NRR-PMDAPEm Resource

From: Hon, Andrew
Sent: Wednesday, June 15, 2016 10:44 AM
To: Murray, William R. (Bill) (Bill.Murray@duke-energy.com) (Bill.Murray@duke-energy.com)
Cc: Biro, Mihaela; Gallucci, Ray
Subject: Brunswick Unit 1 and Unit Request for Additional Information related to LAR to Relocation of Specific Surveillance Frequency Requirements to Licensee Controlled Program (CAC NOS. MF7206 and MF7207)

In a letter dated December 21, 2015, (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML16004A249), Duke Energy Progress (the licensee) requested the subject amendment to Operating Licenses OLs DPR-71 and DPR-62.

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing your submittal and has determined that additional information is required to complete the review. The specific information requested is addressed below. The proposed questions were discussed by telephone with your staff on June 13, 2016. Your staff confirmed that request for additional information (RAI) was understood and did not include proprietary or security-related information, and agreed to provide a response in 30 days of this request, except for Question 4.c to which a response will be provided in 60 days.

The NRC staff considers that timely responses to RAIs help ensure sufficient time is available for staff review and contribute toward the NRC's goal of efficient and effective use of staff resources. Please note that if you do not respond to this request by the agreed-upon date or provide an acceptable alternate date, we may deny your application for amendment under the provisions of Title 10 of the *Code of Federal Regulations*, Section 2.108. If circumstances result in the need to revise the agreed upon response date, please contact me.

RAI Regulatory Bases: For risk-informed licensing applications, Regulatory Guide (RG) 1.200, Revision 2, provides regulatory guidance for assessing the technical adequacy of a PRA. The guidance in NEI 04-10, Revision 1, requires an assessment of the probabilistic risk assessment (PRA) models used to support the Surveillance Frequency Control Program against the requirements of RG 1.200 to ensure that the PRA models are capable of determining the change in risk due to changes to surveillance frequencies of structures, systems, and components, using plant-specific data and models. The staff reviewed the information on PRA quality submitted by the licensee in the application, including the licensee's resolution to the Facts and Observations (F&Os) from PRA peer reviews, and determined that additional information is needed to complete the review.

The requests for additional information are provided below.

1. The following requests for additional information apply to the internal events Facts and Observations (F&Os) reported in Tables 1 and 2 of Enclosure 2 to the License Amendment Request (LAR):

    a. Open F&O 3-12 related to supporting requirement (SR) LE-C3 states that the process for identification of recovery and repair actions that can terminate or mitigate the progression of a severe accident was incorporated into the original analysis, rather than performing a review of significant accident progression sequences and then incorporating repair, as required by the SR. Please clarify whether any credit for repair is taken. If any credit for repair is taken, please justify how this credit for repair is consistent with SR LE-C3 at Capability Category II.

    b. Open F&O 3-12 related to SR LE-C10 and LE-C12 was entered because the peer review team could not find any evidence that significant accident sequences were reviewed to determine if engineering analyses could support continued equipment operation or operator actions that

could reduce Large Early Release Frequency (LERF). Please clarify whether credit for equipment survivability or human actions in adverse environments is taken. If any credit is taken, please justify how it satisfies SR LE-C10 and LE-C12 at Capability Category II.

c. Open F&O 3-13 related to SR LE-C13 indicates that "scrubbing by the reactor building is treated in a conservative method." The resolution to this F&O indicates that Capability Category I of the SR is met, which implies that no credit for scrubbing is taken in a containment bypass event. Please confirm whether credit for scrubbing is taken. If any credit for scrubbing is taken, please justify how it satisfies SR LE-13 at Capability Category II.

d. Open F&O 6-8 related to SR SC-C2 was entered because there was no documentation of computer codes limitations (e.g., potential conservatisms or limitations that could challenge the applicability of computer models in certain cases) as required by the SR. Please identify computer codes that were used to establish PRA success criteria and describe any limitations of these codes to support PRA success criteria.

e. F&O 1-3 related to SR IE-C1 was entered because the peer review team found that initiating event frequencies for pipe breaks outside containment were a factor of 100 to 1000 too low. In the resolution to this F&O the licensee stated that, as a result of an analysis performed using updated pipe break frequencies, Main Steam Line Break (MSLB) should be included as an initiator. Please confirm that MSLB has been included in the internal events initiators or otherwise justify its exclusion.

f. F&O 6-12 related to SR LE-G5 was entered because the peer review team could not find sufficient documentation on the limitations of the LERF analysis that could impact different applications, as required by the SR. Please identify the specific limitations in the LERF analysis for this application.

2. Most of the F&Os related to internal flooding reported in Table 1 of Enclosure 2 to the LAR arose from the 2010 peer review when the internal flooding model or documentation was incomplete. As a result, in most instances, the review team was unable to review the supporting requirements. This is summarized in F&O 1-31 (related to many documentation SRs such as IFSN-B1), which states that "documentation of internal flooding was not conducive to supporting PRA applications, maintenance and upgrade, or peer review." The peer review team identified specific examples of areas where the models or documentation were incomplete, such as:

- The flood scenario development documentation did not provide all of the information needed to fully describe the scenario development process.
- Various items noted in the F&Os related to the IFSN-A SRs, such as:
  - no documentation of flood alarms, blowout panels or HVAC dampers (IFSN-A2)
  - no identification of automatic flood isolation features or operator indications (IFSN-A3)
  - no documentation of qualitative assessment of pipe whip, jet impingement, humidity, condensation and temperature concerns in the flooding analysis (IFSN-A6)
  - no discussion of drain paths as possible propagation paths and propagation through wall penetrations, cable trays and HVAC ducts were not considered (IFSN-A8)
  - flood sources screened without discussion of indication or isolation (IFSN-A14)
  -
- The following items listed in SR IFSN-B2 were not included in the documentation:

- assumptions or calculations used in the determination of the impacts of submergence, spray, temperature, or other flood-induced effects on equipment operability
- screening criteria used in the analysis
- flooding scenarios considered, screened, and retained
- description of how the internal event analysis models were modified to model these remaining internal flood scenarios

- A listing of the specific components assumed to be failed in each flood area was not provided.
- Documentation of risk-important components within each flood area appeared incomplete in the walk-down notes.
- Documentation of characteristics of flood pathways between zones was weak and/or incomplete.
- Documentation and discussion of flood pathways other than doors was limited.
- Assumptions on door behavior, such as pressures doors would withstand or flood propagation rates through door gaps, were not documented.
- Operator actions to be modeled in the Human Reliability Analyses (HRA) for flooding were not clearly identified and described, including documentation of alarms that would be considered for specific flooding scenarios.
- Review of plant operating experience pertinent to these HRA analyses were not documented.
- It was not possible to verify proper development of the HRA Calculator Files, as discussed under IFQU-A5.
- The flooding analysis did not provide information concerning modeling of system/component failures due to pipe failures in that system, as opposed to failure due to flooding and flood propagation, as discussed in IFQU-A1.

The licensee's dispositions to the internal flooding F&Os indicate that they have been addressed, as documented in various plant-specific reports. However, there is little discussion of how these resolutions were done other than reference to specific reports, unavailable for review. The NRC staff needs the result of either one of the two analysis to complete our review of this application:

a. Demonstrate quantitatively that the contribution to Core Damage Frequency (CDF) and LERF from internal flooding scenarios in which basic events potentially affected by the requested changes in surveillance frequency is negligible, or

b. Conduct a focused-scope peer review for the internal flooding technical elements based on the enhancements made since the 2010 peer review and adequately disposition any remaining or new F&Os.

3. In the license amendment for transition to the National Fire Protection Association (NFPA) Standard 805 dated January 28, 2015 (ADAMS Accession Number ML14310A808), license condition # 2 requires the implementation of all plant modifications "by the startup of the second refueling outage for

each unit after issuance of the [NFPA-805] safety evaluation". Since the NFPA-805 implementation period has not ended, please address how the fire PRA that will be used for the surveillance frequency control program (SFCP) reflects the as-built, as-operated plant.

4. The following RAIs apply to the internal fire F&Os reported in Table 3 of Enclosure 2 to the LAR:

   a. F&Os 1-19 and 1-20 related to SR FSS-A1 identified that transient fires in the battery room were not developed where the transient damages or ignites the batteries (e.g., was the fire ignition frequency increased by the transient fire frequency in addition to the fire frequency of the batteries themselves?). Please justify the exclusion of batteries as transient fire targets or perform a sensitivity evaluation incorporating the effect of treating batteries as transient fire targets. Please assess the impact on the SFCP.

   b. Resolution to F&O 1-24 related to SR FSS-B1, HRA-A2, HRA-C1 and HRA-D1 states that possible conservatism associated with not modeling other ASSD actions are not considered to be significant. Please justify why not modeling other ASSD actions are not considered to be significant for the SFCP.

   c. Resolution to F&O 1-36 related to SR QU-B2, QU-F2, QU-B3, FQ-B1 and FQ-F1 states that effective truncation values of 1E-09/yr for CDF and 1E-10/yr for LERF are used for scenario quantification. It further states that the process for establishing truncation limits does not demonstrate that the overall model results converge and SR QU-B3 is assessed as 'Not Met'. Please provide the results from a sensitivity analysis that expands the truncation levels to those comparable for internal events, typically at least 1E-12 for CDF, as the necessary justification why the chosen truncation levels have no impact on the SFCP.

   d. F&O 2-10 related to SR QU-E4, UNC-A1 and PRM-B10 is concerned with PRA items that were assumed failed for the component selection. The resolution to this F&O states that the assumption of items considered always failed in the fire PRA represents a conservatism in the calculated fire CDF. Assuming a component failed may be non-conservative for the SFCP, as it could underestimate the potential increase in CDF and, as a result, underestimate the surveillance frequency for that component. Please confirm that this "always failed" assumption cannot lead to underestimating the surveillance frequency for any component.

   e. F&O 2-19 related to SR FQ-A1 identified that some non-conservatism could exist for some Hot Gas Layer (HGL) scenarios (whole room burnout) where the mapping tables do not cover all the components that are affected by the fire-induced failures. Please confirm that after the resolution of this F&O, which modified the mapping tables, all the components affected by the fire-induced failures are failed for both the HGL scenarios and the individual scenarios.

   f. F&O 2-20 related to SR FQ-A1 identified an assumption that cable trays with solid bottoms, which are present above some transformers in the Diesel Generator Basement (sources 5010 through 5017), will prevent damage to cables for ignition sources with heat release rates (HRRs) of 69 kW or less based on the discussion provided in section Q.2.2 of NUREG/CR-6850. As per Section Q.2.2 of NUREG/CR-6850, while solid bottom barriers for cable trays will delay damage to qualified cables, they do not preclude it. Therefore, to justify the judgement that "the spray shields installed above these transformers will prevent thermal damage to the target cable trays, thus damage resulting from a transformer fire need not be postulated." Please clarify the following:

      i. The basis for limiting the 98th percentile HRR for sources 5010 through 5017 to 69 kW, recognizing that fires from transient combustibles which may be present have a 98th percentile HRR of 317 kW (Note the potential relevance of Item (2), "Clarification for Transient Fires," in the June 21, 2012, letter from Joseph Giitter (NRC) to Biff Bradley (NEI), ADAMS Accession No. ML12171A583) and

ii. The reason why the "test fire model run with FDS" cited by the Peer Review team as acceptably demonstrating that "cable trays with solid bottoms will prevent damage to cables for ignition sources with HRR 69 kW or less" is not cited as the basis for the judgement in the F&O resolution (alternatively, cite this "test fire model" as the basis in conjunction with the discussion for part [i] above).

g. F&O 3-6 related to SR SF-A3 noted that common cause failure of gaseous suppression systems is not addressed. The F&O resolution justifies that there is no potential for common cause failures between the CO_2 system for Unit 1 and the CO_2 system for Unit 2 because their supplies are separated by a large, open distance. Please confirm that the CO_2 systems for the two units are widely separated with regards to both supply tanks and the connecting piping.

h. F&O 4-1 related to SR FSS-A1 identifies that the fire PRA uses a severity factor of 0.1 for cabinet breaching factor for well-sealed Motor Control Centers (MCCs). Resolution to this F&O and F&O 1-30 references Frequently Asked Question (FAQ) 14-0009, "Treatment of Well-Sealed Electrical Panels Greater than 440V," which assigns a breaching factor of 0.23 for well-sealed MCCs above 440 V (if not well-sealed, the breaching factor is always 1.0). Please confirm that the accepted value of 0.23 is used in the fire PRA, as applicable, or alternatively, confirm that the sensitivity studies on breaching factors, similar to those performed for the NFPA-805 application (summarized in response to RAI 1.g, ADAMS Accession No. ML 13205A016, where a factor of 1.0 was used) will be performed for the surveillance frequency calculations.

i. F&O 5-4 related to SR ES-A5, ES-A6, ES-B2, ES-D1 and PRM-B9 identified six fire-induced spurious events that were screened, but could cause a plant trip (or manual shutdown) and impact equipment that is credited for accident mitigation in the fire PRA. Resolution to this F&O justified screening of the cited six potential trip inducers by the fact that they do not introduce any scenarios not already modeled, but did not address impact on initiating event frequencies. Please provide either the results of a sensitivity analysis including these events or justify quantitatively why these potential trip inducers do not impact the initiating event frequencies.

j. F&O 5-8 related to SR IGN-A4 and IGN-B4 identified that the bases for excluding certain historical plant specific fire events should be strengthened to support the use of generic ignition frequency data. The F&O identifies a list of historical fires related to the heater drain pumps (items #1, 2, 5 and 7 in the peer review comments) that need more justification for their exclusion. The resolution to this F&O states that the plant documentation "was revised to include additional discussion of the plant history and corrective actions related to the heater drain pumps." Please clarify whether after resolution of this F&O the heater drain pump fire events are still excluded from potential plant-specific effects on ignition frequencies and provide the basis, or alternatively perform a sensitivity analysis to assess impact.

k. The resolution to F&O 5-16 related to SR LE-F1, LE-F2, LE-G3, UNC-A1, FQ-E1 and FQ-F1 implies that the noted unit asymmetry whereby 98.1% of the Unit 2 fire LERF is due to fires in the Unit 2 Main Control Room (MCR), vs. the approximate 60% contribution from the Unit 1 MCR to the Unit 1 fire LERF, is an accurate representation. Given that the ignition frequency for a Main Control Board fire is now six times higher (NUREG-2169) than that from Supplement 1 to NUREG/CR-6850 (and twice as high as that from the original NUREG/CR-6850), Please clarify, preferably quantitatively, the effect on the MCR fire contribution to the fire LERF at each unit and the status of the asymmetry and whether it remains an accurate representation.

l. Resolution to F&O 6-1 related to SR CS-B1 states that three raceways in the Unit 2 electrical equipment room that could not be routed are identified as a source of uncertainty. It further states that the risk associated with the assumed failure of these raceways is "qualitatively addressed as a non-conservative assumption […] that is likely mitigated in the HGL scenarios

by other failures for the respective power supplies." Please assess the impact of this assumption on the SFCP to confirm it is conservative.

m. F&O 6-7 related to SR CF-A1 identifies that cable failure probabilities are based on the Chapter 10 tables in NUREG/CR-6850. Updated failure probabilities were published in NUREG/CR-7150. Please confirm that the NUREG/CR-7150 cable failure probabilities will be used in the surveillance frequency calculations, and that these probabilities will be applied to both the base and the adjusted PRA when calculating change in CDF/LERF for the SFCP.

5. The following RAIs apply to the high winds and external flooding F&Os reported in Table 4 of Enclosure 2 to the LAR:

a. F&O WPR-A5-02 related to SR WPR-A5 and WPR-A8 identifies two potential errors in utilizing the multiplier criteria for increasing the likelihood of human errors due to high winds. First, ex-control room actions that do not traverse through areas impacted by winds and performed in areas not impacted by winds do not need to be considered at a higher failure probability. Second, some ex-control room action may have a guaranteed failure. Please provide an explanation on how this F&O was addressed and, if not completely addressed, assess the impact on the SFCP.

b. F&O WPR-A11-01 related to SR WPR-A11 states that if system recoveries are credited in the model, then their potential to be impacted by the high winds conditions needs to be evaluated. Please confirm that all recoveries credited in the model were assessed for impact from the high wind conditions and summarize the assessment.

c. F&O WPR-B2-01 related to SR-WPR-B2 states that the uncertainties in each of the inputs and for all important dependencies and correlations have not been assessed, as required by the SR. Please confirm that the uncertainties due to all important dependencies and correlations have been assessed and documented and provide a summary of the assessment.

d. F&O WPR-C3-01 related to SR WPR-C3 was entered because the sources of uncertainty and assumptions were not identified as required by the SR. Please describe the sources of uncertainty and assumptions and assess their impact on the model and on the results for the SFCP.

6. Please confirm that, when citing conservatism in the base PRA model (as for example in internal events F&Os 3-12 and 3-13, internal fire F&Os 1-24, 2-10, and 4-13), calculation of the differential risk for the application is also conservative (i.e., the risk estimated for the before versus after condition uses the same assumptions, etc., except for the change to any basic event values affected by the application, ensuring that the before value is not overestimated such that subtracting it from the after value could underestimate the risk increase).

7. The LAR states that hazard screening performed for the Individual Plant Examination of External Events (IPEEE) studies will be used to assess hazards from transportation and nearby facility accidents. Please confirm that since the IPEEE there were no changes to the plant site that could invalidate the conclusions of the IPEEE study with regards to hazards from transportation and nearby facility accidents.

Docket Nos. 50-324 and 50-325

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