and performance monitoring of LSS SSCs as required by 10 CFR 50.69(e)(3) as being appropriate to address key uncertainties and assumptions. The licensee's response to PRA RAI 24.a states that the sensitivity will be performed by increasing the random failure probability of all LSS components in the XF PRA by a factor of 3. Therefore, events associated with the 23 ft. still water flood will not be included as part of the XF PRA.

PRA RAI 16 requested a description of how sufficient data points for the XF hazard were determined to capture the plant response at different flooding elevations. The licensee's response states that a cliff-edge effect, which is caused by the failure of diesel generators, in the plant response occurs at an elevation of 23 ft. and that the majority of plant risk in response to external flood events occurs at an elevation at and above 20 ft. but below 23 ft. As noted by the licensee's response, the plant response will be different at 23 ft. as compared to 20 ft. Further, the failure of the diesel generators at 23 ft. can affect this application (e.g., SSCs, such as the Severe Accident Mitigation Alternatives (SAMA) diesel generators, becoming high safety significant) which can be missed if that flood elevation is not quantified as part of the base XF PRA.

In light of the above discussion and in the context of this application, discuss why excluding the 23 ft. flood does not identify unique risk significant SSCs and consequently does not impact this application. Alternately, justify how changes to the random failure probability of LSS components will address the "key" assumption related to the plant response at the 23 ft. flood in the context of this application. The response should propose, as appropriate, how two different importance measures for an SSC that would result from the quantification of the PRA model at the 20 ft. and 23 ft. flood elevations will be combined to develop representative importance measures.

PRA RAI 22-1 – Importance Measure Calculation and Categorization of Non-Aligned Components

PRA RAI 22.b requested information on 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. A discussion of the treatment of implicitly modeled components in the HW and XF PRA models in the categorization process was also requested (item ii in PRA RAI 22.b). The licensee's response included a discussion of the importance measure calculation for a component that is credited in one hazard model, but not in all (or any) of the other models.

However, the licensee did not provide any discussion on the treatment of implicitly modeled components in the response.

Discuss how implicitly modeled components in the HW and XF PRA models will be captured and treated in the categorization process.