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DUKE ENERGY®

CNS-15-067

July 15, 2015

10 CFR 50.90

U.S. Nuclear Regulatory Commission (NRC)
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Duke Energy Carolinas, LLC (Duke Energy)
Catawba Nuclear Station, Units 1 and 2
Docket Numbers 50-413 and 50-414
License Amendment Request (LAR) to Adopt National Fire Protection Association (NFPA) 805 Performance-Based Standard for Fire Protection for Light-Water Reactor Generating Plants
Supplemental Response to NRC Request for Additional Information (RAI) (TAC Nos. MF2936 and MF2937)

References:

1. Letters from Duke Energy to the NRC, dated September 25, 2013 (ADAMS Accession Number ML13276A503), January 13, 2015 (ADAMS Accession Number ML15015A409), January 28, 2015 (ADAMS Accession Number ML15029A697), February 27, 2015 (ADAMS Accession Number ML15065A107), March 30, 2015 (ADAMS Accession Number ML15091A339), and April 28, 2015 (ADAMS Accession Number ML15119A533)

2. Letters from the NRC to Duke Energy, dated May 10, 2015 (ADAMS Accession Number ML15125A521) and June 18, 2015 (ADAMS Accession Number ML15147A676)

The Reference 1 letters comprise in their entirety Duke Energy's request for NRC review and approval for adoption of a new fire protection licensing basis which complies with the requirements in 10 CFR 50.48(a), 10 CFR 50.48(c), and the guidance in Regulatory Guide (RG) 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants", Revision 1, dated December 2009. The September 25, 2013 Reference 1 LAR was developed in accordance with the guidance contained in Nuclear Energy Institute (NEI) 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)", Revision 2.

The Reference 2 letters transmitted supplemental RAIs necessary for the NRC to continue its review of the LAR.

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The purpose of this letter is to provide the first docketed response to the Reference 2 RAIs. The enclosure to this letter provides this response. The format of the enclosure is to restate each RAI question, followed by its associated response.

The conclusions of the No Significant Hazards Consideration and the Environmental Consideration contained in the September 25, 2013 Reference 1 LAR are unaffected by this RAI response.

There are no regulatory commitments contained in this letter or its enclosure.

Pursuant to 10 CFR 50.91, a copy of this LAR supplement is being sent to the appropriate State of South Carolina official.

Inquiries on this matter should be directed to L.J. Rudy at (803) 701-3084.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on July 15, 2015.

Very truly yours,

Kelvin Henderson
Vice President, Catawba Nuclear Station

LJR/s

Enclosure

xc (with enclosure):

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Enclosure

Supplemental Response to NRC Request for Additional Information (RAI)

REQUEST FOR ADDITIONAL INFORMATION (RAI)

ADOPTION OF NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

STANDARD 805 FOR FIRE PROTECTION

DUKE ENERGY CAROLINAS, LLC (DUKE)

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413, 50-414

By letter dated September 25, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13276A503), Duke Energy Carolinas, LLC (Duke) submitted a license amendment request (LAR) to change its fire protection program to one based on the National Fire Protection Association (NFPA) Standard-805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition. The U.S. Nuclear Regulatory Commission (NRC) staff is continuing its review and has determined that additional information is needed in the fire modeling and probabilistic risk assessment areas as follows.

Fire Modeling (FM) RAI 01.i.(i).01

NFPA-805, Section 2.4.3.3, states, in part, that the probabilistic risk assessment (PRA) approach, methods, and data shall be acceptable to the NRC. LAR Section 4.5.1.2, "Fire Model Utilization in the Application," states, in part, that fire modeling was performed as part of the Fire PRA development.

In a letter dated January 28, 2015 (ADAMS Accession No. ML15029A697), the licensee responded to FM RAI 01.i.(i) and explained that the Catawba "Cable Use Restrictions Specification" went into effect in 1981 with the primary objective of limiting the quantity of combustible loading. The licensee further stated that the specification provides high confidence that any jacketed cable related to the Fire PRA is minimal. The licensee also quoted the following from the report that investigated the observations from the Duke Armored Cable Control Circuit Fire Test Program conducted in 2006: "Armored cables similar to the types used at Duke Energy nuclear power generating stations exhibit flame propagation characteristics consistent with cable types considered non-propagating or [Institute of Electrical and Electronic Engineers] IEEE 383 or equivalent 'qualified'."

The fact that cables behave as IEEE 383 qualified does not mean that they are not susceptible to fire propagation in accordance to the mechanisms described in NUREG/CR-6850, Appendix R. Although the "Cable Use Restrictions Specification" might support the assumption that jacketed cable need not be considered in the fire modeling analyses, in the response to FM RAI 02(a), the licensee indicated that more than 5% of the cabling in six Fire Areas is thermoplastic (i.e., armored or unarmored cable with a thermoplastic jacket).

There is an apparent inconsistency between the responses to FM RAIs 01 (i).i and 02(a), so explain this inconsistency and provide additional justification for not considering the effect of fire propagation and the resulting Heat Release Rate (HRR) of secondary combustibles (cable trays) on the Zone of Influence (ZOI) determination and Hot Gas Layer (HGL) timing calculations.

Duke Energy Response:

Fire Modeling (FM) RAI 01.i.(i), dated November 20, 2014, originally asked Duke Energy to confirm that the armored cables at Catawba do not have a PVC jacket around the insulated conductors inside the armor and that no cables with a PVC jacket (either inner or outer) are mixed in with the unjacketed "Duke" qualified armored cables (as represented in the tested configuration in 2006). As stated in the original response, the amount of cabling at Catawba with PVC jacketing is minimal based on the cable use restriction specification. In contrast to FM RAI 01.i.(i), FM RAI 02.a requested further information "specifically with regard to the critical damage threshold temperatures and critical heat fluxes for thermoset and thermoplastic cables as described in NUREG/CR-6850". In order to answer that request, the response to FM RAI 02.a described the presence and treatment of cable with thermoplastic insulation material, since the type of insulating material defines the critical damage threshold temperatures and critical heat fluxes. The response was not referring to the presence of any PVC jacketing around the insulated conductors (i.e., it was not indicating that six fire areas had greater than 5% cable with PVC jacket). As such, there is no inconsistency between the response to the two RAIs.

The response to FM RAI 02.a provided an evaluation for the six areas identified with greater than 5% thermoplastic insulated cables to show that this amount of thermoplastic insulated cable would not significantly impact the overall CDF/LERF results. Each of these evaluations has been updated below to show that the presence of additional thermoplastic insulation, with regard to effect of fire propagation and the resulting HRR of secondary combustibles (cable trays) on the ZOI determination and HGL timing calculations, would not change the results described in these evaluations.

1. **Fire Areas RB1 and RB2 (Unit 1 and Unit 2 Reactor Buildings): These fire areas each contain approximately 6% thermoplastic cable. Fire propagation in these areas is addressed by the fact that no specific ignition source ZOIs or heat release rates were used to determine impacted cables, since detailed walkdowns were not feasible. Instead, conservative assumptions were made regarding impacted targets by reviewing cable tray drawings and assuming all trays in the area near the ignition source were impacted. For example, for reactor coolant pump fires, all cable trays within the shield wall were assumed impacted, regardless of the distance to the reactor coolant pump. This conservative process accounts for fire propagation. Additionally, due to the large volume and physical geometry of the reactor buildings, hot gas layer formation is not a concern. Based on this, the amount of thermoplastic cable in these areas has no impact on the Fire PRA results.**

2. **Fire Area 24 (Unit 1 Fuel Storage Area): This fire area contains approximately 5% thermoplastic cable. However, this area contains no credited components or cables and was treated as a full compartment burnout scenario. Therefore, the most conservative treatment of fire propagation and HGL has already been applied, such that the characterization of the cables as thermoplastic or thermoset does not impact the Fire PRA.**

3. **Fire Area 1 (Residual Heat Removal (ND) and Containment Spray (NS) Pump Room): This fire area contains approximately 5% thermoplastic cable. In the FPRA, one scenario was created for each of the eight pumps (four pumps per unit), since each pump is in its own room. Each of these scenarios conservatively assumes all targets in the room are impacted. This conservative approach accounts for fire propagation, since all targets are already impacted. Based on this, the amount of thermoplastic cable in this area has no impact on the Fire PRA results.**

4. **Fire Areas 19 (Unit 2 Electrical Penetration Room) and 20 (Unit 1 Electrical Penetration Room) include multiple scenarios. These fire areas contain approximately 11% and 10% thermoplastic cable, respectively. However, a conditional core damage probability (CCDP) for a full compartment burnout scenario (scenario T01 for both rooms) was calculated for each room. The resulting CCDPs for these scenarios are 1.14E-05 for FA 19 (for Unit 2) and 3.58E-06 for FA 20 (for Unit 1). When this CCDP is applied to the total ignition frequency from all fixed ignition sources in the FA (1.83E-03/yr and 1.75E-03/yr for FA 19 and FA 20, respectively), the resulting CDF values are 2.09E-08/yr for FA 19 and 6.26E-09/yr for FA 20. These values bound any potential increase in CDF that might result from a detailed analysis of the effects of fire propagation and HGL from thermoplastic cables in these areas. This additional CDF, and the corresponding LERF values, will be included in the results provided in the response to PRA RAI 3.**

The above evaluations continue to show that the slightly higher percentage of thermoplastic cables in these six areas has a negligible impact on the Fire PRA results, when taking into account fire propagation and impact on the hot gas layer.

FM RAI 01.I.01

In a letter dated March 30, 2015 (ADAMS Accession No. ML15091A339), the licensee responded to FM RAI 01.I and explained that the installed above-ground high-density polyethylene (HDPE) piping was the only non-cable intervening combustible identified at Catawba Nuclear Station, Units 1 and 2, with the potential to impact the Fire PRA, and provided two reasons to justify ignoring the contribution from the existing HDPE piping to any pertinent fire scenarios.

The NRC staff requests the following additional information:

(i) As part of the first reason the licensee stated that the HDPE piping in the Auxiliary Building is "primarily" located on the floor. This implies that the piping may be at a higher elevation in some areas in the Auxiliary Building. Provide justification for not postulating transient fires that may involve the HDPE piping in these areas of the Auxiliary Building.

Duke Energy Response:

This response will be provided by August 15, 2015.

(ii) Also pertaining to the first reason, provide a quantitative assessment to justify the statement that the HDPE piping in the Auxiliary Building " ... would not contribute any significant amount of energy to increase the zone of influence of an already evaluated transient fire."

Duke Energy Response:

This response will be provided by August 15, 2015.

(iii) As part of the second reason, addressing the HDPE piping in the Turbine Building and the Service Building, provide technical justification for the statement that 50 kW/m2 is "well within the flame zone of any potential ignition source," since the Generic Fire Modeling Treatments and Section 2-14 of the SFPE Handbook of Fire Protection Engineering, which are both cited in the licensee's response to FM RAI 01.l, list significantly higher heat fluxes to surfaces heated by an impinging flame or immersed in a flame. Moreover, an Electric Power Research Institute study of the fire performance of HDPE piping states that the HDPE starts to melt at approximately 235°F (115°C) and has an auto-ignition temperature of about 662°F (350°C). Since the piloted ignition temperature of a solid combustible is lower than the auto-ignition temperature, this indicates that unprotected HDPE piping may ignite and form a pool fire at much lower heat fluxes than those observed in a flame.

Duke Energy Response:

This response will be provided by August 15, 2015.

(iv) Also pertaining to the second reason, provide justification for the statement that the HDPE piping is not in the flame zone of any potential ignition source in the Turbine Building and the Service Building.

Duke Energy Response:

This response will be provided by August 15, 2015.

(v) Given the relatively low melting and ignition temperatures mentioned in part (iii), explain how the licensee will ensure that exposed HDPE piping in any areas in the plant where a fire may impact the Fire PRA will not be exposed to an ignition source that could heat the HDPE to ignition.

Duke Energy Response:

This response will be provided by August 15, 2015.

Follow-ups to January 28, 2015 and February 27, 2015 PRA RAI Responses

PRA RAI 11.01

In PRA RAI 11, the NRC staff noted the discussion in LAR Section V.2.7 that describes two main control room (MCR) abandonment on loss-of-habitability scenarios. The NRC staff requested "[a]n explanation of how the [conditional core damage probabilities] CCDPs account for the range if probabilities for properly shutting down the plant, and discussion of how they were applied in the scenario analysis." Three different levels of fire severity were provided as examples illustrating the source of the range of shutdown probabilities. The response stated, in part, that:

"Both MCR abandonment scenarios encompass the range of results from few functional failures to multiple functional failures, with each condition (b.i, b.ii, & b.iii) leading to the most severe end state where the SSF is the sole remaining success path after abandonment. In the Catawba FPRA, for the abandonment scenarios, the number of fire-induced failures and spurious operations is based on the panel of origin that produces the highest CCDP. Therefore, the abandonment scenarios account for the worst case impacts on the SSF regardless of a potentially more favorable outcome."

The response further clarifies:

"... main control board frequency was applied in the quantification of the abandonment scenario for the main control board (MCB) fire. The remaining fire area-wide ignition frequency (including electrical cabinet and transient frequency) was applied to the abandonment scenario for the non-MCB fires in the control room."

Although the response to PRA RAI 11 states that two scenarios are modelled (one following MCB fires and another following non-MCB fires) it is unclear whether a single CCDP and conditional large early release probability (CLERP) is used for the two abandonment scenarios. No discussion or justification was provided as to why not accounting for the range of probabilities in the fire PRA will result in a well characterized or conservative change-in-risk estimate. 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 would change the acceptable change-in-risk estimates to unacceptable estimates.

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

Duke Energy Response:

This response will be provided by August 15, 2015.

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

Duke Energy Response:

The FPRA model includes a model of the SSF and its related actions and components; therefore there is no modeling difference between the compliant and variant cases. Instead, the compliant case is represented by not failing the functions associated with the non-compliances. In other words, the linkages between fire-induced component failures and the FPRA model are broken such that the compliant case cutsets include the random failures of the functions rather than fire-induced failures. No additional equipment is assumed to be failed in the compliant case that is not failed in the variant case. Risk reduction modifications are accounted for in both cases and the same ignition frequencies and non-suppression probabilities are used.

c) A claim of "worst-case impact" is insufficient when the meaning of conservative can vary as it does with change-in-risk calculations. Summarize how the change-in-risk calculation is performed and justify that the change-in-risk estimates from these loss of habitability abandonment scenarios is well characterized or conservative.

Duke Energy Response:

The Main Control Board (MCB) fire scenario fails all injection capabilities, including normal sources of reactor coolant pump seal injection and fails the motor-driven Auxiliary Feedwater (CA) pumps. The scenario ensures that the only remaining mitigating strategies in the variant case MCR abandonment scenarios involve SSF mitigating functions for seal injection and the Auxiliary Feedwater turbine-driven pump (CATDP). In addition, a non-MCB fire scenario was modeled which captures an additional fire-induced failure of the supply to Steam Generators B and C. The entire fire frequency for all MCB and non-MCB ignition sources is applied to the respective abandonment scenario for both the variant and compliant cases.

The abandonment scenarios were chosen to maximize the overall CDF and LERF of the variant cases, and the compliant cases were structured to remove all variances listed in the FREs. The SSF mitigating functions are modeled directly in the FPRA, including human error probabilities for SSF operator actions and random failure probabilities for SSF equipment failures, and these functions are well characterized within the FPRA model that is used for both the compliant and variant cases. The FPRA logic is consistent with the plant design and operating procedures. Additionally, the overall delta risk of MCR area fire scenarios is well characterized because the FPRA model quantifies the delta risk associated with fires in the MCR area that do not cause an abandonment of the MCR, in addition to those fires which do.

d) The response to PRA RAI 11.c concludes that the failure probability developed using the most limiting time available to transfer control to and establish control at the safe shutdown facility (SSF) is bounding based on the [human reliability analysis] HRA results for McGuire. Confirm that this remains the case for the Catawba HRA results. If not, provide further justification for the conclusion that the analysis is bounding.

Duke Energy Response:

A fire-specific detailed quantification was performed for the HEP to transfer control to and establish control at the SSF and this value was reported in the self-approval post-transition model results reported in the final response to CNS PRA RAI 03 (refer to letter submitted April 28, 2015). The McGuire HEP value is no longer needed as a comparison for Catawba.

PRA RAI 12.01

The response to PRA RAI 12 discussed how the change-in-risk was calculated for fire areas (other than the MCR and cable room) that are designated as SSF areas in accordance with 10 CFR 50 Appendix R III.G.3. This response was augmented with information provided in the slides for the public meeting on April 14, 2015 (ADAMS Accession No. ML15099A587), which included further explanation about how the compliant and post-transition plants for these areas were modelled in the FPRA. Based on the methods used by Catawba in the FPRA as described in the meeting, please provide the following:

a) Confirm that the equipment damaged by each fire in each SSF area has been identified using the Catawba fire damage methodology and is assumed to fail in the FPRA.

Duke Energy Response:

The FPRA model captures the equipment damaged by each fire in the SSF areas using the Catawba fire damage methodology. The equipment damaged in the SSF fire areas is determined in the same manner as other plant areas. For each ignition source the cables and equipment within the zone of influence are identified and the associated components are assigned the appropriate failure mechanism (e.g., spurious operation or failure to operate) and circuit failure probability in accordance with NUREG/CR-7150.

b) Confirm that all applicable equipment undamaged by each fire is nominally available to mitigate the fire, i.e., is credited in the PRA model. Summarize any differences between the nominally available equipment in the complaint versus the variant plant.

Duke Energy Response:

As discussed in the response to PRA RAI 11.01.b, the FPRA model includes a model of the SSF and its related actions and components. The same model is used to calculate both the compliant and variant plant cases, so there are no differences in the modeled equipment. Those components that are undamaged by the fire retain their nominal availability and reliability values as determined by the internal events PRA model. Equipment availability is determined based on whether the cables associated with each component are damaged by the fire. The compliant case breaks the link between the cable and its associated components for each FA, thus ensuring that the equipment associated with each VFDR function is available in the compliant case. No additional equipment is assumed failed in the compliant case.

c) Confirm that each of the fire areas designated SSF fire areas in the LAR has been reviewed by the NRC and has been determined to meet the alternative shutdown option in Section III.G.3 of Appendix R and all the criteria laid out in Section 2.4 b) of RG 1.205, "Risk-Informed, Performance Based Fire Protection For Existing Light-Water Nuclear Power Plants". Provide any limitations and conditions associated with any of the areas and, if any, clarify why such issues are addressed by or not relevant to the FPRA analysis.

Duke Energy Response:

This response will be provided by August 15, 2015.

d) Summarize the procedures and process used by the operating crews to mitigate fires in the SSF areas using the surviving equipment in the area.

Duke Energy Response:

For all FAs, plant symptoms can cause entry into emergency procedures, abnormal procedures, or annunciator response procedures. An active fire in an SSF credited fire area causes entry into AP-45 (Plant Fire Response Procedure). If at any time while utilizing AP-45, the Main Control Room habitability or control of required equipment for safe shutdown is lost, then AP-45 directs the operator to go to AP-17 (Loss of Control Room) for the affected unit(s). If control systems required to safely shut down the affected unit(s) to Hot Standby are available by using a combination of Train A and Train B equipment, control of systems required to safely shut down has not been lost and command and control remains in the control room. AP-17 initiates and completes transfer to the SSF. AP-17 then directs the operators to maintain Hot Standby from the SSF utilizing OP/0/B/6100/013 (SSF Operations).

e) Provide the procedural step(s) including the decision guidelines directing the operating crews to make the decision to activate the SSF and subsequently establish control of the plant at the SSF.

Duke Energy Response:

The procedural steps that provide the guidance to transfer command and control to the SSF are contained in AP-45.

AP-45 Step 11 states: If at any time the control room becomes uninhabitable due to fire, then go to the following:

- **AP/1/A/5500/017 (Loss of Control Room), Case II (Loss of plant control due to fire or sabotage)**
- **AP/2/A/5500/017 (Loss of Control Room), Case II (Loss of plant control due to fire or sabotage)**

NOTE: If control systems required to safely shut down the affected unit(s) to Hot Standby are available by using a combination of Train A and Train B equipment, control of systems required to safely shut down has NOT been lost.

AP-45 Step 12 which provides the directions for transfer to the SSF states: If at any time control of equipment needed to safely shut down the Unit to Hot Standby OR maintain the Unit in Hot Standby is lost, then perform the following:

- **If Unit 1 control lost, then go to AP/1/A/5500/017 (Loss of Control Room), Case II (Loss of plant control due to fire or sabotage)**
- **If Unit 2 control lost, then go to AP/2/A/5500/017 (Loss of Control Room), Case II (Loss of plant control due to fire or sabotage)**

AP-17 then directs the operators to maintain Hot Standby from the SSF utilizing OP/0/B/6100/013 (SSF Operations).

f) Summarize the proceduralized steps directing the operating crews to transfer command and control from the MCR to the SSF.

Duke Energy Response:

The procedure for loss of plant control room due to fire is AP-17 (Case II). AP-17 procedural step 8 initiates transfer to the SSF. The steps below are for Unit 1 (the Unit 2 steps are similar).

- **Operator dispatched to ensure 1SLXG is energized (Use SSF D/G startup enclosure). This step starts the SSF Diesel Generator and energizes the SSF power supplies from the SSF Diesel Generator.**
- **Operator dispatched to 1ETA (Transfer control to the SSF enclosure). This step transfers power to equipment, and ensures critical valves are closed that are required for command and control from the SSF.**
- **Dispatch licensed operator to SSF to maintain Hot Standby conditions (Refer to OP/0/B/6100/013, Standby Shutdown Facility Operations).**

AP-17 procedural step 9 verifies control has been swapped to the SSF and ensures command and control is transferred to the SSF.

g) Summarize the operating training in the activation and the use of the SSF.

Duke Energy Response:

The training used for fires and activation of the SSF are as follows: The operators are trained, qualified, and re-qualified for a plant fire using multiple training lesson plans every two years.

- **AP-45 training guide**
- **AP-17 training guide**
- **OP-13 training guide**

Many of the tasks in the above procedures are incorporated in numerous job performance measures (JPMs) that are also utilized in qualification and re-qualification of operators.

There also is an SSF console simulator that is used in certain simulator exercises for licensed operators on a periodic basis.

h) LAR Section V.2.6 and the response to PRA RAI 12 state that the MCR is only abandoned (i.e., command and control is transferred to the SSF) on loss of control room habitability. Clarify this statement in light of the April 14, 2015, presentation and the statement that the SSF is a primary control station (PCS) as defined in RG 1.205 that indicates that command and control must be transferred to the SSF on loss of control.

Duke Energy Response:

For the purposes of this discussion, command and control refers to the location where the operators are operating equipment to achieve and maintain the plant in a safe and stable condition. This location will be either the Main Control Room (MCR) or the Standby Shutdown Facility (SSF) and the transfer of command and control to the SSF will occur on loss of control or loss of MCR habitability.

The response to PRA RAI 12 states that:

> **"only a loss of control room habitability will cause a transfer of primary command and control to the SSF."**

LAR Section V.2.7 states in part:

> **"Control room abandonment is only considered for cases where the Control Room environment (temperature and smoke) reaches the criteria specified in NUREG/CR 6850. For non-abandonment cases credit may be taken at the Primary Control Station (PCS) as needed to control functions impacted for a given Control Room panel fire. Credit for Control Room actions associated with components not impacted by the fire is allowed for the non-abandonment scenarios."**

The presentation on April 14, 2015 described the fire response for SSF Areas located outside of the MCR. For the Deterministic Fire Analysis, the entire Fire Area (FA) was assumed to be impacted by the fire. For such a fire, a transfer of command and control to the SSF would be required to reach a safe and stable condition. The procedures and actions used to transfer to the SSF and operate the SSF were

described during the April 14, 2015 meeting. These procedures and actions are also described in other RAI responses following the meeting.

As discussed in the April 14, 2015 meeting, whereas the Deterministic Fire Analysis assumes that the entire FA is impacted by the fire, most of the fires evaluated in the Fire PRA do not result in a full room burnout of the FA. As such, there may be equipment available to mitigate the fire that can be operated from the MCR. As described during the April 14, 2015 meeting, the operators will attempt to use this equipment first. Should this attempt fail, the operators will activate the SSF. Some SSF functions, such as reactor coolant pump seal cooling, can be performed without a transfer of command and control. In other words, whereas there are operators in the SSF who are operating SSF equipment to maintain reactor coolant pump seal cooling, there are other operators located in the MCR who are maintaining command and control by operating available mitigating equipment (e.g., maintain secondary side heat removal).

The response to PRA RAI 12 states that control room habitability is the only cause for transferring primary command and control. Whereas primary command and control was not defined in the PRA RAI 12 response, the statement was written with the understanding that primary command and control is only transferred from the MCR when all of the operators are forced to abandon the MCR. This understanding was based on input that one or more operators will remain in the MCR unless MCR habitability is a concern. Going forward the definition of primary command and control at the beginning of this response will be used for both the Fire PRA and the Deterministic Fire Analysis.

Using the definition stated at the beginning of this response, any scenario where the operators use the full capabilities of the SSF requires a transfer of command and control to the SSF. The fire PRA models a loss of MCR habitability as requiring Control Room abandonment and subsequent transfer of command and control to the SSF even if mitigating equipment is available from the MCR. For all other cases, the operators can use a combination of the available mitigating equipment from the MCR and the SSF. This is consistent with LAR Section V.2.7 and the intent of the PRA RAI 12 response.

For fires that require the full SSF capability but do not result in a loss of MCR habitability, the operators may choose to maintain available personnel in the MCR. These operators will have access to the full array of instruments available in the MCR and will also be able to direct other plant responses. However, these operators are not maintaining command and control in the MCR and the electrical design of the SSF transfer ensures that these MCR activities will not prevent the ability of the SSF to achieve and maintain safe and stable conditions. Therefore, for the purposes of maintaining safe and stable conditions, the MCR has been abandoned.

i) Explain how the variance from deterministic requirements (VFDRs) within the SSF areas were identified. LAR Section W.2.1 and the response to PRA RAI 13 explains that, generally, the compliant plant for both abandonment and non-abandonment scenarios was evaluated by "toggling" off or excluding basic events to remove the fire-induced failures associated with the VFDRs. Clarify, relative to the variant plant model, how excluded basic events are identified and removed from the compliant plant quantification.

Duke Energy Response:

Where the SSF was determined to be the assured train for a given FA, VFDRs were generated based on separation conflicts with deterministic success logics associated with SSF functions (i.e., impacts on shutdown from the SSF, the primary control station). VFDRs are not generated for other fire-affected shutdown trains in the given FA.

The VFDRs were then reviewed to map the identified component and the function impacted by the VFDR to the appropriate component or function in the FPRA. As discussed in the response to PRA RAI 12.01.b, the variant case will fail components based on whether the associated cables are damaged by the fire. The compliant case breaks this association between the component and its cables by "toggling" the basic event, which ensures that the components are available for mitigation. No additional equipment is assumed failed in the compliant case.

PRA RAI 12.02

The response to PRA RAI 12.a states that compliance assessment for the some fire areas outside of the MCR relies upon transfer of primary command and control to the SSF as the NSP success strategy.

a) Clarify how the 10 CFR 50.48(c) rule (including the NFPA-805 Standard as incorporated by reference) and associated guidance, allows the assignment of the remotely located SSF facility as the single NSP success for all fires in some fire areas outside of the MCR.

Duke Energy Response:

This response will be provided by August 15, 2015.

b) The response to 12.a states that, "[t]he compliance assessment for the aforementioned fire areas [Fire Areas 1, 2, 3, 4, 9, 10, 11, 16, 17, 18, and 22] relies upon transfer of primary command and control to the SSF as the success strategy." The same response continues at the end of the paragraph that, "[o]nly a loss of control room habitability will cause a transfer of primary command and control to the SSF." Since fires in the aforementioned areas will not affect the habitability of the MCR, clarify how the apparent contradiction between the two statements is resolved in the post-transition and the compliant plant PRA models.

Duke Energy Response:

This response will be provided by August 15, 2015.

c) How and when (i.e., in what PRA accident sequences) is the NSP SSF success strategy for the aforementioned fire areas modelled in the compliant plant PRA model, and in the post-transition plant PRA model.

Duke Energy Response:

This response will be provided by August 15, 2015.

PRA RAI 17.a.01

The response to PRA RAI 17.a states that the response to PRA RAI 03 would use the methods in draft FAQ 14-0009 to evaluate propagation of fires outside of well-sealed and robustly-secured motor control centers (MCCs) greater than 440 Volts (V). The analyses described in draft FAQ 14-0009 has changed considerably since the first draft dated July 1, 2014. To resolve this issue use the method described in the final version of FPRA FAQ 14-0009 (ADAMS Accession No. ML15119A176) in the FPRA and provide updated results as part of the aggregate change-in-risk analysis requested in PRA RAI 03.

Duke Energy Response:

The propagating MCC fire scenarios included in the quantification supporting the PRA RAI 03 response dated April 28, 2015 were based on draft H of FPRA FAQ 14-0009. Subsequent to April 28, 2015, the Catawba Fire PRA model has been updated to incorporate changes made in response to the additional RAIs dated June 18, 2015, which includes changes made to incorporate the final version of FPRA FAQ 14-0009 (ADAMS Accession No. ML15118A810). The impact on the Catawba Fire PRA results due to the final version of FPRA FAQ 14-0009 will be included in the quantification supporting the updated PRA RAI 03 response.

PRA RAI 17.b.01

The response to PRA RAI 17.b indicates that spurious operations for non-severe (i.e., non-propagating) MCC fire scenarios were not evaluated because "this concern is addressed by the random failure probabilities captured within the internal events model." Random spurious operation is very unlikely and seldom contributes to failure data and that failure mode is seldom captured in internal events PRA. The response further states that a fire that may cause a fault originating within the control circuit will also fail the power circuit so no spurious operation is expected. No justification is provided to address the numerous issues associated with this assumption, e.g., the assumption that power will be lost before a hot short to the control circuit causes the end device to spurious operate to an undesired position. The response also states that not including these hot shorts does not contradict the guidance in NUREG/CR-7150, "Joint Assessment of Cable Damage and Quantification of Effects from Fire (JACQUE-FIRE)" Volume 1, Section 6.6.3, and Volume 2, Section 7.4. The proposed method does contradict the guidance in NUREG/CR-7150 insofar as the guidance recommends including hot shorts in the panel wiring's conductor bundles within a cabinet without limiting the recommendation to some sub-set of cabinets and/or fires. To resolve this issue, apply the guidance on conductor bundles within a cabinet in NUREG/CR-7150, Volume

1, Section 6.6.3, and Volume 2, Section 7.4 in the FPRA and provide updated results as part of the aggregate change-in-risk analysis requested in PRA RAI 03.

Duke Energy Response:

Subsequent to April 28, 2015, the Catawba Fire PRA model has been updated to incorporate changes made in response to the additional RAIs dated June 18, 2015, which includes changes made to the analysis of spurious operations for non-severe (i.e., non-propagating) MCC fire scenarios. The internal hot short-induced spurious operation probabilities were applied to the internal spurious events using the guidance contained in NUREG/CR-7150 for panel wiring. The impact on the Catawba Fire PRA results due to spurious operations for non-severe (i.e., non-propagating) MCC fires will be included in the quantification supporting the updated PRA RAI 03 response.

PRA RAI 17.c.01

The response to PRA RAI 17.c did not provide the requested justification for retaining well-sealed electrical cabinets having less than 440 Volts in the Bin 15 count. The response states "appropriate electrical cabinets will be removed from Bin 15 by following the guidance in NUREG/CR-6850." Clarify what is meant by "appropriate" and provide the CDF and LERF associated with Bin 15 cabinet fires and the percentage of that CDF and LERF from cabinets that are less than 440 Volts.

Duke Energy Response:

The intent of the "appropriate" statement was to indicate that a number of cabinets were removed from the Bin 15 frequency calculation prior to the re-quantification effort in support of the PRA RAI 03 response that was submitted on April 28, 2015. With the exception of large floor-mounted cabinets, which are included in Bin 15 regardless of voltage level, wall-mounted electrical cabinets confirmed to be well-sealed, robustly-secured, and housing circuits less than 440V were removed from the Bin 15 count: over 400 Bin 15 entries were removed. The CDF/LERF contribution from the floor-mounted cabinets that were confirmed to be well-sealed and robustly-secured cabinets that are less than 440V but retained in the FPRA is approximately 15% of the overall fire risk contribution from Bin 15 ignition sources and a smaller percentage of the total fire CDF/LERF. This contribution is comprised mostly of Bin 15 scenarios involving area termination cabinets or DC distribution panels. Most of the Bin 15 ignition sources in these scenarios are single-count but there are a few multi-count scenarios (e.g., 1/2 CDA and CDB are eight stack DC distribution panels). Eliminating these additional floor-mounted cabinets would increase the Bin 15 scenario frequency less than 6%. The majority of floor-mounted cabinets that are well-sealed, robustly-secured, and that contain circuits less than 440V are included as scenarios in the FPRA quantification. If the binning rules were interpreted to exclude floor-mounted cabinets that are well-sealed, robustly-secured, and contain circuits less than 440V from the FPRA, the resulting CDF/LERF would slightly decrease. That is, the effects of the increase in individual scenario frequency for the remaining Bin 15 ignition sources would be outweighed by the decrease in CDF/LERF due to the elimination of the associated

scenarios from the quantification. While the removal of these floor-mounted cabinets from the Bin 15 frequency would actually result in a small decrease in the overall CDF/LERF, the continued inclusion of floor-mounted cabinets that are well-sealed and robustly-secured and that contain circuits less than 440V, such as 125/250 VDC distribution panels, is beneficial to the development of comprehensive fire risk insights.

PRA RAI 23

During final review of the implementation items, it was discovered that Catawba's Implementation Item 13 program does not provide confidence that the final change in risk from transition meets the acceptance guidelines. The licensee proposes that "If the revised Fire PRA shows a risk increase of greater than 1E-07 for CDF or 1E-08 for LERF then enter the results into the corrective action program to determine the cause of the risk increase and determine corrective actions."

Entering an increase greater than the self-approval guidelines into the corrective action program does not provide confidence that the final result of any corrective action will be a transition change in risk that is consistent with the acceptance guidelines. Furthermore, unanticipated risk increase greater than the self-approval guideline generally need to be reduced by fixing the cause of exceedance (i.e., the change itself), otherwise the results and the proposed change (if any) should be submitted to the NRC staff according to the license condition. Provide an Implementation Item to verify that the cumulative change-in-risk does not exceed RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" guidelines once all the modifications and procedural implementation items are completed.

Duke Energy Response:

Implementation Item 13 will be updated to state the following:

"Following installation of the risk related modifications and the as-built installation details, additional refinements surrounding the modifications and any procedural implementation items (Table S-3 Items 12 and 16) will be incorporated into the Fire PRA model and Internal Events model, as required. In addition, a verification will be performed to confirm that the risk results are not appreciably changed. If the as-built change-in-risk estimates exceed the RG 1.174 acceptance guidelines, the responsible feature will be identified and evaluated. Actions taken to address such a case may be one or more of the following: 1) implementing additional modifications, 2) refining the analytical estimates, or 3) requesting that exceeding the guidelines be deemed acceptable in a new LAR." Completion will be 180 days after the last risk related modification is completed.

Updated LAR page(s) associated with this response will be submitted in conjunction with Catawba's final RAI response letter, tentatively scheduled for August 31, 2015.