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Serial: RNP-RA/16-0017
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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261 / RENEWED LICENSE NO. DPR-23

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST TO ADOPT NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805, "PERFORMANCE-BASED STANDARD FOR LIGHT WATER REACTOR ELECTRIC GENERATING PLANTS"**

Dear Sir/Madam:

By letter dated September 16, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13267A211) Duke Energy Progress, Inc. (DEP) submitted a license amendment request (LAR) for H. B. Robinson Steam Electric Plant, Unit No. 2 (HBRSEP2). This LAR would adopt a new fire protection licensing basis that complies with the requirements of Title 10 of the Code of Federal Regulations, Sections 50.48(a) and (c); the guidance in Regulatory Guide 1.205, Revision 1, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants"; and National Fire Protection Association (NFPA) 805, "Performance-Based Standard for Fire Protection for Light-Water Reactor Electric Generating Plants" (2001 Edition).

By letter dated July 31, 2015 (ADAMS Accession No. ML15212A136), DEP submitted a response to a NRC request for additional information (RAI). The NRC staff determined that additional information is needed to complete its review related to probabilistic risk assessment (PRA). A draft of that information request was received by DEP via email message on November 20, 2015 (ADAMS Accession No. 15324A328), officially via letter dated March 2, 2016 (ADAMS Accession No. ML16048A349). An RAI clarification call was held on December 7, 2015. The NRC staff also held an onsite audit February 9-10, 2016, to establish a proposed resolution of outstanding issues associated with the HBRSEP2 NFPA 805 review.

During the audit, DEP and the NRC agreed to a schedule for providing RAI responses. By March 18, 2016, DEP will provide responses to PRA RAIs 03.b.01, 05.c.01.01, and 30.02 and revised responses to FM RAI 01.b.01.02 and PRA RAIs 01.c, 01.j, 18.01, 23.a, 24.01, 24.b and 24.c. By May 27, 2016, DEP will provide responses to PRA RAIs 03 and 16.01.01 and a revised response to PRA RAI 15.01.01.01. DEP will also update the LAR submittal and Attachments C,G,H,J,M,S,V, and W, as applicable, by this date. The DEP response to the March 18, 2016 request is provided herein.

Please address any comments or questions regarding this matter to Mr. Scott Connelly, Acting Manager – Nuclear Regulatory Affairs at (843) 857-1569.

There are no new regulatory commitments made in this letter.

I declare under penalty of perjury that the foregoing is true and correct. Executed on March 16, 2016.

Sincerely,

R. Michael Glover

R. Michael Glover
Site Vice President

RMG/jmw

Enclosure

cc: Region Administrator, NRC, Region II
Mr. Dennis Galvin, NRC Project Manager, NRR
NRC Resident Inspector, HBRSEP2
Ms. S. E. Jenkins, Manager, Infectious and Radioactive Waste Management Section (SC)

# RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST TO ADOPT NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805, "PERFORMANCE-BASED STANDARD FOR LIGHT WATER REACTOR ELECTRIC GENERATING PLANTS"

REQUEST FOR ADDITIONAL INFORMATION

VOLUNTARY FIRE PROTECTION RISK INITIATIVE

DUKE ENERGY PROGRESS

H. B ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

DOCKET NO. 50-261

**Fire Modeling (FM) Request for Additional Information (RAI) FM RAI 01.b.01.02**

In its letter dated April 1, 2015, the licensee responded to FM RAI 01.b.01 and referred to the fire PRA quantification documentation for details on how the licensee calculated the HRR of cable trays.

During its review of pertinent sections of the fire PRA quantification documentation, the U.S. Nuclear Regulatory Commission (NRC) staff noted that the licensee determined the time to damaging HGL conditions for scenarios involving cable trays based on the cumulative combined HRR of the ignition source and the cable trays. The fire PRA quantification documentation does not describe this method in detail, but provides an example that seems to indicate that the licensee's approach allows the combined HRR to exceed the previously determined minimum HRR needed for damaging HGL conditions long before the cumulative HRR threshold for damaging HGL conditions is reached.

Provide a detailed description of the methodology that was used to determine the time to damaging HGL conditions for scenarios that do and do not involve secondary combustibles, and provide the technical justification for the underlying assumptions of the approach for both types of scenarios.

**Response:**

The Robinson Nuclear Plant (RNP) Fire PRA includes fire scenarios that have been determined to propagate to secondary combustibles. At the same time, there are also scenarios where no propagation is postulated based on the specific configuration of the fire scenario configuration. The distance between the ignition source and the closest intervening combustible as well as the appropriate fire condition within the zone of influence (ZOI) are used for determining if the fire propagates. In both cases (i.e., for scenarios where fire propagation is postulated as well as for those were no propagation is modeled), the time to a damaging hot gas layer (HGL) is calculated the same way. In general, both the heat release rate (HRR) associated with the ignition source and that associated with the intervening combustibles are added as a function of time to obtain the HRR profile that is used as input in the fire model. For cases where there are no intervening combustibles near the ignition source, the contribution to the HRR from intervening combustibles is set to zero and the HRR profile is based on the ignition source only.

Depending on the amount of combustibles (generally cable trays within the ZOI), the HRR profile is estimated using guidance from NUREG/CR-6850, Appendix R. The fire propagates among a stack of vertical cables trays using the following timeline:

Table 1: Timeline for fire propagation in a cable tray stack

| Timeline | Description |
|---|---|
| T1 | Time to reach HRR capable of damaging first tray |
| T2 | Time to ignite the first target (tray) based on NED-M/MECH-1009 |
| T3 | Time to ignite second tray = T2 + 4min |
| T4 | Time to ignite third tray = T3 + 3min |
| T5 | Time to ignite fourth tray = T 4 + 2min |
| T6 | Time to ignite fifth tray = T5 + 1min |
| TX | Time to ignite remaining trays = previous tray + 1min |

The following properties are assigned to the horizontal cable fire growth for RNP based on NUREG/CR-6850 and NUREG/CR-7010:

Table 2: Cable tray flammability and configuration properties

| | | |
|---|---|---|
| Cable Tray Width | 0.61 m | Typical tray width |
| HRR per unit area | 250 kW/m2 | NUREG/CR-7010, for thermoplastic cables |
| Cable Tray Length | 1 m | Initial cable tray length |
| Cable Tray Spacing | 0.16 m | Typical tray spacing |

Using the values listed above, the HRR for the cable trays is calculated as the surface area of the tray multiplied by the HRR per unit area. The angle of 35° described in Appendix R.4.2 of NUREG/CR-6850 is used for determining the length of the cable trays in the stack above the ignition source. This in turn is used to estimate the appropriate burning surface for each tray. The following contribution per cable tray is added to the fire scenario. It should be noted that the HRR values listed below may increase as a result of the addition of horizontal flame spread in response to FM RAI 01.b.01.03.

Table 3: Cable tray flammability and configuration properties

| Tray Count | Cable Tray Length | Cable Tray Contribution |
|---|---|---|
| 1st Tray | 1 m | 153 kW |
| 2nd Tray | 1.4 m | 339 kW |
| 3rd Tray | 2.2 m | 560 kW |
| 4th Tray | 3.3 m | 815 kW |
| 5th Tray | 4.4 m | 1104 kW |
| 6th Tray | 9.4 m | 2343 kW |

The time to HGL is determined comparing the combined HRR profile of the ignition source and the intervening combustibles with the constant HRR required to increase the temperature of the HGL to a damaging level (i.e., the limiting HRR value). The constant HRR needed for developing a HGL scenario is calculated using either the MQH or Beyler room temperature models assuming a fire

duration of thirty minutes as described in RNP-M/MECH-1826, Hot Gas Layer Calculation. The resulting time to HGL is selected to be the time at which the growing HRR associated with the ignition source and the secondary combustibles exceeds the limiting HRR value.

The process described above is conservative because the HGL temperature model overpredicts the conditions in the room (see NUREG-1824, Vol. 1) and the HRRs associated with cable trays do not account for fuel consumption. Consequently, a selected number of scenarios required further detailed analysis to obtain a refined assessment of the HRR profile and resulting HGL temperatures. For those scenarios, the FLASH-CAT model (See NUREG/CR-7010) and the zone model CFAST were used to calculate the HRR associated with the combination of ignition source and secondary combustibles and the resulting HGL temperature. This is described in the JENSEN HUGHES Report 004048-RPT-01, Evaluation of Damage Timing for Sensitive Electronics in RNP – Compartments FC160 and FC200.

**Probabilistic Risk Assessment (PRA) RAI 01.c**

Section 2.4.3.3 of NFPA 805 states that the PSA (PSA is also referred to as PRA) approach, methods, and data shall be acceptable to the AHJ, which is the U.S. Nuclear Regulatory Commission (NRC). RG 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Revision 1, December 2009 (ADAMS Accession No. ML092730314), identifies NUREG/CR-6850 as documenting a methodology for conducting a fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk Informed Activities," Revision 2, March 2009 (ADAMS Accession No. ML090410014), describes a peer review process utilizing an associated American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) standard (currently ASME/ANS-RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications") as one acceptable approach for determining the technical adequacy of the PRA once acceptable consensus approaches or models have been established for evaluations that could influence the regulatory decision. The primary results of a peer review are the F&Os recorded by the peer review and the subsequent resolution of these F&Os.

Clarify the following dispositions to the fire F&Os and Supporting Requirement (SR) assessments identified in LAR Attachment V that have the potential to impact the fire PRA results and do not appear to be fully resolved:

c) CS-A11-01 and FSS-E4-01 (Undetermined cable routing)
The responses to F&O CS-A11-01 and FSS-E4-01 state that, where specific cable routing could not be determined, "the cable was assumed failed throughout the entire compartment that it was known to traverse through," and that any ignition source within a given fire zone was assumed to "impact all cables." These statements indicate assumed cable routes were modeled conservatively.

Conservative modeling can lead to calculation of non-conservative ΔCDF and ΔLERF if risk-reduction modifications are made in the post-transition model that affect conservative compliant plant scenarios. Explain whether conservative modeling of the compliant plant case contributes to underestimating ΔCDF and ΔLERF. If so, evaluate or remove this conservatism as part of the integrated analysis performed in response to PRA RAI 3.

**Response:**

The approach for treating cables with undetermined routing is to include these cables for all scenarios unless otherwise justified. This is consistent with requirements of the PRA Standard and will result in potentially conservative CDF and LERF values for both the variant and compliant cases. A preliminary sensitivity study has been performed using the Hot Gas Layer (HGL) scenarios to determine the potential impact that the unknown cable routings may have on the ΔCDF and ΔLERF results. The results indicate that the impact from the unknown cable routings is expected to be minimal. The response to PRA RAI 3 will include the final sensitivity results for all fire scenarios to determine potential impact on the ΔCDF and ΔLERF. This sensitivity is stand alone and will not be included in the aggregate sensitivity. Robinson has already performed extensive cable toning in order to minimize the impact of assumed cable routing. The assumptions are limited to a small number of cables in a given compartment.

**PRA RAI 01.j**

Section 2.4.3.3 of NFPA 805 states that the PSA (PSA is also referred to as PRA) approach, methods, and data shall be acceptable to the AHJ, which is the U.S. Nuclear Regulatory Commission (NRC). RG 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Revision 1, December 2009 (ADAMS Accession No. ML092730314), identifies NUREG/CR-6850 as documenting a methodology for conducting a fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk Informed Activities," Revision 2, March 2009 (ADAMS Accession No. ML090410014), describes a peer review process utilizing an associated ASME/ANS standard (currently ASME/ANS-RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications") as one acceptable approach for determining the technical adequacy of the PRA once acceptable consensus approaches or models have been established for evaluations that could influence the regulatory decision. The primary result of a peer review are the facts and observations (F&Os) recorded by the peer review and the subsequent resolution of these F&Os.

Clarify the following dispositions to the fire F&Os and Supporting Requirement (SR) assessments identified in LAR Attachment V that have the potential to impact the fire PRA results and do not appear to be fully resolved:

j) FSS-G6-02 (MCA scenario screening)

The F&O disposition states that there were five unscreened MCA scenarios included in the Fire PRA quantification. Yet, the MCA analysis report presents fourteen final MCA scenarios not screened out, twelve of which exceed 1E-07/year. Explain this seeming inconsistency, and describe which MCA scenarios are reflected in the fire CDF, LERF, ΔCDF, and ΔLERF values reported in Attachment W of the LAR. If MCA scenarios are missing from the risk values reported in Attachment W of the LAR, address these scenarios in the integrated analysis performed in response to PRA RAI 03.

**Response:**

The original MCA report identified fourteen (14) scenarios that did not meet the fire CDF screening criteria of 1E-08/year. This MCA report is based upon the original HGL calculations and PRA results. There were changes to the model during the RAI process that resulted in updated HGL calculation values. The updates are included in the revised quantification analysis and supersede those in the MCA report. In the revised quantification analysis, only four (4) scenarios do not meet the screening criteria. The four scenarios that do not screen are retained in the Fire PRA for quantification and are reflected in the CDF, LERF, ΔCDF, and ΔLERF. No MCA scenarios are missing from the risk which will be reported in revised Attachment W to be submitted May 2016.

**PRA RAI 03.b.01**

Confirm and modify as necessary the information in the following table that summarizes the resolution of the referenced RAIs as requested in PRA RAI 03.b (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14289A260). The following table includes (1) RAIs referenced by PRA RAI 03, (2) RAIs added based on the RAI responses, and (3) applicable follow-up RAIs. The "Reference" column refers to the date of the RAI response. As PRA RAI 03.b.01 is a supplement to PRA 03.b, a combined response to PRA RAI 03.b and PRA RAI 03.b.01 may be designated PRA RAI 03.b.01.

Note that the resolution of some referenced RAIs includes performing confirmatory sensitivity analyses demonstrating that an issue is negligible with respect to transition or additional changes to the PRA should be proposed. In performing such sensitivity studies, synergistic impacts, as described in PRA RAI 03.b, must also be addressed. If the results of the sensitivity study cannot demonstrate that the associated issue is also negligible with respect to future self-approval, then provide an implementation item that resolves the unacceptable method. These sensitivity analyses are identified with PRA RAI 01.c, PRA RAI 02.c, and PRA RAI 15.01.01.

| RAI | Reference* | Resolution of referenced RAI in PRA |
|---|---|---|
| PRA RAI 01.a | January 22, 2015 | RAI associated with Facts and Observations (F&Os) CF-A2-01 and FSS-E1-01. A description of what was done for addressing state of knowledge in the response to PRA RAI 03 should be provided. If mean values will not be generated post-transition, the response to PRA RAI 03 should also clarify how parametric uncertainty, including the state-of-knowledge correlation, will be addressed in the self-approval evaluation of post-transition changes. |
| PRA RAI 01.b | March 16, 2015 | RAI associated with F&O CS-A1-01. No change to PRA methods. Confirm PRA is updated consistent with referenced RAI response. |
| PRA RAI 01.c | December 22, 2014 | RAI associated with F&Os CS-A11-01 and FSS-E4-01. Describe and complete the confirmatory sensitivity analysis. |
| PRA RAI 01.g | March 16, 2015 | RAI associated with F&O FSS-C7-01. No change to PRA methods. |
| PRA RAI 01.h | December 22, 2014 | RAI associated with F&Os FSS-D7-01 and FSS-F3-02. No change to PRA methods. |
| PRA RAI 01.i | March 16, 2015 | RAI associated with F&O FSS-G1-01. No change to PRA methods. |
| PRA RAI 01.j | March 16, 2015 | RAI associated with FSS-G6-02. No change to PRA methods. |
| PRA RAI 01.k.01 | July 31, 2015 | RAI associated with MCR abandonment methods. No change to PRA methods. |
| PRA RAI 02.a | March 16, 2015 | RAI associated with F&O IE-C3-01. No change to PRA methods. Confirm PRA is updated consistent with RAI response. |
| PRA RAI 02.c | March 16, 2015 | RAI associated with F&O LE-E1-01. Describe and complete the confirmatory sensitivity analysis. |
| PRA RAI 04 | March 16, 2015 | See PRA RAIs 05, 06, 11, 14, 16 and 18 as well as associated follow-up RAIs: 05.a.01, 05.c.01, 06.01, 16.01, 16.02 and 18.01. Two issues are under review (refer to PRA RAIs 05.c.01.01 and 16.01.01). |
| PRA RAI 05.a | March 16, 2015 | No change to PRA methods. |
| PRA RAI 05.a.01 | April 1, 2015 | RAI associated with Frequently Asked Question (FAQ) 14-0009 guidance. No change to PRA methods. |
| PRA RAI 05.b | March 16, 2015 | RAI associated with NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, Volume 2: Detailed Methodology," September 2005 (ADAMS Accession No. ML052580118) and FAQ 08-0042 guidance. Confirm PRA method is changed consistent with the referenced RAI response. |

| RAI | Reference* | Resolution of referenced RAI in PRA |
|---|---|---|
| PRA RAI 05.c | March 16, 2015 | RAI associated with FAQ 14-0009 guidance. No change to PRA methods with regard to motor control centers (MCCs). Confirm methodology is consistent with final FAQ 14-0009. For non-MCC cabinets, see PRA RAI 05.c.01. |
| PRA RAI 05.c.01 | July 31, 2015 | RAI associated with NUREG/CR-6850 guidance and the inapplicability of FAQ 14-0009 guidance. This issue is under evaluation (refer to PRA RAI 05.c.01.01). |
| PRA RAI 06 | January 22, 2015 | RAI associated with FAQ 13-0004 guidance. Confirm PRA method is changed consistent with the referenced RAI response. |
| PRA RAI 06.01 | July 31, 2015 | RAI associated with sensitive electronics outside of FAQ 13-0004 guidance. Confirm PRA method is changed consistent with the referenced RAI response. |
| PRA RAI 07 | March 16, 2015 | No change to PRA methods. |
| PRA RAI 10 | January 22, 2015 | RAI associated with FAQ 13-0006 guidance. Confirm PRA method is changed consistent with FAQ 13-0006 guidance (as suggested by the referenced RAI response). |
| PRA RAI 11 | March 16, 2015 | No change to PRA methods. |
| PRA RAIs 12 and 12.01 | January 22, 2015 and July 31, 2015 | RAI associated with guidance in Supplement 1 to NUREG/CR-6850. Confirm PRA method is changed consistent with the referenced RAI responses. |
| PRA RAI 14 | December 22, 2014 | RAI associated with Volume 2 of NUREG/CR-7150, "Joint Assessment of Cable Damage and Quantification of Effects from Fire," May 2014 (ADAMS Accession No. ML14141A129) guidance. Confirm PRA method is changed consistent with the referenced RAI response. |
| PRA RAIs 15, 15.01, and 15.01.01 | March 16, 2015, April 1, 2015, and July 31, 2015 | RAI related to fire probabilistic risk assessment (FPRA) modeling associated with the lack of breaker coordination. Consistent with the response to Part (a) of PRA RAI 15.01.01, PRA method is changed. This issue is still under evaluation (refer to PRA RA 15.01.01.01). Describe and complete any confirmatory sensitivity analysis |
| PRA RAI 16 | January 22, 2015 | No change to PRA methods with regard to in-cabinet incipient detection credit. For area-wide and main control room (MCR) incipient detection credit, see PRA RAIs 16.01 and 16.02, respectively. |
| PRA RAI 16.01 | July 31, 2015 | RAI associated with area-wide incipient detection credit. This issue is still under evaluation (refer to PRA RAI 16.01.01). Describe and complete any confirmatory sensitivity analysis. |
| PRA RAI 16.02 | July 31, 2015 | RAI associated with MCR incipient detection credit. Confirm PRA method is changed consistent with the referenced RAI response. |

| RAI | Reference* | Resolution of referenced RAI in PRA |
|---|---|---|
| PRA RAIs 18 and 18.01 | March 16, 2015 and April 1, 2015 | No change to PRA methods. |
| PRA RAI 19 | March 16, 2015 | No change to PRA methods. |
| PRA RAI 26 | March 16, 2015 | No change to PRA methods. |
| PRA RAI 29 | December 22, 2014 | RAI associated with FAQ 09-0057 guidance. No change to PRA methods. Confirm PRA is updated consistent with RAI response. |
| PRA RAIs 30 and 30.01 | March 16, 2015 and July 31, 2015 | RAI associated with Reactor Coolant Pump (RCP) Shutdown Seals (SDS). Confirm PRA used in support of the License Amendment Request (LAR) is consistent with the response to PRA RAI 30 and PRA used in support of self-approval will be updated consistent with the implementation item proposed in the response to PRA RAI 30.01. |
| PRA RAI 34 | March 16, 2015 | RAI associated with use of fire ignition frequencies from Supplement 1 to NUREG/CR-6850. Sensitivity analysis required. The results of the sensitivity study, which were requested in PRA RAI 34 but not provided in the March 16, 2015 letter, are to be included in the response to PRA RAI 03. |
| Fire Modeling (FM) RAI 01.b.01.01 | July 31, 2015 | RAI associated with fire propagation and zone of influence modeling changes to be updated in the FPRA. Describe and confirm the fire modeling update for the FPRA consistent with the RAI response. |
| FM RAI 01.b.01.02 | July 31, 2015 | RAI associated with a fire modeling method related to hot gas layer. Confirm that the acceptable method described in the supplement to FM RAI 01.b.01.02 and any follow-on FM RAIs is included in the response to PRA RAI 03. |

*ADAMS Nos. associated with RAI Responses in Table
December 22, 2014 - ADAMS Accession No. ML15005A073
January 22, 2015 - ADAMS Accession No. ML15036A059
March 16, 2015 - ADAMS Accession No. ML15079A025
April 1, 2015 - ADAMS Accession No. ML15099A454
July 31, 2015 - ADAMS Accession No. ML15212A136

**Response:**

The following table provides the proposed disposition of the identified RAI item list.

| RAI | Resolution of referenced RAI in PRA | Discussion of RAI Implementation in the PRA | Included in Post-Transition Model | Sensitivity Performed | Sensitivity included in Aggregate |
|---|---|---|---|---|---|
| PRA RAI 01.a | RAI associated with Facts and Observations (F&Os) CF-A2-01 and FSS-E1-01. A description of what was done for addressing state of knowledge in the response to PRA RAI 03 should be provided. If mean values will not be generated post-transition, the response to PRA RAI 03 should also clarify how parametric uncertainty, including the state-of-knowledge correlation, will be addressed in the self-approval evaluation of post-transition changes. | SOKC was incorporated for Hot Short probabilities in a manner similar to that used for ISLOCA, by applying a correction factor during post-processing. This factor also accounts for the floor value of the joint probability caused by multiple spurious operations.<br><br>The final quantification analysis includes a parametric uncertainty evaluation for the total CDF and LERF results that accounts for SOKC.<br><br>See Implementation Item 11 from Table S-3. | Yes | None | N/A |
| PRA RAI 01.b | RAI associated with F&O CS-A1-01. No change to PRA methods. Confirm PRA is updated consistent with referenced RAI response. | Confirmed: PRA is updated consistent with RAI response. No change to PRA methods. | Yes | None | N/A |
| PRA RAI 01.c | RAI associated with F&Os CS-A11-01 and FSS-E4-01. Describe and complete the confirmatory sensitivity analysis. | Model used for self-approval will assume cables are failed in areas with assumed cable routes. | Yes | CDF/LERF evaluated assuming no unknown cable failures | No |
| PRA RAI 01.g | RAI associated with F&O FSS-C7-01.<br>No change to PRA methods. | Confirmed: No changes to PRA methods. | No | None | N/A |
| PRA RAI 01.h | RAI associated with F&Os FSS-D7-01 and FSS-F3-02.<br>No change to PRA methods. | Confirmed: No changes to PRA methods. | No | None | N/A |

| RAI | Resolution of referenced RAI in PRA | Discussion of RAI Implementation in the PRA | Included in Post-Transition Model | Sensitivity Performed | Sensitivity included in Aggregate |
|---|---|---|---|---|---|
| PRA RAI 01.i | RAI associated with F&O FSS-G1-01.<br>No change to PRA methods. | Confirmed: No changes to PRA methods. | No | None | N/A |
| PRA RAI 01.j | RAI associated with FSS-G6-02.<br>No change to PRA methods. | Confirmed: No changes to PRA methods. | No | None | N/A |
| PRA RAI 01.k.01 | RAI associated with MCR abandonment methods.<br>No change to PRA methods. | Confirmed: No changes to PRA methods. | Yes | None | N/A |
| PRA RAI 02.a | RAI associated with F&O IE-C3-01. No change to PRA methods. Confirm PRA is updated consistent with RAI response. | Confirmed: PRA is updated consistent with RAI response. There were no changes to PRA methods. | Yes | None | N/A |
| PRA RAI 02.c | RAI associated with F&O LE-E1-01. Describe and complete the confirmatory sensitivity analysis. | Error and statistical distribution information for the LERF split fractions have been added to the model and is now evaluated quantitatively by the uncertainty analysis as part of quantification calculation. | Yes | Sensitivity not required as uncertainty parameters included in post-transition model. | N/A |
| PRA RAI 04 | See PRA RAIs 05, 06, 11, 14, 16 and 18 as well as associated follow-up RAIs: 05.a.01, 05.c.01, 06.01, 16.01, 16.02 and 18.01. Two issues are under review (refer to PRA RAIs 05.c.01.01 and 16.01.01). | See specific entries for each item in this table for treatment. | N/A | N/A | N/A |
| PRA RAI 05.a | No change to PRA methods. | Confirmed: No changes to PRA methods. | Yes | None | N/A |
| PRA RAI 05.a.01 | RAI associated with Frequently Asked Question (FAQ) 14-0009 guidance. No change to PRA methods. | Confirmed: No changes to PRA methods. | Yes | None | N/A |

| RAI | Resolution of referenced RAI in PRA | Discussion of RAI Implementation in the PRA | Included in Post-Transition Model | Sensitivity Performed | Sensitivity included in Aggregate |
|---|---|---|---|---|---|
| PRA RAI 05.b | RAI associated with NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, Volume 2: Detailed Methodology," September 2005 (ADAMS Accession No. ML052580118) and FAQ 08-0042 guidance. Confirm PRA method is changed consistent with the referenced RAI response. | Confirmed: PRA change is consistent with the RAI response. | Yes | None | N/A |
| PRA RAI 05.c | RAI associated with FAQ 14-0009 guidance. No change to PRA methods with regard to motor control centers (MCCs). Confirm methodology is consistent with final FAQ 14-0009. For non-MCC cabinets, see PRA RAI 05.c.01. | Confirmed: Methodology is consistent with FAQ 14-0009. There were no changes to PRA methods. | Yes | None | N/A |
| PRA RAI 05.c.01 | RAI associated with NUREG/CR-6850 guidance and the inapplicability of FAQ 14-0009 guidance. This issue is under evaluation (refer to PRA RAI 05.c.01.01). | Refer to PRA RAI 05.c.01.01. | N/A | N/A | N/A |
| PRA RAI 05.c.01.01 | This issue is under evaluation. | Electrical cabinets 440V and greater are conservatively treated as open cabinets even if they are well-sealed and robustly secured. Additional considerations are applied to MCCs in accordance with FAQ 14-0009. | Yes | None | N/A |
| PRA RAI 06 | RAI associated with FAQ 13-0004 guidance. Confirm PRA method is changed consistent with the referenced RAI response. | Confirmed: PRA change is consistent with the RAI response. | Yes | None | N/A |
| PRA RAI 06.01 | RAI associated with sensitive electronics outside of FAQ 13-0004 guidance. Confirm PRA method is changed consistent with the referenced RAI response. | Confirmed: PRA change is consistent with the RAI response. | Yes | None | N/A |
| PRA RAI 07 | No change to PRA methods. | Confirmed: No changes to PRA methods. | No | None | N/A |

| RAI | Resolution of referenced RAI in PRA | Discussion of RAI Implementation in the PRA | Included in Post-Transition Model | Sensitivity Performed | Sensitivity included in Aggregate |
|---|---|---|---|---|---|
| PRA RAI 10 | RAI associated with FAQ 13-0006 guidance. Confirm PRA method is changed consistent with FAQ 13-0006 guidance (as suggested by the referenced RAI response). | Confirmed: PRA change is consistent with the FAQ 13-0006. | Yes | None | N/A |
| PRA RAI 11 | No change to PRA methods. | Confirmed: No changes to PRA methods. | No | None | N/A |
| PRA RAI 12 | RAI associated with guidance in Supplement 1 to NUREG/CR-6850. Confirm PRA method is changed consistent with the referenced RAI responses. | Confirmed: PRA change is consistent with the RAI response. | Yes | None | N/A |
| PRA RAI 12.01 | RAI associated with guidance in Supplement 1 to NUREG/CR-6850. Confirm PRA method is changed consistent with the referenced RAI responses. | Confirmed: PRA change is consistent with the RAI response. | Yes | None | N/A |
| PRA RAI 14 | RAI associated with Volume 2 of NUREG/CR-7150, "Joint Assessment of Cable Damage and Quantification of Effects from Fire," May 2014 (ADAMS Accession No. ML14141A129) guidance. Confirm PRA method is changed consistent with the referenced RAI response. | Confirmed: PRA change is consistent with the RAI response. | Yes | None | N/A |
| PRA RAIs 15 | RAI related to fire probabilistic risk assessment (FPRA) modeling associated with the lack of breaker coordination. Consistent with the response to Part (a) of PRA RAI 15.01.01, PRA method is changed. This issue is still under evaluation (refer to PRA RA 15.01.01.01). Describe and complete any confirmatory sensitivity analysis | Refer to PRA RAI 15.01.01. | N/A | N/A | N/A |

| RAI | Resolution of referenced RAI in PRA | Discussion of RAI Implementation in the PRA | Included in Post-Transition Model | Sensitivity Performed | Sensitivity included in Aggregate |
|---|---|---|---|---|---|
| PRA RAI 15.01 | RAI related to fire probabilistic risk assessment (FPRA) modeling associated with the lack of breaker coordination. Consistent with the response to Part (a) of PRA RAI 15.01.01, PRA method is changed. This issue is still under evaluation (refer to PRA RA 15.01.01.01). Describe and complete any confirmatory sensitivity analysis | Refer to PRA RAI 15.01.01. | N/A | N/A | N/A |
| PRA RAI 15.01.01 | This issue is under evaluation. | Cables with identified routing and issues are modeled in the FPRA. Cables not modeled in the FPRA are addressed in a sensitivity. Change consistent with RAI response to be submitted in May 2016. | Yes – FPRA and NSCA Required cables with coordination and secondary fire concerns included | Calculated CDF/LERF of secondary fires caused by non-required cables | Yes |
| PRA RAI 16 | No change to PRA methods with regard to in-cabinet incipient detection credit. For area-wide and main control room (MCR) incipient detection credit, see PRA RAIs 16.01 and 16.02, respectively. | Confirmed: No change to PRA for in-cabinet treatment of incipient detection. | Yes | None | N/A |
| PRA RAI 16.01 | RAI associated with area-wide incipient detection credit. This issue is still under evaluation (refer to PRA RAI 16.01.01). Describe and complete any confirmatory sensitivity analysis. | Refer to PRA RAI 16.01.01 | N/A | N/A | N/A |
| PRA RAI 16.01.01 | This issue is under evaluation. | Will use the method described in the RAI. Post-transition, when an approved method for crediting area-wide incipient detection is available, the fire PRA model will be updated. | Yes | Calculated CDF/LERF without area-wide incipient | Yes |
| PRA RAI 16.02 | RAI associated with MCR incipient detection credit. Confirm PRA method is changed consistent with the referenced RAI response. | Confirmed: PRA change is consistent with the RAI response. | Yes | None | N/A |

| RAI | Resolution of referenced RAI in PRA | Discussion of RAI Implementation in the PRA | Included in Post-Transition Model | Sensitivity Performed | Sensitivity included in Aggregate |
|---|---|---|---|---|---|
| PRA RAI 18 | No change to PRA methods. | Confirmed: No changes to PRA methods. | Yes | None | N/A |
| PRA RAI 18.01 | No change to PRA methods. | Confirmed: No changes to PRA methods. | Yes | None | N/A |
| PRA RAI 19 | No change to PRA methods. | Confirmed: No changes to PRA methods. | No | None | N/A |
| PRA RAI 26 | No change to PRA methods. | Confirmed: No changes to PRA methods. | No | None | N/A |
| PRA RAI 29 | RAI associated with FAQ 09-0057 guidance. No change to PRA methods. Confirm PRA is updated consistent with RAI response. | Confirmed: PRA is updated consistent with RAI response. There were no changes to PRA methods. | Yes | None | N/A |
| PRA RAI 30 | RAI associated with Reactor Coolant Pump (RCP) Shutdown Seals (SDS). Confirm PRA used in support of the License Amendment Request (LAR) is consistent with the response to PRA RAI 30 and PRA used in support of self-approval will be updated consistent with the implementation item proposed in the response to PRA RAI 30.01. | Refer to PRA RAI 30.01. | N/A | N/A | N/A |
| PRA RAI 30.01 | RAI associated with Reactor Coolant Pump (RCP) Shutdown Seals (SDS). Confirm PRA used in support of the License Amendment Request (LAR) is consistent with the response to PRA RAI 30 and PRA used in support of self-approval will be updated consistent with the implementation item proposed in the response to PRA RAI 30.01. | Confirmed: PRA RCP SDS model used in support of self-approval will be updated consistent with the implementation item proposed in the response to PRA RAI 30.01.<br><br>RCP Shutdown Seals (SDS) are modeled using current guidance. | Yes | None | N/A |
| PRA RAI 34 | RAI associated with use of fire ignition frequencies from Supplement 1 to NUREG/CR-6850. Sensitivity analysis required. The results of the sensitivity study, which were requested in PRA RAI 34 but not provided in the March 16, 2015 letter, are to be included in the response to PRA RAI 03. | Confirmed: The results of the standalone sensitivity comparing the original NUREG/CR-6850 frequencies and updated frequencies from Supplement 1 with an alpha less than or equal to 1 will be included in the response to PRA RAI 03. | No | Ignition frequency sensitivity for NUREG/CR-6850 values | No |

| RAI | Resolution of referenced RAI in PRA | Discussion of RAI Implementation in the PRA | Included in Post-Transition Model | Sensitivity Performed | Sensitivity included in Aggregate |
|---|---|---|---|---|---|
| Fire Modeling (FM) RAI 01.b.01.01 | RAI associated with fire propagation and zone of influence modeling changes to be updated in the FPRA. Describe and confirm the fire modeling update for the FPRA consistent with the RAI response. | Confirmed: PRA change is consistent with the RAI response.<br>An empirical fire growth method was applied in the FPRA. For the specific cases where detailed fire modeling was required, the expanded ZOI treatment was applied. | Yes | None | N/A |
| FM RAI 01.b.01.02 | RAI associated with a fire modeling method related to hot gas layer. Confirm that the acceptable method described in the supplement to FM RAI 01.b.01.02 is included in the response to PRA RAI 03 to be submitted May 2016. | Confirmed: The acceptable method described in the supplement to FM RAI 01.b.01.02 is included in the response to PRA RAI 03. | Yes | None | N/A |

**PRA RAI 05.c.01.01**

The response to PRA RAI 05.c.01 (ADAMS Accession No. ML15079A025) states that the treatment of well-sealed and robustly secured cabinets that are not MCCs is consistent with NUREG/CR-6850, as clarified by FAQ 08-0042. The response does not, however, appear to address the statement in Chapter 6 of NUREG/CR-6850 that indicates that for cabinets housing circuits of above 440V, “an arcing fault could compromise panel integrity (an arcing fault could burn through the panel sides, but this should not be confused with the high energy arcing fault type fires)." Justify the FPRA’s treatment of such arcing faults for well-sealed and robustly secured cabinets that are not MCCs and that operate at 440V or greater.

**Response:**

As there is no currently accepted guidance on breaching factors for non-MCC electrical cabinets operating at 440V or greater, the approach used in the Fire PRA has been updated since the response to PRA RAI 05.c.01 in letter RNP RA/15-0071 dated 7/31/15. Electrical cabinets 440V and greater are conservatively treated as open cabinets even if they are well-sealed and robustly secured.

**PRA RAI 18.01**

The response explains that treatment of self-ignited and cutting-and-welding fires is consistent with FAQ 13-0005 for one fire compartment and for other compartments these fires were screened out because they were determined to have “insignificant impact.” In apparent contrast to this, the response PRA RAI 08 states “cable fires due to cutting and welding are assigned no target sets because a continuous fire watch with an extinguisher is required by procedure to be present during hot work activities and is assumed to extinguish such a fire before it can spread beyond the original tray.” The cited responses to PRA RAI 08 and PRA RAI 18 appear to be inconsistent. Please clarify this apparent inconsistency and identify how these cable fires will be modeled in the integrated analysis provided in response to PRA RAI 3.

**Response:**

The statement in the response to PRA RAI 08 (Reference Robinson Letter RNP-RA/14-0122 dated 11/24/14) is consistent with Fire PRA FAQ 13-0005, as it assumes damage is limited to a single tray and no additional target sets. For Robinson, a bounding approach was initially used to assess all cable fires due to cutting and welding by conservatively applying the limiting source scenario CCDP or CLERP (not limited to a single tray) for the applicable compartment to the cutting and welding scenario, effectively assuming the cutting and welding scenarios had a target set equal to the most limiting scenario. If the bounding treatment resulted in significantly high results, then a tray-by-tray assessment was performed per Fire PRA FAQ 13-0005 to identify the limiting tray CCDP and CLERP for the compartment. The tray-by-tray assessment was only needed for Fire Compartments 250 (Turbine Building), 254 (Turbine Building Mezzanine), and 70 (Lower Hallway). This treatment of the cable fires is included in the quantification results presented in the response to PRA RAI 3.

**PRA RAI 23.a**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-

informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

Section W.2.1 of the LAR provides some description of how the change-in-risk and the additional risk of recovery actions associated with VFDRs is determined but not enough detail to make the approach completely understood. Provide the following:

> a) A detailed definition of both the post-transition and compliant plant models used to calculate the reported change-in-risk, including any special calculations for the MCR. Include description of the model adjustments made to remove VFDRs from the compliant plant model, such as adding events or logic, or use of surrogate events. Also include explanation of how VFDR and non-VFDR modifications are addressed for both the post-transition and compliant plant models. Include explanation of whether the approach is consistent with guidance in FAQ 08-0054, "Demonstrating Compliance with Chapter 4 of NFPA 805" and FAQ 07-0030, "Establishing Recovery Actions."

**Response:**

The post-transition (or variant) model is developed using the as-built, as-operated and maintained plant configuration with additional procedure changes and modifications identified in Attachment S of the H. B. Robinson Steam Electric Plant Transition to 10 CFR 50.48(c) LAR submittal. The NFPA 805 compliant Fire PRA model is based on the same post-transition model but excludes fire induced failures of basic events associated with equipment that are related to cables identified as Variances From Deterministic Requirements (VFDRs) per Attachment C of the LAR. The ΔCDF and ΔLERF values are determined by calculating the CDF/LERF differences between the variant and the compliant models.

Recovery actions are defined as risk significant operator actions taken to mitigate VFDRs that are performed outside of the main control room and away from designated primary control stations (PCS). Table G-1 of Attachment G of the LAR provides the recovery actions for each fire area (denoted as “RA” in the “RA/RADID/PCS” column). Main Control Room (MCR) abandonment is a unique case in the post-transition and compliant plant models. For MCR abandonment, operator actions required to transition from the MCR to the PCS are not considered recovery actions. In addition, planned changes to the MCR abandonment procedure (DSP-002, “HOT SHUTDOWN WITH A FIRE IN THE CONTROL ROOM/HAGAN ROOM”) will be addressed in the response to PRA RAI 3. The MCR abandonment is the same for both the compliant and variant models for calculating reported change-in-risk as part of the response to PRA RAI 3. The risk of recovery actions (RORA) is determined by setting the recovery actions to be successful and calculating the change in CDF/LERF from the baseline post-transition model.

Plant modifications that have been completed or committed to be performed are defined in Tables S-1 and S-2 of Attachment S of the LAR. All identified plant modifications that are modeled in the Fire PRA are included in both the variant and compliant Fire PRA models.

This response has been evaluated against the guidance provided in FAQ 08-0054, “Demonstrating Compliance with Chapter 4 of NFPA 805” and FAQ 07-0030, “Establishing Recovery Actions.” The modeling practices of the post-transition and compliant models are consistent with both models.

**PRA RAI 24.01**

In apparent contrast to the response to PRA RAI 24.e, the response to PRA RAI 01.f indicates that there are actions taken in the plant at the remote shutdown locations to recover equipment affected by fire not associated with main control room (MCR) abandonment that are credited in the Fire PRA. Attachment G and the response to PRA RAI 24.e seem to indicate that these actions are designated as defense-in-depth actions. Actions taken in the plant at the remote shutdown locations to recover equipment affected by fire not associated with MCR abandonment may be recovery actions since command and control is not established at the remote shutdown panel. Please clarify whether these actions should be considered recovery actions as discussed in RG 1.205, or discuss the rationale for their designation as defense in depth. If these actions should be recovery actions, discuss how the additional risk of recovery actions for the applicable scenarios in which the MCR is not abandoned will be modeled in response to PRA RAI 3.

**Response:**

The response to PRA RAI 24.e (Reference Robinson Letter RNP-RA/14-0122 dated 11/24/14) has been updated to clarify that RA-DIDs were categorized as such due to low risk significance. The process for determining this outcome is based on assessing the delta risk contribution from modeled actions in the FPRA.

For the Robinson NFPA 805 LAR, recovery actions are identified for operator actions performed in the plant at locations other than in the Main Control Room or at primary control stations, which are identified in Attachment G. The primary control stations (PCSs) are the Dedicated Shutdown Diesel Control Panel, Secondary Control Panel on the Turbine Deck, and the Charging Control Panel in the Charging Pump Room. Therefore, operator actions identified in Attachment G that are credited in the FPRA and performed at locations other than the MCR or PCS are classified as “recovery actions”. It follows that actions taken at the remote alternate control stations, for non-abandonment, are “recovery actions”, given that they are activities outside of the MCR to achieve the nuclear safety performance criteria in response to a Variance From Deterministic Requirement (VFDR).

The change in risk (delta risk) for a recovery action is modeled by the difference between CDF/LERF for the recovery actions based on the post-transition (or variant) base case, which applies the nominal human error probability (HEP), and the compliant case, which has the HEP set to zero (always successful). This calculation can yield conservative results because the HEPs can also be associated with scenarios that do not involve VFDRs. Therefore, the delta risk of the recovery actions is limited by the delta risk for the VFDR cables.

The categorization of RA or RA-DID for recoveries modeled in the FPRA is based on the magnitude of the change in risk of the recovery action.

The results of this analysis are provided in LAR Table W-5.

**PRA RAI 24.b**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

Regarding Fire Risk Evaluations, address the following:

b) Discuss whether the Fire PRA accounts for the synergy between all VFDRs in a fire area.

**Response:**

b) The fire PRA accounts for the synergy among all VFDRs in a fire area by protecting all VFDR cables concurrently in the compliant model. For MCR abandonment the fire PRA accounts for the synergy of Recovery Actions (RAs) by setting all HEPs associated with RAs to zero (i.e., always successful) in the compliant model.

**PRA RAI 24.c**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF, LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

Regarding Fire Risk Evaluations, address the following:

c) LAR Attachment W, Table W-5 provides three columns of results associated with change-in-risk: "VFDR Risk Eval Δ CDF/LERF," "Additional Risk of RAs Δ CDF/LERF," and "Total Fire Risk Eval Δ CDF/LERF." Explain the how the values in the "VFDR Risk Eval Δ CDF/LERF" and the "Total Fire Risk Eval Δ CDF/LERF" columns are different and how they are calculated.

**Response:**

c) Table W-5 will be revised for the LAR update to be submitted in May 2016. There are now only two columns of results associated with change-in-risk: “Fire Risk Eval Δ CDF/LERF” and “Risk of RAs Δ CDF/LERF”.

The “Fire Risk Eval Δ CDF/LERF” values are the delta risk numbers calculated as the difference between the risk from the post-transition model and the risk from the compliant model (VFDR cables protected as per Section W.2.1 of the LAR). Risk reduction modifications are credited in both the post-transition and compliant models.

The “Risk of RAs Δ CDF/LERF” values are the delta risk numbers calculated as the difference between the risk from the post-transition model with HEPs for recovery actions set at the normal probabilities, and

the risk with HEPs for recovery actions set to zero (always successful). This calculation can yield conservative results because the HEPs may also be associated with cases that do not involve VFDRs. Therefore, the delta risk of recovery actions will not exceed the delta risk for the VFDR cables.

**PRA RAI 30.02**

The response to PRA RAI 30 (ADAMS Accession No. ML15079A025) revises Implementation Item 11 of LAR Table S-3 to reference Table S-2; however, while Table S-2 addresses planned modifications, it does not include procedure updates, which appear to be in Table S-3. Risk and change-in-risk results should be re-evaluated after both modifications and procedure updates are completed. Clarify that Implementation Item 11 will also include procedure updates as described in Table S-3.

**Response:**

Subsequent to the completion of the modifications and procedure revisions identified in Tables S-2 and S-3, the post-transition Fire PRA model will be updated as necessary to reflect the as designed and operated plant, and the model results will be compared to the RG 1.174 acceptance criteria for risk and change-in-risk results.