NRR-PMDAPEm Resource

From: Barillas, Martha
Sent: Friday, September 05, 2014 3:42 PM
To: Richard.Hightower@duke-energy.com
Cc: Regner, Lisa; Miller, Barry; Robinson, Jay; Fields, Leslie; Barillas, Martha
Subject: Draft RAI NFPA-805 (TAC No. MF2746)
Attachments: Draft Robinson NFPA 805 RAIs (MF2746).docx

Richard,

By letter dated September 16, 2013, Duke Energy Progress Inc., the licensee of H. B. Robinson Steam Electric Plant, Unit 2 (HBRSEP), 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) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13267A211).

To complete its review, the NRC staff has the following draft request for additional information (RAI) attached. Please see the attached RAI in DRAFT form.

A Sensitive Unclassified Non-Safeguards Information (SUNSI) review was completed by the staff on the draft RAI and the staff concluded the RAI do not contain SUNSI.
If you find any information needs to be withheld from the public, please notify me within 5 days of receipt of this email.

If you need an RAI clarification call, please contact me at 301-415-2760 to schedule the call. The staff is available to support the call the week of September 15, 2014.

We request that you provide a response timeline for each RAI by September 26, 2014.

An audit plan was issued (ADAMS Accession No. ML14246A509) and the audit is scheduled for the week of September 22, 2014.

Please note that review efforts on this task are being continued and additional RAI may be forthcoming.

Thank You,

Martha Barillas
Project Manager
Shearon Harris & H. B. Robinson
NRR/DORL/Licensing Branch II-2
US Nuclear Regulatory Commission
301-415-2760

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DRAFT 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 PROGRESS, INC.

H.B. ROBINSON STEAM ELECTRIC PLANT, UNIT 2

DOCKET NO. 50-261

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

License Amendment Request (LAR) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13267A211), Attachment A, Table B-1, Section 3.3.5.3 identified "complies with clarification" for the use of Frequently Asked Question (FAQ) 06-0022, "Electrical Cable Flame Propagation Tests" (ADAMS Accession No. ML091240278), i.e., flame propagation tests acceptable by the NRC. However, there is no description of how FAQ 06-0022 is being applied. Describe the specific application of this FAQ. Describe which aspects of the FAQ are being credited in lieu of meeting the National Fire Protection Association (NFPA) Standard 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants" (NFPA 805), 2001 Edition, Section 3.3.5.3 requirement.

FPE RAI 02

NFPA 805, Section 3.4.3(b) requires that plant personnel who respond with the industrial fire brigade be trained for their responsibilities, potential hazards to be encountered, and interfacing with the industrial fire brigade. LAR Attachment A, Table B-1, Section 3.4.3(b) indicates that guidance for non-industrial fire brigade members is found in FP-001. The procedure defines the actions needed to be taken by personnel discovering a fire, security personnel actions, and duty health physics contact actions. Provide a more detailed description of the elements of this procedure and training that demonstrates compliance with the requirements for training on responsibilities, potential hazards to be encountered, and interfacing with the industrial fire brigade. Additionally, identify what element of compliance is being "clarified" in the LAR statement "complies with clarification."

FPE RAI 03

LAR Attachment A, Section 3.4.1(c) states that fire brigade members are plant operators and "qualifications of individuals in the fire protection organization are administratively controlled to ensure qualification of the individual commensurate with the position being held and activities being performed." NFPA 805 Section 3.4.1(c) 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. In NRC Regulatory Guide (RG) 1.189, "Fire Protection for Nuclear Power Plants", Revision 2, September 2009 (ADAMS Accession No. ML092580550), Section 1.6.4.1 "Qualifications," the NRC staff acknowledged the following example for the fire brigade leader as sufficient:

> The brigade leader should be competent to assess the potential safety consequences of a fire and advise control room personnel. Such competence by the brigade leader may be evidenced by possession of an operator's license or equivalent knowledge of plant systems.

Provide additional detail regarding the training provided to the fire brigade leader and brigade 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 04

LAR Section 4.8.1 states that, "a summary of the NFPA 805 compliance basis and the required fire protection systems and features is provided in Attachment C." However, LAR Attachment C only identifies the required suppression and detection systems for a fire area. There appears to be no discussion or description of other fire protection features (e.g., Electrical Raceway Fire Barrier Systems (ERFBS), radiant shields, instamatic coatings, enhanced combustible controls, and transient limitations) that may be credited or required relative to the fire area analyses. Provide the fire protection features, by fire area, that are required by the Fire Probabilistic Risk Assessment (PRA), and their respective compliance bases.

FPE RAI 05

NFPA 805, Section 3.9.2 requires that automatic and manual water-based fire suppression systems be equipped with a water flow alarm. LAR Attachment A, Section 3.9.2 indicates that some automatic water-based fire suppression systems do not have water flow alarms. The LAR also states that these systems are not required to have water flow alarms per NFPA 13, "Standard for the Installation of Sprinkler Systems," which only requires water flow alarms to be provided on sprinkler systems having more than 20 sprinklers. In addition, Nuclear Energy Institute (NEI) 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)", Revision 2, (ADAMS Accession No. ML081130188), 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 an editorial issue. Provide a compliance strategy commensurate with the guidance of NEI 04-02 and provide a compliance strategy with a detailed justification relative to NFPA 805 Section 3.9.2.

FPE RAI 06

NFPA 805, Section 3.9.4 requires that the diesel-driven fire pumps shall be protected by automatic sprinklers. LAR Attachment A, Table B-1 indicates that the diesel-driven fire pump is located outdoors and is separated from other important equipment, and therefore "complies with clarification." NEI 04-02 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 automatic sprinklers for the diesel fire pump an editorial issue. Provide a compliance strategy and detailed justification commensurate with the guidance in NEI 04-02 and relative to NFPA 805, Section 3.9.4.

FPE RAI 07

LAR Attachment S, Table S-1, Implementation Item 3 indicates that Hemyc fire barrier wrap was replaced with Interam E54A for protecting the Component Cooling Water pump power cables. However, Promatec "MT" wrap is also described in the LAR Attachment C, in an EEEE for fire areas A3, A6, and A11, addressing protection of the Steam Generator Blowdown System lines and penetrations.

a. Provide a description of any other credited Hemyc or Promatec "MT" fire barriers used for the Nuclear Safety Capability Assessment (NSCA).

b. Where Hemyc or Promatec "MT" is used, provide the basis for barriers' credited rating as an ERFBS or any other credited uses.

c. Describe any other ERFBS and passive fire protection features that are credited for the NSCA and explain how they were identified as being required for this purpose. Provide the technical justification, e.g., test certification, for their use or credit.

d. Identify and describe any proposed plant modifications to these barriers.

e. If performance-based methods are used, include a discussion of the safety margin and defense-in-depth (DID) considered in the evaluation.

FPE RAI 08

LAR Attachment K identifies an existing approved Appendix R exemption that is being transitioned for the installation of fixed fire suppression in the pump bays in lieu of a reactor coolant pump lube oil collection system. This exemption credits the installed fire detection system, dikes to contain oil spills, and the containment spray system as a backup fire suppression system.

However, the dikes and the containment spray system are not identified in the LAR Attachment C, Table B-3 as fire protection features or systems credited for this fire area. Provide justification for not including these fire protection features in LAR Attachment C, Table B-3.

FPE RAI 09

In LAR Attachment L, Request 1, the licensee states that FAQ 06-0022 concluded that the NFPA 262, "Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces," test is equivalent to the IEEE-383-1974 test and therefore, IEEE cable is inherently equivalent to plenum rated cable and acceptable to be routed above suspended ceilings.

While FAQ 06-0022 documented that the NFPA 262 is a more stringent fire test than the IEEE-383 test, the reverse is not true. A cable that passes the IEEE-383 flame test does not necessarily pass the NFPA 262 test. Describe whether the assumption of equivalence between the IEEE-383-1974 and NFPA 262 tests is relied upon and if so, revise the request as needed (i.e., clarify if this is no longer the case).

FPE RAI 10

LAR Attachment S, Table S-2 states the fire probabilistic risk assessment (FPRA) follows the methodology of FAQ 08-0046, "Incipient Fire Detection Systems," (ADAMS Accession No. ML093220426) for the Very Early Warning Fire Detection Systems (VEWFDS) in Fire Areas A16-18, which includes the main control room (MCR). LAR Section 4.8.3.2.5 also identifies the installation of a VEWFD system in the cable spreading room. In addition, LAR Section 4.8.3.2.6 indicates that the VEWFD system installation in the main control boards (MCB) is credited in the FPRA. Provide the following additional information for all VEWFD systems:

a. Because of the various vendor types VEWFD systems, provide a description of the VEWFD system being installed or considered. If the system has not yet been designed or installed, provide the design features for the proposed system along with a comparison of these specified design features to their role in satisfying or supporting the risk reduction features being credited in FAQ 08-0046. Include in this discussion the installation testing criteria to be met prior to operation.

b. Describe the physical separation of the cabinets in which in-cabinet VEWFD is being installed or credited.

c. Describe how each cabinet will be addressable by the detection system. Describe whether the sampling will be independent for each cabinet or will samples be taken by a common header, for instance.

d. Based on the operator recognizing the impacted cabinet(s) fire location sufficiently early, describe what operator actions are necessary to limit fire impact and allow safe shutdown of the plant from the control room. Describe how the operator will be made aware of what must be done to remain in the control room for plant shutdown.

e. Where area-wide VEWFD is being credited, provide a discussion of the system including the design criteria, operator response required, and the justification for the credit being taken in comparison to FAQ 08-0046.

f. Provide the codes of record for the design, installation, and testing of VEWFD systems.

g. Identify the implementation item in LAR Attachment S for VEWFD procedure development and training.

FPE RAI 11

LAR Attachment A, Element 3.3.5.3, describes the basis for acceptability of original plant cable but does not describe the current plant standard for cable installation or identify whether changes to the current specification are necessary for transition. Describe the current plant standard for cable installation relative to the requirements of NFPA 805 Section 3.3.5.3, and identify any changes necessary for implementation, and post-transition.

FPE RAI 12

The discussion in LAR Section 4.7.1 indicates that a design basis document (DBD) has been created, but also describes (in the last paragraph) what the document will contain. There is no specific mention of the DBD in LAR Attachment S, “Modifications and Implementation Items,” although it may be included in LAR Attachment S, Table S-3, Implementation Item 7. Clarify if the DBD will require an update, and if so, identify the implementation item associated with that update action.

FPE RAI 13

LAR Attachment S, Table S-2, Implementation Item 5 proposes that a modification to “ensure configuration meets crediting 10-minute delay on cables in the Cable Spread Room and the E1/E2 Switchgear Rooms.”
Provide the following:

a. Description of the type and extent of barriers being installed.

b. The rated configuration being met for the barriers.

c. Whether the requirements of NFPA 805 Section 3.11.5 for ERFBS will be met or some other standard including the technical justification for the standard used.

d. Describe the purpose of the “10-minute delay.”

FPE RAI 14

NFPA 805, Section 3.4.4, “Fire-Fighting Equipment,” requires that equipment shall conform with the applicable NFPA standards. LAR Attachment A, Section 3.4.4, "Fire Fighting Equipment" states that the licensee has not committed to following any NFPA standards pertaining to firefighting equipment.

Describe what types of requirements or standards will be established when purchasing replacement protective clothing, hoses, nozzles, fire extinguishers and other equipment for the fire brigade use in order to ensure suitable products are procured. Include a discussion of whether manufacturers’ guidelines will be followed, how the licensee intends to ensure the integrity of its equipment over time, and what type of replacement criteria are in place to ensure the equipment remains in good working order.

FPE RAI 15

LAR Attachment L, Approval Request #3 identifies other non-fire uses of the fire protection system and makes the statement that these have “no adverse impact on the ability of the fire protection system to provide required flow and pressure.” Provide more detail to justify that the listed non-fire uses of fire protection water will not impair the ability to deliver the required fire water demand as required by NFPA 805, Section 3.5.16. Include in the response:

a. Whether any uses are considered to be routine, “non-emergency,” or “non-abnormal” operations.

b. Describe any engineering controls, alarms and indications, and training that supports “no adverse impact” statement.

c. Describe any of these operations that may be simultaneously in conjunction with the largest fire demand performed or conducted at the expense of the availability of the fire protection water system during the duration of alternative use. Include the largest design demand conditions required for the fire protection water systems. For instance, state whether the fire protection system is relied upon for any of these conditions.

d. Describe the administrative controls, limitations, allowances, procedures, compensatory actions, dedicated communications, equipment, and work control practices that are in place to preclude interference with the ability of the fire protection systems to meet demand.

Safe Shutdown Analysis (SSA) RAI 01

LAR Section 4.2.1.2, under the heading “Results”, states that the NFPA 805 licensing basis for the plant is to achieve and maintain hot shutdown conditions following a fire. Later in the same section, the LAR describes stabilization in hot standby as the point for determining long term decay heat removal and inventory/pressure control strategies. Provide clarification regarding the safe and stable condition the licensee is assuming in its analyses (i.e., hot standby or hot shutdown).

SSA RAI 02

In LAR Attachment G, Table G-1, for Fire Areas A5 and C, the staff noted that a DID recovery action may be required to provide portable fans for cooling the Control Room (CR). LAR Attachment G, Table G-1 identifies procedures (DSP-001 and EPP-001) for setup of the portable 4 kW generator and blowers used for this recovery action.

The requirements of General Design Criterion 3 (GDC-3) state for fire protection that structures, systems, and components (SSCs) important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. Noncombustible and heat resistant materials shall be used wherever practical throughout the unit, particularly in locations such as the containment and CR. Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on SSCs important to safety. Firefighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these SSCs.

The use of fuel-fired generators near the CR does not align with GDC-3. The use and refueling of portable generators presents a hazard to equipment important to nuclear safety. Describe and justify how the use of portable fuel-fired equipment is consistent with the requirements of GDC-3 or provide an approach to resolving the subject variances from deterministic requirements (VFDRs) and providing CR ventilation that is consistent with the requirements of GDC-3.

SSA RAI 03

LAR Attachment G, Table G-1, appears to have inconsistencies with the VFDR dispositions provided in LAR Attachment C. For examples, in LAR Attachment C, Fire Area A15, components LI-474 and LI-476 are dispositioned with a recovery action (RA) to monitor S/G A level using local instruments, but neither of these RAs is identified in Table G-1. However, in LAR Attachment C, Fire Area A16, components LI-474, LI-476, and LT-477 are dispositioned with RA-DIDs and each of these are identified as recovery actions in LAR Attachment G, Table G-1. Provide a clarification for these inconsistencies.

SSA RAI 04

LAR Attachment G references both LAR Attachment S, Table S-2, Committed Modifications, and LAR Attachment S, Table S-3, Implementation Items, in the discussion for the same implementation items related to incorporating recovery actions in post-fire shutdown procedures, updating training processes, assessing the physical feasibility of new NSCA actions, and updating plant calculations. Based on the content of these items, confirm that both LAR Attachment S, Table S-2 and LAR Attachment S, Table S-3 are the appropriate references.

SSA RAI 05

LAR Attachment S, Table S-3, Implementation Item 8 involves the performance of a feasibility study specifically for new actions taken to reduce self-induced station blackout areas in the plant. Clarify if this implementation item is the same, or has the same scope, as the physical feasibility assessment of new NSCA recovery actions as described in LAR Attachment G. Provide additional information to clarify any remaining feasibility analysis described in LAR Attachment S, Table S-3 and the potential impact on the NSCA, if any.

SSA RAI 06

A few of the completed modifications identified in LAR Attachment S, Table S-1 (i.e., items 8, 14, and 15) are described merely as "Protect the……" with no description of how the components/cables were protected. Provide additional information regarding the means of protection performed for those completed modifications.

SSA RAI 07

LAR Attachment B, Element 3.5.2.1, states that CT circuits of concern have been identified and the final disposition of the potential fire scenarios will be assessed as part of the SSA/Fire PRA transition to NFPA 805, and then refers to an implementation item in LAR Attachment S, Table S-3. However, no implementation item related to CT circuits was identified in LAR Attachment S, Table S-3. Additionally, LAR Section 4.2.1.1 states that "the evaluation concludes that this failure mode is unlikely for CTs that could pose a threat to safe shutdown equipment." From the above statement, it would appear that the evaluation has been completed. Provide clarification as to whether the CTs analysis has been completed, if not, provide the appropriate implementation item in LAR Attachment S, Table S-3.

SSA RAI 08

LAR Section 4.2.3, "Licensing Action Transition," states that "since the exemptions are either compliant with 10 CFR 50.48(c) or no longer necessary, in accordance with the requirements of 10 CFR 50.48(c)(3)(i), CP&L requests that the exemptions listed in Attachment K be rescinded as part of the LAR process." However, LAR Attachment K, "Exemption from the Requirements of Section III.O of Appendix R to 10 CFR Part 50" is identified as being necessary for transition. Address whether the subject exemption should be carried forward with the transition.

SSA RAI 09

There are inconsistencies between LAR Attachment S, Table S-2, and the VFDR dispositions and Fire Area Overview provided in LAR Attachment C.

Examples:

1) In LAR Attachment C, Fire Areas A3, A15, A16, A18 and C have many VFDRs that are dispositioned using the Reactor Coolant Pump (RCP) Shutdown Seal modification. However, this modification is not referenced in the overview of the subject fire areas.

2) LAR Attachment S, Table S-2, Modification Item 5 ensures the intumastic meets the minimum 10-minute fire delay time in the Cable Spreading Room and the E1/E2 Switchgear Room (as identified in response to Section V, F&O FSS-H2-01). However, this modification is not discussed in LAR Attachment C, Fire Area A15 and A16, either as a required modification or as a credited fire protection feature [also see FPE RAI 7].

Reconcile the inconsistencies between LAR Attachment C and LAR Attachment S, Table S-2, as appropriate.

SSA RAI 10

LAR Attachment D, Implementation Guidance F.3 states that "recovery actions were not used in any fire area to restore a KSF path in order to eliminate a pinch point." However, later in the same section, the review proposed several recovery actions or other actions to (1) ventilate the emergency diesel generator (EDG) room, (2) energize supplement plant equipment, and (3) remove power from certain motor operated valves (MOVs). If the proposed recover actions are finalized, describe how the feasibility evaluation will be performed for such actions.

SSA RAI 11

LAR Attachment S, Table S-2, Modification Items 10, 11, 12, 13, and 14 identified additional indication and cut-out switches necessary to eliminate self-induced station blackout (SISBO) strategy to allow for necessary operator actions.

a. Provide a more detailed description of these modifications.

b. As stated in the risk-informed characterization for each modification, no PRA or recovery credit is given and the modification is to ensure the procedure revisions for SISBO elimination are feasible. Clarify if these modifications are necessary for the NSCA.

c. Clarify whether the new switching and monitoring actions are included in the LAR Attachment G, and are considered recovery actions, actions in the Control Room, or actions at a primary control station(s).

d. In LAR Attachment C, the overview for Fire Area B indicates no modification is credited for the area. Provide a clarification for the contradiction with LAR Attachment S, Table S-2, for the above modification items.

SSA RAI 12

In LAR Attachment C, the VFDR list for Fire Area A18 is missing the "Failure Impact" discussion. Provide an updated VFDR list for Fire Area A18.

Fire Modeling (FM) RAI 01

NFPA 805, Section 2.4.3.3, states that "the PSA [probabilistic safety assessment] approach, methods, and data shall be acceptable to the AHJ [authority having jurisdiction]... "

The NRC staff noted that fire modeling comprised the following:

- Fire Dynamics Tools (FDTs) were used for zone of influence (ZOI) calculations of cabinets, pumps, motors, oil fires and transient fire sources, and to evaluate the development and timing of Hot Gas Layer (HGL) conditions in selected compartments.

- The Consolidated Fire Growth and Smoke Transport (CFAST) model was used to calculate MCR abandonment times and to determine HGL temperature, optical density and Halon system activation time for a specific analysis in Fire Zone 20.

- The FLASH-CAT model was used to calculate the fire propagation in a vertical stack of horizontal cable trays in Fire Zone 20.

- The Generic Fire Modeling Treatments (GFMTs) were used to determine 'initial' severity factors.

LAR Section 4.5.1.2, "Fire PRA," 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, "Fire Modeling V&V [verification and validation]," for a discussion of the acceptability of the fire models that were used.

Regarding the acceptability of the PRA approach, methods, and data:

a. Identify any fire modeling tools and methods that have been used in the development of the LAR and that are not discussed in LAR Attachment J.

b. Explain how the effect of the increased heat release rate (HRR) due to fire propagation in cable trays was accounted for in the ZOI, HGL, and multi compartment analysis (MCA) calculations; or provide technical justification for ignoring this effect.

c. Explain how non-cable intervening combustibles were identified and accounted for in the fire modeling analyses.

d. Explain how wall and corner effects in the HGL and MCA calculations were accounted for, or provide a technical justification for why these effects were not considered.

e. Provide technical justification for the assumed fire areas and elevations that were used in the ZOI calculations. Explain how deviations from these assumptions, i.e., different fire area and/or higher fire base elevation, affect the risk (core damage frequency (CDF), ΔCDF, large early release frequency (LERF) and ΔLERF).

f. In the structural steel analysis, a fire scenario is considered that includes a tank with 10,000 gallons of lube oil in an area of the Turbine Building. Provide technical justification for the assumption that, due to the excess design strength of the structural members, the damage as a result of this lube oil fire scenario will be contained and that no building collapse is expected.

Specifically, regarding the acceptability of CFAST for the MCR abandonment times study:

g. Provide the basis for the assumption in the MCR abandonment time calculations that the fire brigade is expected to arrive within 15 minutes. Describe the uncertainty associated with this assumption; discuss possible adverse effects of not meeting this assumption on the results of the fire PRA and explain how possible adverse effects will be mitigated.

h. The kitchen adjacent to the MCR has been excluded from the computational domain as the door between the kitchen and the MCR is fire rated. Provide technical justification for not considering scenarios, where the kitchen door is blocked open and the fire originates in the kitchen.

i. The HRR profile of IEEE-383 unqualified thermoplastic cables was used for electrical cabinet fires in the MCR as the small quantities of IEEE-383 qualified thermoset cable do not affect the overall HRR. Show that the assumption of using thermoplastic cable HRR is consistent with the actual cable types used in the MCR electrical cabinets or provide a technical justification for this assumption in the context of the fire modeling analysis.

j. Provide details about the flow opening used between the MCR volume and the interstitial space above the MCR acoustic ceiling. Demonstrate that this opening is consistent with the actual plant configuration, and if not, provide technical justification for this opening size.

k. A uniform leakage fraction of 5 × 10-5 m^2/m^2 for the walls, floors and ceiling boundaries and 1.7 × 10-4 m^2/m^2 for the acoustic ceiling has been used in the MCR abandonment analysis. The values were adopted from the data provided in Table 4-14.1 of the Society of Fire Protection Engineers (SFPE) Handbook of Fire Protection Engineering, 4th Edition (SFPE Handbook). However, the table lists different leakage factors for the wall and floor. Justify using a uniform leakage factor for the bounding walls, floor, and ceiling of the MCR.

l. A sensitivity study conducted to demonstrate the effect of leakage fraction was done by varying the parameter by 50%. However, Table 4-14.1 of the SFPE Handbook shows that the leakage fraction varies by orders of magnitude between different levels of wall tightness. Justify why the sensitivity study did not evaluate the effect of more realistic variations of wall tightness.

m. Clarify whether 10 or 15 minutes was assumed for fire propagation between adjacent electrical cabinets and provide the technical justification on why the guidance in Appendix S of NUREG/CR-6850, ""EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, Volume 2: Detailed Methodology," September 2005 (ADAMS Accession No. ML052580118), i.e., 10 minutes, was not used.

n. The heat of combustion and soot yield of cables specified in the CFAST calculations for electrical panel fire scenarios are reported to be based on the data for neoprene or ethylene propylene rubber (EPR) cables in Tewarson's Chapter of the SFPE Handbook, (Section 3, 4th Edition.) However, there was no data for cables with this combination of insulation and jacket material in this referenced chapter. Also, the carbon monoxide (CO) and soot yield for wood was used in the CFAST calculations in the transient fire scenarios that were those reported for polyethylene in the SFPE Handbook. Explain in detail how the fuel properties used in the CFAST calculations were derived. Confirm that these values are representative of the cable materials and Class A materials in the MCR, or that they are otherwise bounding.

o. The self-contained breathing apparatus stored at the corner of the MCR in polyethylene containers were modeled as a transient fire and the HRR specified in Table E-7 of NUREG/CR-6850 was used. Provide technical justification to demonstrate that the HRR values specified in this table bound the HRR expected from these containers.

p. Section 5.1.3.1 of the MCR abandonment analysis report indicates that some electronic equipment is not separated per the guidelines in NUREG/CR-6850 Appendix S and that fire may propagate from the initial electrical panel to one or more adjacent electrical panels. However, Section 5.3.1 lists the fire types simulated in the MCR abandonment analysis and it does not include scenarios where fire propagates between back panel electrical cabinets. Provide the technical justification for not considering fire spread between back panel electrical cabinets in the MCR abandonment analysis.

q. Explain exactly how the GFMTs approach was used in the fire modeling analysis.

r. The objective of this detailed fire modeling is to compare the calculated HGL temperature with the smoke detector activation time, which will activate a Halon suppression system after a 30-second delay. Regarding the acceptability of the detailed fire modeling analysis performed for Fire Zone 20, provide the technical justification for using the zone fire model CFAST for this purpose.

s. It is stated in the analysis that the assumed ambient temperature of 32ºC is not bounding, but is consistent with the ambient temperatures present during testing to determine damage threshold times. Provide the technical justification for not using a bounding ambient temperature in the fire modeling analysis, or show that the value used is consistent with actual plant conditions.

t. Given that CFAST often significantly overestimates the soot concentration in the HGL, provide the technical justification for assuming that the use of the HGL optical density, as calculated by CFAST, is representative or otherwise bounding.

u. The heat of combustion and soot yield of cables specified in the CFAST calculations for this analysis are reported to be based on the data for PE/PVC cables in Tewarson's Chapter of the SFPE Handbook. It is stated that the heat of combustion is the lower bound value for PE/PVC cables and that the yield of other products is the upper bound for PE/PVC cables. Provide the technical justification for these bounding assumptions, in the context of calculating a conservative (longest) smoke detector activation time.

v. In the discussion of the uncertainty of this specific calculation, it is stated that the two key parameters, with respect to uncertainty are the HRR and the ventilation. It is understood that that these two parameters are important and that the analysis has considered bounding ventilation configurations and HRRs, which are prescribed in NUREG/CR-6850. However, the analysis does not describe the uncertainty of the key parameter that drives the calculation of smoke detector activation, i.e., soot yield. Explain how the uncertainty of this calculation is affected by not assuming the most conservative fuel properties or provide the technical justification for the properties used.

w. One of the stated limitations of the analysis is that no high energy arcing fault (HEAF) is postulated. However, in the walkdown sheets that were used to build the fire scenarios, multiple scenarios were annotated with the comment that a HEAF should be postulated. Clarify if any alternative analysis (e.g. ZOI, PRA, etc.) considered HEAF events in this Fire Zone and justify not postulating a HEAF as part of this specific analysis in Fire Zone 20.

FM RAI 02

NFPA 805, Section 2.5, requires damage thresholds be established to support the performance-based approach. Thermal impact(s) must be considered in determining the potential for thermal damage of structures, systems, or components. 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 was characterized, specifically with regard to the critical damage threshold temperatures and critical heat flux 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.

b. 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 the technical justification for the damage thresholds used in the analysis.

c. Describe the damage criteria that were used for exposed temperature-sensitive equipment. Explain how temperature-sensitive equipment inside an enclosure was treated, and provide the technical justification for these damage criteria.

FM RAI 03

NFPA 805, Section 2.7.3.2, "Verification and Validation," states that "each calculational model or numerical method used shall be verified and validated (V&Ved) through comparison to test results or comparison to other acceptable models."

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). Reference is made to LAR Attachment J, "Fire Modeling V&V," for a discussion of the V&V of the fire models that were used.

Furthermore, LAR Section 4.7.3 "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805" 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."

Regarding the V&V of fire models:

a. The point source model is used in the structural steel analysis report, to determine the minimum separation distance between electrical cabinet or transient fires and structural members required to avoid damage. The point source model is not included in LAR Attachment J, Table J-1, although it is included in LAR Attachment J, Table J-2, which deals with the GFMTs. However, the licensee doesn't seem to use the GFMTs for the purpose of calculating ZOI. Provide technical details to demonstrate that the point source model as used in the structural steel analysis has been applied within the validated range of input parameters, or to justify the application of the model outside the validated range reported in NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications" (ADAMS Accession No. ML071650546) or other V&V basis documents.

b. In LAR Attachment J, there is a discussion about the HGL analysis, which states that the same FDTs equations are used in a custom built workbook. However, no details are provided about the verification of this custom workbook. Provide the verification basis for this custom workbook used in the HGL analysis.

c. Provide the V&V basis for the fire models identified in the response to FM RAI 01(a). Provide technical details to demonstrate that these models were applied within the

validated range of input parameters, or to justify the application of the model outside the validated range in the V&V basis documents.

FM RAI 04

NFPA 805, Section 2.7.3.3, "Limitations of Use," states that "acceptable engineering methods and numerical models shall only be used for applications to the extent these methods have been subject to verification and validation. These engineering methods shall only be applied within the scope, limitations, and assumptions prescribed for that method."

LAR Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," states that "engineering methods and numerical models used in support of compliance with 10 CFR 50.48(c) were applied appropriately as required by Section 2.7.3.3 of NFPA 805."

Regarding the limitations of use:

a. The NRC staff notes that algebraic models cannot be used outside the range of conditions covered by the experiments on which the model is based. NUREG-1805, "Fire Dynamics Tools (FDTs): Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program," December 2004 (ADAMS Accession No. ML043290075) includes a section on assumptions and limitations that provides guidance to the user in terms of proper and improper use for each FDT.

   Identify uses, if any, of the FDTs outside the limits of applicability of the model and explain how the use of the FDT was justified.

b. Identify uses, if any, of CFAST outside the limits of applicability of the model and explain how the use of CFAST was justified.

c. Identify uses, if any, of GFMTs outside their limits of applicability and explain how the use of GFMTs in those cases was justified.

FM RAI 05

NFPA 805, Section 2.7.3.4, "Qualification of Users," states that "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, for personnel performing fire modeling or Fire PRA development and evaluation, Duke Energy will develop and maintain qualification requirements for individuals assigned various tasks. Position Specific Guides 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. The following Training Guides have been developed and implemented.

ESGO089N - Fire Probabilistic Safety Assessment Engineer (Quantification),
ESGO093N - Fire Probabilistic Safety Assessment Engineer (Initial Development),
ESGO094N - Fire Probabilistic Safety Assessment Engineer (Data Development), and
ESGO105N - Basic Fire Modeling

HBRSEP and Nuclear Generation Group (NGG) Fleet engineering personnel (design, programs and systems engineering) are provided training commensurate with the job responsibility through the Institute of Nuclear Power Operations (INPO) accredited Engineering Support Personnel (ESP) training program. This is provided in either ESP Continuing Training or Work Group Specific Continuing Training. Specific, qualification for performance of the FIR-NGGC-0010, “Fire Protection Program Change Process,” is documented using Training Guide (Qualification Card) ESGO102N, “Fire Protection Plant Change Impact Review.”

Regarding qualifications of users of engineering analyses and numerical models:

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

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

c. Explain the communication process between the fire modeling analysts and PRA personnel to exchange the necessary information and any measures taken to assure

that 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 that "an uncertainty analysis shall be performed to provide reasonable assurance that the performance criteria have been met."

LAR Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," states that "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 fire model input parameters was 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 RAI 01

LAR Section 4.4.2, “Results of the Evaluation Process,” states that certain plant features (i.e., engineering controls), such as curbs and ventilation systems or actions, control smoke management or fire suppression water run-off to ensure fire suppression activities are contained and monitored prior to release to unrestricted areas. LAR Attachment E, “Radioactive Release Transition,” states that forced air ventilation and damming were considered in “Generic Assumptions/Discussions” for each fire pre-plan.

a. Given that ventilation may be secured during a fire event (e.g., Radwaste Facility), explain how forced air ventilation is used and the release pathway for radioactive gaseous effluent from fire suppression activities such that a release would meet the radiological performance criteria.

b. In LAR Attachment E, “Training Review,” identify where forced air ventilation and damming are addressed in fire brigade lesson plans which provide training guidance and information relative to radioactive releases.

Radiation Release RAI 02

For the following compartments (miscellaneous areas) or other potential radiological release areas listed in LAR Attachment E, “Radioactive Release Transition,” please provide: 1) examples of engineering controls or actions considered in fire pre-plans as standard statements concerning airborne contamination and water run-off such that a release would meet the radiological performance criteria; and 2) the bounding analysis, quantitative analysis, or other analysis performed and the administrative controls ensured to demonstrate that the instantaneous release limits specified in the unit’s Technical Specifications (or 10 CFR Part 20 public dose limits) will not be exceeded as a result of fire suppression activities.

a. Outside Yard areas where Radioactive Materials Areas (RMAs) and Sea-Land type containers may be present;

b. Purge Inlet Room (G4/FZ-39);

c. Oil Dispensing Building (YARD/FZ-43);

d. Northern Street Metal Building Adjacent to the Reactor Auxiliary Building (RAB) and Protected Water Storage Tank (PWST) (YARD/FZ-45);

e. Building 230 Contaminated Storage Building; and

f. Building 250 Outage Contaminated Storage Building

Probabilistic Risk Assessment (PRA) RAI 01

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

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

a) CF-A2-01 and FSS-E1-01 (State of knowledge correlation (SOKC))
The dispositions to F&O CF-A2-01 and F&O FSS-E1-01 state that uncertainty analysis does not impact mean risk results. Mean CDF and LERF values can be affected by SOKC and should be accounted for as part of statistical uncertainty analysis. It is not clear to what extent statistical analysis of uncertainty required by SR FSS-E1 was performed or whether SOKC was taken into account. SR QU-A3 (referenced by FQ-A4) requires that CDF be estimated accounting for the SOKC between event probabilities. Clarify whether SOKC was taken into account for hot short probabilities and other Fire PRA parameters (i.e., fire ignition frequency, non-suppression probabilities, and component type failure mode probabilities). If CDF was estimated without accounting for the SOKC for these parameters, then account for SOKC for these parameters in the integrated analysis performed in response to PRA RAI 3.

b) CS-A1-01 (Cables routed and added to database)
The disposition to this F&O states that cables have been routed and added to the FSSPMD database, but it is not clear whether the updated database was used to update the Fire PRA. In addition, the disposition suggests that some components may not have been included in the database after a certain freeze-time related to completion of report RNP/F-PSA-0066. If the PRA has not been updated, justify this exclusion.

c) CS-A11-01 and FSS-E4-01 (Undetermined cable routing)

The responses to F&O CS-A11-01 and FSS-E4-01 state that, where specific cable routing could not be determined, "the cable was assumed failed throughout the entire compartment that it was known to traverse through", and that any ignition source within a given fire zone was assumed to "impact all cables." These statements indicate assumed cable routes were modeled conservatively. Conservative modeling can lead to calculation of non-conservative Δ CDF and Δ LERF if risk-reduction modifications are made in the post-transition model that affect conservative compliant plant scenarios. Explain whether conservative modeling of the compliant plant case contributes to underestimating Δ CDF and Δ LERF. If so, evaluate or remove this conservatism as part of the integrated analysis performed in response to PRA RAI 3.

d) CS-A11-01 (Undetermined cable routing impact on MCA)
The disposition does not address how cable routing was considered for MCA. Describe how cables with unknown routing were modeled in the MCA.

e) FQ-F1-01 (LERF modeling)
The disposition to this F&O explains that since Supporting Requirements (SRs) LE-G2, LE-G4, and LE-G5 were met for the Internal Events PRA they are assumed to be met for the Fire PRA. Confirm that fire-induced failures, such as spurious actuations, cannot result in the need to model the following LERF elements differently for the Fire PRA than for the Internal Events PRA.

- Plant damage states and accident progression factors (SR LE-G2)
- LERF model uncertainty and related assumptions (SR LE-G4)
- LERF modeling limitations (SR LE-G5)

f) FSS-B1-01 (MCR abandonment on loss of control)
The disposition to this F&O appears to indicate that MCR abandonment is credited in the Fire PRA only for loss of habitability in the MCR. Confirm that MCR abandonment is not also credited in the Fire PRA for loss of MCR functionality (i.e. loss of control). If abandonment due to loss of control is being credited in the post transition plant case, then describe the scenarios to which this applies. Also describe the timing of the fire scenarios that are supported by thermal-hydraulic analysis and the resulting cues for operator actions.

g) FSS-C7-01 (Sprinkler suppression and firefighting mutual dependency)
This F&O states that automatic suppression was credited with manual firefighting, and notes that the mutual dependence on the common water supply has not been evaluated. The disposition to this F&O asserts that the unavailability of the water supply has already been accounted for in the non-suppression probability. Though the disposition states that "manual actuation" is not credited, this does not appear to mean that manual firefighting is not credited. If both automatic sprinkler suppression and manual firefighting are credited in the Fire PRA explain how the failures that would impact both suppression features are addressed. If failures that would impact both automatic

sprinkler suppression and manual firefighting fire, such as loss of water supply, are not specifically addressed, then address this mutual dependency in the integrated analysis provided in response to PRA RAI 3.

h) FSS-D7-01 and FSS-F3-02 (Detection and suppression system outlier behavior)
The disposition to this F&O states there is no evidence of outlier behavior for fire suppression and detection systems, explaining that the System Health Reports, covering the last 12 months of operation, indicate these systems performed well. The disposition does not address specific concerns cited in the F&O, namely whether: 1) suppression and detection systems credited in the Fire PRA are maintained and installed in accordance with codes and standards, and 2) statements in the System Health Report imply declining system performance for the detection, CO2 and Halon systems. Given that these concerns suggest evidence of outlier behavior in fire suppression and detection systems, provide:

i. Explanation of whether credited suppression and detection systems are maintained and installed in accordance with codes and standards. Include discussion of the deficiency noted in the F&O concerning the Turbine Lube Oil Deluge system. Note that per the disposition to F&O FSS-F3-02 that the unavailability for the Turbine Lube Oil Deluge system was increased to 0.05 based on “engineering judgment” (the suggested NUREG/CR-6850, Appendix P value).

ii. Explanation of statements in the System Health Report about the need to replace detection, CO2 and Halon systems in the near future.

iii. Explanation of whether System Health Reporting data or other data indicate outlier behavior for the credited suppression and detection systems in periods prior to the 12 month window considered in the System Health report.

iv. An update of the detection and suppression system unavailabilities with plant specific information, if there is evidence of outlier behavior. If detection and suppression system unavailabilities need to be updated, then address these updated values into the integrated analysis provided in response to PRA RAI 3.

i) FSS-G1-01 (MCA treatment of openings and vents)
The disposition to this F&O states that review of the potential for hot gas flow through openings and vents was not performed, but that the impact of such flow on additional targets is expected to be minimal. Openings between fire compartments in which a hot gas layer can form can lead to multiple compartment impact. Justify that no additional targets can be impacted by hot gas flow through openings and vents between fire compartments. Include explanation of whether walkdowns were performed to identify openings and vents. If additional targets can be impacted by hot gas flow through

openings and vents between fire compartments, then address these impacts in the integrated analysis performed in response to PRA RAI 3.

j) FSS-G6-02 (MCA scenario screening)
The F&O disposition states that there were five unscreened MCA scenarios included in the Fire PRA quantification. Yet, the MCA analysis report presents fourteen final MCA scenarios not screened out, twelve of which exceed 1E-07/year. Explain this seeming inconsistency, and describe which MCA scenarios are reflected in the fire CDF, LERF, Δ CDF, and Δ LERF values reported in Attachment W of the LAR. If MCA scenarios are missing from the risk values reported in Attachment W of the LAR, address these scenarios in the integrated analysis performed in response to PRA RAI 3.

k) PRM-B11-01 (Credit for MCR abandonment actions)
The disposition to this F&O explains that human failure events (HFEs) associated with Main Control Room (MCR) abandonment are not modeled directly in the Fire PRA. Table W-3 of the LAR presents MCR abandonment failure as a single scenario, and it appears that a single CCDP/CLERP value was used in a single scenario to represent a range of possible MCR abandonment scenarios. The analysis provides discussion of MCR abandonment, but from this discussion it is not completely clear how MCR abandonment was treated in the Fire PRA. In particular, it is not clear how potential fire-induced failures resulting from fires leading to MCR abandonment were addressed, or how the scenario frequency for MCR abandonment was determined. Therefore, provide the following:

i. Describe how MCR abandonment was modeled for loss of habitability in both the post-transition and the compliant plant. Include identification of the actions required to execute safe alternate shutdown and how they are modeled in the Fire PRA, including actions that must be performed before leaving the MCR. Also, include an explanation of how the CCDPs and CLERPs are estimated for fires that lead to MCR abandonment.

ii. Explain how the CCDPs and CLERPs estimated for fires that lead to abandonment due to loss of habitability address various possible fire-induced failures. Specifically include in this explanation, discussion of how the following scenarios are addressed:

a. Scenarios where fire fails only a few functions aside from forcing MCR abandonment and successful alternate shutdown is straightforward;

b. Scenarios where fire could cause some recoverable functional failures or spurious operations that complicate the shutdown, but successful alternate shutdown is likely; and,

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

iii. Explain how the abandonment scenario frequency due to loss of habitability was determined. Include explanation of how the fire ignition frequencies and non-suppression probabilities contributing to this scenario were addressed.

iv. It appears that 0.1 was used to estimate CLERP since the MCR abandonment scenario from Tables W-3 and W-4 presents a CDF of 4E-6/year and a CLERP of 4E-7/year, respectively. Explain and justify how the apparent CLERP of 0.1 was derived.

l) PRM-B15-01 (LERF to CDF ratio)
This F&O points out that the fire LERF is about 90% of the fire CDF, an unusually high ratio. The disposition to this F&O explains that, following the peer review, "refinements" to the Fire PRA were made that resulted in a more typical LERF-to-CDF ratio. Based on the CDF and LERF results presented in Table W-5 of the LAR the new LERF-to-CDF ration is about 10%, a more typical ratio. However, the degree of change in the LERF-to-CDF ratio implies there may have substantial changes to the LERF modeling, since the peer review. In light of these observations, describe the changes made to the Fire PRA to produce the cited impact to the LERF-to-CDF ratio. Also, include a discussion of the risk associated with different LERF failure modes and the criteria for those modes (e.g., bypass size).

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 fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. RG 1.200 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 event F&Os and SR assessments identified in LAR Attachment U that have the potential to impact the fire PRA results and do not appear to be fully resolved:

a) IE-C3-01: (PORV opening due to pressure transducer failure)
The disposition to this F&O seems to explain that the risk contribution of a power operated relief valve (PORV) opening due to failure of pressure transmitter PT-445 is

dominated by other small LOCAs, so was excluded from the Internal Events PRA model. Explain whether a fire could induce this scenario. If a fire could induce this failure and it was not modeled in the Fire PRA, then justify excluding this scenario from the Fire PRA, or include this scenario in the integrated analysis provided in response to PRA RAI 3.

b) LE-C11: (Containment Spray system credit)
The disposition to this F&O states that "no environmental conditions were identified which required the Containment Spray (CS) system to operate beyond its design basis". However, the disposition also appears to credit CS during a post-accident containment failure whereas, according to the F&O, CS was not previously credited following containment failure. Clarify how the CS system is credited for the LERF analysis given these apparently conflicting observations. If credited for LERF analysis where previously it was not, provide a discussion on the technical justification for the CS use.

c) LE-E1-01: (LERF parameter uncertainty)
The disposition of this F&O acknowledges that many of the Level 2 parameter values are based on expert judgment. Explain whether these were identified as a source of uncertainty in the Fire PRA, and how that uncertainty was addressed.

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, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2, May 2011 (ADAMS Accession No. ML100910006), provides quantitative guidelines on core damage frequency, large early release frequency, 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.

The PRA methods listed below have not been previously accepted by the NRC staff. Unless a method is eventually found to be acceptable by the NRC, that method needs to be replaced by an acceptable method or independently justified. Alternatively it may be demonstrated that the Fire PRA results used to support transition do not exceed the change in risk acceptance guidelines if an acceptable method were used. The PRA methods currently under review in the LAR include:

- PRA RAI 01.a regarding the inclusion of SOKC for internal and fire event related factors
- PRA RAI 01.b regarding assumed cable routing
- PRA RAI 01.c regarding fire-induced instrument cabling

- PRA RAI 01.g regarding sprinkler suppression and firefighting mutual dependence
- PRA RAI 01.h regarding detection and suppression system outlier behavior
- PRA RAI 01.i regarding MCA treatment of opening and vents
- PRA RAI 01.j regarding MCA scenario screening
- PRA RAI 02.a regarding fire-induced PORV opening
- PRA RAI 04 regarding use of unacceptable methods
- PRA RAI 05 regarding fire propagation from electrical cabinets
- PRA RAI 06 regarding treatment of sensitive electronics
- PRA RAI 07 regarding reduced HRRs for transient fires
- PRA RAI 9.a regarding rear side of MCBs
- PRA RAI 11 regarding exclusion of junction boxes as non-damaging ignition sources
- PRA RAI 12 regarding external fire damage due to HEAFs
- PRA RAI 13 regarding external fire damage due to bus duct fires
- PRA RAI 16 regarding breaker fuse coordination
- PRA RAI 20 regarding self-ignited and welding and cutting fires
- PRA RAI 26 regarding conditional probabilities of spurious operations
- PRA RAI 30 regarding credit for modifications
- PRA RAI 33 regarding installation of RCP seals

a) Provide the 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 which are acceptable to the NRC or provide further justification for your proposed method. 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. Based on NRC's review of responses to other RAIs in this letter, the list shown above may have additional RAIs added to it.

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 confidence (e.g., with a proposed implementation item) 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 of the methods not accepted by the NRC staff will be retained in the PRA that 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. 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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105, the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff require additional justification to allow the NRC staff to complete its review of the proposed method.

Though Section 4.8.3 of the LAR discusses method issues and presents a series of sensitivity studies in which certain methods are removed, the LAR does not explicitly state whether the Fire PRA model includes deviations from NRC accepted methods, or contains unreviewed analysis methods (UAMs). Identify any methods employed in the Fire PRA that deviate from guidance in NUREG/CR-6850 or other acceptable guidance (e.g., FAQs or interim guidance documents such as the June 21, 2012, memo from Joseph Giitter “Recent Fire PRA Methods review Panel Decisions and EPRI 1022993, ‘Evaluation of Peak Heat Release Rates in Electrical Cabinets Fires’” - see ADAMS Accession No. ML12171A583). If so, replace those methods with acceptable methods and provide a summary of the changes, or address the impact on Fire CDF, LERF, Δ CDF, and Δ LERF as part of the integrated analysis performed in response to PRA RAI 3.

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. 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 staff for adopting a fire protection program consistent with NFPA-805. In a letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff require additional justification to allow the NRC staff to complete its review of the proposed method.

Based on the following observations, three separate modeling issues on how fire propagation from electrical cabinets is treated need clarification. The first observation is that Section

4.8.3.2.1 of the LAR appears to indicate that a “panel factors” approach was used to treat “open” versus “closed” electrical cabinets in the baseline PRA (i.e., assumption that 10% of the time fires in a motor control center (MCC) result in an open cabinet from which the fire may propagate). NRC interim guidance documents such as the June 21, 2012, memo from Joseph Giitter “Recent Fire PRA Methods review Panel Decisions” and EPRI 1022993 (see ADAMS Accession No. ML12171A583), does not endorse the “panel factors” method.

The second observation is that the licensee’s analysis identifies a number of cabinet configurations from which fires were assumed not to propagate (i.e., radiation monitors, small instrument and control cabinets, lighting panels, small dry transformers and MCCs). Justification for excluding fire propagation from these configurations include rationale such as: 1) the cabinets are “relatively well sealed,” 2) the cabinets are “generally non-vented,” 3) the cabinets contain “low combustible loading,” and 4) the “heat release through slotted vents is assumed to not be capable of damaging cables outside the MCC.” It is not clear whether these arguments are consistent with guidance in NUREG/CR-6850 for fire propagation from electrical cabinets below 440V. Section 6.5.6 of NUREG/CR-6850 and Frequently Asked Question (FAQ) 08-0042 from Supplement 1 of NUREG/CR-6850 clarifies the meaning of "robustly- or well-sealed" to use as a basis to exclude these cabinets from being counted and considered for fire propagation.

The third observation is that the licensee’s analysis indicates that in some cases (perhaps all) fires in electrical cabinets above 440V (i.e., MCCs), are not assumed to propagate outside of the cabinet. For cabinets with circuits that are 440 V and higher, Section 6.5.6 of NUREG/CR-6850 states: "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)." Accordingly, propagation of fire outside the ignition source panel must be evaluated for all Bin 15 electrical cabinets that contain circuits of 440 volts or greater.

In light of these observations:

a) Describe the method referred to in Section 4.8.3.2.1 of the LAR regarding modeling “open” versus “closed” electrical cabinets. If this method reflects the “panel factors” approach not accepted by NRC then remove this method from the integrated analysis provided in response to the RAI 3. For more details, review the history of the method which was submitted to the Electric Power Research Institute (EPRI) Fire PRA Methods Panel regarding the conditional probability of fire propagation from electrical cabinets that was rejected in a letter from NRC staff (letter from Joseph Gitter of NRC to Biff Bradley of NEI dated June 21, 2012, ADAMS Accession No. ML12171A583).

b) Describe the approach used to model fire propagation from electrical cabinets less than 440 V. Include discussion of the criteria used to treat cabinets as “well sealed” and whether the criteria used is consistent with guidance from FAQ 08-0042. Include explanation of whether determination of “well sealed” cabinets is established based on

walk-down or by some other means. If the approach to evaluating fire propagation is not consistent with NRC guidance, then provide an acceptable method or address the impact of your proposed method as part of the integrated analysis performed in response to PRA RAI 3.

c) Describe how fire propagation from well-sealed electrical cabinets greater than 440 V is evaluated. For MCCs include description of which cubicles are assumed to fail in a given fire. If your approach to evaluating fire propagation is not consistent with NUREG/CR-6850 guidance, then replace the current method with an acceptable method or address the impact of your proposed method as part of 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. 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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. 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.

NRC staff could not identify in the LAR or licensee's analysis a description of how potential fire damage to sensitive electronics was modeled or how the licensee's approach of using Generic Modeling Treatment addressed damage to sensitive electronics. Though the treatment of sensitive electronics may be consistent with recent guidance on modeling sensitive electronics, Appendix H of the LAR does not cite FAQ 13-0004 (Clarifications on Treatment of Sensitive Electronics, issued December 3, 2013, ADAMS Accession No. ML13322A085), as one of the FAQ guidance documents used to support the Fire PRA. Describe the approach to modeling sensitive electronics. Explain whether the treatment of sensitive electronics performed for the Fire PRA is consistent with the guidance in FAQ 13-0004, including the caveats about configurations that can invalidate the approach (i.e., sensitive electronics mounted on the surface of cabinets or in the presence of louver or vents). Justify the treatment of sensitive electronics used in the Fire PRA, and if the approach cannot be justified using available NRC guidance, then replace the current approach with an acceptable approach and describe this change to the Fire PRA, or address the impact of your proposed method as part of the integrated analysis performed in response to PRA RAI 3.

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. 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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. 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.

It appears that reductions below the 98th-percentile NUREG/CR-6850 HRR of 317 kW for transient fires may have been credited in the Fire PRA. The licensee's analysis indicates that though a bounding 98% HRR of 317 kW from NUREG/CR-6850 was typically used, that transient fire HRRs were "adjusted down in areas with stricter transient controls." Discuss the key factors used to justify the reduced rate below 317 kW per the guidance endorsed by 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.'" Include in this discussion:

a) Identification of the fire areas where reduced HRR transient fires are credited.

b) For each location where a reduced HRR is credited, description of the administrative controls that justify the reduced HRR including how location-specific attributes and considerations are addressed. Provide a discussion of required maintenance for ignition sources in each location, and types/quantities of combustibles needed to perform that maintenance. Also discuss the personnel traffic that would be expected through each location.

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

d) Discussion of the impact on the analysis.

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. 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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No.

ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff require additional justification to allow the NRC staff to complete its review of the proposed method.

NRC staff could not identify in the LAR or licensee's analysis a description of how "pinch points" for transient fires were treated in the Fire PRA. Per NUREG/CR-6850 Section 11.5.1.6, transient fires should at a minimum be placed in locations within the plant physical analysis units (PAUs) where CCDPs are highest for that PAU, i.e., at "pinch points." Pinch points include locations of redundant trains or the vicinity of other potentially risk-relevant equipment. Cable congestion is typical for areas like the Cable Spreading Room (CSR), and so placement of transient fire at pinch points is in those locations is important. Hot work should be assumed to occur in locations where hot work is a possibility, even if improbable, keeping in mind the same philosophy.

a) Clarify how "pinch points" were identified and modeled for transient fires.

b) Describe how transient and hot work fires are distributed within the PAUs at the plant. In particular, identify the criteria used to determine where such ignition sources are placed within the PAUs.

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. 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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff require additional justification to allow the NRC staff to complete its review of the proposed method.

In regards to modeling the Main Control Board (MCB) for the Fire PRA, address the following:

a) The licensee's description of how MCB fires are modeled for the Fire PRA explains that the NUREG/CR-6850 Appendix L approach was used and that one fire scenario was systemically developed for each MCB panel segment and for each combination of segments. The licensee also shows the contributors to the overall frequencies for each of 26 MCB fire scenarios. Attachment L of NUREG/CR-6850 states that the analyst should "identify localized areas on the control boards where control and instrumentation

damage may have significant impact on core cooling." Confirm that the scenarios developed encompass the important risk scenarios for the MCB.

b) From the licensee's analysis it was not clear whether the MCB has panels on the rear side. FAQ 14-0008, "Main Control Board Treatment," dated June 5, 2014, was issued to clarify the definition of the Main Control Board, and to extend the definition to cover the rear side of the main control board. Explain whether the Fire PRA modeling of the MCB is consistent with guidance in FAQ 14-0008, "Main Control Board Treatment."

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. 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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. 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 states that because junction boxes can be considered a well-sealed non-propagating ignition source, ignition frequency determination is not needed. FAQ 13-0006, "Modeling Junction Box Scenarios in a Fire PRA," indicates that the risk from failure of cables within each junction box needs to be estimated and that, unlike electrical cabinets, there is no exclusion of a junction box from counting because it is robustly secured and well-sealed. Thus, junction boxes that route Fire PRA target cables that can contribute to fire risk should not be excluded as ignition sources. Justify the approach to evaluating junction boxes using NRC guidance or address the impact of your proposed method as part of the integrated analysis performed in response to PRA RAI 3.

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. 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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. 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 states that for buses E-1 and E-2 the evaluation "determined that it would be overly conservative to assume that the HEAF scenarios impacted targets outside of the switchgear." Section 4.8.3.2.3 of the LAR provides the results of a sensitivity study in which these HEAF scenarios were assumed to affect external targets. The results demonstrate that ΔCDF increases by 13% and the CDF increases by 18%. Appendix M of NUREG/CR-6850 provides guidance on fire growth and damage due to HEAFs. Describe treatment of HEAFs in the Fire PRA and provide justification for cases in which HEAF fires are not propagated beyond the originating cabinet. If the basis for excluding consideration of damage to external targets is not consistent with NRC guidance, then address the impact of your proposed method as part of the integrated analysis provided in response to RAI 3.

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. 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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. 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 states that bus ducts were typically treated as HEAFs "without secondary combustibles fire scenarios." NUREG/CR-6850, Supplement 1 (i.e., FAQ-08-0035), provides guidance for determining a zone of influence (ZOI) from bus duct fires, stating that exposed combustible or flammable material within the ZOI should be assumed to ignite. The basis for not propagating fire from bus ducts is not clear. Justify the treatment of bus duct fires in the Fire PRA. Include explanation of how guidance in FAQ-08-0035 was addressed. If treatment of bus ducts cannot be shown to be consistent of NRC guidance then model the excluded bus duct fire scenarios in the integrated analysis provided in response to RAI 3.

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. 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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. 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.

One SR that differs greatly between Capability Category I and II is FSS-D9. Capability Category I can be met without any evaluation of smoke damage. With no F&O on FSS-D9 and no list of Capability Category I SRs in the LAR, the NRC staff could not verify that smoke effects were considered in the Fire PRA. The guidance in Appendix T of NUREG/CR-6850 states that the effects of smoke damage should be quantitatively addressed in the Fire PRA for certain equipment and configurations. Confirm that FSS-D9 was met with a Capability Category II/II or explain how effects of smoke on equipment were evaluated using the guidance provided in Appendix T of NUREG/CR-6850.

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 fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. 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.

Section 4.8.3.1.3 of the LAR explains that for a selected set of risk significant Air Operated Valves and Solenoid Operated Valves the licensee assumed that given a hot short that these valves would return to their fail-safe position once the hot short clears. Section 4.8.3.1.3 of the LAR explains that the probability that the spurious hot short would clear after 15 minutes was 0.06. Should this state that the probability that the hot short “does not clear” in 15 minutes is 0.06? NRC staff notes that guidance about how to analyze hot short duration has recently been issued in Volume 2 of NUREG/CR-7150, ”Joint Assessment of Cable Damage and Quantification of Effects from Fire.”. Given these observations, provide the following:

a) Clarify the probability used in the Fire PRA of the failure of the cited hot shorts to clear and the duration the hot short was assumed to exist.

b) Explain whether the approach taken to modeling hot short durations is consistent with new NRC guidance, and describe the basis (e.g., thermohydraulic basis) for assuming a hot short duration of 15 minutes. Note that NUREG/CR-7150, Vol. 2, addresses hot short duration and includes guidance about treatment of multiple spurious operations (MSO) hot shorts.

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 fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. 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 there was a breaker fuse coordination issue at the time of the LAR submittal that remained to be addressed. The licensee analysis refers to "basic events" assumed to be failed for appropriate scenarios. Describe the breaker coordination issue that was identified and how it was accounted for in the Fire PRA. If the breaker coordination issue was not addressed and can impact the Fire PRA results, include this impact in the integrated analysis provided in response to PRA RAI 3.

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 fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02.

LAR Attachment S, Table S-3 indicates that incipient detection systems (i.e., VEWFDS) are credited in the Fire PRA and will be installed in MCR cabinets; in Safeguards, Hagan Room, turbine supervisory, and Rod Control room cabinets; and the Cable Spreading Room (CSR) as wide-area detection. Though LAR Attachment S, Table S-2 provides some comments about how incipient detection was modelled in the Fire PRA more explanation is needed to fully understand how incipient detection was credited. NRC staff notes that results of sensitivity studies presented in Sections 4.8.3.2.4, 4.8.3.2.5, and 4.8.3.2.6 of the LAR which remove credit for incipient detection and replace it with credit for other detection systems, show an increase in Δ CDF and Δ LERF as high as 18%. The NRC has not accepted credit for incipient detection in the MCR as detection credit is already realized when non-suppression probabilities are applied in an area continuously occupied. Also, NRC has not yet accepted credit for incipient detection as a very early warning fire detection system for wide-area applications. Explain and justify how area-wide incipient detection is credited in the Fire PRA results presented in Attachment W of

the LAR. For VEWFDS credit which followed FAQ 08-0046, describe any departures from guidance in FAQ 08-0046. If incipient detection is credited in the Fire PRA for very early warning in the MCR or in wide area application, or is credited beyond what is allowed by FAQ 08-0046, then remove this credit or incorporate acceptable credit as part of the integrated analysis performed in response to RAI 3.

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 fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02.

The licensee's analysis appears to indicate that spatial separation is used as justification for plant partitioning (e.g., Turbine Building areas). Explain whether spatial separation is used as justification for the plant partitioning used in the Fire PRA. If it was used to identify the fire areas for which this approach is applied, describe how its use impacted the fire modeling for those areas.

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 fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02.

From the licensee's analysis it is not clear whether the licensee used a "transient zones" fire modeling approach where "transient zones" are separated by non-physical boundaries which are used to subdivide a physical analysis unit for fire analyses purposes. If this approach or a similar approach was used, describe it.

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 fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02.

LAR Appendix H does not indicate that FAQ 13-0005, "Cable Fires Special Cases: Self-Ignited and Caused by Welding and Cutting," dated June 26, 2013, was used in preparation of the Fire PRA. Explain whether the treatment of self-ignited fires and fires caused by welding and cutting is consistent with FAQ 13-0005, and if not, provide justification. If justification cannot be provided, then provide treatment of self-ignited fires and fires caused by welding and cutting consistent with NRC guidance in the integrated analysis provided in response to PRA RAI 3.

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 fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805.

The licensee's analysis indicates that significant risk reduction is gained for crediting intumastic coating. Describe the credit given for intumastic coating in the Fire PRA .

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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02.

Discuss how fire-induced failure of instrumentation is addressed for human reliability analysis (HRA) by addressing the following:

a. Identify guidance used for differences approaches (e.g., screening, scoping, detailed analysis) that may have been used;

b. Explain how fire-induced instrument failure (including no-readings, off-scale readings, and incorrect/misleading readings) is addressed in the fire HRA, including a discussion of the implicit or explicit modeling of instrumentation for HRA in the Fire PRA; and,

c. Confirm that instrumentation credited in the HRA has been verified to be available for the fire scenarios in which they are credited.

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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02.

The licensee's analysis describes a plant trip assessment in which conditional plant trip probabilities were developed (i.e., 0.1 and 0.01). Describe why and how these conditional probabilities are used in the Fire PRA, and the assumptions made in incorporating these probabilities.

PRA RAI 23

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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. 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 a minimum joint Human Error Probability (HEP) of 1E-6 was used. NUREG-1921, ""EPRI/NRC-RES Fire Human Reliability Analysis Guidelines," July 2012 (ADAMS Accession No. ML12216A104), indicates, and NUREG-1792, "Good Practices for Implementing Human Reliability Analysis (HRA)" (ADAMS Accession No. ML051160213) (Table 2-1) states, that joint HEP values should not be below 1E-5. 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.

PRA RAI 24

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 staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. 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.

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 state-of-knowledge correlation (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 Fire PRA relative to the updated guidance in NUREG/CR-7150, Volume 2, specifically addressing each of these items. If the Fire PRA 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 25

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, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

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

a) A detailed definition of both the post-transition and compliant plant models used to calculate the reported change- in-risk, including any special calculations for the MCR. Include description of the model adjustments made to remove VFDRs from the compliant plant model, such as adding events or logic, or use of surrogate events. Also include explanation of how VFDR and non-VFDR modifications are addressed for both the post-transition and compliant plant models.

b) A description of how the reported additional risk of recovery actions was calculated, including any special calculations performed for the MCR.

c) An explanation of any major changes made to the Fire PRA model or data for the purpose of evaluating VFDRs.

d) A description of the type of VFDRs identified, and discuss whether and how the VFDRs Identified, but not modeled in the Fire PRA, impact the risk estimates. Include any qualitative rational for excluding VFDRs from the change-in-risk calculations.

PRA RAI 26

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, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

Regarding Fire Risk Evaluations, address the following:

a) LAR Attachment C, Table B-3, "Fire Area Transition," presents just a single component for each VFDR identified. Given that a VFDR could impact more than a single component, explain how VFDRs are mapped in the Fire PRA for the fire impact.

b) Discuss whether the fire area risk considers all VFDRs in the fire area concurrently.

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

Eval Δ CDF/LERF" and the "Total Fire Risk Eval Δ CDF/LERF" columns are different and how they are calculated.

d) According to LAR Attachment W, Table W-5, Note 1 an epsilon symbol is used to indicate a non-significant risk value for CDF and LERF, however an "NA" (i.e., not applicable) symbol would seem to be a more appropriate designation for "deterministic areas." Explain whether an epsilon symbol indicates that a qualitative instead of a quantitative evaluation was performed. If there are VFDRs dispositioned qualitatively, indicate which areas have these types of VFDRs.

e) Clarify if the "RA-DID" (i.e., Recovery Action Defense-in-Depth) operator actions listed in Attachment G of the LAR are quantified in the Fire PRA model. If so, describe the method to quantify them. Include explanation of whether credit for the RA-DIDs is necessary for the change-in-risk to be acceptable.

PRA RAI 27

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, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

Regarding Fire Risk Evaluations, address the following:

a) Step 5, "Evaluate the Reliability of Recovery Actions," of LAR Attachment G states that "For the bounding reliability treatment see results in Attachment W." Explain what this bounding treatment is for the recovery actions.

b) Explain whether the plant is transitioning previously approved recovery actions. Are these recovery actions included in the additional risk from recovery action values presented in Attachment W? Are there self-induced station blackout (SISBO) operator actions that will be retained post-transition as "previously approved" recovery actions?

c) Have dependencies between recovery actions and RA-DIDs (e.g., between actions related to MCCs noted in Table G-1) been addressed in the Fire PRA?

d) Attachment C of the LAR identifies VFDRs associated with recovery actions for the MCR stating: "The actions taken at a remote shutdown location that does not meet the definition of a primary control station are considered VFDRs (RG 1.205)." No mention is

made of cables/equipment-related VFDRs for the MCR. In addition, Table W-5 shows "ε/ε" for the MCR. Based on these observations, provide clarification that cables/equipment-related VFDRs are also appropriately recognized for the MCR analysis.

e) Review of the LAR Attachment G, Table G-1 noted that the start of the DS diesel is considered a primary control station (PCS) action (component "DS-BUS"). Is this a manual action taken at the DSDG control panel? The LAR Table S-1 shows that the auto start/auto load of the DSDG on loss of ac power is completed. Explain the PCS action to start the DSDG in light of the completed modification. Is the auto load loading on the same loads as had previously been manually transferred? There are also still manual load transfers which are identified as RA-DIDs. Are these RA-DIDs a backup if the DSDG does not auto load? Also, discuss the credited reliability and feasibility of using the DSDG in the Fire PRA and fire risk evaluations.

PRA RAI 28

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, large early release frequency, 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.

It is not clear whether modifications listed in LAR Attachment S, Tables S-2 and S-1 are reflected in the dominant risk scenarios result presented in Table W-3 and W-4 of the LAR. For example, LAR Attachment W, Table W-3 shows scenarios listed which only include the failure of three auxiliary feedwater (AFW) pumps, whereas LAR Attachment S, Table S-1 indicates that installation of a fourth AFW pump has been completed. If the scenario in LAR Attachment W, Tables W-3 and W-4 do not include the modifications, provide these scenarios.

PRA RAI 29

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, large early release frequency, 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.

Explain the following anomalies found in LAR Attachment W, Table W-5:

a) In LAR Attachment W, Table W-5 of the LAR, Fire Area A18 is reported as a "performance-based area" consistent with LAR Attachment C, but a "No" is reported in the "VFDR" column of this table.

b) Fire Area A10 is reported as a "deterministic area" consistent with Attachment C, but change-in-risk and additional risk of recovery actions values are reported for this fire area.

c) For Fire Areas A3, A5, A13, A17, C, E, and G1, a "No" is reported in the "RAs" column, but additional risk of recovery action values are reported for these fire areas.

d) Fire Area A10 refers to the Unit 1 rather than Unit 2 Cable Spreading Room.

PRA RAI 30

NFPA 805 Section 2.4.3.3 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 AHJ. RG 1.174 provides quantitative guidelines on core damage frequency, large early release frequency, 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 the following information that is required to fully characterize the risk estimates:

LAR Attachment S, Table S-2 presents Modification 15 that will upgrade the reactor coolant pump (RCP) seals, but does not describe what seals will be installed. Section 4.8.3.1.1 of the LAR states that credit was taken in the Fire PRA for installation of the Westinghouse Shutdown Seals (SDS), using guidance from WCAP-17100-P-A. This credit is stated to provide a "98% reduction in the risk impact of loss of RCP cooling based on a 2% failure rate SDS." Given recent concerns about the operation of new Westinghouse RCP shutdown seals during post-service testing (see Westinghouse letter, LTR-NRC-13-52, from James Gresham to NRC dated July 26, 2013, "Notification of Potential Existence of Defects Pursuant to 10 CFR Part 21," ADAMS Accession No. ML13211A168), the risk estimates shown in Tables W-5 of the LAR may be optimistic. Also, PRA credit using older guidance in WCAP-1700-P-A may not be consistent with the new RCP seal designs. In light of these observations:

a. Indicate the type of Westinghouse SDS model which is to be credited. Justify the credit taken in the Fire PRA for RCP seal installation, and the technical basis for that credit (e.g.,

technical report (TR) submitted to or approved by the NRC), including confirmation that the technical basis for the credit is consistent with the type of RCP seals being installed. Provide relevant information from technical design documents, testing evaluations, draft topical reports, etc., that support the incorporation and quantification of the SDS performance in the Fire PRA model. Clearly indicate what is being credited from the TR and other documents. Justify any assumptions for new risk reduction credit or retention of credit previously assumed. Describe and justify deviations, if any, from the TR.

b. If the RCP shutdown seal reliability is not known or determined (i.e., there is no technical basis, such as engineering evaluation, Topical Report and/or vendor test data), then perform a sensitivity study to remove any credit for the RCP shutdown seal. If the RG 1.174 risk acceptance criteria cannot be met, then alternative modification(s) for transition may be considered; however, LAR Attachment S, Table S-2 would need to be updated accordingly and a re-evaluation submitted to support the licensee's conclusion.

c. Clarify whether credit for installation of RCP seals is being taken in the total fire CDF and LERF, and total change in CDF and LERF reported in LAR Attachment W, Table W-5 (i.e., is it included in both the post-transition and compliant plant models); and whether it is credited in the Internal Events CDF and LERF contribution reported in LAR Attachment W, Table W-1.

PRA RAI 31

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, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

Section 4.8.3.1.2 of the LAR states that the "strategy going forward is to use a symptom based operator response approach" opposed to the current strategy referred to as self-induced station blackout (SISBO). Section 4.8.3.1.2 of the LAR states that Attachment G recovery actions reflect the new strategy of symptom based operator response in case of fire. FAQ 09-0057, "New Shutdown Strategy," describes one acceptable method to simplify transition from a SISBO strategy. The FAQ states, "[t]he FPRA performed for the non-SISBO case would constitute the baseline PRA for all fire risk evaluations performed to support the NFPA 805 transition." In other words, the change in risk is estimated by modifying the post-transition model, not modelling the current plant. Yet, Section 4.8.3.1.2 of the LAR makes the statement that the "current PRA conservatively modeled the plant using the current load shed strategy."

Explain the meaning of this statement including whether the term “current PRA” refers to the post-transition or compliant fire PRA models discussed in Section W.2.1. Confirm that FAQ 09-0057 has been used or describe and justify any differences between the FAQ and your method.

PRA RAI 32

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, large early release frequency, 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 Attachment S, Table S-3, Implementation Item 11 commits to verifying the validity of the reported change-in-risk upon completion of all LAR Attachment S, Table S-1 modifications and a plan of action if the “as-built” change in risk exceeds the risk estimates reported in LAR Attachment W, Table W-4. Is the reference in this implementation item to LAR Attachment S, Table S-1 actually meant to refer to LAR Attachment S, Table S-2 (or both S-1 and S-2), and is the reference to LAR Attachment W, Table W-4 actually meant to refer to LAR Attachment W, Table W-5 which lists the change-in-risk results for each area.

a) Generally the validation of the transition change in risk estimates are completed after all planned modifications and the updated total transition change in fire CDF and LERF estimates are compared to the RG 1.174 acceptance guidelines, and this validation must be completed before transition to NFPA-805 is completed. Risk-informed self-approval of future changes using PRA is not authorized until transition is completed. Clarify why the licensee is proposing a different implementation item and justify the proposal or change the implementation item.

b) Also, the action in this implementation item, if the acceptance guidelines are exceeded, references the post transition change process. This process is not used until transition is completed, i.e., after the validation is acceptable. Generally the action taken if the transition change in risk acceptance guidelines are exceeded include implementing additional modifications, refining the analytic estimates, or requesting that exceeding the guidelines be deemed acceptable in a new LAR. Clarify why the licensee is proposing a different implementation item and justify the proposal or change the implementation item.

c) A final issue generally addressed in this implementation item is reference to a list or table of changes that have been or will be made to the PRA during the LAR review to ensure that only methods acceptable to the NRC are used in the fire PRA. Clarify why

the licensee is proposing a different implementation item and justify the proposal or change the implementation item.

d) LAR Attachment S, Table S-3, Implementation item 10 regarding updating the RCP seal model in the fire PRA with a final acceptable model and values is included in LAR Attachment S, Table S-3, Implementation Item 11 insofar as it may require a change to the fire PRA. Clarify why the licensee is proposing a different implementation item and justify the proposal or change the implementation item.

PRA RAI 33

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 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.

It is not clear whether the F&Os presented in Attachment V encompass all SRs determined to be “not met” or “met only at CC-I,” given that only one table of F&Os is presented. As a separate matter, it is not clear whether the full-scope peer review and follow-up review identified in Attachment V of the LAR were performed to RG 1.200 Revision 2, and whether the follow-up review qualifies as a focused scope peer review given that it was performed by a pair of contractors. In light of these observations:

a) Explain whether the F&Os provided in Attachment V encompass all SRs not met or met only at CC-I. If the F&Os presented in Table V-1 of the LAR do not encompass all SRs not met or met only at CC-I, then identify these SRs and provide an evaluation of the impact of not meeting the SR or meeting it at CC-I.

b) Confirm that both peer reviews were performed to RG 1.200 Revision 2 and account for clarifications defined there. Also, confirm that the follow-on focused scope peer review meets the definition of a focused scope peer review per industry guidance in NEI-07-12, “Fire Probabilistic Risk Assessment (FPRA) Peer Review Process Guidelines.”

PRA RAI 34

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 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 disposition to F&O PRM-B15-01 indicates that significant LERF modeling occurred after the peer review, but it does not appear to NRC staff that a peer review was performed on potential model upgrades. Address the following:

a) Identify any changes made to the Internal Events PRA or Fire PRA since the last full-scope peer review that are consistent with the definition of a "PRA upgrade" in ASME/ANS-RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency for Nuclear Power Plant Applications," as endorsed by RG 1.200.

b) If any changes are characterized as a PRA upgrade, indicate if a focused-scope peer review was performed for these changes consistent with the guidance in ASME/ANS-RA-Sa-2009, as endorsed by RG 1.200, and describe any findings from that focused-scope peer review and the resolution of these findings.

c) If a focused-scope peer review has not been performed for changes characterized as a PRA upgrade, describe what actions will be implemented to address this issue.

PRA RAI 35

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, large early release frequency, 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.

The LAR Attachment C provides some discussion regarding safety margin, but does not provide discussion of the consideration of safety margins in fire modeling. Also, it is not clear what the following statement under the "Other" heading means: "Fire modeling in support of the FREs was performed using conservative heat release rates that are based on NUREG/CR-6850, Task 8, Scoping Fire Modeling." Explain this statement and describe how safety margin for fire modeling was addressed.

PRA RAI 36

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, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

Section 4.8.3.2.2 of the LAR presents the results of a sensitivity study on the updated fire ignition bin frequencies provided in NUREG/CR-6850, Supplement 1 (i.e., FAQ-08-0048, "Revised Fire Ignition Frequencies," June 2009, (ADAMS Accession No. ML091590457)) using the mean of the fire frequency bins contained in Section 6 of NUREG/CR-6850 for those bins with an alpha value less than or equal to one. It is not clear why the change in risk increase for Δ CDF and Δ LERF is higher than the total fire CDF and LERF increases (i.e., CDF increases 32% and LERF 35% while ΔCDF increases 93% and ΔLERF 75%), given that increases in certain fire ignition frequencies would be expected to impact both compliant and post-transition plant case accident sequences the same, and not to affect CCDP and CLERP values. Provide the following:

a) An explanation of the anomaly cited above and whether the change-in-risk values reported in Section 4.8.3.2.2 of the LAR are correct.

b) An updated sensitivity study based on the integrated analysis performed in response to PRA RAI 3. Include in the sensitivity study any adjustments needed to correct anomalous results from the initial sensitivity study.

c) An indication of whether the acceptance guidelines of RG 1.174 may be exceeded when this sensitivity study with respect to FAQ 08-0048 is applied to the integrated study requested in PRA RAI 3. If these guidelines may be exceeded, provide a description of fire protection, or related measures that can be taken to provide additional defense in depth as discussed in FAQ 08-0048.