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

November 20, 2014

Mr. K. Henderson
Site Vice President
Catawba Nuclear Station
Duke Energy Carolinas, LLC
4800 Concord Road
York, NC 29745

SUBJECT: CATAWBA NUCLEAR STATION, UNITS 1 AND 2: REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST TO IMPLEMENT A RISK-INFORMED, PERFORMANCE-BASED FIRE PROTECTION PROGRAM (TAC NOS. MF2936 AND MF2937)

Dear Mr. Henderson,

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 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, as incorporated into Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.48(c).

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's submittal and determined that additional information is needed in order to complete our review. Enclosure 1 describes this request for additional information (RAI). During the regulatory audit that began on October 27, 2014, response dates for the questions in Enclosure 1 were discussed with Duke staff. Enclosure 2 lists the agreed upon response dates for the various questions.

If you have any questions, please call me at 301-415-2481.

Sincerely,

G. Edward Miller, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-413 and 50-414

Enclosures: As stated

cc w/encl: Distribution via Listserv

REQUEST FOR ADDITIONAL INFORMATION

LICENSE AMENDMENT REQUEST TO ADOPT

NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805

PERFORMANCE-BASED STANDARD FOR FIRE PROTECTION

FOR LIGHT WATER REACTOR GENERATING PLANTS

DUKE ENERGY CAROLINAS, LLC

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413 AND 50-414

By letter dated September 25, 2013, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13276A503), Duke Energy Carolinas (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, as incorporated into Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.48(c). In order for the NRC staff to complete its review of the LAR, the following additional information is requested.

Fire Protection Engineering (FPE) Request for Additional Information (RAI) 01

LAR Attachment A, Section 3.4.1(c) states compliance with NFPA 805 Section 3.4.1(c) which requires that the fire brigade leader and at least two brigade members have sufficient training and knowledge of nuclear safety systems to understand the effects of fire and fire suppressants on nuclear safety performance criteria.

Provide additional detail regarding the training provided to the fire brigade leader and members that addresses their ability to assess the effects of fire and fire suppressants on NFPA-805 nuclear safety performance criteria. Include the justification for how the training meets NFPA-805 Section 3.4.1.

FPE RAI 02

NFPA-805, Section 3.9.2 requires that each automatic and manual water-based fire suppression system be equipped with a water flow alarm. The compliance basis for LAR Attachment A, Section 3.9.2 is "Complies with Clarification" and indicates that manual water-based suppression systems are not provided with water flow alarms. Nuclear Energy Institute (NEI) 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Program Under 10 CFR 50.48(c)," defines "complies with clarification" as an editorial issue and compliance

should be explained in the compliance basis field. The NRC staff does not consider the lack of water flow alarms as an editorial issue.

Provide a compliance strategy commensurate with the guidance of NEI 04-02 that demonstrates compliance with NFPA-805 or provide a detailed justification for not meeting the requirement of NFPA-805 Section 3.9.2.

FPE RAI 03

LAR Section 4.1.3 and LAR Attachment I, "Definition of Power Block" states that structures required to meet the radioactive release criteria described in Section 1.5 of NFPA-805 but not required to meet the nuclear safety criteria are not defined as power block. Currently, the endorsed guidance of NEI 04-02 states that, where used in Chapter 3, "power block" and "plant" refers to structures that have equipment required for nuclear plant operations, such as containment, auxiliary building, service building, control building, fuel building, radiological waste, water treatment, turbine building, and intake structure, or structures that are identified in the facility's current licensing basis. As currently described in the LAR Attachment E, the following compartments are not described as part of the power block in Attachment I, Table I-1:

- Radioactive Material Containers Area
- Radiography Vault
- Radiation Materials Control Building (#7767)
- Tents Containing Radioactive Materials
- Mixed Waste Storage

Provide clarification whether these structures listed are accounted for as either within or not within the power block, as described in LAR Section 4.1.3.

FPE RAI 04

LAR Attachment A, Section 3.11.5 states that Catawba Nuclear Station (CNS) does not utilize Electrical Raceway Fire Barrier Systems (ERFBS) for Chapter 4 compliance. ERFBS are fire barrier materials such as Thermo-Lag, 3M Interam, Hemyc, MT, or Darmatt systems. In LAR Attachment C, Table B-3, Hemyc is cited in a number of applications used as an ERFBS. On June 7, 2006, the licensee submitted their response to Generic Letter 2006-03, "Potentially Nonconforming Hemyc and MT Fire Barrier Configurations," (GL 06-03) and committed to bring their Hemyc issues into full compliance through their NFPA-805 transition process, however, the LAR does not provide a summary of this resolution.

a. Provide a description of how CNS resolved the GL 06-03 issue through the NFPA-805 transition process, including any proposed plant modifications. If performance-based methods are used, include a discussion of the risk, safety margin, and defense-in-depth (DID) considered in the evaluation.

b. Provide a description of any credited Hemyc fire barriers used for the Nuclear Safety Capability Assessment (NSCA). Provide the basis for barriers' credited rating as an ERFBS or any other credited uses.

FPE RAI 05

In LAR Attachment A, Table B-1, Section 3.3.5.3, the LAR indicates that electrical cables comply with IEEE-383 flame propagation testing (Institute of Electrical and Electronics Engineers Standard 383, "IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations").

During the audit, the licensee explained that the armored cable control circuit test program conducted by the licensee in 2006 included tests on cable qualified for use in Duke nuclear power plants. The 2006 test program involved comparative tests on cables with and without an outer PVC jacket. The comparative tests indicated that removing the outer PVC jacket may accelerate the horizontal flame spread over the cable. Describe how the requirements of NFPA-805 Section 3.3.5.3 are met.

FPE RAI 06

LAR Attachment K, Licensing Action 02 (unlabeled fire doors), Licensing Action 08 (Unlisted Water Supply Valves), Licensing Action 09 (Seismic Design), Licensing Action 12 (HVAC Penetration of Fire Barriers), and Licensing Action 17 (Installation of Standby Shutdown System) do not identify the specific fire areas that are applicable to each licensing action. Provide a list of the applicable fire area(s) for each Licensing Action that will be transitioning forward in NFPA-805.

FPE RAI 07

NFPA-805 Section 3.11.3 requires that penetrations in fire barriers be provided with listed fire-rated door assemblies having a resistance rating consistent with the designated fire resistance rating of the barriers and that fire doors shall conform to NFPA-805, "Standard for Fire Doors and Fire Windows." LAR Attachment A, Table B-1 states that CNS complies with previous NRC approvals and the compliance bases only describe un-labeled and modified doors and pressure doors, as well as bullet- and missile-resistant doors. However, LAR Attachment K, Licensing Action 02 discusses the use of hollow metal doors in Fire Area 35 that are not rated and hollow metal doors with louvers in radiological areas. These specific doors are not discussed in LAR Attachment A, Table B-1 compliance bases. Provide justification for the apparent discrepancy between LAR Attachment A, Section 3.11.3 and LAR Attachment K Licensing Action 02.

FPE RAI 08

NFPA-805 Section 3.5.5 requires that each fire pump and its driver and controls be separated from the remaining fire pumps and from the rest of the plant by rated fire barriers. In LAR Attachment A, Table B-1, the compliance basis is "complies with previous NRC approval" and states that a 3-hour fire barrier separates two of the three fire pumps. Based on the NRC staff's review of the July 1, 1984, SER, the approved configuration included the "installation of a 1-hr fire rated wrap on the conduit and supports containing cables for fire pump B." However, in LAR Attachment A, Table B-1, an engineering evaluation was referenced for the deletion of the Hemyc fire barrier wrap on the B Main Fire Pump cable. Provide the basis for acceptability of

the removal of this fire barrier and describe how CNS meets the requirements of NFPA-805 Section 3.5.5.

Safe Shutdown Analysis (SSA) RAI 01

LAR Attachment B, Table B-2, identifies certain attributes of NEI 00-01, "Guidance for Post-Fire Safe Shutdown Circuit Analysis" Revision 1, as "Aligns with Intent." For the following attributes, the alignment basis does not fully explain why CNS deviates from the recommendations of the attribute.

For each attribute, provide a more in-depth justification as to what specifically does not align. These include:

a. 3.1C Spurious Operation

b. 3.1.1.3 Use of Pressurizer Heaters

c. 3.1.1.7 Offsite power

d. 3.1.1.11 Multiple units

e. 3.1.2.5 Process Monitoring

f. 3.3.1.3 Isolation Devices

g. 3.3.1.6 Auto Initiation Logic

h. 3.3.1.7 Circuit Coordination

i. 3.5.1.3 Duration of Circuit Failures

j. 3.5.2.1 Circuit Failures Due to an Open Circuit

k. 3.5.2.3 A/B Circuit Failures Due to a Hot Short

l. 3.4.1.4 Manual Actions

m. 3.4.1.7 Additional Equipment

SSA RAI 02

The Nuclear Safety goal described in NFPA-805 Section 1.3.1 is to provide reasonable assurance that a fire during any operational mode and plant configuration will not prevent the plant from achieving and maintaining the fuel in a safe and stable condition. The "Results" of Section 4.2.1.2 of the LAR indicates there are damaged equipment that may be needed to restore a success path to meet particular nuclear safety performance goal, and includes a list of long-term actions that can be instituted, as needed, such as; (i) damage repairs can be

completed as desired/needed resulting in additional success paths being made available, and (ii) offsite power is expected to be restored.

a. Clarify if the long-term actions listed above are needed to maintain the fuel in a safe and stable condition. If needed, then provide a detailed description of the specific repairs that would be needed, the success path(s) being restored, and the time frame required to complete the repair. Also, provide a detailed description of how offsite power is being restored, and the time frame in which offsite power would need to be restored.

b. For maintaining long-term safe and stable at hot standby condition, the alignments of fuel oil, feedwater, and reactor coolant inventory are required. Clarify if these actions are proceduralized and whether feasibility has been demonstrated.

SSA RAI 03

NPFA-805 Sections 2.4.2.4 and 4.2.4.1.5 requires that a fire area assessment be performed to determine the effects of fire or fire suppression activities on the ability to achieve the nuclear safety performance criteria of Section 1.5, and that fire suppression activities shall not prevent the ability to achieve the nuclear safety performance criteria. LAR Attachment C, Table C-1 describes the results of the fire suppression activities effect on Nuclear Safety Performance Criteria as "safe and stable conditions can mostly be achieved and maintained utilizing equipment and cables outside the area of fire suppression activity." This statement appears to be used generically in all fire areas.

a. Provide a more detailed explanation regarding the extent of "can mostly be achieved."

b. For fire areas where safe and stable is not achievable by utilizing only equipment and cables outside the area, provide a description of the equipment and functions that may be affected by fire suppression activities, and a description of how suppression effects are controlled or mitigated so that the nuclear safety performance criteria is achievable.

SSA RAI 04

Regulatory Guide 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Revision 1, (ADAMS Accession No. ML092730314), Section 2.3 allows the use of existing Appendix R deviations to demonstrate compliance with design requirements of NFPA-805 Chapter 4. Additionally, NFPA-805 Section 4.1 requires that fire protection system or features that are required to achieve the nuclear safety performance criteria shall have its design and qualification meet the applicable requirements of Chapter 3. LAR Attachment K, Licensing Action 07, identifies fire protection features that are credited in the licensing action review for Fire Area 01, such as the fixed suppression system in the Reactor Building annulus area (elevations 561-ft, 604-ft and 664-ft) and line-type heat detectors on all six levels of the annulus area. However, these fire protection systems and features are not listed in LAR Attachment C, Tables C-1 and C-2, for Fire Area 01 as required fire protection features (suppression and detection).

a. Clarify whether the fire protection systems or features identified in Licensing Action 07 are required to meet the nuclear safety performance criteria of NFPA-805 Chapter 4.

b. If the subject fire protection systems or features are required, then confirm that they are designed and qualified to meet the applicable requirements of NFPA-805 Chapter 3.

SSA RAI 05

LAR Attachment D describes the methods and results for non-power operations (NPO) transition. Provide the following additional information:

a. A description of any actions that are credited to minimize the impact of fire-induced spurious actuations on power operated valves (e.g., air-operated valves and motor-operated valves) during NPO either as pre-fire plant configuring or as required during the fire response recovery.

b. Identify those recovery actions relied upon in NPO and describe how recovery action feasibility is evaluated.

SSA RAI 06

LAR Attachment B, Table B-2, Section 3.2.1.2, "Fire Damage to Mechanical Components," states that heat sensitive piping materials, including tubing with brazed or soldered joints are not included in the assumption of no mechanical damage. It appears that the NSCA analysis does not address instrument air and instrument sensing lines. Describe how the analysis addressed "heat sensitive piping," including tubing with brazed or soldered joints.

SSA RAI 07

LAR Attachment S, Table S-2b, Items 02, 03, 04, 05, and 06 identify circuit coordination modifications required for various motor control centers (MCCs). However, LAR Section 4.2.1.1 evaluation process results only list the affected MCCs related to Items 02 and 03. Provide a clarification for the above discrepancy.

SSA RAI 08

Attachment S, Table S-2b, proposes several modifications to eliminate protective device coordination issues. For clarification, provide a more detailed description of the following modifications:

a. Proposed modifications 02 and 03 remove the feeder breakers to MCCs 1EMXA, B, C, D, I, J, K and L, and 2EMXA, B, C, D, I, J, K, and L, respectively. Provide a more detailed description to illustrate how the overcurrent protection and coordination are achieved for the subject MCCs.

b. The LAR identified modifications 05 and 06 to eliminate coordination issues. After discussions at the audit, the licensee stated that the purpose of the modifications is to resolve spurious operation concerns. Therefore, provide a revised Table S-2b with a

more accurate problem statement and a detailed description of the proposed modification.

Fire Modeling (FM) RAI 01

NFPA-805 Section 2.4.3.3 states that the PRA approach, methods, and data shall be acceptable to the NRC. The NRC staff noted that the fire modeling analysis comprised the following:

- The Generic Fire Modeling Treatments (GFMTs) approach was used to determine the Zone of Influence (ZOI) for ignition sources and the time to Hot Gas Layer (HGL) conditions in all fire areas throughout CNS, Units 1 and 2.

- The Consolidated Fire Growth and Smoke Transport (CFAST) model was used to assess the main control room (MCR) abandonment time calculations.

LAR Section 4.5.1.2, "Fire PRA," states that fire modeling was performed as part of the Fire PRA (FPRA) development (NFPA 805-Section 4.2.4.2). Reference is made to LAR Attachment J, "Fire Modeling Verification and Validation," for a discussion of the acceptability of the fire models that were used to develop the FPRA.

Regarding the acceptability of CFAST for the MCR abandonment time calculations:

a. During the audit walkdown of the MCR, the NRC staff noted a significant amount of combustibles and ignition sources (table, chairs, refrigerators, microwave, coffee maker, large plastic trash can, plastic self-contained breathing apparatus (SCBA) cases, etc.) in the vicinity of the shift supervisor's office. This area is referred to as the "kitchen" in the MCR abandonment time analysis. In addition, the NRC staff also noted a cubicle with an office workstation. Provide technical justification for not considering fire scenarios that originate in the kitchen, the shift supervisor's office, the storage room next to the supervisor's office, or the cubicle with the workstation in the MCR abandonment calculations.

b. In the MCR abandonment time analysis, the licensee assumed that the external doors of the MCR open at 15 minutes based on an estimated fire brigade arrival time. State whether 15-minute fire brigade response time for the MCR is used in the PRA and provide the technical justification for the time used.

c. For the case where cables in an adjacent electrical cabinet are in direct contact with the separating wall, NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, Final Report," Appendix S recommends a fire spread time of 10 minutes. Provide technical justification for using the assumption in the MCR abandonment time calculations that fire spreads to adjacent cabinets in 15 minutes.

d. LAR Attachment H, Table H-1 indicates that FAQ-08-0052, "Transient Fires: Growth Rates and Control Room Non-Suppression" was used in the MCR abandonment time calculations. Describe and provide technical justification for any deviations taken from

the guidance in FAQ 08-0052 in the MCR abandonment time calculations, including the transient fire growth rates.

e. Confirm that the soot yield and heat of combustion values that were used in the analysis result in conservative estimates of the soot generation rate for electrical cabinet and transient fires, or provide technical justification for the values that were chosen.

f. Explain why, based on the sensitivity analysis, it appears that a 4°C (39°F) increase of the initial ambient temperature in some cases does not affect the abandonment time, and in one case even results in an increase of the abandonment time.

Specifically regarding the acceptability of the GFMTs approach:

g. The GFMTs approach describes the critical heat flux for a target that is immersed in a thermal plume. Explain how the modification to the critical heat flux was used in the ZOI and HGL timing determinations.

Specifically regarding the acceptability of the PRA approach, methods, and data:

h. Identify whether any fire modeling tools and methods have been used in the development of the LAR that are not discussed in Attachment J of the LAR. One example would be a methodology used to convert damage times for targets in Appendix H of NUREG/CR-6850 to percent damage as a function of heat flux and time.

i. During the audit, the licensee explained that the armored cable control circuit test program conducted by the licensee in 2006 included tests on cable qualified for use in Duke nuclear power plants (NPPs) and fill cable. The construction of the fill cable is different from "Duke" qualified cable construction. Instead of the fiberglass scrim between the steel armor and conductors used in the "Duke" qualified cables, a plastic Mylar material was wrapped around the conductors, over which an inner PVC jacket was extruded in the fill cables.

   The 2006 test program involved comparative tests on cables with and without an outer PVC jacket. The comparative tests indicated that removing the outer PVC jacket may accelerate the horizontal flame spread over the cable if an inner PVC jacket is present inside the armor. The comparative tests also indicated that removing the outer PVC jacket significantly accelerates fire propagation due to the migration of products of pyrolysis that are generated from the thermal decomposition of the insulation inside the armor to a connection point where the armor is removed and the gases ignite.

   (i) Confirm that the armored cables at CNS 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), or conduct an analysis to account for the impact of the horizontal flame spread, vertical fire propagation and the resulting additional HRR on the ZOI and HGL temperature

timing determination for fires that involve cables with a PVC jacket. Provide a summary of this re-evaluation, including the impact on the risk and delta risk.

(ii) Explain how the licensee addressed fire propagation due to migrating products of pyrolysis inside the armor within the fire zone (flames emerging from armored cable ends inside cabinets, junction boxes, switchgear, etc.) and across fire compartment boundaries (e.g., MCR and cable spreading rooms). Provide a summary of the evaluation.

j. Regarding fires in the proximity of a corner or walls, explain how the GFMTs approach was applied. Explain how wall and corner affects the ZOI and HGL timing calculations were accounted for, or provide technical justification if these effects were not considered.

k. Regarding high energy arcing fault (HEAF) generated fires, describe the criteria used to decide whether a cable tray in the vicinity of an electrical cabinet will ignite following a HEAF event in the cabinet. Explain how the ignited area was determined and subsequent fire propagation was calculated. Describe the effect of cable tray covers and fire-resistant wraps on HEAF induced cable tray ignition and subsequent fire propagation.

l. During the audit walkdowns, the NRC staff observed significant amounts of fixed non-cable combustibles in a number of fire areas. For example, large amounts of exposed above-ground high-density polyethylene (HDPE) piping, which may be involved in specific scenarios as intervening combustibles, were observed in the turbine and auxiliary buildings. Explain how non-cable intervening combustibles (e.g., HDPE piping) were identified and accounted for in the fire modeling analyses.

FM RAI 02

American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) Standard RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessments for Nuclear Power Plant Applications," Part 4, requires damage thresholds be established to support the FPRA. The standard further states that thermal impact(s) must be considered in determining the potential for thermal damage of systems, structures, and components (SSCs) and appropriate temperature and critical heat flux criteria must be used in the analysis.

Provide the following information:

a. Describe how the installed cabling in the power block, armored and unarmored, was characterized, specifically with regard to the critical damage threshold temperatures and critical heat fluxes for thermoset and thermoplastic cables as described in NUREG/CR-6850. If thermoplastic cables are present, explain how raceways with a mixture of thermoset and thermoplastic cables were treated in terms of damage thresholds and flame spread rates. State whether varying cable types are distributed throughout the power block or concentrated in any particular portion, such that the relative proportions are either effectively constant throughout the plant vs. a

preponderance of one particular type in selected locations. If the latter, how was the treatment modified?

b. The GFMTs approach includes damage criteria for different types of targets and states that, "Damage to IEEE-383 qualified cables is quantified as either an imposed incident heat flux of 11.4 kW/m^2 (1 Btu/s-ft^2) or an immersion temperature of 329°C (625°F) per Nuclear Regulatory Guidance [NRC, 2005, NUREG 6850, 2005]." The GFMTs approach further states: "Damage to non-IEEE-383 qualified cables is quantified as either an imposed incident heat flux of 5.7 kW/m^2 (0.5 Btu/s-ft^2) or an immersion temperature of 204°C (400°F) per Nuclear Regulatory Guidance [NRC, 2005, NUREG 6850, 2005]."

   The NRC staff notes that in the GFMTs approach, IEEE-383 qualified cables are assumed to be equivalent in terms of damage thresholds to "thermoset" cables as defined in Table 8-2 of NUREG/CR-6850. In addition, in the GFMTs approach, non-IEEE-383 qualified cables are assumed to be equivalent to "thermoplastic" cables as defined in Table 8-2 of NUREG/CR-6850. These assumptions may or may not be correct. An IEEE-383 qualified cable may or may not meet the criteria for a "thermoset cable" as defined in NUREG/CR-6850. It is also possible that a non-IEEE-383 qualified cable actually meets the NUREG/CR-6850 criteria for a "thermoset" cable.

   For those areas that are assumed to have thermoset damage criteria, confirm that the cables are actually thermoset and that the potential confusion about IEEE-383/thermoset is not applicable.

c. Describe how cable tray covers, conduits and wraps affect the damage thresholds that were used in the fire modeling analyses.

d. Explain how the damage thresholds for non-cable components (i.e., pumps, valves, electrical cabinets, etc.) were determined. Identify any non-cable components that were assigned damage thresholds different from those for thermoset and thermoplastic cables, and provide a technical justification for these damage thresholds.

e. Explain how exposed temperature-sensitive equipment was treated, and provide a technical justification for the damage criteria that were used.

FM RAI 03

NFPA-805, Section 2.7.3.2, states that each calculational model or numerical method used shall be verified and validated through comparison to test results or comparison to other acceptable models.

LAR Section 4.5.1.2, states that fire modeling was performed as part of the FPRA development (NFPA-805 Section 4.2.4.2). Reference is made to LAR Attachment J for a discussion of the verification and validation (V&V) of the fire models that were used. Furthermore, LAR Section 4.7.3 states that "calculational models and numerical methods used in support of

compliance with 10 CFR 50.48(c) were verified and validated as required by Section 2.7.3.2 of NFPA 805."

a. Regarding the V&V of fire models, for any fire modeling tool or method that was used in the development of the LAR or that is identified in the responses to the above fire modeling RAIs, provide the V&V basis if it is not already explicitly provided in the LAR (for example in LAR Attachment J).

FM RAI 04

NFPA-805, Section 2.7.3.3, states that acceptable engineering methods and numerical models shall only be used for applications to the extent these methods have been subject to V&V. These engineering methods shall only be applied within the scope, limitations, and assumptions prescribed for that method.

LAR Section 4.7.3, states that engineering methods and numerical models used in support of compliance with 10 CFR 50.48(c) are used and applied appropriately as required by Section 2.7.3.3 of NFPA-805.

a. Regarding the limitations of use, identify uses, if any, of the GFMTs approach outside the limits of applicability of the method and for those cases explain how the use of the GFMTs approach was justified.

FM RAI 05

NFPA-805, Section 2.7.3.4, "Qualification of Users," states: "Cognizant personnel who use and apply engineering analysis and numerical models (e.g., fire modeling techniques) shall be competent in that field and experienced in the application of these methods as they relate to nuclear power plants, nuclear power plant fire protection, and power plant operations."

LAR Section 4.5.1.2, "Fire PRA," states that fire modeling was performed as part of the Fire PRA development (NFPA-805 Section 4.2.4.2). This requires that qualified fire modeling and PRA personnel work together. Furthermore, LAR Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," states:

> Cognizant personnel who use and apply engineering analysis and numerical methods in support of compliance with 10 CFR 50.48(c) are competent and experienced as required by Section 2.7.3.4 of NFPA-805.
>
> During the transition to 10 CFR 50.48(c), work was performed in accordance with the quality requirements of Section 2.7.3 of NFPA-805. Personnel who used and applied engineering analysis and numerical methods (e.g. fire modeling) in support of compliance with 10 CFR 50.48(c) are competent and experienced as required by NFPA-805 Section 2.7.3.4.
>
> Post-transition, cognizant personnel who use and apply engineering analysis and numerical models shall be competent in this field and experienced in the application of

these methods as they relate to nuclear power plants, nuclear power plant fire protection, and power plant operations. Duke Energy will develop and maintain qualification requirements for individuals assigned various tasks. Individuals will be qualified to appropriate job performance requirements per ACAD 98-004. Engineering training guidelines will be developed to identify and document required training and mentoring to ensure individuals are appropriately qualified per the requirements of NFPA-805 Section 2.7.3.4 to perform assigned work.

Regarding qualifications of users of engineering analyses and numerical models:

a. Describe what constitutes the appropriate qualifications for staff and consulting engineers to use and apply the methods and fire modeling tools included in the engineering analyses and numerical models.

b. Describe the process/procedures for ensuring the adequacy of the appropriate qualifications of the engineers/personnel performing the fire analyses and modeling activities.

c. Describe who performed the walk-downs of the MCR and other fire areas in the plant. Describe whether these were the same people who performed the fire modeling analysis.

d. Explain the communication process between the CNS fire modeling analysts, PRA personnel, consulting engineers and CNS personnel to exchange the necessary information and any measures taken to assure the fire modeling was performed adequately and will continue to be performed adequately during post-transition.

FM RAI 06

NFPA-805, Section 2.7.3.5, "Uncertainty Analysis," states, "An uncertainty analysis shall be performed to provide reasonable assurance that the performance criteria have been met."

LAR Section 4.7.3, states "Uncertainty analyses were performed as required by Section 2.7.3.5 of NFPA-805 and the results were considered in the context of the application. This is of particular interest in fire modeling and Fire PRA development."

Regarding the uncertainty analysis for fire modeling:

a. Describe how the uncertainty associated with the input parameters (compartment geometry, radiative fraction, thermophysical properties, etc.) was addressed and accounted for in the fire modeling analyses.

b. Describe how the "model" and "completeness" uncertainties were accounted for in the fire modeling analyses.

Radiation Release (RR) RAI 01

LAR Attachment E, Compartment: Monitor Tank Building, "Smoke and By Products of Combustion-Airborne Effluent Evaluation," states that the portions of the building that contain the process equipment, tank storage and the truck bay are exhausted through filters prior to monitored release. For the portions of the building that do not contain the process equipment, tank storage and truck bay, what administrative controls (e.g. limits on activity, etc.) will be used in these areas to meet the applicable limits in Title 10 of the *Code of Federal Regulations,* Part 20 (10 CFR 20)?

If radioactive material (RAM) is stored in the areas that are exhausted unmonitored, provide a bounding calculation.

RR RAI 02

LAR Attachment E, Compartment: Retired Steam Generator Storage Facility, "Smoke and By Products of Combustion-Airborne Effluent Evaluation," states that the Retired Steam Generator Storage Facility (RSGSF) ventilation system includes a passive high-efficiency particulate air (HEPA) system to prevent contaminated release, but there is a lack of active ventilation controls. What are the administrative controls that will be in place, to compensate for the lack of active ventilation controls, in order to ensure that the applicable 10 CFR 20 limits are not exceeded? Are combustibles or other RAM stored in this fire area?

Provide a bounding calculation to demonstrate that the applicable 10 CFR 20 limits will not be exceeded.

RR RAI 03

LAR Attachment E, Compartment: Service Building – Radiologically Controlled Area (RCA), "Smoke and By Products of Combustion-Airborne Effluent Evaluation," states that treatment and monitoring of exhaust air is not provided and that all ventilation is discharged directly to the atmosphere. Since all ventilation is discharged directly to the atmosphere, and not treated or monitored, what are the administrative controls (e.g. limits on activity etc.) that will be used to meet the applicable 10 CFR 20 requirements?

It is also stated in "Fire Suppressant Runoff-Liquid Effluent Evaluation" that treatment and monitoring of floor drainage is not provided in the Service Building. What are the administrative controls that will be put in place since floor drainage treatment and monitoring is not provided? Do the rooms adjacent to the Single Point of Access (SPA) also not have treatment and monitoring for liquid or airborne effluents? If not, what are the administrative controls for this area?

Provide a bounding calculation for the SPA and adjacent rooms that demonstrates that the applicable 10 CFR 20 limits will not be exceeded.

RR RAI 04

LAR Attachment E, Compartment: Turbine Buildings – RCA, "Smoke and By Products of Combustion-Airborne Effluent Evaluation" states that all ventilation is discharged directly to the atmosphere, without treatment and monitoring. What are the administrative controls that will be used since exhausted air is not treated or monitored prior to being released to the atmosphere?

Provide a bounding calculation to demonstrate that airborne effluents will not exceed applicable 10 CFR 20 limits.

RR RAI 05

LAR Attachment E, Compartment Yard and Miscellaneous – RCA, "Smoke and By Products of Combustion-Airborne Effluent Evaluation," states that the Yard-RCA areas are open to the atmosphere.

Since the Yard-RCA areas are open to the atmosphere, provide a bounding calculation that demonstrates that the applicable 10 CFR 20 limits will not be exceeded in any of the Yard and Miscellaneous-RCAs. What will be the administrative controls (e.g. activity limits) for the Yard areas? Also, are any other types of containers (e.g. sea-land containers) used as storage for RAM in the Yard?

RR RAI 06

LAR Section 4.4.2 states that in a significant storm event, Yard Drain Collection Sumps overflow directly to Lake Wylie. What administrative controls will be added to the fire strategies and how will they ensure that the Yard Drain Collection Sumps do not overflow and release the runoff from firefighting activities, directly to Lake Wylie?

RR RAI 07

LAR Section 4.4.2 states that the fire protection program will be compliant with the requirements of NFPA-805 and the guidance in NEI 04-02 and RG 1.205 upon completion of the Implementation Items identified in LAR Attachment E. Should this be LAR Attachment S instead of LAR Attachment E?

Probabilistic Risk Assessment (PRA) RAI 01

Section 2.4.3.3 of NFPA-805 states that the probabilistic safety assessment (PSA) (PSA is also referred to as PRA) approach, methods, and data shall be acceptable to the authority having jurisdiction (AHJ), which is the U.S. Nuclear Regulatory Commission (NRC). Regulatory Guide (RG) 1.205 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 NRC staff for adopting a fire protection program consistent with NFPA-805. RG 1.200 describes a peer review process utilizing an associated ASME/ANS standard (currently ASME/ANS-RA-Sa-2009) 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 fire F&Os and Supporting Requirement (SR) assessment identified in LAR Attachment V that have the potential to impact the Fire PRA (FPRA) results and do not appear to be fully resolved:

a) FSS-A1-01: The disposition to this F&O indicates that analysis documentation was updated to identify ignition sources screened from quantification. A review of the documentation reveals a large number of scenarios identified as having an "insignificant fire risk contribution;" however, the criteria used for reaching this conclusion are unclear. In addition, the licensee's analysis appears to indicate that the risk contribution from the "non-severe" portion of some Bin 15 ignition sources may have also been dismissed as being already captured by random failure probabilities within the FPRA model. As a result, describe and justify the criteria used to screen non-propagating fixed and transient ignition sources, or portions thereof. Note that Section 8.5.3 of NUREG/CR-6850 provides guidance on screening non-propagating fixed ignition sources and that Tables 7-2 and 7-3 of NUREG/CR-6850 provide quantitative screening criteria, which, according to Section 7.2, may also be implemented for screening fire scenarios, in general.

b) HRA-A4-01 and HRA-B3-01: The resolutions to F&Os HRA-A4-1 and HRA-B3-01 explain that human error probability (HEP) values for the Fire PRA uses a set of multipliers as described in the model development report to account for fire impacts on human reliability. This process is intended to implicitly account for factors influencing operator performance such as fire effects on instrumentation, operator stress, and possible impact on timing. Table V-2 of the LAR justifies the peer reviewer assessment for SRs HRA-A4, HRA-B3, HRA-C1, and HRA-D1 to be acceptable for the NFPA 805-application on the basis that this factor or multiplier methodology is a conservative approach. The methodology, which is essentially an HRA scoping approach, does not follow the NRC-accepted guidance in NUREG/CR-6850 or NUREG-1921. In light of these issues:

   i. Provide further justification that explains how the multiplier methodology for developing HEPs accounts for the various factors discussed in Section 5 of NUREG-1921 for performing a scoping/screening fire HRA. Alternatively, provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03 applying HEP and JHEP values developed using NRC-accepted guidance such as NUREG-1921 or NUREG/CR-6850.

   ii. Provide further explanation of how using conservative or scoping values for HEPs for significant human actions impacts the delta risk results reported in the fire risk evaluations. The response should specifically address each HFE determined to be significant in accordance with the PRA standard. Alternatively, provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03 applying HEP values for risk significant HFEs developed using detailed HRA.

iii. NUREG-1921 indicates, and NUREG-1792 (Table 2-1) states that joint HEP values should not be below 1E-5. Electric Power Research Institute (EPRI) Table 4-3 provides a lower limiting value of 1E-6 for sequences with a very low level of dependence. Confirm that each joint HEP value used in the FPRA below 1E-5 includes its own justification that demonstrates the inapplicability of the NUREG-1792 lower value guideline. Provide an estimate of the number of these joint HEPs below 1E-5 and at least two different examples of the justification.

iv. The resolution to F&O HRA-A4 states that talk-throughs of the operator actions are not necessary because the evaluation is conservative. A simple claim of conservatism is insufficient to support skipping an essential element in a methodology. Describe the talk-throughs of plant procedures conducted with plant operations and training personnel and confirm that the results of these talk-throughs have been incorporated into the FPRA and the risk results reported in the LAR. If talk-throughs have not been performed to current plant procedures, provide justification for why this is acceptable for the NFPA-805 application and post-transition plant change evaluations.

c) PRM-B6-01 and HRA-D2-01: The dispositions to these F&Os do not provide a basis for crediting a "not fire specific" operator action, TSSPZRLRHE, that is apparently not proceduralized nor trained upon. Identify whether any other non-proceduralized actions are credited in the FPRA and describe and justify credit given to non-proceduralized actions.

PRA RAI 02

Section 2.4.3.3 of NFPA-805 states that the PRA approach, methods, and data shall be acceptable to the NRC, RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the NRC staff for adopting a fire protection program consistent with NFPA-805. RG 1.200 describes a peer review process utilizing an associated ASME/ANS standard (currently ASME/ANS-RA-Sa-2009) as one acceptable approach for determining the technical adequacy of the PRA once acceptable consensus approaches or models have been established. 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 Internal Events F&Os and SR assessments identified in LAR Attachment U that have the potential to impact the FPRA results and do not appear to be fully resolved:

a) F&Os IE-06, DE-04 and TH-06 identify that loss of HVAC was not modeled in the PRA and that there is no room heat-up analysis to support this assumption. The dispositions to these F&Os conclude that any additional risk incurred from modeling loss of HVAC would be small and would not have a significant impact on the FPRA results or results for the NFPA-805 application. Discuss generally the evaluations performed to reach this conclusion and specifically address a) how HVAC dependencies were considered, b) the evaluations performed for the switchgear and battery rooms, and c) the cable routing sensitivity analysis performed to support this conclusion. Also, define what is meant by

small and non-significant impact. The response should address small and non-significant in the context of both the RG 1.174 risk guidelines for transition and the post-transition change evaluation criteria, which is two orders-of magnitude less than the RG 1.174 risk guidelines.

b) F&O QU-05 identifies a specific instance in which the time available for a credited recovery action was not consistent with the time assumed in the PRA. Related to this issue, the disposition of SR HR-G6 indicates that the 2013 self-assessment concludes that this SR is not met and the status of this SR is reported as "open." The disposition further states that a meeting will be conducted with the PRA model integrator, the HRA specialist and plant operators to perform a formal consistency check of the post-initiator human error probability quantifications. Clarify if this action has been completed and, if so, discuss the results of the review and if it resulted in any PRA model changes. If changes to the PRA were necessary to resolve the issue, discuss their potential impact to the FPRA and results reported in the LAR.

c) The disposition of F&Os SY-03, TH-01, TH-03, and TH-05 discuss the development of new success criteria and include the statement that "While the success criteria has been updated, it has not been incorporated into the PRA model. However, there are no significant changes to the success criteria, so the impact on the FPRA results and NFPA 805 is expected to be negligible." Provide further information on the updated success criteria, specifically addressing all aspects of the F&Os (systems/components required, time windows for operator actions). Furthermore, define what is meant by "no significant changes" and "expected to be negligible" in the context of both the RG 1.174 risk guidelines for transition and the post-transition change evaluation criteria, which is two orders-of-magnitude less than the RG 1.174 risk guidelines.

d) The disposition of F&Os TH-01 and TH-02 concludes that difference in the time to core damage is not significant when using either 2000 F or 4000 F "because the exothermic nature of the zircaloy-water reaction rapidly increases the fuel temperature." Relatively small changes in "the time available for human recoveries or other non-recovery events such as loss of offsite power recoveries" could change the likelihood of some events. Provide further clarification on the difference in the time available and what is meant by not significant and negligible impact. The response should address not significant and negligible in the context of both the RG 1.174 risk guidelines for transition and the post-transition change evaluation criteria, which is two orders-of-magnitude less than the RG 1.174 risk guidelines.

e) The disposition of F&O SY-04, concerning excluding the failure to isolate the non-Essential Reactor Building Header from the fault trees, discusses the number of valves that must fail to close to cause the failure to isolate and that common cause failure of all the valves is considered probabilistically insignificant. Explain whether all multiple failure models not included in internal event model were included in the MSO evaluation.

f) Discuss whether the cumulative impact of the following findings on the total CDF and LERF would make these measures exceed the RG 1.174 risk guidelines.

a. Peer review F&O IE-08 indicates that the estimation of the frequency of loss of service water is incorrect in the application of common cause factors and underestimates the frequency by a factor of 122. Discuss the impact of the loss of service water frequency underestimation on the total CDF and LERF reported in the LAR.

b. The disposition of a number of internal flooding F&Os (IFSN-A10-01, IFSN-A7-01, IFSO-A1-01 and, potentially, IFPP-A2-01) indicates that changes in the flooding analysis resulted from the F&O. Confirm that all changes resulting from the internal flooding peer review F&Os have been incorporated in the internal flooding model that produced the CDF results in LAR Attachment W. If changes have not been incorporated, discuss the impact of the missing changes on the total CDF and LERF reported in the LAR.

c. The disposition to SR IE-C14 indicates that if credit for motor-operated valves (MOVs) (that may not function under the differential pressure conditions that result from ruptured check valves) is removed from the PRA the base Fire CDF and LERF and the base internal events CDF and LERF will increase, but that the impact will be sufficiently small enough that the risk metrics would remain within the risk acceptance guidelines. Discuss the impact of crediting these MOVs on the total CDF and LERF reported in the LAR.

d. It is unclear how the disposition to F&O QU-12 (i.e., redefinition of the small loss-of-coolant accident (LOCA) initiator) resolves the two issues identified in the F&O: 1) three orders of magnitude difference in the conditional core damage probabilities (CCDPs) for small loss-of-coolant accident (LOCA) and steam generator tube rupture initiators and 2) same CCDP for the Loss of Instrument Air and the Inadvertent SS Actuation initiators. Discuss the impact of addressing these issues on the total CDF and LERF reported in the LAR.

e. The disposition to F&O DA-02 indicates that the primary generic data source was updated to NUREG/CR-6928 and notes that this report is limited to independent failures. The disposition does not address the source of other generic data such as common-cause failure and loss of offsite power recovery. In addition the disposition does not address the less than adequate reliability characterization for which several examples are provided in the F&O. Provide justification for the conclusion that resolution of this issue does not impact the risk results reported in the LAR or post-transition plant change evaluation criteria, which is two orders-of-magnitude less than the RG 1.174 risk guidelines.

f. The seismic CDF (1.1E-05/yr) reported in LAR Table W-1 used to estimate the total plant CDF for both units is low compared to the seismic CDF estimate (range 1.7E-05/yr to 3.7E-05/yr) developed by the NRC staff and presented in an NRC staff memorandum dated September 2, 2010 (titled: "Safety/Risk Assessment Results for Generic Issue 199, Implication for Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants"). The total CDF for each unit, if the highest CDF value for seismic events was used, exceeds the RG 1.174 risk guidelines. As a result, provide the basis and

corresponding technical justification for the seismic events CDF presented in the LAR.

PRA RAI 03

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 core damage frequency (CDF), large early release frequency (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 additional information that is required to fully characterize the risk estimates.

The PRA methods currently under review in the LAR include:

- PRA RAI 01.b regarding the Fire PRA HRA
- PRA RAI 02.a regarding not modeling loss of HVAC
- PRA RAI 02.b regarding consistency of time available for recovery actions
- PRA RAI 02.c regarding updating the success criteria
- PRA RAI 05 regarding application of state of knowledge correlation (SOKC)
- PRA RAI 08 regarding deviations from NRC guidance
- PRA RAI 09 regarding reduced circuit failure probabilities
- PRA RAI 10 regarding ignition bins missing from the sensitivity study
- PRA RAI 11 regarding main control room (MCR) abandonment on loss of habitability
- PRA RAI 12 regarding treatment of recovery actions
- PRA RAI 14 regarding sensitive electronics
- PRA RAI 15 regarding reduced heat release rate (HRR) for transients
- PRA RAI 17.a regarding fire propagation from electrical cabinets and fire frequency allocation/screening
- PRA RAI 17.b regarding treatment of spurious actuation for cabinet fires
- PRA RAI 17.c regarding well-sealed cabinets less than 440V in the Bin 15 count
- PRA RAI 18 regarding the multi-compartment analysis (MCA)
- PRA RAI 19 regarding modeling of multiple spurious operations (MSOs)
- PRA RAI 20 regarding modeling of junction boxes
- PRA RAI 21 regarding modeling of cable fires caused by welding and cutting (CFWC)
- FM RAI 01.i regarding fire propagation from armored cable
- FM RAI 01.a, b, c, d regarding MCR abandonment timing analysis
- FM RAI 01.l regarding non-cable intervening combustibles

Provide the following:

a) Results of an aggregate analysis that provides the integrated impact on the fire risk (i.e., the total transition CDF, LERF, ΔCDF, ΔLERF) of replacing specific methods

identified above with alternative methods that are acceptable to the NRC. In this aggregate analysis, for those cases where the individual issues have a synergistic impact on the results, a simultaneous analysis must be performed. For those cases where no synergy exists, a one-at-a-time analysis may be done. For those cases that have a negligible impact, a qualitative evaluation may be done. It should be noted that this list may expand depending on NRC's review of the responses to other RAIs in this document.

b) For each method (i.e., each bullet) above, explain how the issue will be addressed in 1) the final aggregate analysis results provided in support of the LAR, and 2) the PRA that will be used at the beginning of the self-approval of post-transition changes. In addition, provide a process to ensure that all changes will be made, that a focused-scope peer review will be performed on changes that are PRA upgrades as defined in the PRA standard, and that any findings will be resolved before self-approval of post-transition changes.

c) In the response, explain how the RG 1.205 risk acceptance guidelines are satisfied for the aggregate analysis. If applicable include a description of any new modifications or operator actions being credited to reduce delta risk as well as a discussion of the associated impacts to the fire protection program.

d) If any unaccepted methods will be retained in the PRA and will be used to estimate the change in risk of post-transition changes to support self-approval, explain how the quantification results for each future change will account for the use of these methods.

PRA RAI 04

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 additional information that is required to fully characterize the risk estimates.

LAR Section 4.5.2.2 provides a high-level description of how the impact of transition to NFPA-805 impacts DID and safety margin was reviewed, including using the criteria from Section 5.3.5 of NEI 04-02 and from RG 1.205. However, no explanation is provided of how specifically the criteria in these documents were utilized and/or applied in these assessments.

a) Provide further explanation of the method(s) or criteria used to determine when a substantial imbalance between DID echelons existed in the Fire Risk Evaluations (FREs), and identify the types of plant improvements made in response to this assessment.

b) Also, provide further discussion of the approach in applying the NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," Revision 2, (ADAMS Accession No. ML081130188) criteria for assessing safety margin in the FREs.

PRA RAI 05

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's review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Section 4.7.3 explains that the sources of uncertainty in the FPRA were identified and specific parameters were analyzed for sensitivity in support of the NFPA-805 FRE process. It is further explained that during the FRE process, the uncertainty and sensitivity associated with specific FPRA parameters were considerations in the evaluation of the change in risk relative to the applicable acceptance thresholds. Based on these explanations, it is apparent that the risk results presented in Attachment W of the LAR are point estimates and do not include parameter uncertainty. Explain how SOKCs were taken into account in the FPRA quantification, including circuit failure likelihood and hot short duration, and non-suppression probabilities. If SOKC for these parameters were not accounted for in the FPRA quantification, then include the impact of the SOKC for these parameters in the integrated analysis performed in response to PRA RAI 3.

PRA RAI 06

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 additional information that is required to fully characterize the risk estimates.

LAR Attachment G, "Recovery Actions Transition," identifies a "third" category of operator manual actions (OMAs) (beyond risk reduction and defense-in-depth) that appear to be associated with variances from deterministic requirements (VFDRs) and that are screened out due to "no or very low risk."

a. Clarify how these OMAs were originally identified.

b. Clarify the process and criteria for screening out these OMAs.

c. Explain how the screened-out OMAs will be treated in the post-transition fire procedures. If they will be retained in the procedures, clarify that they have been evaluated for adverse impact on the PRA (e.g., the HRA/feasibility analysis of RAs considered these OMAs in development of timing, operator availability, etc.).

PRA RAI 07

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 additional information that is required to fully characterize the risk estimates.

LAR Table S-3, Implementation Item #13 commits to updating the FPRA and re-evaluating the risk results after installation of the plant modifications identified in Table S-2 are completed. This implementation item does not address completion of the implementation items identified in Table S-3. Clarify your plans for re-evaluating the risk results following completion of the modifications in Tables S-2a and S-2b and the implementation items in Table S-3. The clarification should include the actions that will be taken if the guidelines in RG 1.205 are exceeded.

PRA RAI 08

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 additional information that is required to fully characterize the risk estimates.

LAR Attachment V Section V.2.1 states that the "The Fire PRA does not utilize unreviewed analysis methods (UAMs)." Indicate if any other methods were employed that deviate from guidance in NUREG/CR-6850 or other acceptable guidance (e.g., FAQs or interim guidance documents). If so, describe and justify any proposed method that deviates from NRC guidance, or replace the proposed method with an accepted method. Also, include the proposed method as a method "currently under review" as part of the integrated analysis in the response to PRA RAI 3.

PRA RAI 09

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 additional information that is required to fully characterize the risk estimates.

LAR Section V.2.2 states that reduced circuit failure probabilities for circuits with control power transformers (CPTs) was not credited in the FPRA. LAR Section V.2.1 states that credit for hot short duration probability was applied in accordance with FAQ 08-0051. Recently, new guidance on using conditional probabilities of spurious operation for control circuits was issued by the NRC in Section 7 of NUREG/CR-7150, Volume 2. This guidance included: a) replacement of the conditional hot short probability tables in NUREG/CR-6850 for Option #1 with new circuit failure probabilities for single break and double break control circuits, b) Option #2 in NUREG/CR-6850 is not an adequate method and should not be used, c) replacement of the probability of spurious operation duration figure in FAQ 08-0051 for AC control circuits, d) aggregate values for circuit failure probabilities should be used unless it is demonstrated that a cable is only susceptible to a single failure mode, e) incorporation of the uncertainty values for the circuit failure probabilities and spurious operation duration in the SOKC for developing the mean CDF/LERF, and f) recommendations on the hot short probabilities to use for other cable configurations, including panel wiring, trunk cables, and instrument cables. Provide an assessment of the assumptions used in the CNS FPRA relative to the updated guidance in NUREG/CR-7150, Volume 2, specifically addressing each of these items. If the FPRA assumptions are not bounded by the new guidance provide a justification for each difference or provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03, utilizing the guidance in NUREG/CR-7150.

PRA RAI 10

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 additional information that is required to fully characterize the risk estimates.

LAR Section V.2.6 indicates that only Bins 4 and 15 are applicable to the fire ignition frequency sensitivity analysis. For each of the other Bins having an alpha of less than or equal to 1, provide the basis for concluding that each does not impact the VFDR delta risk results.

PRA RAI 11

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.

LAR Section V.2.7 describes two MCR abandonment on loss-of-habitability scenarios, W1 and W2, where, in both cases, "failures were assumed which virtually eliminated all success paths other than the Standby Makeup Pump and the TD CA [turbine-driven auxiliary feedwater] pump from the SSF [Safe Shutdown Facility]." It is further explained that the CCDP for these scenarios is based on the highest CCDP for main control board (MCB) and non-MCB fires with additional failures as necessary to ensure no credit for functions that require continued presence in the MCR. Regarding this analysis, provide the following:

a) Summarize what "failures were assumed" and why they were assumed. Specifically, are they assumed because of general issues (e.g., unknown cable routing for functions always assumed failed) or are the assumptions only used for MCR abandonment scenarios?

b) An explanation of how the CCDPs account for the range of probabilities for properly shutting down the plant, and discussion of how they were applied in the scenario analysis. In doing so, provide examples over the full range of values utilized, a characterization of the scenarios to which these values are applied, and a summary of how each value is developed.

   This information should include explanations of how the following scenarios are addressed:

   i. Scenarios where the fire fails few functions aside from MCR habitability and successful shutdown is straightforward.

   ii. Scenarios where the fire could cause some recoverable functional failures or spurious operations that complicate the shutdown but successful shutdown is likely.

   iii. Scenarios where the fire induced failures cause great difficulty for shutdown by failing multiple functions and/or causing complex spurious operations that make successful shutdown unlikely.

c) Explanation of the timing considerations (i.e., total time available, time until cues are reached, manipulation time, and time for decision-making) made to characterize

scenarios in Part (b). Include in the explanation the basis for any assumptions made about timing.

d) Discussion of how the probability associated with failure to transfer control to the safe shutdown facility (SSF) is taken into account in Part (b).

PRA RAI 12

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 staffs review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates.

LAR Section V.2.7 states "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." LAR Table G-1 identifies PCS actions for the following 12 fire areas: 01 (U1 and U2), 02 (U2), 03 (U1), 04 (U1 and U2), 09 (U1 and U2), 10 (U1 and U2), 11 (U1 and U2), 16 (U1 and U2), 17 (U1 and U2), 18 (U1 and U2), 21 (U1 and U2), and 22 (U1 and U2). If primary command and control is retained in the MCR (i.e., the MCR is not abandoned), then RG 1.205 states, "operation of dedicated or alternative shutdown controls while the main control room remains the command and control location would normally be considered a recovery action." In light of this, provide the following:

a) Clarify if primary command and control is retained in the MCR for fire scenarios in each of these 12 fire areas and explain how this decision is reached. If primary command and control is retained in the MCR, actions taken at the PCSs should be recovery actions. If these actions are not considered recovery actions in your analysis, please justify. Provide the additional risk of all recovery actions for each fire area if not already provided in the LAR. Also, discuss the results of the feasibility and reliability evaluation in accordance with FAQ 07-0030.

b) If command and control is not retained in the MCR and is transferred to the PCS, the actions taken at the primary control station are not recovery actions. Describe how PCS actions are modeled in the FPRA. In the response, describe the cues that result in the decision to transfer control and the timing of these cues, and identify the instruments being relied upon to make this decision. Discuss whether these instruments are protected.

c) Discuss how failure to transfer control to the primary control stations is taken into account.

PRA RAI 13

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 additional information that is required to fully characterize the risk estimates.

LAR Section W.2.1 describes only one method for estimating the delta risk, as follows: "The compliant case was created by manipulating the Fire PRA model to 'remove' the VFDR(s). Fire PRA manipulations involved 'toggling off' or excluding specific PRA basic events to remove the potential fire induced failure associated with the VFDRs." It does not address if there are any exceptions to this method, such as potentially with MCR abandonment scenarios or the use of bounding methods per FAQ 08-0054. Provide further description of the methods used to determine the change in risk values reported in LAR Tables W-3 and W-4 and additional discussion of the results as requested below.

a) Were any methods other than the basic event toggling already described used to determine the fire area change in risk or delta risk reported in LAR Tables W-3 and W-4 for VFDRs modeled in the FPRA? If so, describe each method.

b) Describe how the change in risk was determined for MCR abandonment scenarios, including a summary of how the CCDP was determined for the compliant and the variant plants. Note that an overestimate of the compliant plant risk, unless offset with a similar overestimate in the variant plant risk, results in a non-conservative analysis of the delta risk. If the method described applies different assumptions to the variant and the compliant plant risk estimates, an indeterminate but non-conservative impact on the change-in-risk estimate may result.

PRA RAI 14

Section 2.4.3.3 of NFPA-805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the NRC staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

In regard to modeling fire damage to sensitive electronics, neither Appendix H of the LAR or the licensee's procedures refer to use of FAQ 13-0004, "Clarifications on Treatment of Sensitive Electronics," dated December 3, 2013 (ADAMS Accession No. ML13322A085). Describe the treatment of sensitive electronics for the FPRA and explain whether it is consistent with the

guidance in FAQ 13-0004, including the caveats about configurations that can invalidate the approach (i.e., sensitive electronic mounted on the surface of cabinets and the presence of louver or vents). If the approach is not consistent with FAQ 13-0004, justify the approach or replace the current approach with an acceptable approach in the integrated analysis performed in response to PRA RAI 3.

PRA RAI 15

Section 2.4.3.3 of NFPA-805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the NRC staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The licensee's analysis indicates that the ZOI associated with a 142 kilo-watt (kW) heat release rate (HRR) (75th percentile) transient fire was used in almost all fires areas (the one exception identified is the Turbine Building). Discuss the key factors used to justify the reduced rate below 317 kW per the guidance provided in the June 21, 2012, memo from Joseph Giitter to Biff Bradley ("Recent Fire PRA Methods review Panel Decisions and EPRI 1022993, 'Evaluation of Peak Heat Release Rates in Electrical Cabinets Fires,' " ADAMS Accession No. ML12171A583). Include in this discussion:

a) Identification of all fire compartments/areas where a ZOI for a reduced HRR of 142 kW (75th percentile) was used. The guidance in the referenced June 21, 2012, memo indicates that a reduced HRR would be an exception supported by rigorous controls and restrictions. Discuss how using a reduced HRR for almost all fire areas, if correct, is consistent with the guidance.

b) For each location (or group of similar locations) where a reduced HRR is credited, a description of the administrative controls that justify the reduced HRR including how location-specific attributes and considerations are addressed.

c) The results of a review of records related to violations of the transient combustible and hot work controls.

d) Confirm that 142 kW and 317 kW HRRs were the only transient fire sizes used in the FPRA.

PRA RAI 16

Section 2.4.3.3 of NFPA-805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the NRC staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the

NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The MCB is described as having a horseshoe arrangement that is fully enclosed and is effectively a sub-enclosure. The analysis of MCB fires appears to treat the front and back panels of the horseshoe as an integral part of the MCB.

a) FAQ 14-0008 provides guidance on how MCB fires should be treated for MCBs that are sub-enclosures. Describe how your MCB configuration and MCB fire scenario analysis is consistent with the FAQ.

b) Describe how MCB fire scenarios are postulated and evaluated, including how the fire ignition frequency is determined for each scenario, how NUREG/CR-6850 Appendix L is applied to individual scenarios, how partitions between panels/cabinets are treated if credited, and how propagation between the front and back sides of the MCB is evaluated including identification of and evaluation of damage to target sets.

PRA RAI 17

Section 2.4.3.3 of NFPA-805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the NRC staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The licensee's analysis appears to indicate that fires within some Bin 15 cabinets above 440V (e.g., motor control centers (MCCs)) are not assumed to propagate outside of the cabinet. In addition, it is indicated that the damage from non-severe fires within some Bin 15 cabinets is limited by not considering spurious actuations. Guidance in Frequently Asked Question 08-0042 from Supplement 1 of NUREG/CR-6850 applies to electrical cabinets below 440 V. With respect to Bin 15 as discussed in Chapter 6, it clarifies the meaning of "robustly- or well-sealed" when used in conjunction with these lower voltage cabinets. For those cabinets of 440 V and higher, the original guidance in Chapter 6 remains: "Also note that panels that house circuit voltages of 440 V or greater are counted because 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)." Therefore, propagation of fire outside the ignition source panel must be evaluated for all Bin 15 panels that house circuits of 440 V or greater.

a) Describe how fire propagation outside of well-sealed cabinets greater than 440 V is evaluated.

b) Discuss how spurious actuation is considered for non-severe fire within Bin 15 cabinets. Discuss the sensitivity of the risk results to this evaluation, considering the

guidance in NUREG/CR-7150 Sections 6.6.3 and 7.4 regarding hot short probabilities for panel wiring.

c) If well-sealed cabinets less than 440 V are included in the Bin 15 count provide a qualitative or quantitative justification that using this approach will identify risk contributors that may be important and does not inappropriately dilute the ignition frequency in greater than 440V cabinets.

PRA RAI 18

Section 2.4.3.3 of NFPA-805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the NRC staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

A severity factory of 0.20 is applied to some MCA scenarios "to account for the probability that only 1 in 5 fires are expected to challenge the zone boundary." This is an industry average-type factor that does not account for the design-specific considerations and potential for HGL formation at CNS. In addition, a barrier failure probability of 7.4E-03 is also applied to all MCA scenarios, which only accounts for the barrier having the highest probability of failure (e.g., non-rated barrier, door, damper, or wall)."

a) Is the 0.20 factor only applied when there is a rated fire barrier? If not provide further justification of the use of any factor.

b) Provide justification for the use of the single barrier failure probability appropriately accounting for the CNS-specific design and potential for HGL formation potential in the MCA, or provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03 without the severity factor and summing the barrier failure probabilities for each type of barrier present per NUREG/CR-6850.

PRA RAI 19

Section 2.4.3.3 of NFPA-805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA 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. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The licensee's analysis describes how each MSO from the industry generic list was addressed in the FPRA model. This list is not consistent with the generic MSO list in Appendix G of NEI 00-01, Revision 2 which, according to Attachment F of the LAR, may not have been the

source of the generic MSO list used in the FPRA. Identify the MSOs in Appendix G of NEI 00-01, Revision 2, that are not identified in Table A-1 of the Fire Model Development Report and describe how these are dispositioned in the FPRA model. Provide justification for any generic MSOs not identified in Table A-1 or provide updated risk results as part of the aggregate change-in-risk analysis requested in PRA RAI 03 that incorporates the additional MSOs in the FPRA model.

PRA RAI 20

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the NRC staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The CNS FPRA does not employ junction boxes and therefore there were no Bin 18 fires assumed in the CNS FPRA. However, per FAQ 13-0006, it is noted that junction box frequencies should be included for both thermoplastic and thermoset cables as the fire event experience suggests that these fires start due to small arcs generated by bad connections, which is not influenced by the cable insulation or jacket type. Provide further justification for not including junction box fires in the FPRA by specifically addressing the definition and characteristics of junction boxes in FAQ 13-0006. If the apportioning method used is not in conformance with the acceptable methods defined in NUREG/CR-6850 or FAQ 13-0006, provide a detailed justification for the alternate method that includes a discussion of conservatisms and non-conservatisms relative to the accepted methods and assesses the associated impacts on the fire total and delta risk results, or replace the current approach with an acceptable approach in the integrated analysis performed in response to PRA RAI 3.

PRA RAI 21

Section 2.4.3.3 of NFPA-805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 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 NRC staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The fire ignition frequency for cable fires caused by welding and cutting (CFWC) is apportioned based on the number of raceways in each compartment in lieu of cable loading per NUREG/CR-6850. Provide a justification of your method that includes a discussion of conservatisms and non-conservatisms relative to the accepted methods. Assess the impact of using the accepted method instead of the proposed method on several high and intermediate risk areas.

Alternatively, replace the current approach with an acceptable approach in the integrated analysis performed in response to PRA RAI 3.

PRA RAI 22

Section 2.4.3.3 of NFPA-805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 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 NRC staff for adopting a fire protection program consistent with NFPA-805. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

For Bin 15 electrical cabinet scenarios, the licensee adds the frequency of HEAF events to the Bin 15 severe fire scenario frequency. As a result, it appears that the non-suppression probability (NSP) for the severe fire scenarios is also applied to the HEAF scenarios. Per Appendix P of NUREG/CR-6850, HEAF events and electrical cabinet fires have different NSP curves. In addition, the NRC staff's interpretation of the NUREG/CR-6850 guidance is that the growth of a fire subsequent to a HEAF event instantaneously starts at a non-zero HRR because of the intensity of the initial heat release from the HEAF. Provide a detailed justification of your treatment of HEAF events and the ensuing fire that includes a discussion of conservatisms and non-conservatisms relative to the accepted methods and assesses the associated impacts on the fire total and delta risk results, or replace the current approach with an acceptable approach in the integrated analysis performed in response to PRA RAI 3. If not done according to an accepted approach, the response should address the treatment of all HEAF scenarios, including in the HGL analysis and MCA.

Request for Additional Information	Response Date
FPE 1, 3, 4, 5, 7 SSA 1, 3, 4, 5, 6 FM 1.b, 1.g, 1.h, 1.j, 1.k, 2.c, 2.d, 2.e, 3, 5 RR 7 PRA 2.d, 4, 10, 16, 18.a, 21	1/13/2015 (75 days*)
FPE 2, 6, 8 SSA 2, 7, 8 FM 1.a, 1.c, 1.d, 1.e, 1.f, 1.i, 1.l, 2.a, 2.b, 4, 6 RR 1, 2, 3, 4, 5, 6 PRA 1.b, 1.c, 2.b, 2.c, 2.e, 2.f, 5, 6, 7, 8, 11, 13, 15, 18.b, 20, 22	1/28/2015 (90 days*)
PRA 1.a, 2.a, 3, 9, 12, 14, 17, 19	2/27/2015 (120 days*)

*from conclusion of audit on October 30, 2014

Acronyms:
FPE – Fire Protection Engineering
SSA – Safe Shutdown Analysis
FM – Fire Modeling
RR – Radiation Release
PRA – Probabilistic Risk Assessment

November 20, 2014

Mr. K. Henderson
Site Vice President
Catawba Nuclear Station
Duke Energy Carolinas, LLC
4800 Concord Road
York, NC 29745

SUBJECT: CATAWBA NUCLEAR STATION, UNITS 1 AND 2: REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST TO IMPLEMENT A RISK-INFORMED, PERFORMANCE-BASED FIRE PROTECTION PROGRAM (TAC NOS. MF2936 AND MF2937)

Dear Mr. Henderson,

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 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, as incorporated into Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.48(c).

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's submittal and determined that additional information is needed in order to complete our review. Enclosure 1 describes this request for additional information (RAI). During the regulatory audit that began on October 27, 2014, response dates for the questions in Enclosure 1 were discussed with Duke staff. Enclosure 2 lists the agreed upon response dates for the various questions.

If you have any questions, please call me at 301-415-2481.

Sincerely,

/RA/

G. Edward Miller, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-413 and 50-414

Enclosures: As stated

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ADAMS Accession No. ML14308A037 *Via E-mail

OFFICE	NRR/LPL2-1/PM	NRR/LPL2-1/LA	NRR/DRA/APLA	NRR/DRA/AFPB	NRR/LPL2-1/BC
NAME	GEMiller	SFigueroa	HHamzehee*	AKlein*	RPascarelli
DATE	11/06/14	11/05/14	10/03/14	10/03/14	11/20/14

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