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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), April 28, 2015 (ADAMS Accession Number ML15119A533), and July 15, 2015 (ADAMS Accession Number ML15198A036)

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 July 15, 2015 Reference 1 letter provided the first docketed response to the Reference 2 RAIs. The purpose of this letter is to provide the second 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 August 14, 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.

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:

As indicated in electronic mail correspondence between Duke Energy and the NRC, this response will be provided by August 31, 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:

As indicated in electronic mail correspondence between Duke Energy and the NRC, this response will be provided by August 31, 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:

As indicated in electronic mail correspondence between Duke Energy and the NRC, this response will be provided by August 31, 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:

As indicated in electronic mail correspondence between Duke Energy and the NRC, this response will be provided by August 31, 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:

As indicated in electronic mail correspondence between Duke Energy and the NRC, this response will be provided by August 31, 2015.

<u>Follow-ups to January 28, 2015 and February 27, 2015 PRA RAI Responses</u>

<u>PRA RAI 11.01</u>

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:

As indicated in electronic mail correspondence between Duke Energy and the NRC, this response will be provided by August 31, 2015.

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:

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:

Below is a listing of the fire areas where the SSF is the NFPA 805 assured train for safe and stable conditions (designated as SSS for Standby Shutdown System). Each of the fire areas where the SSF is designated as the NFPA 805 assured train in the LAR has been previously reviewed by the NRC (reference: NUREG-0954 (February 1983) and Supplements 1 through 5, "Safety Evaluation Report Related to the Operation of Catawba Nuclear Station, Units 1 and 2, Docket Nos. 50-413 and 50-414, Duke Power Company", and associated correspondence).

CATAWBA FIRE AREA	FIRE AREA DESCRIPTION	NFPA 805 ASSURED TRAIN
1	ND & NS Pump Room El 522 (Common)	SSS
2	Unit 2 CA Pump Room El 543	SSS
3	Unit 1 CA Pump Room El 543	SSS
4	Aux Bldg Gen Area & NV Pump Room El 543 (Common)	SSS
9	Unit 2 Battery Room El 554	SSS
10	Unit 1 Battery Room El 554	SSS
11	Aux Bldg Gen Area & Unit 1 KC Pump Room El 560 (Common)	SSS
16	Unit 2 Cable Room El 574	SSS
17	Unit 1 Cable Room El 574	SSS
18	Aux Bldg Gen Area & Unit 2 KC Pump Room El 577 (Common)	SSS
21	Control Room El 594 (Common)	SSS
22	Aux Bldg Gen Area El 594 (Common)	SSS

The SSF was designed to ensure an alternative shutdown path for Fires. For fire areas designating the SSF as the credited safe shutdown train for safe and stable

conditions, all of the provisions of RG 1.205 Section 2.4b are met upon completion of SSF transfer.

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:

NFPA 805 Section 4.2.3 requires one success path of required cables and equipment be assured to achieve and maintain the nuclear safety performance criteria. The SSF may be used to provide an assured success path to achieve and maintain the nuclear safety performance criteria, similar to the use of a Train A, Train B, or Train A & B success path. The Nuclear Safety Capability Assessment (NSCA) assesses fire areas assuming all equipment in and cables routed through the fire area have failed. When a NSCA fire area analysis is performed, the train least impacted is selected as the assured success path. Cable routes were carefully laid out during the construction of the SSF so that fire areas that utilized the SSF as the assured success path were as free of fire damage as possible.

In addition, all NFPA 805 SSF assured fire areas have been previously approved by the NRC (reference: NUREG-0954 (February 1983) and Supplements 1 through 5, "Safety Evaluation Report Related to the Operation of Catawba Nuclear Station, Units 1 and 2, Docket Nos. 50-413 and 50-414, Duke Power Company", and associated correspondence).

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:

The apparent contradiction between the two statements quoted in the RAI has been addressed in FPRA RAI 12.01.h (see the July 15, 2015 response letter).

This RAI (12.02.b)) also questions that for the SSF fire areas outside of the MCR, MCR

habitability should not be challenged. For all SSF fire areas, the Fire PRA model determines the fire impacted components and cables for each fire scenario. If the combination of fire induced failures leads to a loss of the MCR equipment required to achieve and maintain safe and stable conditions, then the Fire PRA models the transfer of primary command and control to the SSF regardless of MCR habitability.

Going forward, the definition of primary command and control, including the key inputs for the decision to transfer to the SSF, at the beginning of the response to PRA RAI 12.01.h (see the July 15, 2015 response letter) will be used for both the Fire PRA and the Deterministic Fire Analysis. No modeling changes are required to reflect the definition of primary command and control as defined in this response. The Fire PRA model reflects the as-built, as-operated, post-transition plant. The same model is used to calculate both the compliant and the variant plant cases, so there are no differences in the modeled equipment other than the removal of the variances from the compliant case.

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:

The Deterministic Fire Analysis assumes that the entire fire area is impacted by the fire (i.e., all equipment in the area fails). However, the Fire PRA (FPRA) model does not assume a full room burnout by default and instead determines the fire impacted components and cables for each fire scenario. Most of the fires evaluated in the FPRA do not result in a full room burnout of the fire area.

As discussed in the response to PRA RAI 12.01.h, for the purposes of this discussion, primary 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. From the perspective of the Deterministic Fire Analysis, all of the SSF fire areas transfer command and control to the SSF. However, the FPRA model allows for primary command and control to be maintained in the MCR if the MCR mitigating equipment required to achieve safe and stable conditions has not been failed in the fire scenario. The FPRA model automatically credits SSF mitigation strategies for FPRA accident sequences where the functions that can be performed by the SSF are lost from the MCR but are available from the SSF. These SSF functions include control of secondary side heat removal via the turbine-driven auxiliary feedwater pump and reactor coolant pump seal injection from the spent fuel pool using the standby makeup pump.

There are two MCR abandonment scenarios in the FPRA model which were designed to force the transfer of primary command and control to the SSF on a loss of habitability. For the remaining SSF fire area scenarios (including the non-abandonment cases in the MCR), the fire accident scenario will determine whether command and control is transferred to the SSF or remains in the MCR based on the

availability of equipment. This modeling reflects the as-built, as-operated, post-transition plant.

The same model is used to calculate both the compliant and the variant plant cases, so there are no differences in the modeled equipment other than the removal of the variances from the compliant case. If cutsets for the variant case indicate the scenario to be a likely candidate for transfer of command and control to the SSF based on loss of function, then the compliant case cutsets will also indicate transfer of command and control to the SSF. In other words, the removal of the variances from the compliant case does not change the location of command and control. This modeling treatment will be carried forward in the post-transition plant FPRA model.