NRR-PMDAPEm Resource

From: Gratton, Christopher
Sent: Tuesday, April 16, 2013 8:59 AM
To: Murray, William R. (Bill)
Cc: Fields, Leslie
Subject: Draft NFPA-805 Audit RAIs
Attachments: Draft Brunswick Audit RAIs final April 10 end.docx

Mr. Murray,

By letter dated September 25, 2012, (ADAMS Accession Nos. ML12285A430, ML12285A428), as supplemented by letter dated December 17, 2012 (ADAMS Accession No. ML12362A284, ML12362A285) Brunswick Steam Electric Plant, Unit Nos. 1 and 2, (Brunswick) submitted a license amendment request (LAR) to transition the fire protection licensing basis at Brunswick, from Title 10 of the *Code of Federal Regulations* (CFR), Section 50.48(b), to 10CFR50.48(c), National Fire Protection Association Standard NFPA 805 (NFPA 805), (Transition Report, ADAMS Accession No. ML12170A869).

The NRC staff has reviewed the information provided by Brunswick and also participated in an audit from April 8 to April 12, 2013, and have determined that additional information is needed to complete the review. Enclosed are draft requests for additional information (RAIs).

The NRC staff requests that you schedule a conference call within the next 2 week to discuss the questions and ask clarifying questions, as appropriate. The objective of the call is the ensure the Brunswick staff clearly understands the RAIs. During the call, the NRC staff expects the licensee to provide a firm commitment date within 60 days from the date of the call to respond to these RAIs. Following the call, the NRC staff will issue the final version of the RAI questions in a letter to the licensee.

Please note that review efforts on this task are continuing and additional RAIs may be forthcoming.

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AUDIT QUESTIONS

VOLUNTARY FIRE PROTECTION RISK INITIATIVE

CAROLINA POWER AND LIGHT

BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2

DOCKET NOS. 50-325 AND 50-324

Safe Shutdown Analysis (SSA) Question 01

The LAR Attachment S, Table S-1 Item #1, an incipient detection system is identified to be installed in Control Room cabinets. 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 or delay to alternate shutdown. Describe how the operator will be made aware of what must be done to remain in the control room for plant shutdown. Include discussion of alarms, procedures, and training.

SSA Question 02

The LAR Attachment S, Table S-1 Items #5 and #7 provide an electrical raceway fire barrier system (ERFBS) wrap in the control room. Provide more detail regarding the separation scheme being provided in the control room by this modification. Include in the description the protection scheme provided for large early release frequency (LERF) risk reduction (Item #7). Describe the intent of the modification in the control room. Include the hourly rating that is being provided for these configurations and describe the separation criterion that is being met.

SSA Question 03

The LAR Attachment S, Table S-1 Item #10 currently lists a modification to "address valve pressure boundary issues due to fire induced spurious actuations." The Table S-1 entry goes on to state "evaluate and modify valves, as necessary, to address pressure boundary concerns due to fire induced spurious actuations. Perform a study for the extent of condition for valves of concern." Attachment S, Table S-2, Implementation Item #8, addresses a study to evaluate the extent of condition related to spurious operation of pressure boundary valves. Describe how these components are included in the nuclear safety capability assessment (NSCA) and how they are subsequently treated in the fire probabilistic risk assessment (FPRA). Describe the scope, methods, and implications for impact to NSCA and FPRA of this study.

SSA Question 04

The LAR Attachment B, Table B-2, Section 3.1.1.9, 72-hour Coping, indicates that the alternate shutdown methodology ensures cold shutdown can be achieved in 72 hours, including repairs. However, the cold shutdown actions including repairs are not identified as variances from deterministic requirements (VFDRs). It also states that the analysis may be modified in the future because NFPA 805 does not have a cold shutdown requirement. LAR Section 4.2.1.2 indicates that based on the criteria discussed in NCSA calculation for safe shutdown, the NFPA 805 licensing basis for Brunswick is to achieve and maintain hot shutdown conditions following any fire occurring prior to establishing cold shutdown. This appears to include cold shutdown as part of the "safe and stable" plant condition being achieved, which would require actions and repairs necessary to be addressed as VFDRs. Describe the plant mode that the operator is attempting to achieve and maintain for safe and stable. NFPA 805 requires the plant to achieve and maintain safe and stable conditions. Provide additional information that would justify not identifying VFDRs for an analysis that "ensures cold shutdown can be achieved in 72 hours."

SSA Question 05

The LAR Section 4.2.1.2 for safe and stable condition(s) achieved, provides a qualitative evaluation of the risk for achieving and maintaining safe and stable conditions, including the aspects of having to perform repairs in order to achieve cold shutdown in the event that it is necessary during the post-fire "long-term strategy" described in LAR Section 4.2.1.2. Provide justification for any low-risk conclusions.

Provide a more detailed description of the systems, evolutions, and resources required to maintain this condition between hot standby and cold shutdown. Include the following items:

a. Specific capabilities and required actions to maintain safe and stable for an extended duration (beyond 24 hours) including a qualitative description of the risk.

b. Capacity limitations for each applicable performance goal. Provide a description of capacity limitations and time-critical actions for other systems needed to maintain safe and stable conditions (e.g., gas/air supply for control valves, boron supply, DC battery power, diesel fuel, water resources).

c. Describe in more detail the resource (staffing) requirements, and timing of operator actions to recover NSCA equipment to sustain safe and stable conditions. Describe how soon "off-shift" personnel will be required to perform functions necessary to maintain safe and stable.

d. Provide a more detailed description of the risk of failure of operator actions and equipment necessary to sustain safe and stable conditions.

SSA Question 06

The LAR Attachment B Table B-2 Section 3.5.2.1 for current transformer open circuit potential of secondary fires indicate that analysis of open circuits on high voltage (e.g., 4.16 kV) ammeter current transformers was completed, and the final disposition of this potential fire scenario is assessed as part of the analysis. Section 4.2.1.1 of the LAR states that the evaluation concludes that this failure mode is unlikely for control transformers (CTs) that could pose a threat to safe shutdown equipment. Provide a more specific description and justification of this conclusion, and include the aspects of secondary fires that may be created and subsequently impact the NSCA. Describe the analysis method and provide the outcome for damage to the safe shutdown (SSD) equipment where the CT is mounted. If fire models were performed to satisfy resolution of fire area failures, then provide verification and validation (V & V) information in Attachment J.

SSA Question 07

For breaker fuse coordination, describe whether cable length was considered as additional impedance in the study necessary to meet maximum available short circuit current. AC and DC coordination procedure (EGR-NGGC-0106) indicates that the impedance length of the cable can be 10 feet or 10% of the cable length (whichever is less), or longer where justified. If this qualification was used, describe how this length was factored into the potential impact to the FPRA. For establishing targets in the zone of influence (ZOI) describe how cable lengths were considered and provide any justifications required for the FPRA.

SSA Question 08

The LAR did not appear to include table entries for ERFBS by fire area. Provide a list of fire areas that rely on ERFBS for compliance with NFPA 805. Additionally provide the reason(s) for relying on the ERFBS.

SSA Question 09

LAR Section 4.5.2.2, Step 3, defines the defense-in-depth (DID) and safety margin criteria consistent with the Nuclear Energy Institute (NEI) LAR Template and other submittals. However, these criteria were not discussed in Attachment C on an area by area basis or in the resolution of VFDRs. Evaluations of DID and safety margin are stated to be performed as part of the area-by-area Fire Risk Evaluations. The DID echelons, as defined in NEI 04-02, and the general strategy of looking for substantial imbalance in the echelons is described at a high level manner in Section 4.5.2.2 of the LAR. However, the specific criteria used to perform DID and safety margin evaluation is not provided in the LAR. Provide a more detailed description and summaries regarding the DID and Safety Margin established for fire areas that used the NFPA 805 performance-based Section 4.2.4 compliance strategy.

SSA Question 10

LAR Attachment C Fire Areas RB1-1 and RB2-1 are evaluated using both deterministic (4.2.3) and performance-based (4.2.4) methods in the same fire areas. Provide additional explanation to provide a better understanding of the approach in these areas. These areas are also identified as having recovery actions (RAs). NFPA 805 excludes the ability to classify an area as deterministically compliant with RAs. Justify the use of RAs in what appears to be deterministically compliant areas. Provide only one strategy for each fire area. Include any other fire areas which are currently represented as compliant with both deterministic and performance-based strategies.

SSA Question 11

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

a. Provide a list of the components (including power supplies) added, that were not included in the at-power analysis and a list of those at-power components that have a different functional requirement for NPO.

b. Provide a list of key safety features (KSF) pinch points by fire area that were identified in the NPO fire area reviews including a summary level identification of unavailable paths in each fire area.

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

d. Identify locations where KSFs are achieved via RAs or for which instrumentation not already included in the at-power analysis is needed to support RAs required to maintain safe and stable conditions. Identify those RAs and instrumentation relied upon in NPO and describe how RA feasibility is evaluated. Include in the description whether these variables have been or will be factored into operator procedures supporting these actions.

e. Describe any new, changed, or deleted manual operator actions resulting from Item 1, "Implement the results of the Non-Power Operational Modes Analysis. Technical and administrative procedures and documents that relate to non-power modes of plant operating states will be revised as needed for implementation."

SSA Question 12

LAR Attachment G, under the heading, "Results of Step 4," contains an incomplete reference to the feasibility assessment as follows, "contained in Change Package BNP-". The complete reference will be needed for correction of the LAR and performance of the detailed review.

SSA Question 13

LAR Table G-1 Unit 1 Recovery Actions for CB-23E identifies some Unit 2 components, for example:

- 2-DG4-GEN DIESEL GENERATOR NO 4 Take local control of 2-DG4-GEN at EDG #4 Control Panel, located in fire zone DG-02 and operate as required.

- 2-E4-AJ9-FTO COMPT FOR INCOMING LINE FROM SWGR 2C De-energize DC Control Power to 2-E4-AJ9 at Bus 2-E4, Compt AJ9, located in fire zone DG-14. Then verify tripped/manually trip 2-E4-AJ9, in fire zone DG-14.

  The same entries are found for the U2 Recovery Actions (Table G-2).

  And for Table G-2 Unit 2 Recovery Actions for CB-23E identifies some Unit 1 components for example:

- 1-E6-AV4 - UNIT SUBSTATION E6 MAIN FEED BKR COMPT - Take local control of 1-E6-AV4 at Bus 1-E6 located in fire zone DG-07 and operate as required.

Provide additional information for the following:

a. Describe whether this means that some components support shutdown for both units simultaneously.

b. Describe whether these cross-connecting actions require staff from both units. If so, describe how the feasibility analysis reflects this Unit 1 – Unit 2 staffing, communication, and operational interface.

c. Describe the operational impacts on the unaffected (by fire) unit created by cross-connecting these systems.

d. Describe whether the FPRA considers by analysis, only one unit shut down for a fire in the MCR. If so, provide the contribution to Unit 1 risk (core damage frequency (CDF) and LERF) due to a fire requiring shutdown in Unit 2 and vice-versa.

e. Describe whether the Technical Specifications accommodate such cross connections.

SSA Question 14

LAR Attachment G "Recovery Actions" states that "In accordance with the guidance provided in NEI 04-02, FAQ 07-0030, Revision 5, and RG 1.205, the following methodology was used to determine recovery actions required for compliance (i.e., determining the population of post-transition recovery actions)," and that "these actions were described in Section 6.2 of the 1984 ASCA report under "Alternative Shutdown Control Stations". The applicable SE was issued on December 30, 1986 (Serial: BSEP-86-805).

a. Describe whether all of the actions (PCS and RA) have been individually reviewed and approved in the 1984 Safety Evaluation identified in Attachment G.

b. Describe whether the location or locations of all of the actions become primary when command and control is shifted from the MCR to these other locations.

c. Describe whether the actions in both cases meet the criteria in RG 1.205, Section 2.4 a. and b.

SSA Question 15

During the BNP audit discussions the licensee determined that Table B-3 would be updated to identify dispositions for each VFDR. Provide the updated LAR Attachment C Table B-3.

Fire Protection Engineering Question 01

LAR Attachment S, Table S-1, Item #1, identifies the proposed installation of incipient detection system(s) for cabinets in the Control Room. Provide more details regarding NFPA code(s) of record, proposed installation configuration (common piping or individual cabinet), acceptance testing, sensitivity and setpoint control(s), alarm response procedures and training, and routine inspection, testing, and maintenance that will be implemented to credit the new incipient detection system. If the system has not yet been designed or installed, provide the specified 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 description the installation testing criteria to be met prior to operation. Describe whether this installation and the credit that will be taken will be in compliance with each of the method elements, limitations and criteria of NUREG/CR-6850 Supplement 1, Chapter 13, and FAQ 08-0046 including the closeout Memo. Provide justification for any deviations.

Fire Protection Engineering Question 02

LAR Attachment S, Table S-1, Item # 11 identifies a modification of suspended ceiling configuration to allow for an effective increase in ceiling height and associated volume of the main control room (MCR). Provide a more detailed explanation of what this modification entails. Describe whether the suspended ceiling is to be removed. Describe how this modification will affect the fire detection systems (including the potential for stratification), both current and planned detection. Describe how this modification will be incorporated into the Fire Protection Program.

Fire Protection Engineering Question 03

LAR Section 5.5 indicates modifications will be completed by the startup of the second refueling outage (RFO) for each unit after issuance of the Safety Evaluation (SE). Describe the basis for extending completion until the end of the second RFO after approval.

Fire Protection Engineering Question 04

LAR Attachment A, Table B-1, Section 3.3(2), for design controls that are used to restrict combustibles, indicates two compliance strategies “complies” and “complies via EEEE”. Provide a description of what portion of this requirement “complies via EEEE”.

Fire Protection Engineering Question 05

LAR Attachment A, Table B-1, Section 3.3.2, Structural, indicates two compliance strategies; “complies” and “complies via EEEE”. Provide a description of what portion of this requirement “complies via EEEE”. Because the references, identify a structural steel fireproofing calculation for only one specific modification package 92-081 dealing only with the west walls of the control building elevator shaft, describe whether it can be assumed that the “complies via EEEE” is only this specific scope and that all other aspects of the plant complies.

Fire Protection Engineering Question 06

LAR Attachment A, Table B-1, Section 3.3.5.2, Metal Tray and Conduit, identifies the requirement that only metal tray and metal conduits shall be used for electrical raceways. The licensee's compliance strategy indicates "complies via previous NRC approval". However, the section of the 1977 Safety Evaluation Report (5.1) cited in the LAR addresses only cable access ways in the control building for safety related equipment. Describe whether there are any non-metal tray or conduit raceway outside the control building. This "previous approval" does not encompass the extent of the NFPA 805 requirement for all tray and conduit electrical raceway. Provide additional detail sufficient to allow "previous NRC approval" or submit an alternative compliance strategy.

Fire Protection Engineering Question 07

LAR Attachment A, Table B-1, Section 3.3.5.3, Electrical Cable Flame Propagation Limits, states three levels of compliance in the "Compliance Statement" column, but only defines the compliance basis for "complies with clarification" and "complies via previous NRC Approval". Provide a specific description of what portion of this requirement is satisfied by the existing engineering equivalency evaluation (EEEE).

Fire Protection Engineering Question 08

LAR Attachment A, Table B-1, Section 3.3.6, Roofs, indicates compliance by "clarification" and identifies compliance with an equivalent APCSB BTP 9.5-1 requirement (current licensing basis) as the clarification. The compliance is with a different standard than that listed in NFPA 805, and therefore would need to be justified as a suitably equivalent standard to Class A of NFPA 256. Provide sufficient justification for regarding 'Class A', NFPA 256, as equivalent to 'Class I' Factory Mutual.

Fire Protection Engineering Question 09

LAR Attachment A, Table B-1 Section 3.3.7.1 Bulk Flammable Gas Requirements: The compliance strategy regarding storage of flammable gas states that "No flammable gases are stored in safety related buildings." However, the same compliance statement also states that "The bulk flammable gas stored in the Reactor Buildings, Diesel Generator Rooms, and AOG Building, as approved in the SER, are still in use at BSEP." Clarify this apparent contradiction and cite the SER section that approves the locations of this flammable gas. Additionally, the LAR references SER section "6.3 Control of Combustibles" as the previous approval for gas storage. This appears to be incompatible. Provide clarification regarding why the SER Section 6.3 applies to flammable gas storage or identify the appropriate section(s).

Fire Protection Engineering Question 10

LAR Attachment A, Table B-1 Section 3.3.9 "Transformers" was omitted. The B-1 Table needs to address 3.3.9 Transformers. Provide the appropriate information and compliance strategy for all applicable transformers. In providing the appropriate information for the compliance strategy, include an explanation of Plant Modification Table S-1 Item #2 to "provide a method to ensure the compliance with NFPA 805". Explain what this modification entails and how it relates to Code compliance.

Fire Protection Engineering Question 11

LAR Attachment A, Table B-1, Section 3.5.5, identifies compliance with fire pump separation from each other and from the rest of the plant by rated fire barriers. Table B-1 indicates "complies" with "no additional clarification". The referenced design basis DBD-62 "Water Based Suppression System" addresses the pump separation from each other in section 3.3.5 as "flame impingement barriers". Describe whether this separation includes the pumps, controllers, and drivers. Is this "flame impingement barrier" fire rated as required in NFPA 805? If so, what rating is provided? Provide a detailed description of the separation credited. Describe the bases for how the configuration meets the NFPA 805 requirement of separation by rated barriers?

Fire Protection Engineering Question 12

LAR Attachment A, Table B-1, Section 3.5.15, Hydrant Code Requirements, states compliance by "previous NRC approval". The 1977 SER cited indicated that the proposed extension of the loop to the Service Water Intake Structure, required two additional hydrants for improved coverage. The LAR compliance strategy indicates that "in association with upgrades for the Service Water Intake Structure, a nearby yard hydrant will be installed" and stated that this was accomplished. Describe the number of hydrants that were installed to meet the conditional approval of the 1977 SER Section 4.3.1(3). Provide additional information to demonstrate the 1977 SER prerequisite was fully met.

Fire Protection Engineering Question 13

LAR Attachment A, Table B-1, Section 3.6.5, "Seismic Hose Stations", was omitted. Table B-1 needs to address 3.6.5. Provide the appropriate information and compliance strategy.

Fire Protection Engineering Question 14

LAR Table B-1, Section 3.11.4, "Through Penetration Stops" identifies three compliance strategies, but there is nothing written in the compliance basis for "Complies via Previous NRC Approval", or "Complies via EEEE". Provide more detail regarding these two compliance strategies to clarify which portions of the requirements apply to which strategies.

Fire Protection Engineering Question 15

LAR Attachment A, Table B-1 Section 3.11.5 ERFBS are identified as part of the compliance strategy. The compliance is achieved by "Complies" and "Complies via EEEE". There is no attempt to differentiate the two in terms of compliance. Provide a detailed description of what portion of the requirement is satisfied by "Complies" and what portion of the requirement is satisfied by the "Complies via EEEE".

Specifically, for the Pyrocrete ERFBS in the Diesel Generator Building EDG Cell #1, it is not apparent in which compliance category this barrier falls. There is no referenced EEEE for Pyrocrete in the Table B-1 of the LAR Section 3.11.5 ERFBS, however BNP-PSA-080 Attachment 23 indicates there is an "adequate for the hazard" evaluation for the configuration even though it does not comply with GL 86-10 Supplement 1 (Evaluation 85-125-0-10-F Revision 1). Provide clarification with regard to the compliance strategy for the Pyrocrete barrier credited as ERFBS in the FPRA.

Fire Protection Engineering Question 16

LAR Attachment A, Table B-1, Section 3.2.3, Procedures, and Attachment S, Table S-2, Implementation Item #5 indicates the intent to use the performance-based frequencies from Electric Power Research Institute (EPRI) Technical Report TR-1006756, "Fire Protection Surveillance Optimization and Maintenance Guide for Fire Protection Systems and Features". The adoption of the EPRI method as a performance-based alternative to the deterministic Chapter 3 element requires approval in accordance with 10 CFR 50.48(c)(2)(vii). Address whether EPRI TR 1006756 is intended as an alternative, and, if so, provide the appropriate supporting information consistent with Section 50.48(c)(2)(vii).

Fire Protection Engineering Question 17

LAR Attachment C, Table B-3 for Fire Areas RB1-6 and RB2-6 Mini Steam Tunnels, describes one sprinkler head placed over one safety related RCIC Steam Isolation Valve in a deterministically compliant fire area. Both of these areas are identified as compliant by deterministic section 4.2.3 of NFPA 805. Provide more detail regarding the intent of fire protection separation scheme and a justification of deterministic compliance. Describe whether the single sprinkler head contributes in any way to deterministic compliance. The Fire Safety Analysis for RB1-6 in Section A6.1 DID indicates that fire detection and suppression will be credited and designated as DID. However, this area is deterministically compliant. Provide more information regarding this issue.

Fire Protection Engineering Question 18

NFPA 805 Section 3.5.16, Dedicated Fire Protection Water, states: “The fire protection water supply system shall be dedicated for fire protection use only.” The LAR Attachment L Approval Request #1 identifies twelve uses of the fire water system other than for fire protection purposes. The evaluation needs to address the potential impact of each of these evolutions on the availability of the fire protection system being capable of meeting its primary function. If during the conduct of each of these alternative uses, there is the possibility of simultaneous demand for fire protection purposes, provide the following:

a. For each of these operations provide the estimated flow and pressure demand requirement for the system uses over and above the fire protection design demand if they were to be concurrent. Describe any of these operations that may be simultaneously performed. Include the design demand conditions required of the fire protection water systems.

b. Identify what restoration requirements (such as tank refilling including time restraints) are needed to restore the standby nature of the fire protection system(s). What engineering design features, design controls, or alarm features are in place to prevent these operations from impairing the ability of the fire protection systems to meet demand?

c. Describe the administrative controls, procedures, communications, equipment, training, and work control practices that are in place to preclude interference with the ability of the fire protection systems to meet demand.

d. Attachment L states that the Fire Protection Tank level shall be maintained with a minimum contained volume of 232,500 gallons (corresponding to a level of 24' 9 1/2"), and the Demineralized Water Tank, with a minimum contained volume of 90,000 gallons (corresponding to a level of 14' 0"). Describe the controls, alerts, and annunciators that are in place to prevent these requirements from being violated. Include the rate or how quickly can these required levels be restored. Describe whether the procedures and level instrumentation use the same units of measure, e.g. feet, or gallons.

e. Provide justification why the use of the Fire Protection water supply is allowed for normal evolutions. The use of the Fire Protection water supply for abnormal or emergency conditions when no other sufficient source is available seems reasonable, but using it for the purposes that follow will require further justification:
   i. RHR Service Water Shutdown and wet layup process.
   ii. Flushing, filling, and venting RHR service water and heat exchangers.
   iii. RHR Service Water System Operability Test.
   iv. Flushing Radwaste Radiation Monitor.
   v. Seal water to Storm Drain Collector Basin Pumps.
   vi. Temporary Cooling Water Supply to Service Air Compressor 1(2) D.
   vii. Transfer of Fire Protection System Water Supply to the MUD Tank.
   viii. Refill of SBGT drain trough.

Fire Protection Engineering Question 19

LAR Attachment C, Table B-3, identifies the “Required Regulatory Systems” for each applicable fire area. For fire areas with deterministic compliance strategies (4.2.3), there appear to be numerous cases where suppression systems and detection systems are identified as required systems for DID performance-based compliance. For example; Fire Areas DG-2 identifies Flame detection as required for “D” DID (4.2.4). Other cases include Fire Areas DG-3, DG-6, DG-9, DG-13, DG-19, DG-20, DG-21, DG-22, MWT-1, RB1-6, and RB2-6. Provide clarification regarding the apparent discrepancy.

Fire Protection Engineering Question 20

LAR Attachment A, Table B-1 Section 3.3.1.3.1 Control of Ignition Sources indicates that the hot work process will be controlled by procedures including FIR-NGGC-0003 “Hot Work Permit”. Section 3.16 of that procedure indicates that “roving Hot Work Fire Watches” are used for BNP during operating modes 4 and 5. The roving fire watch is allowed to monitor “several hot work jobs in relatively close proximity to each other.” Additionally, Section 4.8.9 of that procedure indicates that using a video camera and monitor is acceptable for viewing hot work activities. The NRC staff position is that neither of these practices are recognized by NFPA 51B, Standard for Fire Prevention during Welding, Cutting, and other Hot Work. Provide the bases why these practices are considered acceptable for compliance with NFPA 805 Section 3.3.1.3.1.

Fire Protection Engineering Question 21

LAR Attachment A, Table B-1 Section 3.4.1(c) requires that the 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. Describe the duties of the BNP Fire Brigade Operations Advisor. If this advisor performs any other duties not in direct support of the fire brigade provide an evaluation in compliance with the 10CFR 50.48 (c)(2)(vii) including Defense-in-Depth and Safety Margin that justifies any additional duties.

Probabilistic Risk Assessment (PRA) RAI 01 - Fire PRA F&Os

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

a) F&O 1-8 against ES-A1 (Not Met), ES-A2 (Cat-I/II/III), ES-A3 (Not Met), and FQ-A2 (Cat I/II/III):
Attachment 8 of BNP-PSA-085 shows in a table whether, and in some cases how, internal events initiators were addressed in the fire PRA. Describe how equipment, whose fire-induced failures, could cause initiating events, were matched to the appropriate plant response models (i.e., internal events sequences). Given the cited sensitivity study results, justify treating the cited initiators as fire-induced failure of equipment following a plant trip opposed to using the internal events plant response models associated with internal event initiators.

b) F&O 1-9 against ES-A1 (Not Met), ES-A4 (Cat-I/II), and FQ-A2 (Cat I/II/III):
The disposition to this F&O indicates that the independence of HPCI and RCIC is a source of uncertainty. Explain how the dependency between HPCI and RCIC was accounted for in the fire PRA.

c) F&O 1-14 against PRM-B4 (Cat-I/II/III):
This F&O indicates that cable tracing was not performed in some cases. In areas for which cable tracing was not performed, identify the assumptions made about possible plant trips and fire induced failures.

d) F&O 1-19 against FSS-A1 (Not Met):
The disposition for this F&O explains that the ZOI associated with a 143 kW HRR transient fire was used in all fires areas, except the Turbine Building where a ZOI for a 317 kW HRR fire was used. The disposition provides the basis for this lower HRR as existing and planned administrative controls, plant experience, and insights from a bounding sensitivity study. Provide further justification for the use of 143 kW transient fires. Include in this justification further description of the administrative controls used in the different areas for managing transient combustibles, the results of reviewing plant experience and records of violations of transient combustible controls, other key factors for this reduced fire size, and the results of the bounding sensitivity study referred to in the disposition. Also, confirm that 143 kW and 317 kW HRRs were the only transient fire sizes used in the fire PRA.

e) F&O 1-20 against FSS-A1 (Not Met):
As stated in the disposition, Appendix H.2 of NUREG/CR-6850 recommends that vulnerability to transient fires be limited to cable vulnerability. However, Appendix H.2 also recommends that if sensitive electronics can be impacted, then ignition of such components should be also considered. Describe how the impact on sensitive electronics from transient fires is modeled in the fire PRA (Refer to the draft FAQ under development on sensitive electronics). If this impact was not considered provide a sensitivity study that estimates this impact on CDF and LERF, and Δ CDF and Δ LERF.

f) F&O 1-26 against HR-G1 (Cat 1), FSS-B2 (Cat II), and HRA-C1 (Cat II):
Describe how the Human Reliability Analysis (HRA) was performed for alternate shutdown following control room abandonment. Include in this description:

i. Identification of events or conditions that prompt the decision to transfer command-and-control from the MCR to the alternate shutdown station. Clarify how the loss-of-control due to fires in the Main Control Room or Cable Spreading Room was modeled.

ii. Explanation of how timing was established (i.e., total time available, time until a cue is reached, manipulation time, and time for decision-making) and which fire or fires were used as the basis for the timing. Include in the explanation the basis for any assumptions made about timing.

iii. Discussion of how different core damage end-states defined by the Abandonment HRA Event Trees presented in Attachment 10 of BNP-PSA-084 were incorporated into the fire PRA, given that some sequences resulted in early and others resulted in late core damage.

iv. Description of how the feasibility of the operator actions supporting alternate shutdown was assessed.

v. Justification for assuming that continuous communication and coordination will occur during implementation of 0ASSD-02 by the different operators at their different locations. Include consideration of actions that require taking off headsets or the unavailability of phone systems.

vi. Description of how the impact of complexity on coordination of actions and operator performance in 0ASSD-01 and 0ASSD-02 was addressed.

vii. Description of the treatment of potential dependencies between individual actions, including discussion of operator actions that can impact the actions of other operators.

g) F&O 1-30 against FSS-A1 (Not met):
Describe the approach and assumptions used to model fires in open and closed cabinets, and the sensitivity study on MCCs presented in Section 4.8.3.1 of the LAR. Include in this description:

i. Confirmation that walkdowns were performed to determine open and closed cabinets.

ii. Given an MCC cubicle fire, identification of the cubicles in the MCC assumed to fail.

iii. Explanation of why the sensitivity study shows no impact on Unit 1 LERF and Δ LERF, and Unit 2 CDF, Δ CDF, LERF, and Δ LERF, while showing an increase in Unit 1 CDF and Δ CDF.

h) F&O 1-32 against FSS-C1 (Cat 1):
Provide justification for using the Heat Release Rate (HRR) associated with “other electrical fires” (i.e., 69 kW) for pump fires, rather than the HRR for a pump motor electrical fire (i.e., 211 kW), as recommended by NUREG-6850 Table G-1.

i) F&O 1-38 against LE-G2 (Not Met), LE-F3 (Not Met), UNC-A1 (Not Met), FQ-E1 (Not Met), FQ-F1 (Not Met) combined with
F&O 4-18 against QU-E3 (Cat I), QU-A3, UNC-A4 (not Met), and FQ-A4 (Cat I/II/III):
Explain how parametric data uncertainty was propagated and state of knowledge correlation (SOKC) was evaluated for fire CDF and LERF. Identify fire PRA specific parameters (e.g., hot short probabilities, fire frequencies) that can appear in a fire PRA cutset and were correlated. Justify why the SOKC was performed only for components failure modes within the same system, rather than for similar component failure modes across systems.

j) F&O 2-2 against CS-A1 (Cat I/II/III), CS-A3 (Cat I/II/III), CS-C1 (Not Met):
Document BNP-PSA-085 (Component Selection) provides a description of component selection methodology and refers to cable selection methods, but provides no description of the cable selection and location methodology. Clarify how cable selection is documented and where the methodology for the cable selection and location is described.

k) F&O 2-14 against FSS-D7 (Cat 1):
Clarify whether information from the System Health Reporting and System Notebook processes, or other sources, shows data for more than one year to confirm that the Fire Detection and Suppression Systems have not experienced “outlier behavior”. If only one year of data was used, justify whether this is sufficient.

l) F&O 2-16 against FSS-D9 (Cat 1):
Provide additional justification for not postulating smoke damage. Address in this justification the specific types of components vulnerable to smoke damage and the potential damage mechanisms presented in Appendix T of NUREG 6850.

m) F&O 4-13 against FSS-D3 (Cat 1):
Capability Category II of Supporting Requirement, FSS-D3, as clarified by RG 1.200 Rev 2, requires that significant contributors to fire risk be accurately characterized. Further justify how this requirement is met, and the criteria used to determine when fire scenarios should be modeled in more detail. Also, include identification and justification of physical analysis units and scenarios where fire modeling remains bounding rather than realistic.

n) F&O 4-14 against FSS-E3 (Cat I), FSS-H5 (Cat I), FSS-H9 (Cat I/II/III), UNC-A2 (Cat I/II/III),:
Explain how CDF and LERF uncertainty was treated. Include clarification of the extent to which quantitative statistical representation of uncertainty was used to evaluate fire CDF and LERF, and the extent to which qualitative discussion was used to characterize uncertainty for significant fire scenarios. For sources of uncertainty qualitatively characterized explain, per Supporting Requirement QU-E4, how the fire PRA is affected by these sources of uncertainty.

o) F&O 5-13 against QU-D2 (Not Met), QU-F3 (Cat I), FQ-E1 (Not Met), and FQ-F1 (Not Met):
The disposition to this F&O indicates that a review was performed on fire PRA modeling to confirm that no inconsistencies were created between sequence and system modeling, or between the fire PRA and how the plant is operated. This discussion of this review is not apparent in the cited documentation (BNP-PSA-085). Describe this review and identify where it is documented.

p) F&O 5-15 against QU-F2 (Cat I/II/III), QU-F3 (Cat I), QU-D6 (Cat I), QU-D7 (Not Met), FQ-E1 (Not Met), and FQ-F1 (Not Met) combined with
F&O 5-16 against LE-F1 (Not Met), LE-F2 (Cat I), LE-G3 (Not Met), UNC-A1 (Not Met), FQ-E1 (Not Met), and FQ-F1 (Not Met):
Describe the assessment performed to determine the significant risk contributors and risk importance events and failures for CDF and LERF. Clarify how the insights from importance analysis was used to review the correctness and reasonableness of the fire PRA modeling.

q) F&O 5-18 against LE-G2 (Not Met), LE-F3 (Not Met), LE-G4 (Not Met), UNC-A1 (Not Met), UNC-A2 (Cat I/II/III), FQ-E1 (Not Met), and FQ-F1 (Not Met):
These F&Os note that uncertainty and importance analysis was not performed for fire LERF. Describe the sources of uncertainty and results of importance analyses of fire LERF.

r) F&O 6-1 against CS-B1 (Cat II) and CS-C4 (Not Met):
It is not clear from the documentation if the breaker coordination studies for Brunswick Unit 1 and 2 are complete. It is stated in Section 3.3.1.7 of the LAR that “short circuit and coordination calculations shall be updated as necessary”, and it is noted that there are several breaker coordination Change Packages, and revised packages, documented in BNP-PSA-080. Attachment 36 of BNP-PSA-080 states that three raceways could not be routed. In light of these observations:

    i. Clarify how the breaker coordination study assessed the three raceways that could not be routed, given that breaker coordination is assessed based on length of cable.

    ii. Clarify that all panels modeled in the fire PRA have been evaluated and whether the breaker coordination study is complete.

PRA RAI 02 - Use of Unreviewed Analysis Methods (UAMs)

Clarify whether there are any other the Unreviewed Analysis Methods (UAMs), besides the UAM identified in Section 4.8.3.1 of the LAR, or similar deviations from NUREG/CR-6850). If so, identify and describe those methods and clarify whether guidance from the June 21, 2012, memo from Joseph Giitter to Biff Bradley was used in applying those methods (“Recent Fire PRA Methods review Panel Decisions and EPRI 1022993, ‘Evaluation of Peak Heat Release Rates in Electrical Cabinets Fires’”).

PRA RAI 03 – Transient Fire Frequency Calculation

NUREG/CR-6850 Section 6 and FAQ 12-0064 describe the process to be used for assigning influence factors for hot work and transient fires. Provide the following regarding application of this guidance:

a) Clarify that the methodology used to calculate hot work and transient fire frequencies applies influencing factors from NUREG/CR-6850 using NUREG/CR-6850 guidance or from FAQ 12-0064, using FAQ 12-0064 guidance.

b) Clarify whether administrative controls are used to reduce transient fire frequency, and if so, describe and justify these controls.

c) Clarify the basis for assigning an influencing factor of "0" to Maintenance, Occupancy, or Storage for fire compartments FC296 and FC346 (Reactor Building MSIV Pit), FC305 (Reactor Building CRD Repair Room, and FC 356 (Reactor Building Skimmer Surge Tank Room Vault).

d) Provide a sensitivity study using a weighting factor of "50" per the guidance in FAQ 12-0064.

PRA RAI 04– Transient Fire Placement at Pinch Points

Per NUREG/CR-6850 Section 11.5.1.6, transient fires should at a minimum be placed in locations within the plant Physical Analysis Unites (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, including the cabling associated with each. Transient fires should be placed at all appropriate locations in a PAU where they can threaten pinch points. Hot work should be assumed to occur in locations where hot work is a possibility, even if improbable (but not impossible), keeping in mind the same philosophy. Describe how transient and hot work fires are distributed within the PAUs at your plant. In particular, identify the criteria for your plant which determine where an ignition source is placed within the PAUs. Also, if there are areas within a PAU where no transient or hot work fires are located since those areas are considered inaccessible, describe the criteria used to define "inaccessible." Note that an inaccessible area is not the same as a location where fire is simply unlikely. If there are "inaccessible" locations where hot work or transient fires are improbable, and these locations are pinch points, provide a sensitivity study to determine the possible risk increase reflecting the possible size and frequency of fires in these locations.

PRA RAI 05 – Use of Incipient Detection in the MCR

The sensitivity study presented in Section 4.8.3.6 of the LAR removes credit for incipient detection that will be installed in the Main Control Room (MCR) Main control Boards. Explain why the sensitivity study results indicate no change (i.e., 0%) in Δ CDF but relatively significant change (i.e., +48%) in Δ LERF.

PRA RAI 06 - MCR Fire Modeling

Attachment 6 of BNP-PSA-080 states that a Main Control Room (MCR) fire that does not result in a manual or automatic shutdown and is "contained" would be treated as a "non-event" by the fire PRA. Explain how Main Control Board (MCB) and cabinets fires in the MCR were modeled. Include in this explanation:

a) Discussion of how MCB or cabinet fire propagation was considered and which cabinet fires were considered "contained,"

b) Discussion of placement and explanation of the basis for placement of transient fires including how open back panels were considered,

c) Clarification of credit taken for ion smoke detectors mentioned in Attachment 6.

PRA RAI 07 – Fire Induced Instrument Failure

Fire-induced instrument failure should be addressed in the HRA per NUREG/CR-6850 and NUREG-1921. Describe how fire-induced instrument failure (including no readings, off-scale readings, and incorrect/misleading readings) is addressed in the fire HRA. Include discussion of instrumentation that was modeled explicitly in the fault trees, the success criteria assumed for this modeling, and how explicit modeling of instrumentation was done in the evaluation of HEPs.

PRA RAI 08 – Fire PRA Modeling of HVAC

Describe how HVAC modeling was performed to support the fire PRA, and whether HVAC cable tracing and fire modeling was performed to support this modeling. Confirm that additional operator actions are not needed for crediting HVAC. Heat load calculations performed for the internal events PRA do not account for the additional heat load from fires. Confirm that heat load from fires do not fail additional equipment in rooms that do not credit HVAC.

PRA RAI 09 - Wrapped or Embedded Cables

Identify if any variance from deterministic requirements (VFDRs) in the LAR involved performance-based evaluations of wrapped or embedded cables. If applicable, describe how wrapped or embedded cables were modeled in the Fire PRA, including assumptions and insights on how these cables contributes to the VFDR delta-risk evaluations.

PRA RAI 10 - Bases for Total Reported Plant CDF and LERF

Attachment W of the LAR presents the total CDF and LERF for Units 1 and 2 and breaks down the CDF from each of the following contributors: "Internal Events (including internal flooding)", "External Flood" "High Wind", "Seismic", and "Fire". The seismic CDF (6.2 E-8/yr for Unit 1 and 6.E-8/yr for Unit 2) used in this estimate appears to be low compared to the seismic CDF estimate (1.5E-5/yr) presented in a memorandum from NRC staff dated September 2010 providing updated results for Generic Issue 199 (memo titled: Safety/Risk Assessment Results for Generic Issue 199, Implication for Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United states on Existing Plants"). Also, the CDF provided for internal events (7.9E-6/yr) appears much lower than the internal events CDF (4.2E-5/yr) reported in NUREG-1437, Supplement 25, dated 2006, for the BSEP license renewal environmental report. Identify the bases for the internal and seismic events CDFs and LERFs presented in the LAR, and justify the adequacy of these risk estimates for this application

PRA RAI 11 – Risk of MCR Abandonment

Attachment 16 of BNP-PSA-080 describes how the risk of main control room abandonment was calculated for fire in Fire Area CB-23E. Address the following:

a) No transient fire scenarios were postulated in the region of the MCR where operators manipulate controls, either for loss-of-control or for abandonment. The guidance in NUREG/CR-6850 is to evaluate transient fires in the control room, including its potential contribution to abandonment. Please complete this evaluation and provide the results. One approach is to provide a sensitivity analysis that assesses the impact on CDF, LERF, ΔCDF, and ΔLERF of postulated transient fires in the MCR.

b) The abandonment risk is highly sensitive to whether the MCR electrical cabinets are assumed to be single bundle cables or multiple bundle cables. Provide justification for the assumption that the MCR cabinets only contain single bundle cables. If cabinets containing multiple bundle cables are present in the MCR, provide the results of a sensitivity analysis accounting for the MCR cabinets that contain multiple bundle cables.

PRA RAI 12 - Calculation of VFDR Δ CDF and Δ LERF

Attachment W of the LAR provides the ΔCDF and ΔLERF for the variances from the deterministic requirements (VFDRs) for each of the fire areas, but the LAR does not describe how ΔCDF and ΔLERF were calculated. Describe the method(s) used to determine the changes in risk reported in the Tables in Appendix W. The description should include:

a) A description of how the reported changes in risk (i.e. VFDR risk) were calculated. Include in this description any exceptions to the normal modeling mechanisms such as cases where not enough resolution exists in the PRA to model the VFDR. Also, clarify whether FAQ 08-0054 guidance was used, and describe the use of any data or methods that were not included in the fire PRA Peer Review.

b) A separate description specific to how the ΔCDF and ΔLERF were calculated for the MCR (Fire Area CB-23E). Include in the description how this calculation was performed for loss-of-control scenarios and for control room abandonment scenarios (i.e., alternate shutdown).

PRA RAI 13 – Scenario Results Asymmetry Between Unit 1 and 2

Attachment W of the LAR presents fire scenario results for the top contributors. These results indicate an asymmetry of the CDF and LERF results between Unit 1 and 2 (e.g., FC210_4525_BFM, FC213_4522_B75, FC230_4801_B75, FC230_4801_B98, FC213_4621_B75, FC230_4718_B75, FC213_4617_B75, FC230_4731_B75, FC230_4811_B75, FC212_4608_B75, FC212_4607_B75, FC210_4521_BFM). Explain the reason for this asymmetry of seemingly parallel scenarios for the two units. Also explain the asymmetries between MCR results for Unit 1 and 2.

PRA RAI 14 – Table W Results for Fire Area CB-23E

Explain how the additional risk of recovery actions was determined for abandonment scenarios.

PRA RAI 15 – Table W-4-1 & 2 Table Inconsistencies

There appears to be a number of inconsistencies in Tables W-4-1 and 2 of the LAR Supplement. Clarify the following:

a) Why "N/A" is reported in the additional risk of recovery actions column for fire areas where Recovery Actions are indicated (i.e., RB2-1, SW1-1, and TB-1).

b) Why a "below truncation" value is reported in the Δ CDF/LERF column for deterministic fire areas (i.e., AOG-1, CB-7, CB-8, DG-3, DG-4, DG-6, DG-10, DG-19, DG-20, DG-21, DG-22, ISB, MWT-1, RB1-6, RB2-6, RMCSB, RPDC1, RPDC-2, RW-1, SERV, STORES, and STORM), as opposed to indicating "N/A".

c) Why a zero value is reported in the Δ CDF/LERF column for fire areas with VFDRs (i.e., DG-13, DG-14, DUCTBANK, TB1, and Yard).

PRA RAI 16 - Implementation Item Impact on Risk Estimates

Identify any plant modifications (implementation items) in Attachment S of the LAR that have not been completed but which have been credited directly or indirectly in the change-in-risk estimates provided in Attachment W. When the effect of a plant modification has been included in the PRA before the modification has been completed, the models and values used in the PRA are necessarily estimates based on current plans. The as-built facility after the modification is completed may be different than the plans. Please add an implementation item that, upon completion of all PRA credited implementation items, verifies the validity of the reported change-in-risk. This item should include your plan of action should the as-built change-in-risk exceed the estimates reported in the LAR.

PRA RAI 17- Model Changes and Focused Scope Reviews Since Full Peer Review

Identify any changes made to the internal events PRA or fire PRA since the last full-scope peer review of each of these PRA models 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 Regulatory Guide 1.200. Also, address the following:

a) 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 Regulatory Guide 1.200, and describe any findings from that focused-scope peer review and the resolution of these findings.

b) If a focused-scope peer review has not been performed for changes characterized as a PRA upgrade, describe what actions will be implemented to comply with the ASME/ANS standard.

PRA RAI 18 - Internal Events PRA F&Os

Please clarify the following dispositions to internal events PRA F&Os identified in Attachment U of the LAR that appear to have the potential to impact the fire PRA results and do not seem fully resolved:

a) F&O 6-8 against SC-C2 (Cat I/II/III):
Identify software codes beyond MAAP that were used to establish success criteria (e.g., GOTHIC), and describe any limitations of these codes to support success criteria used in the PRA.

b) F&O 4-5 against SY-A13 (Cat I/II/III):
Based on this F&O, cited feedwater check valves (i.e., F032A or F032B) can lead to flow diversion that defeats HPCI or RCICI. The disposition to this F&O argues that these failures are two orders of magnitude lower than other HPCI or RCICI failures. Given that check valve failures are approximately 2E-4/demand, it is not clear why these failures can be dismissed per guidance in SR SY-A15. Provide further justification for dismissing these failures

c) F&O 3-3 against HR-E3 (Cat I):
F&O 3-4 against HR-E4 (Cat I):
Annex E4 of BNP-PSA-034 (Human Reliability Analysis) presents an "Operator Interview Worksheet" form and an "engineering review", but no operator interview results. Describe how and where interviews with plant operators and training staff for the purpose of confirming procedure interpretation in support of the PRA modeling are documented. Likewise, describe where and how talk-throughs with plant operators or simulator observations for the purpose of confirming the response models for the scenarios modeled in the PRA are documented.

d) F&O 2-3 against HR-I2 (Cat II/III):
Describe how Human Failure event (HFEs) were screened out and justify how those screened out in the internal events PRA but could be important in the fire PRA were evaluated.

e) F&O 2-2 against DA-C8 (Cat I):
The F&O states that actual plant specific data concerning standby time is not collected and used in the PRA. Explain how the requirement to use operational records to determine component standby time (i.e., DA-C8) is met, or justify why meeting this requirement at Capability Category II is not needed.

f) F&O 6-12 against LE-G5 (Not Met):
It is not clear what was done to resolve this F&O. Characterization of LERF uncertainty is presented in BNP-PSA-075, but limitations in the LERF analysis does not appear to be provided in this document or elsewhere. Clarify what the specific limitations in the LERF analysis are for this application.

g) F&O 1-22 against IFSO-A4 thru IFQU-B2 (Many SRs are Not Met):
For nearly all internal flooding findings presented in Attachment U of the LAR the dispositions state that internal flooding can have no impact on the fire PRA. A number of scenarios listed in Tables W-2-1 and W-2-2 of the LAR supplement are described to result in LOCAs. In general, spurious actuations have the potential to cause internal flooding. Clarify whether any fire event can result in internal flooding. If flooding can occur as a result of a fire event, then further justify why these F&Os and other internal flooding F&Os can have no impact on fire CDF, LERF, Δ CDF, and Δ LERF.

h) F&O 6-16 against IFSN-A6 (not Met) and F&O 1-33 against IFQU-A9 (Not Met)
Since spurious actuations also have the potential to cause spray effects, clarify whether any fire event can result in spray effects impacting components modeled in the PRA. If so, justify why these F&Os can have no impact on fire CDF, LERF, Δ CDF, and Δ LERF.

Programmatic Question 01

Describe the specific documents that will comprise the post transition NFPA 805 fire protection program design basis.

Describe whether documents, analyses, designs, and engineering reviews prepared to support the NFPA 805 fire protection program are managed as controlled documents under the document control process.

Programmatic Question 02

Describe how the training program will be revised to support the NFPA 805 change evaluation process, including the training by plant position and how the training will be implemented (e.g., classroom, computer-based, reading program).

Programmatic Question 03

Describe how the various configuration control and change control procedures are implemented together to ensure compliance with NFPA 805 change evaluation and configuration control requirements.

Programmatic Question 04

Describe how the combustibles loading program will be administered to ensure that the Fire Probabilistic Risk Assessment assumptions regarding combustibles loading are met.

Programmatic Question 05

LAR Section 4.7.3, “Compliance with Quality Requirements in Section 2.7.3 of NFPA 805,” does not indicate whether future NFPA 805 analyses will be conducted in accordance with the requirements of NFPA 805, Section 2.7.3. Indicate whether future NFPA 805 analysis will be conducted in accordance with NFPA 805, Section 2.7**.3.**

Programmatic Question 06

NEI 04-02 Section 4.6 indicates that the LAR should contain a “discussion of the changes to Updated Final Safety Analysis Report (UFSAR) necessitated by the license amendment and a statement that the changes will be made in accordance with 10 CFR 50.71(e).” LAR Section 5.4 indicates that after approval of the LAR, the UFSAR will be revised consistent with NEI -04-02, however, there is no description of the changes that need to be made to the current UFSAR. Describe the changes that will to be made to the current UFSAR as a result of implementing NFPA 805. Alternatively, indicate whether the UFSAR will be updated following the guidance provided in Frequently Asked Question (FAQ) 12-0062 (ADAMS Accession No. ML121980557).

Programmatic Question 07

Describe how the plant specific requirements and configuration are incorporated when corporate or fleet wide procedures are implemented at the Brunswick plant.

Fire Modeling RAI 01

National Fire Protection Association Standard 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition, (NFPA 805), Section 2.4.3.3, states: "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:

- The Generic Fire Modeling Treatments (GFMTs) approach was used to determine the ZOI for transient and oil spill fires in all fire areas throughout plant

- Fire Dynamics Tools (FDT's) were used for ZOI calculations of cabinet and cable tray fires throughout the plant

- The Consolidated Fire Growth and Smoke Transport (CFAST) model was used to calculate control room abandonment times

- Fire Dynamics Simulator (FDS) used for various fire hazard calculations

Section 4.5.1.2, "Fire PRA" of the Transition Report states that fire modeling was performed as part of the FPRA development (NFPA 805 Section 4.2.4.2). Reference is made to Attachment J, "Fire Modeling V&V [verification and validation]," for a discussion of the acceptability of the fire models that were used.

Specifically regarding the acceptability of CFAST for the Main Control Room Abandonment Times study:

a. Attachment 13 to BNP-PSA-083, Rev 2 presents a compilation of fire brigade response times from drills performed between 2002 and 2010. Of the 56 drills for which fire brigade response time data are given, 5 are for the Control Building. The responses times for these drills were 20, 21, 25, 19 and 17 minutes. On page 18 of BNP-PSA-083 it is stated that the drill times are reduced by a factor of two. During the onsite audit the licensee indicated that the reduced drill times were used as the basis for the assumption in the Main Control Room Abandonment Times study that the fire brigade is expected to arrive within 15 minutes. Describe the uncertainty associated with the 15 minute 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.

b. The Modeled Domain Section of Revision 2 of the Main Control Room Abandonment Times report on page 36 states “In spaces where the compartment height varies with position, the maximum height is assumed since this maximizes the entrainment.” This assumption may not be conservative because, everything else (heat release rate, floor area, ventilation, etc.) being the same, the hot gas layer generally will descend faster when the ceiling height is lower. Provide justification for the use of the maximum height in the CFAST analysis.

c. The sensitivity study in Appendix B of the Main Control Room Abandonment Times report: shows that poorly ventilated burning conditions result in a significant reduction of the MCR abandonment times in some scenarios. For instance, according to Table B-3, for a scenario involving a closed cabinet with multiple cable bundles and normal ventilation, poorly ventilated burning conditions result in a reduction of the abandonment time from 9.41 to 5.85 minutes. Explain how these abandonment time reductions affect the CDF, ∆CDF, LERF and ∆LERF; or provide justification for why these scenarios were not included in the Fire PRA calculations.

Specifically regarding the acceptability of the Generic Fire Modeling Treatments (GFMTs) approach:

d. Explain how the modification to the critical heat flux for a target that is immersed in a thermal plume described in Section 2.4 of the Generic Fire Modeling Treatments document was used in the ZOI determination at BNP.

Regarding the acceptability of the PSA approach, methods, and data in general:

e. Explain how the effect of the increased HRR from intervening combustibles (cable trays) on the ZOI was accounted for, or provide justification for ignoring this effect.

f. Explain how wall and corner effects in the HGL calculations were accounted for, or provide a justification if these effects were not considered.

g. The Fire PRA Walkdown Instructions indicate that generally a 3’ × 3’ footprint was assumed for transient combustibles, and that the vertical ZOI was measured from the floor (see page 8 of FPIP-200, Rev 8). Actual transient fires may have a smaller area and their base may be elevated above the floor. Provide justification for the transient fire areas and elevations that were assumed during the walkdowns. Explain how deviations from these assumptions, i.e., smaller actual transient fire area and/or higher transient fire base elevation, affect the risk (CDF, ∆CDF, LERF and ∆LERF).

h. Address how it was assured that cables not credited in the PRA and non-target and non-cable intervening combustibles were not missed in all areas of the plant. Provide information on how intervening combustibles were identified and accounted for in the fire modeling analyses.

i. Attachment 7 to BNP-PSA-080, Rev. 2, discusses the multi-compartment analysis (MCA). Section 1.1.2 discusses some of the underlying assumptions in the MCA, which include that (1) an open surface area of approximately 9 ft^2 is a general rule of thumb for the minimum area between compartments to transmit a HGL, and (2) the zone of influence is defined as approximately 5 ft vertical and 2 ft horizontal. The licensee stated that this is appropriate, based on discussions with industry experts, which concluded that "the heat diffusion in the adjacent room would limit the HGL to a local area around the failed barrier." Provide additional information about how these two sets of criteria were specifically used in the MCA at BNP.

Fire Modeling 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.

Section 3.1.1.b of the Hot Gas Layer Calculation (BNP-MECH-HGL-001, Rev 1), states that "BNP predominantly has thermoset cables so the damage criteria associated with thermoset cables has been used in this analysis."

Provide the following information:

a. How was the installed cabling in the power block 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. Section 2.0 of the GFMTs document provides a discussion of damage criteria for different types of targets. Section 2.1 of the GFMTs document states: "Damage to IEEE-383 qualified cables is quantified as either an imposed incident heat flux of 11.4 kW/m^2 (1 $Btu/s\text{-}ft^2$) or an immersion temperature of 329°C (625°F) per Nuclear Regulatory Guidance [NRC, 2005, NUREG 6850, 2005]." Section 2.2 of the GFMTs document states: "Damage to non-IEEE-383 qualified cables is quantified as either an imposed incident heat flux of 5.7 kW/m^2 (0.5 $Btu/s\text{-}ft^2$) or an immersion temperature of 204°C (400°F) per Nuclear Regulatory Guidance [NRC, 2005, NUREG 6850, 2005]."

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

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

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

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

Fire Modeling RAI 03

NFPA 805, Section 2.7.3.2, "Verification and Validation," states: "Each calculational model or numerical method used shall be verified and validated through comparison to test results or comparison to other acceptable models."

Section 4.5.1.2, "Fire FPRA" of the Transition Report states that fire modeling was performed as part of the Fire PRA development (NFPA 805 Section 4.2.4.2). Reference is made to Attachment J, "Fire Modeling V&V," for a discussion of the V&V of the fire models that were used.

Furthermore Section 4.7.3 "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805" of the Transition Report states "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. Attachment J of the LAR does not provide the V&V basis for the following fire models and correlations that were used in the transition:
    a. All models and correlations that were used in the development of the GFMTs.
    b. Method to determine the “heat soak” time in the MQH hot gas layer calculations for naturally vented compartments, described in Section 3.3.1.1 of BNP-MECH-HGL-0001, Rev. 1.
    c. Method to determine the “heat soak” time in Beyler’s hot gas layer calculations for closed compartments, described in Section 3.3.2.1 of BNP-MECH-HGL-0001, Rev. 1.
    d. Method to account for the “cable thermal endurance duration” in the calculation of the thermal damage time of cables above a burning electrical cabinet, described in HNP-M/MECH-1194.
    e. Method to determine the horizontal ZOI described in HNP-M/MECH-1129, Rev 0.
    f. Method to determine the radiant energy target damage profile described in NED-M/MECH-1007, Rev 0.
    g. Fire Dynamics Simulator (FDS), in particular the version(s) that were used in the analyses in support of the NFPA 805 transition at BNP.

    Revise Attachment J to the LAR to include a discussion of the V&V basis of these models and correlations, and describe their application in the transition at BNP.

b. Provide technical details to demonstrate that fire models that were used in the NFPA 805 transition at BNP have 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 or other V&V basis documents.

c. The discussion for the flame height calculation in Table J-1 states incorrectly that it “is used in both the CFAST and FDS.” Revise the discussion to correct this error.

Fire Modeling RAI 04

NFPA 805, Section 2.7.3.3, "Limitations of Use," states: "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."

Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," of the Transition Report 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 parts of the GFMTs that were used in the transition at BNP have an applicability section, which discusses the limitations of the treatments described in each part. Explain how it was ensured that the GFMTs were used within their limits of applicability, or that uses of the GFMTs outside their limits of applicability were justified.

b. The following documents describe the ZOI, HGL and MCA and related calculations performed in support of the transition at BNP.
   a. BNP-MECH-HGL-001, Rev 1, “Hot Gas Layer Calculation”
   b. BNP-PSA-080, Attachment 7, Rev 1, “Multi-Compartment Analysis”
   c. BNP-PSA-080, Attachment 19, Rev 1, “Cable Tray Fire Propagation”
   d. HNP-M/MECH-1129, Rev 0, “Fire Zone of Influence Calculation”
   e. HNP-M/MECH-1194, Rev 0, “Thermal Damage Time of Cables above a Burning Electrical Cabinet”
   f. NED-M/MECH-1006, Rev 0, “Generic Fire Modeling Treatments”
   g. NED-M/MECH-1007, Rev 0, “Radiant Energy Target Damage Profile”

   Each of these documents has a section that describes the assumptions and limitations of the calculations presented in the document. Explain how it was ensured that the results of these calculations were used within their limits of applicability, or that uses of these results outside their limits of applicability were justified.

c. Demonstrate that FDS was used within its scope, assumptions and limitations to evaluate the effect of fire-induced flow in a MCC (see HNP-M/MECH-1207, “Fire Induced Flow within a Motor Control Center,” Rev 0).

Fire Modeling RAI 05

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

Section 4.5.1.2, "Fire PRA" of the Transition Report states that fire modeling was performed as part of the FPRA development (NFPA 805 Section 4.2.4.2). This requires that qualified fire modeling and PRA personnel work together. Furthermore, Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," of the Transition Report 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, CP&L has developed and maintains qualification requirements for individuals assigned various tasks. Position-Specific Guides have been 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.
>
> ESG0089N-Fire Probabilistic Safety Assessment Engineer (Quantification)
> ESG0093N-Fire Probabilistic Safety Assessment Engineer (Initial Development)
> ESG0094N-Fire Probabilistic Safety Assessment Engineer (Data Development), and
> ESG0105N-Basic Fire Modeling"

Regarding qualifications of users of engineering analyses and numerical models:

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

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

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

Fire Modeling RAI 06

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

Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," of the Transition Report states that "Uncertainty analyses were performed as required by 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” uncertainty was accounted for in the fire modeling analyses.

c. Describe how the “completeness” uncertainty was accounted for in the fire modeling analyses.

Radioactive Release Question 01

For areas where containment/confinement is relied upon, provide the qualitative/quantitative assessment.

a. For Liquids:
   1) Identify where the capacities of sumps, tanks, transfer pumps, etc., is provided.
   2) Identify any operator actions. (e.g., to direct effluent flow/overflow with temporary measures (drain covers, etc.))
   3) Identify if any of the sumps being relied upon, have auto pump out features. (an automatic discharge/release at a certain sump level)
   4) Identify if there are any plant features that may divert the effluent flow that were not taken into account (e.g., Aux. Bld. roll-up doors).

b. For Gaseous
   1) Identify where filtering and monitoring of confined gaseous (smoke) effluent is addressed.
   2) Identify any operator actions (e.g., “manual” ventilating fire areas to other ventilated areas)
   3) Identify if there are plant features that can bypass the planned filtered/monitored ventilation pathway that have not been accounted for.

Radioactive Release Question 02

For areas where containment/confinement is not available, provide the quantitative assessment (liquid and/or gaseous as appropriate). Identify whether the assessment credits operator actions.

Radioactive Release Question 03

Indicate whether any of the operator actions identified in the assessments are addressed in the fire pre-plans and fire brigade training materials. Provide examples.