UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 7, 2015

Mr. Richard Michael Glover
Site Vice President
H. B. Robinson Steam Electric Plant
Duke Energy
3581 West Entrance Road, RNPA01
Hartsville, SC 29550

SUBJECT: H. B. ROBINSON STEAM ELECTRIC PLANT UNIT NO. 2 – REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST TO ADOPT NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805, "PERFORMANCE-BASED STANDARD FOR FIRE PROTECTION FOR LIGHT WATER REACTOR ELECTRIC GENERATING PLANTS" (TAC NO. MF2746)

Dear Mr. Glover:

By letter dated September 16, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13267A211), Duke Energy Progress, Inc., the licensee, for H. B. Robinson Steam Electric Plant Unit No. 2, submitted a license amendment request to adopt a new fire protection licensing basis that complies with the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), 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).

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the licensee's submittal and determined that additional information was needed in order to complete its review. By letters dated October 23, 2014, and March 26, 2015 (ADAMS Accession Nos. ML14289A260 and ML15057A403, respectively), the NRC staff issued requests for additional information (RAIs). By letters dated December 22, 2014; January 22, 2015; March 16, 2015; and April 1, 2015 (ADAMS Accession Nos. ML15005A073, ML15036A059, ML15079A025, and ML15099A454 respectively), the licensee provided RAI responses related to the enclosed RAI. The licensee's March 16, 2015, letter supersedes its November 24, 2014, RAI response letter in order to request to withhold, under 10 CFR 2.390, security-related information contained in the November 24, 2014, RAI response.

The NRC staff has determined that additional information is needed to complete its review related to fire modeling and probabilistic risk assessment (PRA). The enclosed RAI was e-mailed to the licensee in draft form on June 17, 2015 (ADAMS Accession No. ML15169A027). RAI clarification calls were held on June 24, 2015, and July 1, 2015. On the July 1, 2015, call, the licensee agreed to provide the RAI responses by July 31, 2015. The licensee also agreed to provide the remaining submittals, which are the responses to PRA RAI 03 and updates to Attachments C, G, J, S, V, and W, by September 25, 2015. The NRC staff agreed with these dates.

If you have any questions, please contact me at 301-415-2760 or Martha.Barillas@nrc.gov.

Sincerely,

/RA/

Martha Barillas, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-261

Enclosure:
Request for Additional Information

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REQUEST FOR ADDITIONAL INFORMATION

REGARDING LICENSE AMENDMENT REQUEST TO ADOPT

NATIONAL FIRE PROTECTION ASSOCIATION STANDARD (NFPA) 805,

"PERFORMANCE-BASED STANDARD FOR FIRE PROTECTION

FOR LIGHT WATER REACTOR ELECTRIC GENERATING PLANTS,"

DUKE ENERGY PROGRESS, INC.

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

DOCKET NO. 50-261

H. B. Robinson Steam Electric Plant Unit No. 2 (Robinson) NFPA 805 3rd Round Requests for Additional Information (RAIs) – Fire Modeling (FM)

FM RAI 01.b.01.01

In a letter dated April 1, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15099A454), the licensee responded to FM RAI 01.b.01. For the first part of the RAI response, the licensee referred to Figure 9-2 of NUREG/CR-7010, "Cable Heat Release, Ignition, and Spread in Tray Installations During Fire (CHRISTIFIRE)," as an example to show that as the progression of the fire extends outwards, "the burning region remains somewhat constant." In the second part of its response, the licensee further stated that the vertical zone of influence (ZOI) would be extended to the ceiling if there are multiple trays in the ZOI of the ignition source.

Figure 9.2 in NUREG/CR-7010 clearly shows that between the 15th and 30th minute periods, flames have spread laterally, while no sections of the trays have burnt out. According to the FLASH-CAT model described in Chapter 9 of NUREG/CR-7010, lateral flame spread begins as soon as a tray ignites and propagates at a rate of 0.9 millimeters per second for thermoplastic cable. Cables do not burn out until the combustible jacket and insulation have been consumed. In addition, from the response to the second part of FM RAI 01.b.01, it does not appear that the licensee accounted for the effect of the increased heat release rate (HRR) due to fire propagation in cable trays on the horizontal ZOI and the development of a damaging hot gas layer (HGL).

Reevaluate the target damage for all scenarios that involve secondary combustibles (i.e., cable trays). In this reevaluation, calculate fire propagation in stacks of cable trays taking horizontal flame spread into account, determine the expanded ZOI that corresponds to the combined HRR from the ignition source and the cable trays, and identify any targets that are in the expanded ZOI. If in the reevaluation the licensee does not use the model described in Section R.4 of NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," or the FLASH-CAT model described in Chapter 9 of NUREG/CR-7010, explain in detail how the time

to ignition of the lowest tray is determined and how subsequent fire propagation in cable trays is calculated. Determine the impact of the results of the reevaluation on the risk (CDF, ΔCDF, LERF, and ΔLERF). Alternatively, demonstrate that the approach currently used by the licensee to determine target damage in fire scenarios that involves cable trays as intervening combustibles is conservative and bounding.

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.

FM RAI 01.b.01.03

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 time to ignition of the lowest tray in a stack of cable trays.

The response refers to Section 5.6.2 of fire PRA calculation RNP-F/PSA-0094 (fire PRA quantification), which in turn refers to another document for a description of the method that was used to determine the time to ignition of the lowest tray in a stack. This method relies on Heskestad's correlation to calculate the plume temperature at the tray as a function of time based on the HRR of a cabinet during the t^2 growth phase. However, the report also indicates that in addition, a damage accrual method was used to determine the damage delay based on Tables H-5 and H-6 in NUREG/CR-6850, Appendix H. There is no detailed description of the method, and it appears that the damage accrual method used does not account for the effect of the preheat that would occur during the initial period when the plume temperature is below the damage threshold.

In addition, Section 5.6.2 of the fire PRA quantification seems to imply that a cable is assumed to ignite when it has reached the damage threshold. Since Section H.1.5.2 in NUREG/CR-6850, Appendix H, does not discuss the application of Tables H-5 and H-6 to determine ignition delay, the use of the damage accrual method to estimate the time to ignition requires technical justification.

Finally, the licensee's response to FM RAI 01.a in a letter dated December 22, 2014 (ADAMS Accession No. ML15005A073), states that all fire modeling tools and methods used in the development of the license amendment request (LAR) were discussed in LAR Attachment J. However, a discussion of the damage accrual method that was used is not included and should be, particularly because it is used to determine ignition delay.

Provide a detailed description of the damage accrual method used and the technical basis and verification and validation to justify its use to determine ignition and damage delays. In the description, discuss how the method accounts for the effect of the preheat that would occur during the initial period when the plume temperature is below the ignition/damage threshold. If the method does not address preheat, either revise the analysis to address this phenomenon, or provide technical justification that the method used is conservative.

Robinson NFPA 805 2nd Round RAIs – PRA

PRA RAI 01.k.01

PRA RAI 01.k requested additional information on how scenarios involving abandonment of the main control room (MCR) due to loss of habitability are evaluated. PRA RAI 23.a requested additional information on any special calculations used to evaluate the change-in-risk from MCR abandonment. (In its letter dated December 22, 2014, the licensee responded to PRA RAI 01.f and stated that only the MCR abandonment scenarios in the PRA are loss of habitability scenarios, so it is assumed that the responses to PRA RAI 01.k and PRA RAI 23.a (both provided in a letter dated January 22, 2015 (ADAMS Accession No. ML15036A059), refer only to loss of habitability).

The response to PRA RAI 01.k.ii states:

> The CCDP/CLERP [conditional core damage probability/conditional large early release probability] values were only calculated based on the worst-case scenario; these different scenarios are bounded by the current modeling results. The worst-case scenario is determined by failure of any operator actions as discussed in the previous section.

The response to PRA RAI 23.a states:

> For the compliant case, critical actions that occur outside of a PCS [primary control station] in the updated MCR abandonment procedure will be set to always succeed as these would be considered recovery actions. However, the planned changes to the MCR abandonment procedure will not include critical actions that occur outside of a PCS. Therefore, it is currently assumed that MCR abandonment will not differ between the compliant and [post-transition] variant models for calculating reported change-in-risk.

The NRC staff requests the following information to determine whether accounting for the range of probabilities for properly shutting down the plant following loss of MCR habitability could change the acceptable change-in-risk estimates to unacceptable estimates.

a) Identify the fire frequency, CCDP, and CLERP assigned to the abandonment scenarios for the compliant and the variant plant.

b) Explain all differences between the compliant and the variant plant PRA models for the abandonment scenarios.

c) A simple claim of "worst case scenario" is insufficient when the meaning of worst case can vary as it does with change-in-risk calculations. For each of the three fire severity bins identified in PRA RAI 01.k.ii (ADAMS Accession No. ML14289A260), summarize how the change-in-risk calculation is performed and justify that the change-in-risk estimates from the loss of habitability abandonment scenarios are well characterized or conservative.

d) Confirm that "will not differ" means that the post-transition plant and the compliant MCR abandonment PRA model are identical (both quantitative values and logic models) and model only the human actions to operate the single train, or explain any differences. Clarify how post-transition plant changes that affect non-modelled details, such as the equipment available and alternative operator actions, will be included in the post-transition change-in-risk evaluations.

e) If the post-transition plant and the compliant MCR abandonment PRA model are the same, all variances from the deterministic requirements (VFDRs) in Fire Area 18 must have been removed during transition. Otherwise, the two models would differ because of retained VFDRs in one but not the other. Please confirm that all VFDRs in the fire area will be removed or clarify why the two models (i.e., the post-transition and the compliant) are the same.

PRA RAI 05.c.01

In a letter dated March 16, 2015 (ADAMS Accession No. ML15079A025), the licensee responded to PRA RAI 05.c and indicated that for well-sealed and robustly secured cabinets that are not motor control centers (MCCs) but do house circuits greater than 440 volts (V), propagation of fire outside the ignition source will be evaluated using the guidance in Frequently Asked Question (FAQ) 14-0009, dated April 29, 2015. However, as stated in the final revision to the FAQ, "[t]he scope of this FAQ is limited to well-sealed, robustly-secured MCCs operating at 440V or greater, and does not apply to other electrical cabinets..." Confirm whether fire propagation outside of well-sealed and robustly secured cabinets that are not MCCs but do house circuits greater than 440V are evaluated consistent with guidance in NUREG/CR-6850. If it is not, to resolve this issue, provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03, evaluating propagation for these cabinets consistent with NRC-accepted guidance.

PRA RAI 06.01

In its letter dated January 22, 2015, the licensee responded to PRA RAI 06 and indicated that the FAQ 13-004 guidance will be applied in the fire probabilistic risk analysis (FPRA) used for the integrated analysis provided in response to PRA RAI 03. PRA RAI 06 also requested explanation on how several specific configurations that fall outside the guidance will be treated.

The response failed to provide the information about the specific configurations. Discuss how configurations outside the guidance in FAQ 13-0004 are addressed (i.e., sensitive electronics external to cabinets, within adjacent cabinets, mounted on the surface of cabinets, or in the presence of louver or vents).

PRA RAI 12.01

In its letter dated January 22, 2015, the licensee responded to PRA RAI 12 and stated that following a high energy arching fault (HEAF), exposed combustibles within the initial HEAF ZOI are ignited consistent with guidance in FAQ 07-0035, but that continued propagation beyond the initial ZOI is not assumed to occur for the ensuing fire. The response states that the basis for this assumption is FAQ 13-0005, which states that a relatively small quantity of molten slag resulting from cutting or welding is insufficient to establish sustained combustion. Cable fires due to welding and cutting are not comparable to HEAF events, which, as indicated by event descriptions in FAQ 07-0035, are capable of producing large amounts of slag. To resolve this issue, modify the methodology to be consistent with the accepted guidance by applying continued fire propagation in accordance with FAQ 07-0035 guidance in the PRA model and in the results provided in the response to PRA RAI 03.

PRA RAI 15.01.01

In a letter dated March 16, 2015 (ADAMS Accession No. ML15079A025), the licensee responded to PRA RAI 15.01 and explained "[c]able protection against overload and short circuit is a consideration in the general design criteria for protective device selection, however is limited in application," and that the fire PRA does not model secondary fires resulting from lack of adequate circuit protection. The phrase "however is limited in application" seems to imply that there may not be adequate circuit protection in some cases and that secondary fires could occur. If breaker coordination will not be implemented through modifications described in Attachment S of the LAR, provide further information about how lack of coordination is reflected in the fire PRA.

a) Please clarify what "limited in application" means and whether this means that some secondary fires cannot be precluded. If the secondary cable fires cannot be precluded based on the general design criteria, why can they be precluded. If they cannot be precluded, resolve this issue by including the secondary fires in the transition and post-transition FPRA and in the results reported in the response to PRA RAI 03.

a. The response to PRA RAI 15.01 explains that, "[i]n some cases breaker coordination was achieved by crediting cable length for the load." The guidance in NUREG/CR-6850, Section 3.5.4.2, Step 4.1, item 3, states, "Coordination should not be predicated on limiting fault current based on cable length." Clarify whether the guidance in NUREG/CR-6850 is being met. If the guidance is not met, resolve this issue by adding the affected breakers to the uncoordinated breaker population in the transition and post-transition FPRA and in the results reported in the response to PRA RAI 03.

PRA RAI 16.01

In its letter dated January 22, 2015, the licensee responded to PRA RAI 16, and regarding areawide incipient detection, described the system that will be installed and credited three items in the fire PRA: 1) prompt detection credit, 2) 5-minute credit for detecting a fire during its incipient stage, and 3) use of the MCR suppression curve.

a) Justify applying the 5-minute credit for i) the open relay racks and ii) for the other cabinets, or remove the credit from some or all of the ignition sources in the transition and post-transition FPRA and in the results reported in the response to PRA RAI 03.

b) Use of the MCR non-suppression curve was argued as justified, "because the detection of a fire during the incipient stage by an area-wide incipient detection system is expected to prompt an operator response to act as a continuous fire watch in fire compartment 190 until the incipient alarm is resolved." A continuous fire watch in a compartment does not appear to be equivalent to the staffing and attentiveness in the MCR. The general electric cabinet non-suppression curve may be the most applicable. To resolve this issue, justify and use an alternative non-suppression curve in the transition and post-transition FPRA and in the results reported in the response to PRA RAI 03.

c) Appendix P of NUREG/CR-6850 provides a method for calculating the non-suppression probability, which depends on time for manual suppression. With respect to its use for areawide incipient detection, please address the following:

   i. Discuss how much reduction in the non-suppression probability is associated with crediting areawide incipient detection and the basis for the reduction.

   ii. The time to manual suppression in Appendix P is dependent on the time to target damage, the time for fire brigade response, and the time to detection. Discuss differences in the assumptions for these terms depending on success or failure of incipient detection.

   iii. Discuss the range of non-suppression probabilities for fire scenarios crediting areawide incipient detection (when detection is successful and not successful).

d) Discuss how the areawide and in-cabinet incipient detection compare in terms of reducing the risk for credited sequences (i.e., the reduction factor from crediting incipient detection).

PRA RAI 16.02

The response to PRA RAI 16 states that FAQ 08-0046 is not used to credit incipient detection in main control board (MCB) scenarios but then describes an overview of an evaluation that includes the same factors in the same sequence as those described in FAQ 08-0046. The factors in FAQ 08-0046 only apply to in-cabinet detection for non-continuously occupied areas and cannot be used for the MCB. To resolve this issue, modify the methodology to be consistent with the accepted guidance by removing the credit for incipient detection for reducing

the frequency of MCB fires from the transition and post-transition FPRA and in the results reported in the response to PRA RAI 03.

PRA RAI 30.01

With regard to the planned new reactor coolant pump seals, the NRC is accepting models of shutdown seal (SDS) failure based on the best available information at the time of transition, when accompanied by assurance that accepted models will be used when available. Please include a Table S-3 implementation item (e.g., implementation item 11) that ensures Robinson will use NRC-accepted SDS failure models as they become available and to confirm, as a minimum, that the transition change-in-risk estimates will not exceed Regulatory Guide 1.205, Revision 1, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," acceptance guidelines. The implementation item should also clarify that self-approved changes that rely on the SDS failure model will not be undertaken before acceptable models have been developed. In addition, please clarify how transition to NFPA 805 could be achieved if an acceptable RCP seal model is delayed for an extended time.

If you have any questions, please contact me at 301-415-2760 or Martha.Barillas@nrc.gov.

Sincerely,

/RA/

Martha Barillas, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-261

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Request for Additional Information

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