NRR-PMDAPEm Resource

From: Wall, Scott
Sent: Thursday, July 11, 2013 4:23 PM
To: ERICKSON, JEFFREY S
Cc: Chawla, Mahesh; Robinson, Jay
Subject: DRAFT Palisades Audit RAIs
Attachments: Palisades Audit RAIs DRA Final MF0382.docx

Jeff

By letter dated December 12, 2012, (ADAMS Accession No. ML12348A455), as supplemented by letter dated February 21, 2013 (ADAMS Accession No. ML13079A090) Palisades Nuclear Plant, (PNP) submitted a license amendment request (LAR) to transition the fire protection licensing basis at PNP, 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).

The NRC staff Fire Protection, PRA Licensing, and Health Physics & Human Performance Branches have reviewed the information provided by PNP and also participated in an audit from June 24 to June 28, 2013 and have determined that additional information is needed to complete the review. Enclosed are requests for additional information (RAIs) in the draft stage.

Please contact the PNP Project Manager at 301-415-8371, Mahesh.Chawla@nrc.gov, me at 301-415-2855, Scott.Wall@nrc.gov, or Robert Carlson, Branch Chief, NRR/DORL/LPL3-1 at 301-415-1995, Robert.Carlson@nrc.gov, as soon as possible to schedule a tele-conference if needed. During the tele-conference, the NRC staff expects that you will also provide a response timeline to respond to these RAIs along with justification for response times greater than 60 days.

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

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REQUEST FOR ADDITIONAL INFORMATION

VOLUNTARY FIRE PROTECTION RISK INITIATIVE

ENTERGY NUCLEAR OPERATIONS, INC.

PALISADES NUCLEAR PLANT

DOCKET NO. 50-255

Fire Protection Engineering (FPE) RAI 01

License Amendment Request (LAR) Attachment A, Table B-1 Section 3.3.1.2(1) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12348A455) states that approval is requested for the use of non-pressure impregnated or fire retardant wood used within the power block. LAR Attachment L, Approval Request #2 states that the administrative procedure used to control combustibles will be revised to place stricter requirements on areas that are deemed risk significant, but does not detail these requirements. In addition, the approval request appears to indicate that permanent untreated wood can be installed as long as it is addressed by the combustible loading calculation. Describe the additional administrative controls and any compensatory measures that are intended to be put in place when using untreated wood in the power block. Include a description of the controls that will prevent the permanent installation of untreated wood.

FPE RAI 02

The compliance basis for LAR Attachment A, Table B-1, Section 3.3.1.2 (4), states that "ENO procedure EN-DC-161, section 5.6, sets forth limits on the types and quantities of stored combustible materials with the applicable Combustible Control Zones defined in Attachment 9.5." Provide a more detailed description of those limits on type and quantities as applied to Combustible Control Zones.

FPE RAI 03

The compliance statement for LAR Attachment A, Table B-1, Section 3.3.6 is "complies with clarification". National Fire Protection Association Standard 805, "Performance-Based Standard for Fire Protection for Light-Water Reactor Electric Generating Plants" (NFPA 805), Section 3.3.6, requires metal roof coverings be Class A as determined by tests described in NFPA Standard 256, "Standard Methods of Fire Tests of Roof Coverings". The compliance basis states that since the testing requirements are more stringent for a Factory Mutual (FM) Class 1 assembly, it can be substituted for a Class A roof assembly. Provide an evaluation justifying the use of the alternate requirement and include a discussion of how all the requirements of Class A are met.

FPE RAI 04

LAR Attachment A, Table B-1, Section 3.3.8, "Bulk Storage of Flammable and Combustible Liquids", identifies controls in place for storage of flammable and combustible liquids inside structures containing systems, equipment or components important to nuclear safety; but does not address the prohibition of bulk storage of these liquids in accordance with Section 3.3.8 of NFPA 805. Provide additional information of how this requirement is met.

FPE RAI 05

NFPA 805, Section 3.4.1(c) specifically requires the fire brigade leader and two members to have sufficient training and knowledge of nuclear safety systems to understand the effects of fire and fire suppressants on nuclear safety performance criteria. In Regulatory Guide (RG) 1.189, "Fire Protection for Nuclear Power Plants", Rev. 2, the staff has acknowledged the following example for the fire brigade leader as sufficient : "The brigade leader and at least two brigade members should have sufficient training in or knowledge of plant systems to understand the effects of fire and fire suppressants on safe-shutdown capability. 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."

LAR Attachment A, Table B-1, Section 3.4.1(c) indicates compliance with this requirement. The compliance basis does not specify the details of this training and knowledge.

Describe the requirements of NFPA 805 Section 3.4.1(c) are met with regard to training and qualifications for the brigade leader and at least two of the brigade members.

FPE RAI 06

LAR Attachment A, Table B-1, Section 3.5.5, contains the requirements for separation of fire pumps. The compliance basis indicates that clarification of previous approval is being requested in LAR Attachment T. The request in Attachment T states that "ENO is requesting that the prior approval of the protection and separation of the service water pumps and diesel fire pump, P-41, be considered acceptable under the new licensing basis." The request further states that the "diesel fire pump P-41 was not sufficiently protected from the service water pumps to provide reasonable assurance that a single fire would not damage both normal and alternate shutdown capability." The separation described in LAR Attachment T, Prior Approval Clarification Request 1, is not the separation requirement described in Chapter 3, Section 3.5.5, of NFPA 805. The prior approval deals with safe shutdown separation to meet service water redundancy and not fire pump separation. Provide a justification for how "previous approval" or the fire pump separation requirements of Section 3.5.5 of NFPA 805, both physically and electrically are met.

FPE RAI 07

LAR Attachment L, Approval Request 10, indicates approval is requested for the use of the fire water system for non-fire emergency and non-emergency activities. The request indicates examples of non-emergency uses of fire protection water. Provide an estimated, total or bounding, flow and pressure demand for such non-emergency uses, and a discussion of any administrative or work controls that will be used to ensure the fire protection water supply is available when needed for fire protection.

Safe Shutdown Analysis (SSA) RAI 01

LAR Attachment C, Table B-3, Fire Area 13 (Aux Building 590 Corridor), VFDR ENP-1467 identifies CV-0910, 911, and other valves as potentially failing closed for a fire, and dispositioned as no modification, recovery action, or defense in depth (DID) is required because risk, safety margin, and DID are met without further action.

However, LAR Attachment G, Table G-3 "Operator Actions Required for Additional Risk Reduction" lists for all fire areas (except 1) the need for a Recovery Action (RA) for the primary coolant pump seal cooling from the main control room (MCR). Additionally, LAR Attachment S, Table S-2, Item S2-14, identifies a modification being performed to prevent this spurious closure potential. Provide clarification for this RA and/or modification.

SSA RAI 02

LAR Attachment S, Table S-2, Item S2-1 identifies that a new auxiliary feedwater (AFW) pump will be installed in a dedicated hardened structure within the protected area (PA). The pump will have local control only (with no connection to the control room (CR) or auxiliary shutdown panel (ASP)) and will be equipped with local flow monitoring instrumentation. Describe how the feasibility of using this external facility/ component factored into the RAs that rely on the new AFW pump. Describe the diagnostic instrumentation that will be available to the operators at this location. Describe any remote controls in the new building. Describe the methods to monitor and control steam generator (SG) Levels. Identify which implementation item in LAR Attachment S, Table S-3, covers procedures and training for the new AFW pump.

SSA RAI 03

LAR Attachment F describes the process for evaluating multiple spurious operations (MSOs). The staff noted that the licensee used the expert panel approach per frequently asked question (FAQ) 07-0038, "Multiple Spurious Operation Resolution", Rev. 3, (ADAMS Accession Number ML103090608). Step 1 of the approach identifies information sources to be considered in the analysis including generic and plant-specific sources. In the "Results of Step 1," the licensee cites draft sources of information for MSOs during both reviews that were performed and does not cite any update based on completed references. Describe the process used to review final documents to ensure no changes had occurred to the draft documents that could affect the results and confirm the completion of that activity, or the identification of future work in the implementation tables of LAR Attachment S.

SSA RAI 04

LAR Section 4.5.2.2 and Figure 4-7 summarizes the approach to evaluating DID and safety margin in the resolution of variance from deterministic requirements (VFDRs). Under the heading, "Disposition of VFDR," the LAR indicates the results of the risk evaluation, DID, and safety margin are summarized in LAR Attachment C. LAR Attachment C includes a standardized statement or summary of DID and safety margin for the VFDRs. Provide additional discussion of the methods and criteria for evaluating DID and safety margins and summarize the results, as required by Section 4.2.4.2 of NFPA 805. The description should include what was evaluated, how the evaluations were performed, and what, if any, actions or changes to the plant or procedures were taken to maintain DID or sufficient safety margins.

SSA RAI 05

LAR Section 4.2.1.2 addresses the safe and stable condition as hot shutdown. Provide a more detailed description of the systems, evolutions, and resources required to maintain this condition. Include the following items:

a) LAR Section 4.2.1.2, "Safe and Stable Conditions for the Plant, End State Characterization" states that the internal events model does not take credit for repairs, but it does not describe what is credited in the fire probabilistic risk assessment (FPRA). The LAR also states that "Consequences of failures that occur when hot shutdown is reached were examined to ensure that a safe and stable state is achieved. If a safe and stable state was not achieved, then an appropriate plant damage state was assigned." Provide clarification as to what "an appropriate plant damage state" means and how it is used. Describe whether repairs were required to establish a safe and stable condition for the FPRA. If so, explain what repairs were considered, and how they were included in the model.
b) Provide a description of system capacity limitations and/or time-critical actions for systems (e.g., gas/air supply for control valves, boron supply, direct current (DC) battery power, diesel fuel) needed to maintain safe and stable conditions similar to what was provided for AFW system water supply (100,000 gallons/8 hours).
c) Provide a more detailed qualitative description of the level of risk associated with the failure of operator actions and equipment necessary to sustain safe and stable conditions for an extended period of time.

SSA RAI 06

The review of the circuit analysis calculation indicated instructions that stated "it is not required to determine all possible combinations of cable/contact faults that may cause a given failure mode. If one combination of failures is identified, tag the necessary cables with the appropriate fault code and proceed to check combinations of other cables not yet labeled with a given fault code." In order to clarify that all failure modes were considered, provide more detail with regard to this assumption including some examples. Explain how this assumption aligns with NEI 00-01, "Guidance for Post-Fire Safe Shutdown Circuit Analysis", Rev. 2.

Additionally, one of the purposes of the analysis was to determine cable locations and to validate routing information was complete and continuous. The conclusion did not address whether this was accomplished. Describe how the calculation met that purpose. If cable routing was not complete and continuous, describe the assumptions that were made with regard to the FPRA.

SSA RAI 07

In LAR Attachment G, Table G-2, for Fire Area 23, the staff noted that a recovery action may be required to provide portable fans for cooling to the CR based on a postulated fire in Fire Area 22, turbine lube oil room. During the audit, the licensee indicated the portable fans used for this recovery action are gasoline powered.

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 structures, systems, and components 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 structures, systems, and components.

The use of gasoline near the CR does not align with GDC-3. The use and refueling of a portable gasoline-powered blower presents a hazard to equipment important to nuclear safety. The use of portable fuel-fired equipment should be consistent with the requirements of GDC-3.

Provide an approach to resolving the subject VFDRs and providing CR ventilation that is consistent with the requirements of GDC-3.

SSA RAI 08

Provide the following pertaining to non-power operations (NPO) discussions provided in LAR Section 4.3, and LAR Attachment D:

a) LAR Section 4.3.2 states that incorporation of the recommendations from the 'KSF pinch point' evaluations into appropriate plant procedures prior to implementation will be done to ensure the requirements of NFPA 805 are met. Identify and describe the changes to outage management procedures, risk management tools, and any other document resulting from incorporation of key safety functions (KSF) identified as part of NFPA 805 transition. Include changes to any administrative procedures such as “Control of Combustibles”.
b) LAR Section 4.3.2 states that for those components which had not previously been analyzed in support of the at-power analysis or whose functional requirements may have been different for the non-power analysis, cable selection was performed in accordance with approved project procedures. If any new components were added to the analysis, describe the difference between the at-power safe shutdown function and the NPO function. Include a description by system indicating why components would be selected for NPO and not be included in the at-power analysis.
c) Provide a list of KSF pinch points by fire area that were identified in the NPO fire area reviews using FAQ 07-0040, “Non-Power Operations Clarifications”, (ADAMS Accession No. ML082200528, closure memo) guidance including a summary level identification of unavailable paths in each fire area. Describe how these locations will be identified to the plant staff for implementation.
d) During NPO modes, spurious actuation of valves can have a significant impact on the ability to maintain decay heat removal and inventory control. Provide a description of any operator actions being 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 (e.g., pre-fire rack-out, actuation of pinning valves, and isolation of air supplies).
e) During normal outage evolutions certain NPO credited equipment will have to be removed from service. Describe the types of compensatory actions that will be used during such equipment down-time.

f) The description of the NPO review for the LAR does not identify locations where KSFs are achieved via operator actions or for which instrumentation not already included in the at-power analysis is needed to maintain safe and stable conditions. Identify those operator actions 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.

SSA RAI 09

LAR Table 4-3 for the 1-C Switchgear Room (fire area 4) identifies the use of “concrete wrap” as a fire protection feature used for NFPA 805 compliance. LAR Attachment A, Table B-1, Section 3.11.5 states that the only raceway wrap credited in the nuclear safety capability assessment (NSCA) is Junction (pull) Box J1198 and the power cable conduits for Service Water (SW) Pump P-7A. Junction (pull) Box (JB J1198) is described as being enclosed in a one-hour-rated concrete enclosure. Describe how this complies with Section 3.11.5 of NFPA 805. Describe the rated compliance configuration, and the technical basis used to obtain the rating.

SSA RAI 10

LAR Attachment S, Table S-2, “Plant Modifications Committed” listed the proposed modifications S2-2; S2-3; S2-6; S2-7; S2-8; S2-9; S2-10; S2-13; S2-15; S2-16; S2-17;S2-18;S2-21; S2-23; S2-24; S2-25; and S2-26. With respect to compensatory measures currently in place, provide a statement regarding whether or not compensatory measures have been implemented in accordance with the plant’s fire protection program for the listed modifications.

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

Contrary to Regulatory Guide 1.200, “An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities,” Rev. 2, it is not clear that all the peer review F&Os were resolved to bring them into alignment with Capability Category (CC) -II (Met) or justified why a lesser CC was acceptable. Clarify the following dispositions to fire F&Os and Supporting Requirement (SR) assessments identified in Attachment V of the LAR that have the potential to impact the FPRA results:

a) <u>F&O CS-A9-01 against CS-A9:</u>
Confirm that the supplemental analysis work discussed in the disposition to this F&O considered proper polarity hot shorts on ungrounded DC circuits up to and including two independent faults. Additionally, describe what portions of the cable analysis have yet to be integrated into the FPRA model, and discuss the quantitative impact of this exclusion on the risk estimates, clarifying the anticipated numerical changes referenced in Table 2, “Supplemental Information to Table V-1”, of the LAR supplement dated February 21, 2013 (ADAMS Accession No. ML13079A090).

b) <u>F&O CS-B1-01 against CS-B1 and F&O CS-C4-01 against CS-C4:</u>
Attachment 2 of EA-APR-95-004 (Rev. 5) notes that “the coordination was not verified for some power sources” and states that “these coordination issues are being addressed through the PRA model”. Provide additional clarification regarding the treatment of breaker coordination issues in the FPRA, particularly for those power sources for which coordination could not be verified or demonstrated.

c) <u>F&O CS-C1-01 against CS-C1:</u>
The disposition to this F&O states that the results of the data verification performed on cable routing have not been fully implemented into the FPRA model. Describe the results of the verification process, and discuss the quantitative impact of this exclusion on the risk estimates, clarifying the anticipated numerical changes referenced in Table 2, “Supplemental Information to Table V-1”, of the LAR Supplement dated February 21, 2013.

d) <u>F&O ES-A2-01 against ES-A2 and ES-B4:</u>
This F&O cites incomplete treatment of interlock and permissive circuits. Describe the process utilized to review power supply, interfacing equipment (e.g., interlocks, permissives, autocontrol functions, etc.), instrumentation, and support system dependencies to identify additional equipment whose fire-induced failure, including spurious actuation, could result in a fire-induced initiating event or adversely affect accident mitigating equipment. Evaluate the impact on the FPRA (i.e., core damage frequency (CDF), large early release frequency (LERF), delta (∆)CDF and ∆LERF) of not completing the treatment of interlock and permissive circuits.

For self-approval, complete the on-going evaluation of instrumentation that could potentially affect accident mitigating equipment, and complete the associated cable tracing as appropriate. Provide revised risk results (i.e., CDF, LERF, ∆CDF and ∆LERF) based on this modeling update.

e) <u>F&O ES-A5-01 against ES-A5:</u>

Appendix B of the MSO Report states that “the PCP seal module is currently undergoing an update for consistency with the latest CEOG guidance and to ensure the potential for multiple spurious operations failure modes due to specific fire scenarios can be captured”. Provide additional information regarding this update and its status. Additionally, confirm whether related modeling changes have been integrated into the FPRA model; if not, discuss the quantitative impact.

f) F&O ES-C1-01 against ES-C1:
This F&O cites incomplete treatment of instrumentation needed to support operator actions. Describe how fire-induced instrument failure (including no readings, off-scale readings, and incorrect/misleading readings) is addressed in the human reliability analysis (HRA) credited in the FPRA. Include discussion of the success criteria assumed for this modeling and description of how instrumentation that is relied on for credited operator actions was identified and verified as available to a level of detail commensurate with the risk importance and quantification of the human error probabilities (HEPs). Evaluate the impact on the FPRA (i.e., CDF, LERF, ΔCDF and ΔLERF) of not completing the treatment instrumentation and associated cable tracing.

For self-approval, complete the on-going identification and mapping of instrumentation for credited human failure events (HFEs) in the FPRA as well as associated cable tracing. Provide revised risk results (i.e., CDF, LERF, ΔCDF and ΔLERF) based on this modeling update.

g) F&O ES-C2-01 against ES-C2 and F&O HRA-A3-01 against HRA-A3 and HRA-B4:

1. There appears to be no documented process for systematically identifying and defining HFEs that may result in an undesired operator response (i.e., error of omission or commission) to spurious cues and indication as recommended in Section 3.4.1 of NUREG-1921, “EPRI/NRC-RES Fire Human Reliability Analysis Guidelines.” Describe and further justify the process utilized to identify and model such actions on a fire scenario basis per HRA-A3 and HRA-B4.

   Additionally, according to Appendix H of the Model Development Report, the annunciator system is impacted by fires in almost all physical access units (PAUs); however, cable tracing was not performed. Discuss how this cable location uncertainty associated with the fire impact on alarms and annunciators is accounted for in the FPRA HRA, particularly regarding those HFEs for which the alarm or annunciator serves as the primary cue (as defined by Section 5.2.5.2 of NUREG-1921).

h) F&O FQ-C1-01 against FQ-C1:
Describe the process used to identify and evaluate HFE combinations, and further justify those assumptions identified as non-conservative in EA-PSA-FPRA-HEPDEP (Rev. 0) using guidance provided in Section 6.2 of NUREG-1921 for each branch of the dependency analysis decision tree (e.g., manpower, same location, etc.). Additionally, discuss how the timing (i.e., for simultaneous and sequential actions) and stress levels associated with HFE combinations were determined to support the dependency evaluation.

i) F&O FQ-E1-01 against FQ-E1:
This F&O cites incomplete presentation of dominant results. Describe the scope of the reasonableness review, including the number of non-significant cutsets reviewed and the criteria used to determine the extent to review them. Additionally, discuss the

assessment performed and the results obtained related to the determination and review of significant risk contributors to fire CDF and LERF, including the extent to which individual basic events (e.g., equipment failures, operator actions, common-cause failures, etc.) and FPRA-related parameters (e.g., hot short probabilities, non-suppression probabilities, etc.) are considered in the importance analysis.

j) F&O FSS-A1-01 against FSS-A1:
Section 6.1 of the Fire Scenario Development Report states that all motor control centers (MCCs) have been treated as “closed, sealed and robust in which damage beyond the ignition source will not be postulated”. However, this same section also notes that the walkdown team only addressed a selection of MCCs and appears to have limited their review to determining whether or not select MCCs were robustly secured (but not also well-sealed). Provide additional justification that all MCCs are both well-sealed and robustly secured FAQ 08-0042, “Fire Propagation from Electrical Cabinets”, (ADAMS Accession No. ML092110537, closure memo). In addition, discuss and further justify per FAQ 08-0042 any other electrical cabinets that were treated as “closed, sealed and robust”. If any do not meet these criteria, provide risk estimates (i.e., CDF, LERF, ΔCDF and ΔLERF) treating them as open cabinets.

k) F&O FSS-B1-01 against FSS-B1:
The disposition to this F&O and Section 14.2 of the Fire Scenario Development Notebook note that the current FPRA model does not specifically identity fire scenarios that result in abandonment due to equipment damage. Clarify whether MCR abandonment due to loss of control or function is not modeled for fire areas or scenarios modeled in the FPRA, and provide additional justification as needed.

l) F&O FSS-B2-01 against FSS-B2:
Describe how CDF and LERF are estimated in MCR abandonment scenarios. In doing so, discuss how abandonment scenarios modeled in the PRA reflect the equipment, instrumentation, and/or control that may or may not be available following MCR abandonment. In addition, describe the HRA approach utilized for MCR abandonment scenarios, stating if "screening" values for post MCR abandonment actions are used or if detailed human error analyses have been completed for this activity. Include a discussion of those actions credited as being performed in the MCR prior to abandonment, confirming whether such actions were treated in accordance with guidance within NUREG-1921. Also, provide the results of the HFE quantification process described in Section 5 of NUREG-1921, including the following:

i. The results of the feasibility assessment of the operator action(s) associated with the HFEs, specifically addressing each of the criteria discussed in Section 4.3 of NUREG-1921.
ii. The results of the process in Section 5.2.7 of NUREG-1921 for assigning scoping HEPs to actions associated with switchover of control to an alternate shutdown location, specifically addressing the basis for the answers to each of the questions asked in the Figure 5.4 flowchart.
iii. The results of the process in Section 5.2.8 of NUREG-1921 for assigning scoping HEPs to actions associated with the use of alternate shutdown, specifically addressing the basis for the answers to each of the questions asked in the Figure 5-5 flowchart.
iv. The results of a sensitivity analysis that shows the impact on the PRA results (i.e., CDF, LERF, ΔCDF and ΔLERF) of using the resultant scoping HEPs for MCR abandonment scenarios.

Note that results of a detailed HRA quantification per Section 5.3 of NUREG-1921 may be provided as an alternative to items l.ii and l.iii above.

m) F&O FSS-C3-01 against FSS-C3:
The resolution to F&O FSS-C3 provided in EA-PSA-FIREF&O-11-02 states that the fire impacts of an ignition source are in general bounded by assuming 98th percentile heat release rates (HRRs) from NUREG/CR-6850 and EPRI 1011989, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," at time t=0. Section 7.4 of the Fire Scenario Development Report states that refinements to this approach have been made to incorporate fire growth utilizing the MathCAD approach discussed in Appendix E. Section 2.1.1 of the Fire Scenario Development Report notes that scenarios for fixed ignition sources in PAUs 03 and 04 (1C and 1D Switchgear Rooms) are based on three HRR bins representing the 49th, 81st, and 98th-percentile HRRs; however, Appendix E does not appear to be used. Section 9.6 indicates that scenarios in PAU 02 (Cable Spreading Room) are defined based on a grid system related to the arrangement of sprinkler heads. Given the variety of approaches to fire scenario development utilized by the FPRA, provide an overview of these approaches, clarifying how target sets, severity factors and non-suppression probabilities are developed and applied for each approach. In doing so, describe the treatment utilized for the growth stages of a fire's HRR and the corresponding fire scenarios modeled in the FPRA.

n) F&O FSS-C4-01 against FSS-C4:
Section 8.3 of the Fire Scenario Development Notebook indicates that prompt suppression is credited for hot work fire scenarios using the welding suppression curve at a time of 5 minutes. Describe whether a fire watch is proceduralized for all hot work, and provide additional justification for using a time of 5 minutes in lieu of an estimated time to target damage as recommended by NUREG/CR-6850. Also, discuss whether or not any additional suppression credit is taken (e.g., automatic suppression system, delayed manual suppression, etc.).

o) F&O FSS-C5-01 against FSS-C5:
According to this F&O, no scenario was evaluated for conditions where the target damage criteria are those of sensitive electronics. Noting guidance within Appendix S of NUREG/CR-6850, provide additional justification for not modeling the potential impacts to sensitive electronics from fires in adjacent cabinets, including those within the MCR and PAUs for which detailed fire modeling was performed (e.g., 1C and 1D switchgear rooms).

In addition, although Appendix H of NUREG/CR-6850 recommends that vulnerability to transient fires be limited to cable vulnerability, Section H.2 recommends that if sensitive electronics can be impacted, then damage to and ignition of such components from transient fires should be considered. Describe how the impact on sensitive electronics from fire effects is modeled in the fire PRA.

p) F&O FSS-C7-01 against FSS-C7:
Describe the dependencies that exist amongst credited suppression paths (including dependencies associated with recovery of a failed fire suppression system), and discuss how they were evaluated and modeled.

q) F&O FSS-D1-01 against FSS-D1:

The target damage time model programmed in MathCAD is used extensively in the fire PRA (e.g., including electrical cabinets, transients and high energy arc fault (HEAF) events) and appears to be an unreviewed analysis method. The final peer review report notes that "the model development and application have not been independently reviewed [by the industry] and the applicability of the tool to scenarios is not sufficiently justified". Also, based on review of Appendix E in the Fire Scenario Development report, the approach contains numerous assumptions that lack sufficient bases. The documentation provided is also insufficient to understand its application.

A sensitivity analysis is provided in Section 7.3.1 of the Fire Risk Quantification and Summary report; however, this study only addresses one assumption of the approach (i.e., credit for time delay) and does not appear to replicate NUREG/CR-6850 methods. In addition, the sensitivity study is discussed as producing more conservative non-suppression probability (NSP) values; however, Table 7-4 documents values both above and below those of the original MathCAD analysis.

Describe the approach documented in Appendix E of Fire Scenario Development report, including identification and justification of assumptions used in applying the approach. In addition, explain and justify how the approach is implemented for each type (or "case") of fire scenario.

r) <u>F&O FSS-D2-01 against FSS-D2:</u>
No fire detection analysis was conducted in support of the activation of fixed suppression systems or the time to smoke detection. Appendix E of the Fire Scenario Development Report appears to indicate that only simplified assumptions, independent of the context of individual fire scenarios, were made. For example, PAUs with automatic detection assume a detection time of 0 minutes; otherwise, manual suppression is assumed to occur at 15 minutes. Provide further technical justification for these detection times as well as the results (i.e., CDF, LERF, ΔCDF, and ΔLERF) of a sensitivity analysis characterizing the uncertainty associated with their selection.

s) <u>F&O FSS-D4-01 against FSS-D4:</u>
According to Section 7.2 of the Fire Scenario Development report, the transient fires were generally assumed to be one foot above floor level unless a ledge or permanent scaffolding was present. Given that transient fire might occur at a higher elevation, provide additional justification for this assumption. Additionally, explain whether the risk estimates reported in Attachment W are based on the 317 kW (98th percentile) HRR for transient fires per NUREG/CR-6850.

t) <u>F&O FSS-D7-01 against FSS-D7:</u>
The basis for fire detection and suppression system unavailability provided in Section 10.1 of the Fire Scenario Development Report is limited to an interview with a fire protection engineer and appears to only discuss system unreliability. The intent for CC-II is to additionally require a review of plant records to determine if the generic unavailability credit is consistent with actual system unavailability. Generic values reported in NUREG/CR-6850 only provide estimates of system unreliability and do not include maintenance contributions to unavailability, credit for manual actuation of the system, dependent failures, and plant-specific data. Provide additional justification, such as evaluation of plant records, that generic estimates bound actual system unavailability.

u) <u>F&O FSS-D8-01 against FSS-D8:</u>

Section 10.1 of the Fire Scenario Development report notes that fire scenarios, in general, credit automatic suppression to prevent the formation of a hot gas layer (HGL) or propagation beyond the zone of influence (ZOI); however, it is not clear that the effectiveness of the fire suppression and detection systems credited in the context of each analyzed fire scenario are assessed as required by CC-II of SR FSS-D4.

Describe and justify how the effectiveness of the fire suppression and detection systems were addressed on a fire-scenario basis to assure their effectiveness as credited in the FPRA.

v) F&O FSS-F1-01 against FSS-F1:
Describe how the FPRA addresses the possibility of effects of oil pooling, flaming oil traversing multiple levels, and oil spraying from continued lube-oil pump operation. In addition, confirm that the analysis considered scenarios involving other high-hazard fire sources as present in the relevant PAUs (e.g., oil storage tanks, hydrogen storage tanks and piping, mineral oil-filled transformers, etc.).

w) F&O FSS-F3-01 against FSS-F3:
The catastrophic turbine/generator (T/G) fire frequency analysis presented in Section 3.2.2 of the Structural Steel Analysis report is not consistent with NUREG/CR-6850 guidance; namely, information from NUREG/CR-6850 appears not to have been correctly applied. Table O-2 of NUREG/CR-6850 lists a frequency (i.e., 1E-5/yr) in the conditional probability column that is actually meant to be used as the fire frequency (as opposed to a conditional probability) for catastrophic turbine building fires. Moreover, this frequency already accounts for the conditional probability for catastrophic T/G fires (i.e., 0.025) and the failure of fixed suppression preventing catastrophic damage with a probability of 0.02. Evaluate the impact of this correction on CDF, LERF, Δ CDF and Δ LERF.

Additionally, Section 3.2.2 of the Structural Steel Analysis report indicates that credit for manual suppression is taken. If a suppression credit associated with a catastrophic T/G fire is desired beyond that which is quantified in NUREG/CR-6850 (namely, failure of fixed suppression with a probability of 0.02), provide a basis for this credit based on the severity of such a fire as outlined in Table O-2 of NUREG/CR-6850 and in light of plant specific training and conditions, as appropriate. Note that the NSP curve presented in Appendix P of NUREG/CR-6850 for T/G fires does not reflect the severity of the catastrophic T/G fire scenario.

x) F&O FSS-G2-01 against FSS-G2:
A primary screening criterion used in the multi-compartment analysis (MCA) is based on the exposing or exposed PAU being incapable of forming a HGL; however, it is not clear how related criteria are applied. For example, MCA Screening Criterion 3.02 for PAU 13 appears to screen based on an approximated volume of the full PAU; however, based on Table D-1 of the Fire Scenario Development report, this PAU is highly compartmentalized, and some of the fire zones within have the potential to form HGLs (e.g., 13G, 13E, etc.).

Explain and further justify the screening criteria used for PAU combinations, including how the sub-volumes (e.g., fire zones) within PAUs were addressed. Also, if an exposed PAU is determined to be unable to support a HGL, clarify whether or not additional components (e.g., cables) within the exposed area could be damaged due to hot gas impingement from an exposing PAU via its propagation pathways (e.g., door plumes).

y) F&O FSS-G4-01 against FSS-G4:
Section 1.0 of the Multi-Compartment Analysis Report states that the MCA methodology "may differ slightly" from that specified in NUREG/CR-6850, but that the overall intent remains the same. Provide further clarification on this statement, including the differences between methodologies.

Also, Assumption 1 of the Multi-Compartment Analysis Report states that "a fire damper exists between adjacent PAUs", noting that "the most limiting boundary was not always obvious from review of design documents". In light of this assumption, provide an overview of the criteria used to assign failure probabilities to passive barriers. Discuss how credited barriers were confirmed to be consistent with their demonstrated fire-resistance ratings, and describe the treatment of passive fire barrier features that do not have an established fire-resistance rating or those barriers with openings. Lastly, given the use of 'generic' barrier failure probabilities, discuss how it is verified that there are no plant-specific barrier problems identified by the plant fire protection staff that may result in a higher failure probability.

z) F&O FSS-G5-01 against FSS-G5:
A review of the fire hazards analysis (FHA) indicates that some doors (e.g., PAUs 3, 21, 33, etc.) and dampers (e.g., PAUs 22, 23, etc.) between PAUs are held open with fusible links. Table A-1 of the Multi-Compartment Analysis Report indicates that failure of the fusible link to function appropriately is similar to a valve failing to close. Justify the basis for this assumption and the assigned barrier failure probability used for associated scenarios in the MCA.

In addition, discuss, in general, how the effectiveness, reliability and availability of active fire barrier elements (e.g., normally open fire doors or dampers closed upon detection, water curtains, etc.) were evaluated in the MCA, including how potential random and fire-induced failures were addressed.

aa) F&O FSS-H2-01 against FSS-H2:
The Plant Partitioning and Fire Ignition Frequency Development Report states that the Bin 19 frequency (misc. hydrogen fires) is apportioned by linear feet. The frequency report for Fire Area 04 (1-C Switchgear Room) appears to suggest that the frequency is based on 1 foot of piping; however, Scenario 04_FC01-3 of the Fire Scenario Development Report states that the "hydrogen line enters in about door from turbine, runs along path of raceways and enters into Reactor Building along with raceways." Clarify this discrepancy and how hydrogen piping was traced and the Bin 19 frequency apportioned. Additionally, discuss how targets for hydrogen fires were established.

bb) F&O HRA-A4-01 against HRA-A4:
Post-Initiator Operator Action Questionnaires, Recovery Action Feasibility Evaluations and Validation Forms are provided in Attachment F; however, the attachment states that several reviews are currently in progress or under revision. A review of Attachment F indicates a number of actions do not appear to have been addressed. As a result, clarify the extent to which talk-throughs with plant operations and training personnel have been performed to confirm that interpretation of current and planned procedures relevant to modeled actions is consistent with plant operational and training practices.

cc) F&O HRA-B3-01 against HRA-B3:
Describe the extent to which the definition of HFEs takes into account scenario context, including timing, procedural guidance, instrumentation, task complexity, path of travel, etc. Include discussion of how accident-sequence-specific timing of cues and the time window for successful completion are addressed, including the methods used.

dd) F&O HRA-C1-01 against HRA-C1:
The HRA screening analysis does not follow the guidance in NUREG/CR-6850 or in NUREG-1921, which updates NUREG/CR-6850. Provide the results of a sensitivity analysis (i.e., CDF, LERF, ∆CDF and ∆LERF) using screening/scoping approaches in NUREG/CR-6850 and/or NUREG-1921.

For self-approval, upgrade the fire HRA to account for relevant fire-related effects by using detailed analyses for significant HFEs and conservative estimates (e.g., screening values) for non-significant HFEs in accordance with CC-II for SR HRA-C1-01.

ee) F&O HRA-D1-01 against HRA-D1:
Given that screening HEP values are utilized in the FPRA for both HFEs currently modeled in the internal events PRA (IEPRA) as well as fire response actions, explain how operator RAs are included in the FPRA to provide a realistic evaluation of significant accident sequences, or discuss why not meeting this SR at CC-II or greater is acceptable for transition. In particular, clarify actions taken to address the peer review observation that top core damage fire scenarios do not account for realistic RAs. Provide a description of the RAs added for the risk-significant fire scenarios, their method of HEP quantification, and the resulting HEPs.

ff) F&O HRA-D2-01 against HRA-D2:
Post-Initiator Operator Action Questionnaires, Recovery Action Feasibility Evaluations and Validation Forms are provided in Attachment F; however, the attachment notes that several reviews are currently in progress or under revision. A review of Attachment F indicates numerous actions do not appear to have been documented. Describe how modeled RAs account for relevant fire effects, including any effects that may preclude a RA or alter the manner in which it is accomplished. In addition, discuss whether or not RAs carried over from the IEPRA, (e.g., recovery of off-site power) also address fire-related effects accordingly.

gg) F&O IGN-B4-01 against IGN-B4:
The descriptions provided for plant-specific fire events in Appendix A do not provide a sufficient level of detail to determine whether established criteria for classifying events as potentially challenging are met or not. For instance, Event #12 is classified as not challenging; however, Appendix C of NUREG/CR-6850 notes that electrical fires that self-extinguish after plant personnel de-energize the impacted equipment are generally classified as potentially challenging given that the act of de-energizing is one mechanism of active intervention by plant personnel. Provide additional justification for each fire event classified as not challenging in Appendix A and a documented basis as to why each established criteria are met or not met.

hh) F&O PP-B2-01 against PP-B2:
Discuss whether or not partitioning credits wall, ceiling, or floor elements that lack a fire-resistance rating. In particular, provide further justification for those plant locations that

were not specifically addressed in the FHA and identified as new PAUs in the FPRA (e.g., cooling tower pump house, feedwater purity building, etc.). Describe how NUREG/CR-6850 guidance was followed.

ii) F&O PRM-B11-01 against PRM-B11 and related SRs PRM-B12, PRM-13 and PRM-C1:
The disposition to this F&O does not address deficiencies associated with unmet SRs PRM-B12, PRM-B13 and PRM-C1. Identify any FPRA plant response model (PRM) probability input values that either required reanalysis given the fire context or that were not included in the IEPRA, and explain whether a data analysis was performed consistent with the requirements of PRM-B12.

jj) F&O PRM-B3-01 against PRM-B3:
Describe the modeling changes made to include the DC power dependency for the primary coolant pump breaker trip function. In particular, discuss credit given for operator actions to trip pumps to prevent seal failure for cases in which DC power is lost. In doing so, address the impact and modeling of Modification S2-5 (see LAR Attachment S, Table S-2, Item S2-5).

kk) F&O PRM-B9-01 against PRM-B9:
This F&O indicates that failure to trip pressurizer heaters was not explicitly addressed. Describe the modeling changes made to include the failure to trip pressurizer heaters. In particular, discuss credit given to operator actions to trip heaters both in the MCR and locally.

ll) F&O SF-A1-01 against SF-A1:
The peer review identifies numerous deficiencies associated with seismic fire interactions analysis as identified on Pages C-35 and C-36 of the final peer review report; however, the disposition provided states that the analysis has not been updated. Demonstrate that the scope of work performed meets the objectives of the Standard and addresses the deficiencies identified by the peer review. Also, discuss why the treatment from the individual plant examination for external events (IPEEE) remains valid. Given that the (United States Geological Survey (USGS) updated the seismic hazard curves (see Safety/Risk Assessment Results for Generic Issue 199, "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States in Existing Plants"), provide at least a qualitative discussion of these updated effects.

mm) F&O UNC-A1-01 against UNC-A1:
This F&O notes that only a limited number of parameter and modeling uncertainties and associated assumptions have been identified, and that the associated analysis was incomplete and not of sufficient detail to support a reasonable characterization. In addition, it does not appear that sources of uncertainty originating from the IEPRA were reviewed to determine their impact on the FPRA application.

Describe and justify how key assumptions and sources of uncertainty for the FPRA model were comprehensively identified, documented and characterized. In this description, identify criteria used to judge the importance of assumptions and whether any sensitivity studies were performed as a result. Evaluate the impact on FPRA CDF, LERF, ΔCDF and ΔLERF values reported in Attachment W for the key sources of uncertainty and other uncertainties (such as fire phenomenological modeling uncertainties) considered for SR UNC-A2. Include in this evaluation the impact of using NUREG/CR-6850 frequencies for all bins. Note that this is in addition to the sensitivity analysis for selected bins in FAQ 08-0048, "Revised Fire Ignition Frequencies," (ADAMS Accession No. ML092190457, closure memo) (see PRA RAI 20) in that uncertainties on all bins needs to be quantified.

nn) F&O UNC-A2-01 against UNC-A2:
According to this F&O and F&O UNC-A1-01, the state of knowledge correlation (SOKC) for FPRA-specific parameters has not been addressed. In addition, uncertainty intervals assigned to fire ignition frequencies, spurious actuation probabilities, severity factors and non-suppression probabilities are noted as not being based on acceptable methods and differ in part from recommendations provided within NUREG/CR-6850. Describe and further justify how parametric data uncertainty was characterized per relevant SRs and propagated. Include discussion on how the SOKC was evaluated for fire CDF and LERF. Identify FPRA-specific parameters (e.g., hot short probabilities, fire frequencies) that can appear in FPRA cutsets and how they were correlated.

PRA RAI 02 - Fire PRA Development

The American Society of Mechanical Engineering/American Nuclear Society (ASME/ANS) PRA Standard and Regulatory Guide 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the probabilistic safety assessment (PSA) (PSA is also referred to as PRA) approach, methods, and data shall be acceptable to the authority having jurisdiction (AHJ). RG 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Rev. 1, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. Regulatory Guide 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, "*Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)*, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

Summarize any FPRA development completed since the final peer review as well as any development or reviews not yet complete and their significance to the NFPA 805 LAR.

PRA RAI 03 - "Open" F&Os

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

A number of F&O dispositions listed in LAR Attachments U and V are indicated as having an "open" status. For each open F&O disposition, discuss its significance to the NFPA 805 LAR (transition and post-transition).

PRA RAI 04 - Unreviewed Supporting Requirements

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

Based on Table 3 of Attachment 1 to the LAR Supplement dated February 21, 2013, PRM-14 has not been identified as being peer reviewed. The evaluation provided for PRM-B14 states that no new LERF phenomena are applicable to the FPRA that were not addressed for LERF estimation in the IEPRA. Discuss the process utilized or analysis performed to arrive at this conclusion.

PRA RAI 05 - Transient Fire Frequency Calculation

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

Section 4.4.3 of the Fire Ignition Frequency Development Report states that the approach followed to apportion transient and cable fire frequencies associated with hot work deviates from NUREG/CR-6850 given that a separate hot work influence factor is developed. A review of LAR Attachment H, and the Fire Ignition Frequency Development Report indicates that FAQ 12-0064, "Hot Work/Transient Fire Frequency Influence Factors" (ADAMS Accession No. ML12346A488, closure memo) is not referenced. Clarify whether the guidance from NUREG/CR-6850 or FAQ 12-0064 was used, including:

a) Clarification that the methodology used to calculate hot work and transient fire frequencies applies influencing factors using NUREG/CR-6850 guidance or FAQ 12-0064 guidance.
b) Identification and description of administrative controls used to reduce transient fire frequency, e.g., using low (1) influencing factors per FAQ 12-0064, as well as justification of the reduction assumed for these controls.

c) Additional justification for apportioning turbine building fire frequency bins for general transients and transient activities (e.g., hot work) to the diesel-generator-related PAUs (i.e., 5, 6, 7 and 8).

PRA RAI 06 - Transient Fire Placement at Pinch Points

Per Section 11.5.1.6 of NUREG/CR-6850, transient fires should at a minimum be placed in locations within the plant PAUs where conditional core damage probabilities (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, keeping in mind the same philosophy. Describe how transient and hot work fires are distributed within all PAUs (including the MCR). In particular, identify the criteria used to 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 postulated because 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 placement of a transient 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 07 – Cable Spreading Room (CSR) Fire Modeling

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

Section 9.6 indicates that scenarios in PAU 02 (CSR) for both fixed and transient ignition sources are defined according to a grid system related to the arrangement of sprinkler heads within the PAU such that only those targets within the grid coordinate(s) associated with the physical location of the ignition source are modeled as failed given successful suppression of the fire by the wet-pipe suppression system. However, the impacted grid coordinates associated with fixed ignition sources do not appear to appropriately bound the respective ZOIs of each source as determined by the generic fire modeling treatments. In addition, transient and hot work fire scenarios appear to only be postulated as affecting a single grid coordinate, resulting in the potential exclusion of locations (e.g., in between two or more grid coordinates) within the PAU where CCDPs are highest (i.e., pinch points). Provide further justification that the current method appropriately bounds fire risk within this PAU for both fixed and transient ignition sources, or provide the results of a sensitivity study (i.e., CDF, LERF, ΔCDF, and ΔLERF) that appropriately considers all pinch points associated with transient and hot work fire scenarios as well as those fixed sources for which the respective ZOI is not encompassed by the grid coordinates associated with the physical location of the ignition source alone.

PRA RAI 08 - Cable Fire Frequency Calculation

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

Describe the process used to identify and locate cable fires scenarios due to either self-ignition or hot work within a PAU, and discuss how frequencies are apportioned to such scenarios. In addition, clarify the special consideration applied to cable fire scenarios in the turbine building as noted in Section 7.2 of the Fire Scenario Development Report.

PRA RAI 09 - Fire PRA Modeling of HVAC

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

Describe how heating ventilation and air conditioning (HVAC) modeling was performed to support the FPRA and whether HVAC cable tracing and fire modeling were performed to support this modeling. Confirm that additional operator actions are not needed for crediting HVAC. Heat load calculations performed for the IEPRA do not account for the additional heat load from fires. Confirm that heat loads from fires do not fail additional equipment in rooms including those that do not credit HVAC.

PRA RAI 10 - Wrapped or Embedded Cables

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

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 FPRA, including assumptions and insights on how these cables contribute to the VFDR delta-risk evaluations.

PRA RAI 11 - Use of Unreviewed Analysis Methods

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

Identify and describe all unanalyzed methods (UAMs) or deviations from NUREG/CR-6850, and clarify whether guidance from the June 21, 2012, letter from NRC to NEI, "Recent Fire PRA Methods Review Panel Decisions and EPRI 1022993, 'Evaluation of Peak Heat Release Rates in Electrical Cabinets Fires'" (ADAMS Accession No. ML12171A583) was used in applying related methods. For identified deviations from NUREG/CR-6850 that fall outside this guidance memo, provide a sensitivity study that estimates the impact of their removal on CDF, LERF, ΔCDF, and ΔLERF.

PRA RAI 12 - Model Changes and Focused Scope Reviews Since Full Peer Review

ASME/ANS-RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," as clarified in RG 1.200, Rev. 2, describes when changes to a PRA should be characterized as a "PRA upgrade," e.g., new common cause failure (CCF) or HRA methods. Identify any such changes made to the IEPRA or FPRA subsequent to the most recent full-scope peer review. In addition, 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, and describe any findings and their resolution.
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 13 - Generic Fire Ignition Frequencies

Section 4.1 of the Plant Partitioning and Fire Ignition Frequency Development Report indicates that fire ignition frequencies were updated to reflect conclusions drawn in Attachment 1, "Description of Treatment for Hot Work Fires" to NEI Letter dated October 7, 2011, "Recent Fire PRA Methods Review Panel Decision: Frequencies for Cable Fires Initiated by Welding and Cutting" (ADAMS Accession Nos. ML113130465 and ML113130468). However, a review of Tables 4-1 and 4-4 indicates that the Bin 24 frequency was not altered. Additionally, the Bin 26 frequency is inconsistent with Supplement 1 to NUREG/CR-6850. Provide a re-analysis using values consistent with applicable guidance.

PRA RAI 14 - HEAF Fire Ignition Frequencies for Electrical Cabinets

The Bin 15.2 ignition frequency from EPRI 1016735, “Fire PRA Methods Enhancements: Additions, Clarifications, and Refinements to EPRI 1011989,” was further subdivided into frequencies associated with low- and medium-voltage panels as proposed by FAQ 06-0017, “Clarifying/Enhancing Guidance for Counting High Energy Arcing Faults in NUREG/CR-6850,” (ADAMS Accession No. ML072500300, closure memo). Given that this FAQ was closed out prior to issuance of Supplement 1 to NUREG/CR-6850 (i.e., FAQ 08-0048), discuss the basis for frequencies 16a and 16b in Table 4-1 of the Plant Partitioning and Fire Ignition Frequency Development report, further justifying the approach provided in Attachment G.

PRA RAI 15 - Smoke Damage

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

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/CR-6850. Include discussion of the potential for smoke to cause failures in a common enclosure (e.g., bust ducts).

PRA RAI 16 - Electrical Cabinet Frequency Apportionment

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

Section 2.1.1 and severity factors listed in Table 8-2 of the Fire Scenario Development Report appear to indicate that scenarios involving switchgear were assigned frequencies apportioned by the number of switchgear cubicles (i.e., horizontal divisions within a vertical section) in lieu of the number of vertical sections per NUREG/CR-6850 and FAQ 06-0016, “Clarifying Guidance for Counting Electrical Panels and Cabinets,” (ADAMS Accession No. ML072700475, closure memo). Describe the approach utilized to apportion frequencies to switchgear and other electrical cabinets. Provide a sensitivity analysis that aligns with guidance in NUREG/CR-6850 and FAQ 06-0016 if the approach does not.

PRA RAI 17 - Main Control Room Fire Scenarios

Not all elements of MCR fire modeling appear consistent with NUREG/CR-6850 guidance including treatment of electrical sub-enclosures. In particular, per NUREG/CR-6850 guidance the Main Control Board (MCB) is intended to be that subset of cabinets from which primary control and monitoring is performed. Clarify how MCR modeling was performed. Provide:

a) A sensitivity study that updates the MCB fire ignition frequency to treat the whole back panel of sub-enclosure 1 as electrical cabinets as opposed to part of the MCB.
b) Discuss the approach used to develop and apportion frequencies to MCB fire scenarios.
c) Clarify how panel fires within the MCR that are not associated with the MCB are treated by the FPRA.
d) Explain and justify how MCB or panel fire propagation in the MCR and MCR sub-enclosures was modeled, including how fire propagation was considered between panels with open backs opposite to each other, within close proximity, and connected by cable bundles.
e) Explain and justify the basis for transient fire placement including how locations next to open-back panels and inside sub-enclosures were considered.
f) Clarify any credit taken for ionization smoke detectors mentioned in Section 14.1.1 of the Fire Scenario Development report.
g) Describe how cable conduits mentioned in Section 14.1 of the Fire Scenario Development report are addressed in MCR fire scenarios.
h) Discuss how HVAC was treated in the MCR, including both fire-induced and random failures.

PRA RAI 18 - HEAF Fire Scenario Target Development

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

Sections 15.1 and 15.2 of the Fire Scenario Development report indicate that secondary fires from HEAF events in PAUs 03 and 04 are assumed to be bounded by the detailed modeling performed to determine the fire impact associated with the Bin 8 HRR of an electrical cabinet with a single unqualified cable bundle obtained from Table E-4 of NUREG/CR-6850. Clarify whether or not this approach was applied to fire scenarios in other PAUs (e.g., PAU 02). Provide the risk results (i.e., CDF, LERF, ΔCDF and ΔLERF) from a sensitivity study that utilizes guidance provided in Appendix M of NUREG/CR-6850 to develop HEAF fire scenarios and damage sets that considers damage at “time zero”.

PRA RAI 19 - Impacts of Fire Suppression System Activation

According to NUREG/CR-6850, where water from fire suppression efforts will likely enter a potentially vulnerable component (e.g., a panel with unsealed penetrations or an unshielded electrical motor), it is appropriate to include that component in the fire scenario damage set. Explain and justify the level of assessment of the impact of suppression system activation on component operation using guidance in Section 11.5.1.2 of NUREG/CR-6850. Include identification of walkdowns performed to identify unsealed penetrations or unshielded electrical equipment.

PRA RAI 20 - Use of NUREG/CR-6850 Generic Fire Ignition Frequencies

Section 4.1 of the Plant Partitioning and Fire Ignition Frequency Development report discusses that the FPRA was quantified using fire ignition frequencies obtained from Supplement 1 to NUREG/CR-6850. Explain whether the LAR Attachment W risk results are based on these frequencies, and provide the results (i.e., CDF, LERF, ΔCDF and ΔLERF) of a sensitivity study that utilizes NUREG/CR-6850-based ignition frequencies as indicated in Footnote 10 of Supplement 1 to NUREG/CR-6850. If the use of NUREG/CR-6850-based ignition frequencies produces risk results that exceed RG 1.174, Rev. 2, risk acceptance guidelines, discuss the fire protection, or related, measures that can be taken to provide additional DID to offset this risk.

PRA RAI 21 - Quantification Process

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

According to EA-PSA-FPIE-FIRE-12-04, SAPHIRE performs the fault tree and sequence quantification for the IEPRA using fault trees initially created in computer aided fault tree analysis (CAFTA). The final peer review indicates that the FPRA is quantified using systems analysis programs for hands-on integrated reliability evaluations (SAPHIRE), CAFTA and fracture analysis code (FRANC); however, it is unclear how the inputs and outputs of these codes are linked. Describe the quantification process utilized by the FPRA to support the LAR, and discuss to what extent this process and the resulting model have been peer-reviewed. Additionally, provide an overview of efforts performed to validate the model conversion documented in Appendix A of the Model Development report.

PRA RAI 22 - RG 1.200 Rev 2 Clarifications

SR DA-D9 does not appear to have been assigned a CC by the peer review for the IEPRA. Confirm that the peer review for the IEPRA and FPRA considered the clarifications and qualifications from RRG 1.200, Rev. 2, March 2009 to the ASME/ANS PRA Standard.

PRA RAI 23 - Calculation of VFDR ΔCDF and ΔLERF

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

Attachment W of the LAR provides the ΔCDF and ΔLERF for the VFDRs and the additional risk of RAs for each of the fire areas in which the LAR describes (but not in detail) how ΔCDF and ΔLERF or the additional risk of RAs were calculated. Describe the method(s) used to determine the changes in risk reported in the LAR Attachment W, Table W-2. The description should include:

a) A detailed definition of both the post-transition and compliant plants used to calculate the reported changes in risk and additional risk of RAs.
b) A description of how the reported changes in risk and the additional risk of RAs were calculated. Include in this description a discussion of PRA modeling mechanisms used to determine the reported changes in risk (e.g. altering the probabilities of basic events and modeled recovery actions). Clarify whether FAQ 08-0054, "Demonstrating Compliance with Chapter 4 of NFPA 805," (ADAMS Accession No. ML110140183, closure memo) guidance was used.
c) A discussion of any exceptions to normal modeling mechanisms discussed in b. (above), including those cases for which the PRA model lacks sufficient resolution to model the VFDR or those that utilize surrogate basic events or HFEs to estimate/bound the change in risk in lieu of manipulating components or actions directly associated with the VFDR.
d) A statement whether all PRA manipulations performed effectively bound ΔCDF and ΔLERF.
e) A description of any modeling manipulations that use data or methods not included in the FPRA peer review.
f) A separate description specific to how the ΔCDF and ΔLERF and additional risk of RAs were calculated for the MCR (PAU 01). Include in the description how this calculation was performed for loss-of-control scenarios and for control room abandonment (CRA) scenarios (i.e., alternate shutdown).
g) An explanation of the following anomalies identified in LAR Attachment W, Table W-2:
    i. Values for ΔCDF and ΔLERF exceed CDF and LERF values for some PAUs (e.g., 02, 03, 15, 16, 21, 23 and 32).
    ii. Values for ΔLERF exceed ΔCDF values for some PAUs (e.g., 23, 24, 40 and 41).
    iii. Values for additional risk of RAs appear to be too low for several fire areas (e.g., Fire Areas 01, 03, 13, 16 and 23), particularly in light of the respective ΔCDF and ΔLERF values reported, the use of HEP screening values and the number of VFDRs with RAs for some of the impacted PAUs.
    iv. ΔCDF and ΔLERF values reported for PAU 15 in LAR Attachment W, Table W-2, differ from those reported in LAR Attachment C, Table B-3.
    v. CDF and LERF values for Fire Area 56 are reported as epsilon.
h) A discussion of how RAs were quantified and treated in the fire risk evaluations (FREs) for fire scenarios inside and outside the MCR. Describe whether there are any previously approved RAs.

PRA RAI 24 - Calculation of Total CDF

LAR Attachment W, Section W.2.2 states that the total CDF is "reasonably estimated" to be below 1E-4/year; however, when summing the CDFs for all hazards reported in this section and LAR Attachment W, Table W-2, a CDF that exceeds 1E-4/year is obtained. Discussion in LAR Attachment W states that a "better estimate" for the fire CDF, which would result in the total CDF falling below 1E-4/year, is estimated as a factor of 5 to 10 lower than the fire CDF reported in LAR Attachment W, Table W-2 based on review of uncertainties associated with FPRA tasks; however, there appears to be no basis for the aforementioned factor (e.g., F&Os against UNC-A1 and UNC-A2). Provide additional information to demonstrate that the total CDF is below 1E-4/year.

PRA RAI 25 - Risk Offset for Modifications Beyond Compliance

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

LAR Attachment W, Table W-2, provides the ΔCDF and ΔLERF for each fire area, where the "beyond compliance" modifications are credited for both the compliant and transition plants. LAR Attachment W, Table W-2 also presents a total "risk offset" attributable to beyond compliance modifications indicating a significant reduction in risk. This risk offset is based on a "surrogate approach" described in Section 6.8 of the Fire Risk Evaluation report (EA-PSA-805-FRE-10-03) and is presented to show that the NFPA 805 transition meets RG 1.174 risk acceptance guidelines. The "surrogate approach" utilizes a ratio of CCDPs (or conditional large early release probabilities (CLERPs)) with and without selected beyond compliance modifications (i.e., additional feedwater pump and atmospheric steam dump valve nitrogen bypass) obtained from "a 'better than compliant' plant in which no components are failed by fire. It is not clear that this surrogate approach produces the same risk reduction effect as calculating the ΔCDF and ΔLERF directly. Provide the ΔCDF and ΔLERF for each fire area that removes credit for beyond compliance modifications directly for the compliant plant (i.e., does not use the surrogate approach).

PRA RAI 26 - Treatment of Modifications

Address the following regarding modifications presented in LAR Attachment S, Tables S-1 and S-2:

a) Some modifications (e.g., S1-1, S2-21 and S2-23) are cited as being modeled in the FPRA but are assigned a risk ranking of "N/A". Justify the dismissal of any risk impact of these modifications.
b) Several modifications (e.g., S1-2, S2-26, S2-29, S2-30, S2-31 and S2-34 through S2-42) are cited as not being modeled in the FPRA but appear to result in improvements to existing configurations, indicating that either a less robust configuration is retained in the FPRA or that the subject of the modification is not modeled. Describe how these

modifications are treated by the FPRA, discussing whether or not they are either implicitly or explicitly modeled.

c) Some modifications (e.g., S2-2, S2-3, S2-5, S2-6, S2-7 and S2-9 through S2-15) either indicate or suggest the routing of new cabling or the movement of existing cabling. Discuss whether or not the exact locations of new or relocated cabling are known and modeled accordingly. Explain what approach (e.g., exclusion) was used.
d) Modification S1-3 is indicated as not being evaluated in the FPRA. Discuss the implications of fuse failure, and further justify its exclusion from the model.
e) Describe and justify the PRA modeling of Modification S2-1. If a screening value is utilized in lieu of detailed system and HRA modeling, provide a basis that this value appropriately reflects or bounds the equipment- and human-related failures associated with the modification.

PRA RAI 27 - Configuration Control

The ASME/ANS PRA Standard and RG 1.200, Rev. 2, provide guidance for the technical adequacy, including supporting requirements and peer reviews. Section 2.4.3.3 of NFPA 805 states that the PSA approach, methods, and data shall be acceptable to the AHJ. RG 1.205, provides guidance for use in complying with the requirements promulgated for risk-informed, performance-based fire protection programs that meet the requirements of 10 CFR 50.48(c) and the referenced 2001 Edition of NFPA 805. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a FPRA and endorses, with exceptions and clarifications, NEI 04-02, Rev. 2, as providing methods acceptable to the NRC for adopting a fire protection program consistent with NFPA-805. The following additional information is requested in order for the staff to complete its review:

Describe the revisions of the IEPRA and FPRA models seen by the respective peer review teams, and outline any subsequent revisions that the models have undergone. Additionally, clarify any differences between the revision of the IEPRA model reviewed by the peer review teams and that used to support the FPRA model upon which the LAR is based. Lastly, identify the revision of the FPRA model that is being used for transition to NFPA-805, and clarify whether or not a different revision of the model is expected to be used following transition to NFPA-805.

PRA RAI 28 - IE PRA F&Os

Contrary to RG 1.200, Rev. 2, it is not clear that all the peer review F&Os were resolved to bring the findings into alignment with CC-II (Met) or justified why a lesser CC was acceptable. Clarify the following dispositions to IEPRA F&Os identified in LAR Attachment U that have the potential to impact the FPRA results:

a) <u>F&O HR-A2-01 against HR-A2:</u>
The pre-initiator methodology documented in NB-PSA-HR (Vol. 2) utilizes scoping values lower than those recommended by NUREG-1792, "Good Practices for Implementing Human Reliability Analysis (HRA)," for both independent and joint HFEs. Further justify the basis of chosen values. Assess the impact of using values consistent with those recommended.

b) <u>F&O HR-E3-01 against HR-E3:</u>
Although the disposition to this F&O notes that a review of HFEs credited in the IEPRA model was performed with operations and training personnel, the completeness of this

review remains unclear given discussion in Appendix F of NB-PSA-HR (Vol. 1), which states that several reviews are currently in progress or under revision. Elaborate on the completeness of reviews performed for the IEPRA HFEs, clarifying the impact, if any, on HFEs credited in the FPRA.

c) F&O HR-G7-01 against HR-G7 and F&O QU-C1-01 against QU-C1:
The disposition to this F&O indicates that a dependency analysis has not been performed for the IE HRA. Estimate the impact on risk metrics (e.g., internal events CDF and LERF) reported in LAR Attachment W by performing a sensitivity study (e.g., setting any subsequent HEP beyond the maximum in a cutset to 1.0). Also, discuss the conclusion in the disposition that there is no impact to the NFPA-805 analysis because fire-specific HEPs are used in the FPRA. Recognize that there may be fire-affected cutsets carried from the IE model where the internal HFEs are retained at their original values, (i.e., not fire-affected, such that failure to properly account for dependency may underestimate the cutset risk contribution to fire).

d) F&O LE-G5-01 against LE-G5:
Discuss which of the two source term models is used to support the NFPA-805 LAR, and identify limitations in the LERF analysis that would impact the NFPA-805 LAR.

e) F&O QU-A3-01 against QU-A3:
The RG 1.200 clarification of QU-A3 requires that the SOKC be taken into account for both CDF and LERF regardless of significance. Discuss the extent to which the correlation of basic event data has been addressed to meet CC-II.

f) F&O QU-B2-01 against QU-B2:
The disposition to this F&O indicates a truncation study has not been performed for the IEPRA. Estimate the impact on risk metrics (e.g., IE CDF and LERF) reported in Attachment W of the LAR.

g) F&O QU-D1-01 against QU-D1 through D7, QU-F1, and QU-F2:
Describe the reasonableness review performed on quantification results, including a discussion of the results, and provide additional justification for the conclusion of no impact on the NFPA 805 analysis.

h) F&O SY-B12-01 against SY-B12-01 and F&O IE-C6-01 against IE-C6:
Clarify the basis for excluding control room HVAC initiating events and dependencies from the IE model. Confirm that the FPRA results are conservative by excluding the potential mitigating effects from MCR HVAC in the event of an accident.

i) F&O DA-A8-01 against DA-A8, F&O HR-C2-01 against HR-C2, F&O IE-A9-01 against IE-A9, F&O IE-C2-01 against IE-C2, and F&O SY-A20-01 against SY-A20-01:
The following observations related to the gathering of plant-specific data are noted:
   i. A review of NB-PSA-DA indicates that plant-specific data related to equipment failures, unavailability, equipment demands and run time, etc. were collected and documented over a three-year period from January 1, 2005 to January 23, 2008.
   ii. Section 2.4 of NB-PSA-HR (Vol. 2) indicates that plant-specific operating experience was reviewed from 2005 to 2009 to identify additional modes of unavailability for pre-initiators.

iii. Section 2.2.6 and 2.2.8 of NB-PSA-IE indicates that license event reports from 1996 to 2003 and maintenance rule and work order databases from 2005 until 2008 were reviewed to identify potential precursor events.

iv. The disposition to IE-C2-01 indicates that the update of generic initiating event frequencies excluded plant-specific data prior to January 2003.

v. The disposition to SY-A20-01 indicates that plant operating experience over a three-year period was used to screen certain cases of coincident unavailability as non-repetitive activity.

Provide a basis for each of the above data collection windows. In doing so, justify the exclusion of past data, and discuss whether or not other time periods were considered.

Programmatic RAI 01

Based on the NRC staff's review of the LAR and during the subsequent audit, it was determined that the licensee did not adequately describe the fire protection licensing basis.

Describe the specific documents (e.g., analysis, designs, and engineering reviews) that will comprise the post transition NFPA 805 fire protection program (FPP) licensing basis. In addition, describe whether these documents prepared to support the NFPA 805 FPP will be managed as controlled documents under the document control process.

Programmatic RAI 02

Based on the NRC Staff's review of the LAR and associated documentation, it was determined that the LAR did not provide the information needed for the NRC staff to evaluate what changes will be made to the FPP to incorporate NFPA 805 requirements.

Describe the changes that are planned to the FPP as part of the NFPA 805 transition process specifically associated with training and identification of the positions where any such training necessary would be to support the program changes.

Programmatic RAI 03

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.

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

Programmatic RAI 04

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. Describe whether future NFPA 805 analysis will be conducted in accordance with NFPA 805, Section 2.7.3.

Fire Modeling (FM) RAI 01

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

- The Generic Fire Modeling Treatments (GFMT) approach was used to determine the zone of influence (ZOI) in all fire areas throughout plant, with the exception of Switchgear Rooms 1-C and 1-D.

- CFAST, Fire Dynamics Simulator (FDS) and the Thermally Induced Electrical Failure (THIEF) model were used to calculate the damage time to raceways credited in the FPRA in Fire Area 3 (Switchgear Room 1-D) and 4 (Switchgear Room 1-C).

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.

Specifically regarding the acceptability of CFAST for the CR abandonment time study:

a) Provide the basis for the assumption that the fire brigade is expected to arrive within 15 minutes. In addition, describe the uncertainty associated with this assumption, discuss possible adverse effects of not meeting this assumption on the results of the FPRA and explain how possible adverse effects will be mitigated.

b) LAR Table H-1, “NEI 04-02 FAQs Utilized in LAR Submittal”, credits FAQ 08-0052, “Transient Fires Growth Rates and Control Room Non-Suppression”, (ADAMS Accession No. ML092120501, closure memo). Provide justification for using transient fire growth rates that deviate from those specified in FAQ-08-0052, and discuss the effect of these deviations on the risk results (i.e., CDF, LERF, ∆CDF and ∆LERF).

c) During the audit, it was discussed how fires originating close to a wall or corner in the MCR were addressed. Explain the methodology for considering a fire (transient and fixed ignition source) located against a wall or in a corner and explain the effect on the CR abandonment times.

d) During the audit, it was discussed how some parameters (e.g. fire growth rate and fire base height) have a significant effect on MCR abandonment times. Explain how the results of the sensitivity analysis in Appendix B of the Evaluation of Control Room Abandonment Times calculation were used in the FPRA and provide a discussion of the impact on fire risk results (i.e., CDF, LERF, ∆CDF and ∆LERF).

Specifically regarding the acceptability of the GFMTs approach:

e) Explain how the modification to the critical heat flux for a target that is immersed in a thermal plume was used in the ZOI determination.

f) Provide technical justification to demonstrate that the GFMTs approach as used to determine the ZOI of fires that involve multiple burning items (e.g., an ignition source and an intervening combustible such as a cable tray) is conservative and bounding.

g) Describe how the flame spread and fire propagation in cable trays and the corresponding heat release rate (HRR) of cables was determined, and provide justification for deviations from NUREG/CR-6850, “Fire PRA Methodology for Nuclear Power Facilities”. Explain how the flame spread, fire propagation and HRR estimates affect the ZOI determination and hot gas layer (HGL) temperature calculations.

h) Describe how transient combustibles in an actual plant setting are characterized in terms of the three fuel package groupings in Supplement 3, “Transient Ignition Source Strength” of the GFMT. Identify areas, if any, where the NUREG/CR-6850 transient combustible HRR characterization (probability distribution and test data) may not encompass typical plant configurations. Finally, explain how any administrative action will be used to control the type of transient combustibles in a fire area.

Detailed fire modeling was performed in Switchgear Room 1-C (Fire Area 4) and Switchgear Room 1-D (Fire Area 3). The following questions are regarding the acceptability of the use of CFAST, FDS and THIEF in Fire Areas 3 and 4:

i) Part of the approach described in the analysis is to treat the individual switchgear panel enclosures as a series of compartments, each capable of supporting a one-zone or well-stirred fire environment. CFAST is used to calculate the maximum steady fire size that can be supported within an enclosure given the vent flows under a one-zone assumption. Section 3.3 of the Technical Reference Guide for CFAST (National Institutes of Standards and Technology (NIST) Special Publication 1026, September 2010) describes the single zone approximation and states that this approximation is appropriate for smoke flow far from a fire source where the two-zone layer stratification is less pronounced than in compartments near the fire (e.g., elevator shafts, stairwells, etc.) Section 3.3 of the Technical Reference Guide for CFAST describes limitations of the zone model assumptions and provides a quantitative limit for when to consider the single-zone approximation. This limit is the ratio of a compartment height (H) to its length (L) which is 10 or more. Based on the figures in the detailed fire modeling reports, the upper cubicle of the individual panels in the switchgear cabinets, which were modeled in CFAST as worst-case have an H/L ratio of approximately 1.

Provide justification for the acceptability of using CFAST for this purpose and explain why the approach described in Supplement 1 to the GFMTs was not considered for the purpose of calculating the fire size specified in the FDS model.

j) During the audit, the licensee discussed how cable tray propagation and flame spread are considered in the analysis of the 1-C and 1-D switchgear rooms; however, it was not clear how the first cable tray is ignited and whether it is a function of time, temperature/heat flux, or both.

Clarify the mechanism for ignition of the first cable tray above an ignition source (upper cubicle of switchgear panel or other fixed cabinet source). In addition, provide justification for using a vertical flame spread rate of 0.0258 m/s as opposed to 0.258 m/s, which is the highest value in Table R-4 of NUREG/CR-6850.

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

k) Address how it was assured that non-cable intervening combustibles were not missed in areas of the plant. Provide information on how intervening combustibles were identified and accounted for in the fire modeling analyses and the FREs.

l) During the audit, the licensee stated that, "Most Palisades cables are not IEEE-383 qualified. Therefore, vertical fire propagation of cable trays was postulated when the cable trays were separated by less than 2-3 feet and horizontal propagation was assumed when trays were in close proximity."

   Provide technical justification for the methodology used to determine when to consider horizontal and vertical cable tray propagation.

m) During the audit, the licensee stated that the fire location factor was used to account for this configuration for transient fire sources.

   Explain the methodology used for considering a fire (transient and fixed ignition source) located against a wall or in a corner.

n) During the audit, the licensee stated that the activation of detection and suppression systems is credited in the FPRA.

   Provide a technical justification for the methodology used to determine or calculate detector and sprinkler activation time (in any fire area). For instance, discuss the fire modeling tool used to perform these calculations and include the verification and validation justification for this tool in the response. If detector/sprinkler activation time was not calculated, provide a technical justification for not having to determine this time quantitatively.

o) During the audit, the non-abandonment fire scenarios considered in the CR envelope were discussed. It was stated that, "…consideration of many of these cables in common enclosures required a more detailed analysis not amendable to the source/ZOI/target methods used throughout the remainder of the plant." It was also stated that, "the remaining control room ignition sources were more similar to standard electrical cabinet construction and were therefore analyzed in a manner consistent with the rest of the fire PRA."

   Describe the methodology used to consider non-abandonment fire scenarios and whether the GFMTs were used to assess potential damage in the MCR envelope for ignition sources other than the main control board (MCB). In addition, state whether this analysis included fixed ignition sources as well as transient sources. If transient sources were not considered, provide a technical justification for not considering this type of ignition source.

p) During the audit, the licensee discussed the detailed calculations performed with MathCad, used to modify the non-suppression probability curves. The licensee stated that one of the underlying assumptions of the analysis involves converting damage times presented for thermoplastic cables in Appendix H of NUREG/CR-6850 to percent damage as a function of heat flux. For instance, the licensee stated that: “It is assumed that these times can be converted to a percent of damage function as a function of heat flux.”

Provide a technical justification for this assumption and explain the physical basis for a continuous damage function. In addition, describe how this assumption affects the CDF, LERF, ΔCDF, and ΔLERF.

q) During the audit, the licensee discussed the exposed structural steel analysis that was performed. Specifically, one of the fire scenarios postulated on the 590-ft elevation of the turbine building was discussed. This scenario considered a feedwater pump lube oil fire and a CFAST analysis that was performed to evaluate the temperature rise of an exposed structural steel target from a defined lube oil pool fire source.

The fire scenario utilizing the CFAST modeling assumes a lube oil fire, which engulfs one structural steel column and exposes another structural steel column. The licensee stated that this analysis assumes that the engulfed column fails and considers the temperature rise of the adjacent column. Provide a technical justification for not having to consider structural collapse of the compartment as a result of the failure of one structural steel column.

FM RAI 02

American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) Standard RA-S-2008, “Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessments for Nuclear Power Plant Applications.”, Part 4, requires damage thresholds be established to support the FPRA. Thermal impact(s) must be considered in determining the potential for thermal damage of SSCs. Appropriate temperature and critical heat flux criteria must be used in the analysis. During the audit, the damage criteria used for cables, sensitive electronics and component failures due to smoke damage was discussed.

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.

b) During the audit, the detailed calculations performed with MathCad, used to modify the non-suppression probability curves were discussed. One of the underlying assumptions of the analysis involves converting damage times presented for thermoplastic cables in Appendix H of NUREG/CR-6850 to percent damage as a function of heat flux. The following was stated: “It is assumed that these times can be converted to a percent of damage function as a function of heat flux. This provides a representative means to apportioning the impact of the varying heat fluxes over time. This may be slightly non-conservative as the damage threshold may not be the same at each heat flux value.”

Provide additional discussion of how the damage threshold might change in a given analysis when this assumption is applied. Provide a list of each fire area where this methodology was used.

c) During the audit, the licensee stated that, “NUREG/CR-6850 recommends failure criteria for solid-state control components of 3 kW/m^2 (versus 11 kW/m^2 for IEEE-383 qualified cables and 6 kW/m^2 for non-IEEE-383 qualified cables) be used for screening purposes. However, given that the enclosure would provide protection to the sensitive internal contents from external fire effects, it is reasonable to apply the same zone of influence established for cable damage. The omission of the credit for the enclosure is judged to offset the non-conservatism of the damage threshold.”

Provide technical justification for using cable damage thresholds for temperature sensitive equipment located inside cabinets.

FM 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."

LAR Section 4.5.1.2, "Fire FPRA" 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," for a discussion of the verification and validation (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 "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) It is stated on page J-3 of LAR Attachment J that “CFAST does not use a fire diameter, therefore, it is possible to specify a fire that falls within the range of Froude numbers considered in the NUREG-1824 validation documentation.”

   Provide confirmation that this is true for all the CFAST model calculations or justify why CFAST can be used for Froude numbers outside the validated range.

b) It is stated on page J-3 of LAR Attachment J that “[The] flame length ratio is normally met, but in the case of the largest fire sizes postulated, the flame height may reach or exceed the ceiling height. Because sprinkler actuation and thermal radiation to targets are not computed with the CFAST model, this parameter is not an applicable metric.”

   Provide a technical justification for the use of CFAST to model fires with flames that impinge on the ceiling.

c) During the audit, the licensee stated that a CFAST analysis was performed to evaluate the temperature rise of an exposed structural steel target from a defined lube oil pool fire source on the 590-ft elevation of the turbine building.

   Provide a V&V basis for the use of CFAST for this application (calculation of structural steel target temperature) and include its reference in Attachment J of the LAR.

d) During the audit, the licensee discussed the use of CFAST to calculate the maximum possible fire size in an upper cubicle of switchgear cabinets in Switchgear Rooms 1-C and 1-D. The licensee also stated on page J-14 of LAR Attachment J that "Appendix A of the 1-C Switchgear Room (FA4) [Hughes Associates, Rev. 0, 2012a] report documents the validation basis for CFAST as applied in the 1-C Switchgear Room. Essentially, CFAST is used as a one-zone model to provide a mass and energy balance over a control volume and a bounding empirical model based on the equivalence ratio is used to determine the maximum heat release rate at a vent. This is the most limited use of CFAST and the application to the switchgear cubicles relies on the verification of the vent mass flows and the energy balance as provided in NIST-SP 1086 [2008]. Because the model is used in the most simplistic way possible, it is considered to be applied within in its validation basis."

   Provide the validation basis for using the single zone approximation in CFAST to simulate fires in the upper cubicles of switchgear panels at PNP.

FM 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) Identify uses, if any, of the GFMTs (including the supplements), CFAST, and FDS outside the limits of applicability of the method and justify how the use of these fire modeling approaches were appropriate.

FM RAI 05

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

Section 4.5.1.2, "Fire PRA" of the LAR 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 LAR 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, ENO [Entergy Nuclear Operations, Inc.] 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. (See Attachment S).

Regarding qualifications of users of engineering analyses and numerical models:

a) Describe what constitutes the appropriate qualifications for the 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 for ensuring the adequacy of the appropriate qualifications of the engineers and personnel performing the fire analyses and modeling activities.

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

d) Describe the communication process between the consulting engineers and PNP personnel to exchange the necessary information and any measures taken to assure the fire modeling was performed adequately and will continue to be performed adequately during post-transition.

FM RAI 06

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

Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," of the LAR 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" and "completeness" uncertainty was accounted for in the fire modeling analyses.

Radiological Release (RR) RAI 01

Describe the radiological criteria that were used to screen fire areas out of the review. Describe how Radiation Protection staff participated in the screening process.

RR RAI 02

For areas where containment/confinement is relied upon:

a) Liquid
   1) Describe how the assessment addresses capacities of sumps, tanks, transfer pumps, etc., as appropriate.
   2) Describe whether operator actions are specified (e.g., to direct effluent flow/overflow with temporary measures (drain covers, etc.)).
   3) Describe whether there are plant features that may divert the effluent flow that were not taken into account (e.g., Aux. Bld. roll-up doors).
   4) Section 4.4.2 of the LAR, page 34, states that "radiological release via the equipment hatch during non-power operations is not a credible scenario." Provide the basis for this statement.
   5) Section 4.4.2 of the LAR, page 34, of the submittal indicates that "if the Dirty Radioactive Waste Drain Tank capacity is exceeded, then water will back up on the ground level floor of the Auxiliary Building and remain within the building." Describe the design features of the building that prevent leaks from the ground level floor. Describe whether any other sumps being relied upon, have overflow potential. If so describe how the overflow is controlled.

b) Gaseous
   1) Describe whether there are any plant features that can bypass the planned filtered/monitored ventilation pathway that have not been accounted for.

RR RAI 03

Describe whether all modes of operation (e.g., non-power/outage operations) have been considered. Specifically describe whether there are any increases in outdoor storage of radioactive materials during non-power operations/outages.

RR RAI 04

For areas where containment/confinement is not available:

a) Provide Calculation TID 2012-007.
b) Describe whether TID 2012-007 accounts for all of the areas indicated in Table E-1 as having no engineering controls/containment.
c) Describe whether there are any administrative controls in place to limit the amount of combustible material in the area (ISFSI, S/G mausoleum) or the amount of radioactive materials in the area to ensure releases are acceptable.
d) Describe whether the assessment credits operator actions. Describe the plans that were developed to minimize the potential for uncontrolled radioactive releases from these areas.

RR RAI 05

Attachment E, Table E-1, “Radioactive Release Review,” indicates that “training materials include strategies to minimize radiological release.” Provide examples of these strategies and describe how they will ensure releases do not result in doses that exceed Part 20 (or alternatively Technical Specification) limits.