## NRR-PMDAPEm Resource

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**Sent:** Friday, June 08, 2012 12:27 PM
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**Subject:** Draft RAIs on VC Summer NFPA-805 review
**Attachments:** ME7586 VC Summer NFPA 805 Draft Audit RAIs.docx

By letter dated November 15, 2011, South Carolina Electric and Gas Company submitted a license amendment request (LAR) to transition the fire protection licensing basis at the Virgil C. Summer Nuclear Station, Unit 1, 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 the SCE&G and also participated in an audit from June 4 to June 8, 2012 and have determined that additional information is needed to complete the review. Enclosed are requests for additional information (RAIs) in the draft stage.

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

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DRAFT REQUEST FOR ADDITIONAL INFORMATION
LICENSE AMENDMENT REQUEST TO ADOPT
NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805
PERFORMANCE-BASED STANDARD FOR FIRE PROTECTION FOR LIGHT WATER
REACTOR GENERATING PLANTS
VIRGIL C. SUMMER NUCLEAR STATION
(TAC NO. ME7586)

Fire Protection Branch
PRA Licensing Branch
Health Physics and Human Performance Branch

**Summer Monitoring Program RAI 01**

National Fire Protection Association Standard 805 (NFPA 805), section 2.6 "Monitoring" states that "a monitoring program shall be established to ensure that the availability and reliability of the fire protection systems and features are maintained and to assess the performance of the fire protection program in meeting the performance criteria" and that "Monitoring shall ensure that the assumptions in the engineering analysis remain valid."

Specifically, NFPA 805, Section 2.6 states that (2.6.1) "Acceptable levels of availability, reliability, and performance shall be established." (2.6.2) "Methods to monitor availability, reliability, and performance shall be established. The methods shall consider the plant operating experience and industry operating experience." (2.6.3) "If the established levels of availability, reliability, or performance are not met, appropriate corrective actions to return to the established levels shall be implemented. Monitoring shall be continued to ensure that the corrective actions are effective."

Section 4.6.2 "Overview of Post-Transition NFPA 805 Monitoring Program" of the Transition Report states that the NFPA 805 monitoring program will be implemented "after the safety evaluation issuance as part of the fire protection program transition to NFPA 805" (Table S-2, Implementation Items, item 4 of the Transition Report).

Furthermore, the licensee has committed to comply with Frequently Asked Question (FAQ) 10-0059. The staff noted that the information provided in Section 4.6.2 of the Transition Report is insufficient for the staff to complete its review of the monitoring program, and as such, is requesting that the following additional information be provided:

a. A description of the process by which structures, systems, and components (SSCs) and programmatic elements will be identified for inclusion in the NFPA 805 monitoring program, including the approach to be applied to any fire protection SSCs that are already included within the scope of the Maintenance Rule program.

b. A description of the process that will be used to assign availability, reliability, and performance goals to SSCs and programmatic elements within the scope of the monitoring program including the approach to be applied to any SSCs and programmatic elements for which availability, reliability, and performance goals are not readily quantified.

c. A demonstration of how the monitoring program will address response to programmatic elements that fail to meet performance goals (example discrepancies identified in programmatic areas such as combustible controls programs).

d. A description of how the monitoring program will address fundamental fire protection program elements.

e. A description of how the guidance in EPRI Technical Report 1006756, “Fire Protection Equipment Surveillance Optimization and Maintenance Guide” if used, will be integrated into the monitoring program.

Note that such changes permitted by NFPA Section 3.2.3 require NRC approval with an appropriate justification and required in accordance with 10 CFR 50.48 (c)(2)(vii).

f. A description of how periodic assessments of the monitoring program will be performed taking into account, where practical, industry wide operating experience including whether this process will include both internal and external assessments and the frequency at which these assessments will be performed.

g. A confirmation that periodic NFPA 805 assessments (audits) of the fire protection program will be conducted under the existing Fire Protection Quality Assurance Program. If not, describe the process that will be used to conduct these assessments.

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**Summer SSD RAI 01**

LAR Section 4.2.1.1, “Compliance with NFPA 805 NSCA (Nuclear Safety Capability Assessment) (Section 2.4.2)” states: “The NSCA methodology review evaluated the existing NSCA methodology against the guidance provided in NEI 00-01, “Guidance for Post-Fire Safe Shutdown Analysis”, Rev. 1, Chapter 3, "Deterministic Methodology," as discussed in Appendix B-2 of NEI 04-02, “Guidance for Implementing a Risk Informed Performance Based Fire Protection Program under 10 CFR 50.48(c).”

NEI 00-01, Rev. 2 is the current version cited in Regulatory Guide 1.205, “Risk Informed Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants”, Rev. 1. The license amendment request (LAR) references section lists Revision 1 and 2. Provide a gap analysis on the differences between the alignments using NEI 00-01, Rev.1, as the basis for transitioning the NFPA 805 nuclear safety capability as indicated in NEI 04-02, versus using NEI 00-01, Rev. 2, which is the current version cited in Regulatory Guide 1.205, Rev. 1.

**Summer SSD RAI 02**

LAR Section 4.2.1.2, “Safe and Stable Conditions for the Plant” states that “For the plant to be in a safe and stable condition, it may not be necessary to perform a transition to cold shutdown as currently required under 10 CFR 50, Appendix R. Therefore, the unit may remain at or below the temperature defined by a hot standby/hot shutdown plant operating state for the event.”

The above states that for the plant to be in a safe and stable condition, it may not be necessary to perform a transition to cold shutdown. Describe if there are any fire areas where it is necessary to perform a transition to cold shutdown. If yes, describe the fire areas/zones along with a list of cold shutdown systems and equipment for NFPA 805 compliance. Define the word “event” as it applies to the above statement.

**Summer SSD RAI 03**

LAR Section 4.2.1.2, “Safe and Stable Conditions for the Plant” states that “If evacuation of the Main Control Room (MCR) was required due to a significant fire in the Control Complex, the Control Room Evacuation Panel (CREP) is designed to provide the Instrumentation and Controls to maintain Hot Standby, as a Primary Control Station (PCS).”

Describe instrumentation and controls such as local equipment operation or instrument indications, not part of the CREP, used to maintain Hot Standby.

**Summer SSD RAI 04**

LAR Section 4.2.1.2, “Safe and Stable Conditions for the Plant” states that “Mode 5 - Cooldown to Cold Shutdown (Mode 5, RCS<200 $^{o}$F) uses the same equipment as Mode 4 and may proceed without further significant recovery actions. Other operational concerns include mode-dependent engineered safeguards features (ESF) equipment operability and equipment racked out for overpressure concerns.”

Describe whether single and multiple spurious actuations have been addressed for spurious initiation of containment sprays for over pressure concerns. This may include sprays initiated with a hot, dry containment that could result in a rapid depressurization of the containment, resulting in a challenge to containment integrity.

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**Summer SSD RAI 05**

LAR Section 4.2.1.2, “Safe and Stable Conditions for the Plant (Results)” states that “Some systems, such as the Chemical and Volume Control System (CVCS), serve multiple goals of coolant inventory addition and boric acid addition for long term reactivity control. Following the initial coping/assessment period at the start of a fire, the operators will maintain safe and stable conditions as follows:”

Define the term “initial coping/assessment period” as it is used in the above section. During this period, describe if and how any operators will be performing any safe shutdown operator (recovery) actions as a result of the fire. Describe what guidance documents and procedures operators use to determine when to exit the initial coping/assessment period.

**Summer SSD RAI 06**

LAR Section 4.2.1.3, “Establishing Recovery Actions” states “The discussion below provides the methodology used to define and assess the Recovery Actions necessary to support the goals of the NFPA 805 Nuclear Safety Capability Assessment (NSCA) for VCSNS. This process was initially based on FAQ 07-0030 (ML110070485) and consists of the following steps:”

Describe what this process is currently based on.

**Summer SSD RAI 07**

LAR, Attachment G, “Recovery Actions Transition” states that “Based on the definition provided in RG 1.205, and the additional guidance provided in FAQ 07-0030, the following location is considered taking place at the primary control station:”

A list of the actions is in the Results of Step 1 Section of the LAR.

RG 1.205, Section 2.4 states “The staff has identified two cases where operator actions taken outside the main control room may be considered as taking place at a *primary control station*. These two cases involve dedicated shutdown or alternative shutdown controls, which have been reviewed and approved by the NRC. In either case, the location or locations become primary when command and control is shifted from the main control room to these other locations.” Describe whether all of the actions in both cases have been reviewed and approved by the NRC and include the references indicating approval, including excerpts of statements of explicit NRC approval. Describe whether the location or locations of all of the actions become primary when command and control is shifted from the main control room to these other location. Describe whether the actions in both cases meet the criteria in RG 1.205, Section 2.4 a. and b.

**Summer SSD RAI 08**

LAR Section 4.2.1.2, “Safe and Stable Conditions for the Plant (Results)” states that “Reactor coolant system (RCS) pressure control is maintained by the ability to increase pressure by an emergency bus supplied pressurizer heater bank or by control of the charging rate and by the ability to reduce pressure by pressurizer power operated relief valve (PORV) operation.”

LAR Attachment B, Section 3.1.2.2, “Pressure Control Systems” states that “Although utilization of the pressurizer heaters and/or auxiliary spray reduces operator burden, neither component is required to provide adequate pressure control. Pressure reductions are made by allowing the

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RCS to cool/shrink, thus reducing pressurizer level/pressure. Pressure increases are made by initiating charging/makeup to maintain pressurizer level/pressure. Manual control of the related pumps is acceptable."

Explain the apparent differences between credited use of the pressurizer heaters for post fire safe shutdown. Provide a justification for the generic statement in Appendix B, Section 3.1.2.2 that "Manual control of the related pumps is acceptable." When pressurizer PORV operation is used for reducing RCS pressure, describe how it is analyzed as "required" for safe shutdown.

**Summer SSD RAI 09**

LAR Table S-1, "Plant Modifications Committed", indicates that a modification will provide instrument air auto start capability for Diesel Driven Air Compressor (XAC0014).

Explain the process used to analyze possible fire damage to instrument air equipment such as air filters that could create an air leak and affect the instrument air system pressure and/or capacity.

**Summer SSD RAI 10**

LAR Table 4-2, "NEI 04-02 Improvements, Post Transition Alignment (3.3.1.1 Cable Selection)" states "For the electrical functions/equipment identified in the NFPA 805 nuclear safety equipment list (NSEL), "required" circuits and circuit failure consequences were evaluated to support the NSCA functions have been targeted, analyzed and incorporated as input files into the NSCA.

Describe and explain how the above process includes cables for equipment that is classified as Important to Safety and associated circuits.

**Summer SSD RAI 11**

LAR Table 4-2 "NEI 04-02 Improvements, Post Transition Alignment (3.3.2 B Common Power Source Cables)" states "The NFPA 805 transition project has analyzed common power supplies required to be energized for the NSCA function to ensure compliance with NEI 00-01. Cases where breaker coordination has been determined to be insufficient, entries will be made into the Corrective Action Program as a part of NFPA 805 implementation."

Provide the status for the cases where breaker coordination was determined to be insufficient for the current electrical system. Describe whether entries were made into the Corrective Action Program for these cases, including compensatory measures for the current license, if necessary.

**Summer SSD RAI 12**

LAR 4.2.1.2 "Safe and Stable Conditions for the Plant, Safe and Stable Summary Description" states "An important part of maintaining RCS inventory is maintaining Reactor Coolant Pump (RCP) seal integrity. RCP seal cooling is maintained by either the charging pump seal injection path or the Component Cooling (CC) flow to the RCP thermal barrier heat exchanger. Modifications are planned (see Table S-1 in Attachment S) to provide a redundant seal injection system that is independent of the existing system and not affected in the problem fire areas. Second, a new seal material is planned (see Table S-1 in Attachment S) so that the loss of seal

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cooling does not lead to significant loss of RCS inventory. Until new seal materials are installed, procedures for seal cooling interruptions are in place to address the issue as a part of the existing appendix R analysis."

Describe if any of the new seal materials are scheduled to be installed during the transition period. If the new seals are not scheduled to be installed during the transition period, describe whether the procedures for seal cooling interruptions are planned to be part of the approved NFPA 805 license.

**Summer SSD RAI 13**

LAR Section 4.2.1.2, "Safe and Stable Conditions for the Plant, (Safe and Stable Summary Description)" states "Systems typically not credited (but potentially available) include instrument air, secondary side support, Industrial cooling, and other plant systems not associated with a safety function."

The above, addresses systems not typically credited. Provide the areas where any of these systems are credited and the analysis that documents that they would be available or describe how the probabilistic risk assessment (PRA) addresses their loss.

**Summer SSD RAI 14**

Describe the basis for Section 4.5.2, "Proper Polarity Three Phase Hot Shorts on alternating current (AC) Power Conductors" of the "NFPA and FPRA Circuit Analysis Technical Report", TR07800-009.

Describe whether the 13 open items in Appendix C, Circuit Analysis Opens Table, of "NFPA and FPRA (FPRA) Circuit Analysis Technical Report", TR07800-009, have been entered into the corrective action program (CAP) and whether they have been completed.

**Summer SSD RAI 15**

LAR Section 1.2, "Historical Perspective and Discussion", states that "Molded case circuit breakers should be periodically exercised and inspected and on a rotating refueling outage basis, should be sample tested to confirm drift remains in acceptable limits."

Describe how the above testing and exercising of the plant molded case breakers is procedurally controlled for breakers that are credited for meeting NFPA 805.

**Summer SSD RAI 16**

Section 2.0 "Scope" of "Safe Shutdown Separation Fire Protection Engineering Evaluations," TR0780E-001 states "The scope of this Technical Report is for the fire protection engineering evaluations (FPEEs) that are related to the NSCA and Safe Shutdown Separation requirements..."

Describe whether all open items, such as rework existing fire protection systems, have been completed. If not, describe how they are being tracked and provide the latest schedule for completion. Describe whether items that are not in compliance with the current license have been entered into the corrective action program.

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**Summer SSD RAI 17**

The alternate shutdown recovery actions (RAs) of Attachment 6 "(CREP Shutdown Transition (PCS) and Recovery Actions)", of "Nuclear Safety Capability Assessment Report Fire Shutdown Analysis" TR08620-312, differ from the alternate recovery actions in LAR Table G-1, "Recovery Actions and Activities Occurring at the Primary Control Stations."

Describe which document is correct, explain the apparent discrepancy, and make and describe any corrections made.

**Summer SSD RAI 18**

NEI 04-02 Table B-3, "Fire Area Transition" Attachment 14, Fire Area Assessment Table (Table B-3); Attachment 14, Fire Area IB08, and LAR, Attachment C, Fire Area IB08, discuss water from fire suppression activities draining to adjacent fire zones in the 412' Main floor area.

Describe whether the 412' Main floor area has been analyzed for this additional water draining into the area. Describe if there are similar areas where water from fire suppression activities could affect other areas and whether they have been analyzed.

**Summer SSD RAI 19**

Section 4.4.4.3.2, "Chilled Water Mechanical Chillers" of Technical Report TRO8620-015 "Nuclear Safety Equipment Report", Part 1, states that "A RA is available to start the B chiller or the C chiller on B train at the respective chiller control panel after taking the transfer switch to local."

This RA does not appear on LAR Table G-1. Discussions of RAs not in Table G-1 are found throughout TRO8620-015. Explain this discrepancy.

**Summer SSD RAI 20**

Section 4.3.1.3.5.c, "heating ventilation and air conditioning (HVAC) Systems" of Technical Report TRO8620-015 "Nuclear Safety Equipment Report", Part 1, states that "Plant-specific evaluations are necessary to determine which HVAC systems are essential to safe shutdown equipment operations."

Describe whether all HVAC systems evaluations been completed. Describe the actions, modifications and procedures that have been identified and include a schedule for completion.

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**Summer FPE RAI 01**

Incipient Detection is described as a necessary modification in LAR Attachment S for electrical cabinets. FAQ 08-0046 (NUREG 6850 Supplement 1) provides detailed discussion of the elements that are necessary to credit incipient detection systems for FPRA.

Provide more details regarding the elements of FAQ 08-0046. These elements include, but are not limited to system design features, NFPA code(s) of record, acceptance testing, and routine inspection, testing, and maintenance that will be implemented to credit the new incipient detection system. Provide details regarding availability and reliability. Describe whether this installation and the credit that will be taken will be in compliance with the methods and criteria of NUREG/CR- 6850 Supplement 1, Chapter 13, and FAQ 08-0046 (including conditions and limitations provided in the NRC closure memo ADAMS accession No. ML093220426) or will there be deviations. Provide justification for any deviations.

**Summer FPE RAI 02**

LAR Attachment S "Plant Modifications Committed" Table S-1 for ECR1553 identifies a modification to "improve availability and reliability of station communication system(s) during fire scenarios."

Provide more detail with regard to what specific modifications are being done. Describe whether these modifications are assumed to be in place when determining feasibility for Recovery Actions. Describe whether there are open items in the feasibility evaluation identifying the need to complete these modifications.

Table S-1 indicates that communications is "implicitly considered in credit for operator actions." Describe how communications was evaluated during Recovery Action feasibility evaluation and in the FPRA (establishment of Human Error Probabilities and Human Reliability Analysis).

**Summer FPE RAI 03**

LAR Attachment S "Plant Modifications Committed" ECR50810 is supposed to "provide mitigation strategies to address fire initiators or limit fire propagation."

Provide more detail for this modification(s) and describe what is being modified or being built, where it is being done, what design standards are being applied, and what elements of defense-in-depth are being satisfied.

This modification is identified as in the FPRA. Describe specifically where "in the FPRA" is the modification identified.

**Summer FPE RAI 04**

The LAR states in Table B-1 Section 3.2.3(2), Compensatory Actions will be revised and updated incorporating NFPA 805 insights.

Describe what compensatory actions will be revised and whether actions, impairment duration limits, or reporting requirements will be created or modified. If yes, provide a detailed list of those changes being made, and the justification for those changes in compensatory measures

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being considered. Describe whether the Technical Requirements Manual (or comparable plant document) is expected to transition or will it be superseded.

**Summer FPE RAI 05**

The LAR states in Table B-1 Section 3.3.1.2 states that "controls of limited duration" for untreated wood will be put in place…Attachment L1 identifies the need to use non-treated wood in limited quantities in an attempt to address unique situations.

Provide a description of the process that would control these deviations. Describe whether the future process will use the "Plant Change Evaluation" defined in NFPA 805 to evaluate the impact to the Fire Protection Program. Provide a specific description of engineering and administrative procedure changes that the FPE will use to control these elements of the requirement 3.3.1.2. Describe whether temporary noncompliances of limited duration will be considered program noncompliances requiring compensatory measures. Explain how instances of untreated wood will be controlled such that the assumptions of the FPRA will remain valid.

**Summer FPE RAI 06**

The LAR states in Table B-1 Section 3.3.9 that "A Fire Hazard Evaluation of the Transformer area considered drainage alternatives to that cited in this section. (Table S-2, Item 2)."

Provide more detailed explanation of the "considered drainage alternatives". Describe the significance of the reference to alternatives with regard to the compliance strategy in 3.3.9.

**Summer FPE RAI 07**

LAR Table B-1 Section 3.3.7.2 identifies that the outdoor high pressure flammable gas storage is evaluated in TR0780E-006. There is no bulk gas storage in this evaluation. Clarify this apparent discrepancy.

**Summer FPE RAI 08**

LAR Attachment L2 requests approval for "existing wiring in suspended ceilings." Describe what fire area(s) constitute "…suspended ceilings is limited in risk significant areas important to the NSCA, FPRA and NPO analysis?" The request states that "...wiring is specified to be within metal conduits, cable trays, armored cable, or rated for plenum use."

Explain whether this describes the "as-built" condition or the "as designed" condition. Describe the types of cables, the types of service, and the fire protection features (e.g. detection) that are currently installed above the suspended ceilings. Describe whether these cables are considered ignition sources in the FPRA and analyzed as fire scenarios in the individual physical analysis units (PAUs). Provide more detail regarding the as-built configuration and the justification for hazards mitigation.

**Summer FPE RAI 09**

LAR Attachment L3 "Electrical Cable Construction" does not identify the as-built condition of currently installed "existing non-compliant" cables.

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Describe the cable flame spread or other cable construction standards that were used for the currently installed cables. Describe whether these standards are addressed in FAQ 06-0022 and whether the current installation is different from the NFPA 805 requirement. Describe the hazards that are being presented and whether those elements are alternatively meeting the intent of the requirement.

**Summer FPE RAI 10**

LAR Attachment L4 “Bulk Gas Storage” presents an alternative method to meet a NFPA 805 requirement.

Provide justification why this alternative method is acceptable. The justification should include details regarding the extent of the hazard, the quantity and capacity of the tanks, a description of the refilling process and a description of the features that reduce the hazards associated with this alternative method.

**Summer FPE RAI 11**

LAR Attachment request L5 “Fire Brigade Notification” identifies the need to allow for delayed fire brigade response based on verification of a “direct visual contact with the fire”.

Describe how this delay will be factored into the assumptions for time-to-damage and non-suppression probability for the FPRA assumptions.

**Summer FPE RAI 12**

LAR Attachment request L9 “Hose Station” identifies that pressure and flow rates are not reduced by pressure reducers and requests that the NRC approve this configuration.

Provide justification why not reducing water pressure at hose stations is acceptable. Include a description of the system including the minimum and maximum calculated pressures and flows, the impact to personnel and equipment of not having the pressure reducing valves installed. In addition also include a description of any training provided to plant personnel using the hose stations at this higher pressure.

**Summer FPE RAI 13**

LAR Attachment request L11 appears to ask for approval of all existing fire detector layouts throughout the plant in accordance with NFPA 72E.

Describe whether the intention of this request is for the NRC staff to approve the individual locations of the detectors throughout the plant as being compliant with NFPA 72E. There is insufficient detail for the staff to approve the entire scope of fire detector layouts. If this is the intention, detailed code evaluations which include deviations for each noncompliance, a justification for the suitability of noncompliance, and proposed resolutions for each deviation should be provided to the staff.

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**Summer FPE RAI 14**

Table B-1 compliance statement CA – is defined as either 1.) Clarification of the requirement or as a 2.) Submitted request for approval. Approvals are listed in Attachment L and presented as (C)(2)(vii)'s.

NEI 04-02 Section 4.3.1 provides specific compliance statements for each Chapter 3 attribute. Two of the means to comply are:

- Complies with Clarification - Items that are not in 'literal compliance' with the requirement as listed in NFPA 805 but should be transitioned as complies, and
- 10 CFR 50.48(c)(2)(vii) allows licensees to use performance-based methods to demonstrate compliance with NFPA 805 Chapter 3 requirements.

These two compliance strategies are combined into "Complies by Alternative (CA)." This is interpreted as some CA's in table B-1 are merely editorial clarifications and others require separate NRC approval as a 10 CFR 50.48 (c)(2)(vii) listed in Attachment L.

In an effort to ensure clarity, provide a listing of each Chapter 3 requirement that uses "CA" as the compliance strategy and explicitly delineate which strategy is being chosen. If the strategy is intended to be an editorial change then explicitly state the editorial clarification or change. If the strategy is a request for approval then state which approval in Attachment L is being credited for compliance in the specific NFPA 805 Chapter 3 requirement.

**Summer FPE RAI 15**

Table B-1 identifies Chapter 3 elements where credit is being taken for "Previous NRC Approval (CNRC)". Compliance statements are identified in Table B-1, but the reference SER NRC Approval is not identified. The results summary only indicates "…were previously found to be acceptable and has been summarized in the defined evaluation." NEI 04-02 Section 4.3.1 and associated Figure 4-2 delineate the method to identify those requirements where previous approval has been used. The section 4.3.1 and the simplified flowchart identify the need to provide verbatim excerpts from the submittal documents and the approval documents in the compliance basis field.

For those requirements in Table B-1 of the LAR where the licensee has chosen to credit CNRC, provide appropriate SER references and excerpted submittal and approval statements of explicit NRC approval. Provide statements regarding the continued validity of the original basis of approval.

**Summer FPE RAI 16**

In the definition of the Power Block Attachment I Table I-1 the Yard is identified as a power block structure included in the fire protection program. Confirm that this designation includes the following structures/features:

a. Condensate Storage Tank
b. Refueling Water Storage Tank
c. Manholes
d. Diesel Generator Fuel oil Tanks
e. Auxiliary Boiler Oil Storage Tanks

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f. Transformers

If any of these are not included provide justification for their exclusion.

**Summer FPE RAI 17**
In plant partitioning for FPRA, confirm that no active fire barriers (e.g. water curtains), thermal wraps, ERFBS, or fire resistant coatings are used to credit partitioning boundaries. If any of these fire protection features are credited in this manner, identify what type, fire area / zone location, and duration of rating credited.

**Summer FPE RAI 18**

The LAR states in Table B-1, Section 3.11.3, that NFPA101 is exempted from the scope of the NRC review per 10 CFR 50.48 C.2 (i) regarding Life Safety.

The NFPA 805 requirement relates to the features of penetrations in fire barriers, specifically doors and dampers. Identify the strategy of compliance with Section 3.11.3 Fire Barrier Penetrations with regard to NFPA 101.

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**Summer FM RAI 01**

National Fire Protection Association Standard 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition, (NFPA 805), Section 2.4.3.3, states: "The PSA [probabilistic safety assessment] approach, methods, and data shall be acceptable to the AHJ [authority having authority] ... " 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.

- CFAST was used to calculate Hot Gas Layer (HGL) temperature for damage determinations in selected fire zones throughout the plant.

- Fire Dynamics Tools (FDT$^s$) was used to calculate Zone of Influence (ZOI) dimensions in selected fire zones throughout the plant.

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

Specifically regarding the acceptability of CFAST for the control room abandonment time study:

a. Provide the input files in electronic format for 6 selected CFAST runs that were conducted, i.e., the input files for the cases with the highest heat release rate (HRR) in Tables 6, 8, 10, 13, 15 and 17 in the Control Room Risk Calculation Report (Section 8 of Calculation No. DC0780B-100, Fire Modeling: CB17.01).

b. Due to presence of a large number of cabinets and control boards, the effective volume of the MCR will be less than if calculated using the length, width and height. Explain why the presence of this equipment was not considered in the volume estimation.

c. In Section 4.3.3 of Calculation No. DC0780B-100, it is discussed how the horizontal natural ventilation flow areas are determined. It appears that a characteristic opening fraction from the study of Klote and Milke was used to calculate the average opening fraction for every door. Explain why an average characteristic value for all opening gaps is used instead of the actual door gaps.

   Explain why this approach is conservative and describe the results of the parametric analysis to show the dependence of abandonment time on the ventilation opening area, if such an analysis was performed.

d. Explain why the default drop-off and zero flow pressure values in CFAST were used. Explain how these values are consistent with the plant specific HVAC data.

e. Calculation No. DC0780B-100 mentions (page 16 of PDF) that the fire location was chosen such that it produces worst case fire scenarios. Explain the justification for this assertion.

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In addition, it is noted (page 21 of PDF) that the fire location for all simulations is at floor level in the center of the room. It is stated that the central location of the fire limits the effects of the walls on the fire growth and the plume behavior. It is not clear to the NRC staff what is meant by 'limits the effects of the walls on fire growth and plume behavior.' Explain this statement in greater detail.

f. The abandonment time analysis has not considered fire spread from one cabinet to adjacent cabinets. However, Section 9.2 and Table 20 of Calculation No. DC0780B-100 discuss the phenomenon of fire propagating to adjacent cabinets. Please provide justification for not considering a scenario involving multiple cabinet fires in the calculation for time to abandonment.

g. It is assumed that the HRR of the transient fires is bounded by the large fixed ignition source fire (electrical cabinets with unqualified cable, fire in multiple cable bundles).

    i. The growth time for the cabinet fire is 12 minutes, whereas according to FAQ-52, the average growth time for transient fires could be 0, 2 or 8 minutes, depending on the actual transient combustible. Provide additional justification for the assumption that the large fixed ignition source fire is bounding for transient fires.

    ii. Though the hot gas layer temperature and optical density is not dependent on the location of the fire, the licensee has used targets to assess the radiant heat flux criterion. It would seem that the location of a transient fire could affect these calculated target heat fluxes. Provide additional justification for not postulating any transient fires for the purpose of calculating control room abandonment.

h. The report provides results of a sensitivity study for the times to abandonment for different arrival times of the fire brigade with and without forced ventilation. Provide the results from any additional sensitivity studies performed to address fire location, ambient temperature, etc.

Regarding the acceptability of the PSA approach, methods, and data in general as discussed in the paragraph above:

i. Calculation DC0780B-001 suggests that an opening of 0.5-in. is assumed below every door if the leakage area is not known, as per NUREG-6850 section F.2. It appears that NUREG-6850 prescribes this assumption only for hot gas layer calculations. Please clarify whether this assumption was used for every fire modeling calculation or just for hot gas layer calculations. Also, the methodology used in the MCR risk calculation seems to differ from this approach. Provide further justification for this approach to door leakage areas.

j. It is not clear how the dimensions of a "transient zone" are determined. The report states that the transient zones are larger compared to the traditional ZOI dimensions. Clarify how the dimensions for the transient zones are determined.

k. On page 12 of the PDF of Calculation DC0780B-001 (bullet No. 4 of the second paragraph described under the engineering judgment scenario), it is assumed that some fire suppression activity will be initiated before fire spreads from one transient zone to others. Explain how this is ensured when determining the transient zone size.

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l. Based on the last paragraph of page 13 of the PDF (Calculation DC0780B-001), it appears that the decision to perform detailed fire modeling for a transient zone was not based on some numerical screening threshold, but was based on the judgment of the PRA analyst. Clarify what criteria were used to screen areas where fire modeling would be performed. Include a justification for why the criteria are acceptable.

m. Page-22 of the PDF (Calculation DC0780B-001) describes the method, by which targets have been identified. It is stated that if the specific location of the target is not known, it has been assigned to all the scenarios. Clarify how the location of the target was determined for every scenario that it has been assigned to and how the guidance on fire location discussed on page 27 of the PDF has been applied for this case.

n. Clarify what is meant by "bounding vertical and horizontal distances were used for calculating detection time" (page 27 of the PDF of Calculation DC0780B-001). It is not clear how these values were calculated for a room that has numerous obstructions that could significantly delay detection and activation. Provide examples from specific analyses in which these activation times are calculated.

   Also, elaborate how the suppression time was conservatively estimated as stated in Section 6.2 2(b) of Calculation DC0780B-001.

o. What are the criteria used in the generic methodology described in Calculation DC0780B-001 for determining when a more complicated fire model is necessary for evaluation of a given problem (e.g., prediction of sprinkler activation in a space with complicated geometry)?

p. On page 27 of PDF of Calculation DC0780B-001 there is discussion about uncertainty of fire location. Location factor is not explicitly discussed here. Provide additional information about how the generic methodology treats fires located close to walls or corners.

q. On page 54 of the PDF of Calculation DC0780B-001 there is a discussion about the targets at VCS. It is reported that since there is approximately 10% unknown cable and the rest is known to be thermoset, the whole plant is considered to have only thermoset cable. Provide additional justification why it is not necessary to address this 10% of unknown cable more conservatively, if any non-thermoset cables are located in the fire zones for which detailed fire modeling was conducted.

r. On page 60 of PDF of Calculation DC0780B-001, there is discussion about the assumption of an 'incubation time' of ten minutes from hotwork fire initiation to propagation to the next tray. This same approach is used on page 63 of the PDF in Section E.4 on Junction Boxes. Is this methodology utilized at VCS and if so, provide additional justification for this assumed time period.

s. On page 26 of the PDF of Calculation DC0780F-096 for Fire Modeling Fire Area CB10 VFDR, it is discussed that this staging area also requires that no combustible be placed within one foot of the adjacent walls, so that wall effects of the fire source do not have to be accounted for. Provide additional justification for this critical dimension of one foot of separation, beyond which wall and corner effects can be ignored. Expand the response

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to this question for the other fire areas where this critical separation distance is utilized (CB 12, CB18 and IB11).

t. During the walkdown of fire zone IB25, the staff reviewed the analysis of the fire scenarios in IB25.01.02 subzone, which credited fire suppression/detection. The staff has the following questions about the analysis performed in this fire zone.

- During the audit, the staff noted that it is discussed in the detailed fire modeling report that standard response sprinklers are used in the fire zone and therefore a Response Time Index (RTI) of 130 $(m\text{-}s)^{0.5}$ was used for the analysis. The licensee justified this value for the RTI by way of reference to NUREG 1805, "which provides a generic RTI value of 130 $(m\text{-}s)^{0.5}$ for standard response heads with a fusible link." However, in Chapter 10 of NUREG 1805, there is a note about selecting the RTI of a sprinkler element which states, "the actual RTI should be used when the value is available." Provide justification for the RTI value chosen for this analysis and describe how that value compares with the RTI of the actual sprinklers in the fire zone. Apply this response to any additional fire zones where detailed fire modeling was conducted to address credited suppression systems.

- For at least one of the fire scenarios in this zone, a sprinkler activation calculation was performed to determine if/when a sprinkler would actuate. In this fire zone, there are sprinklers and smoke detectors at ceiling level and additional sprinklers at an intermediate level several feet below the ceiling. The staff have the following questions about how that configuration may impact the existing analysis:

    - The FDT calculation for sprinkler activation assumes that the fusible link is located a short distance (a few inches) below a flat ceiling extending in all directions. The current analysis credits intermediate level sprinklers activating, however, these heads are located several feet below the ceiling overhead. In addition, these intermediate level sprinklers were not observed to have "heat collectors" over the heads. The staff request the licensee to provide justification for the assumption that this configuration does not affect the conclusions of the analysis

    - At the audit, the staff was informed that the sprinkler system is a pre-action system and therefore requires a signal from the smoke detection system in order for water to flow to the heads. Therefore, it is important for the analysis to include the timing of smoke detection activation with respect to intermediate level sprinkler activation. The staff request that the licensee provide further clarification about the timing between smoke detector activation and intermediate-level sprinkler activation.

u. During the audit, the staff walked down fire zone CB10, which is one of the performance-based fire modeling zones. In this zone a "transient staging area" has been proposed in the fire modeling analysis. In this southwest corner of the compartment, the staff observed three vertical pipes directly adjacent to the staging area. One of the pipes is steel, but the other two are copper pipes that are jacketed with some insulation that is non-metallic. It was not obvious what the material flammability characteristics of this insulation are and if it could be ignited from an adjacent transient fire. The staff request

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that the licensee provide additional information about this insulation and how it could affect the conclusions of the analysis.

v. During the audit, the staff walked down fire zone IB11, which is one of the performance-based fire modeling zones. In this zone a “transient staging area” has been proposed in the fire modeling analysis. This staging area is identified as being located 4.5-ft from a nearby VFDR cable tray. However, during the walkdown, the staff observed several exposed cables extending from this VFDR tray in the direction of the staging area. The staff confirmed that the licensee measured the distance to the staging area from the edge of the VFDR cable tray, rather than this exposed cable. The staff request that the licensee provide additional information about this configuration and how it could affect the conclusions of the analysis.

w. During the audit, the staff discussed the fire modeling analysis performed in fire zone CB4. Part of this analysis utilized CFAST to calculate the HGL temperature, which was used to determine whether damage would propagate outside the originating transient zone. Since CFAST is a zone fire model, the HGL temperature that is calculated is an average temperature for the upper gas layer in the compartment. In reality, a higher HGL temperature will be observed closer to the fire source than far away from the fire source. The staff request that the licensee provide additional information to confirm that the fire postulated will not lead to damage beyond the originating transient zone.

   It is of interest that the limits of applicability, with respect to room dimension aspect ratios for CFAST, were slightly exceeded for the L/H ratio. Explain why this is acceptable.

x. Provide the CFAST input files in electronic format for 9 selected fire zones (that were walked down during the site audit on June 5, 2012) that utilized detailed fire modeling calculations, i.e., the input files for CB10, CB12, CB18, IB11, CB15, CB04, CB06, AB01 (21.02), and IB25 (01.02).

**Summer FM RAI 02**

NFPA 805, Section 2.5, requires damage thresholds be established to support the performance-based approach. Thermal impact(s) must be considered in determining the potential for thermal damage of structures, systems, or components. Appropriate temperature and critical heat flux criteria must be used in the analysis.

It is stated in Section 3.1.3 on page 21 of the Fire PRA Plant Final Report (Calculation DC000340-001) that " The damage and ignition criteria used for the VCSNS Fire PRA are 205°C (401°F) or 6 kW/$m^2$, which correspond to thermoplastic cable (See Table 8-2 of NUREG/CR-6850). The ZOI is developed assuming that any cable in a thermal environment that meets or exceeds the damage and ignition criteria above will be damaged.”

Section C.10 of Calculation DC0780B-001 there is a discussion about the targets at VCS. It is reported that there is approximately 10% unknown cable and the rest is known to be thermoset, the whole plant is considered to have only thermoset cable.

Provide the following information:

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a. For the 10% of unknown cabling, characterize the installed thermoset and thermoplastic cabling in the power block specifically with regard to the critical damage threshold temperatures and critical heat flux threshold as described in NUREG/CR-6850. Provide a statement regarding the extent of installed thermoplastic cable insulation.

b. If necessary, explain how raceways with a mixture of thermoset and thermoplastic cables were treated in terms of damage thresholds and heat release rate and fire propagation.

c. If thermoplastic cabling is present, discuss impact on ZOI size due to increased HRR and fire propagation.

d. If thermoplastic cabling is present, discuss self-ignited cables and their impact to additional targets created.

e. Explain if and how covered, partially covered, or holes in closed raceways affected the damage thresholds of cables used in the analysis.

f. How were the damage thresholds for non-cable components (i.e., pumps, valves, electrical cabinets, etc.) determined? Are there any non-cable components that were assigned damage thresholds different from those for cables and, if so, explain how those thresholds have been evaluated for damage and ignition?

g. If more targets are identified describe the impact to core damage frequency (CDF) and large early release frequency (LERF), as well as changes in CDF ($\Delta$CDF) and changes in LERF ($\Delta$LERF) for those fire zones affected.

**Summer 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."

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

Furthermore Section 4.7.3 "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805" of the Transition Report states that, "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 has been mentioned in both Generic Methodology calculations (DC0780B-001 and DC0780C-001) that a tool called VC Summer Fire Modeling Database has been developed using Microsoft® Access. Explain how it was developed along with the underlying mathematical bases for this package and the supporting spreadsheets that were used to perform the FDT calculations. In addition, explain how this package and the supporting spreadsheets were verified.

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b. Provide technical details to demonstrate that the fire models have been applied within the validated range of input parameters, or to justify the application of the model outside the validated range reported in NUREG-1824 or other V&V basis documents.

c. In Attachment J of the LAR, the normalized parameter $L_f/H_c$ was calculated and reported to be within range for the four fire areas that had performance-based calculations, per Section 4.2.4.1 of NFPA 805. The most recent draft of NUREG 1934, which explains how to calculate these parameters, corrects a clerical mistake for this normalized parameter. This parameter should be $(L_f+H_f)/H_c$ (to account for fire elevation). Please confirm that this normalized parameter was calculated correctly and if not, describe whether the new value is within the parameter's range of applicability. Provide justification for the use of the fire model in cases when the new parameter value is outside the validation range.

d. It appears that these normalized parameters were only calculated for fire zones where the methodology described in Section 4.2.4.1 of NFPA 805 was used. Provide a discussion of the normalized parameters for all fire zones where fire modeling was conducted.

e. During the audit, the staff observed that the spreadsheets included in Attachment 1 (Supporting Documents) of the reports for the zones where detailed fire modeling was performed show hand calculations. The equation that was used to calculate the plume temperature at a specified height shown on some printouts (e.g. one of the printouts in the report for zone AB01.21.02) is different from that shown on the 09_Plume_Temperature_Calculations FDT spreadsheets. Provide the origin of the version of Heskestad's equation that was used and explain how this equation was verified and validated.

**Summer 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 verifications 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 and are used with the same limitations and assumptions supported by the V&V for the methods as required by Section 2.7.3.3 of NFPA 805."

Regarding the limitations of use, identify uses, if any, of the fire modeling tools outside the limits of applicability of the method and for those cases explain how the use of the fire modeling approach was justified. An example of this limit of applicability issue can be referenced in RAI 01, item v.

**Summer 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

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

"Cognizant personnel who use and apply engineering analysis and numerical methods in support of compliance with 10 CFR 50.48(c) was competent and experienced as required by Section 2.7.3.4 of NFPA 805.

This requirement will continue to be met by adherence to SCE&G procedures and project management of contractor support staff. For personnel performing fire modeling or Fire PRA development and evaluation, VCSNS and contract personnel developed and maintained project instructions to be used by individuals assigned various tasks, to ensure consistency of the engineering and PRA products. These instructions were developed by personnel with intimate knowledge and experience in the task subject matter. Task specific instructions were developed to identify and document required training and mentoring to ensure individuals are appropriately qualified per the requirements of NFPA 805 Section 2.7.3.4 to perform assigned work."

Regarding qualifications of users of engineering analyses and numerical models:

a. Describe what constitutes the appropriate qualifications for the VCS, Unit 1 staff and consulting engineers to use and apply the methods and fire modeling tools included in the engineering analyses and numerical models.

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

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

**Summer 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."

NFPA 805, Section 1.6.9, defines “Completeness Uncertainty” as “uncertainty in the predictions of the model due to model scope limitations. This uncertainty reflects an unanalyzed contribution or reduction of risk due to limitations of the available analytical methods.”

NFPA 805, Section 1.6.40, defines “Model Uncertainty” as uncertainty in the predictions of a model related to the equations in the model being correct, whether or not they are appropriate to the problem being solved, and whether or not they are sufficiently complete.”

NFPA 805, Section 1.6.43, defines “Parameter Uncertainty” as uncertainty in the predictions of a model due to uncertainties in the numerical values of the model parameters.”

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Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," of the Transition Report states that "The impact of important uncertainties on the Fire PRA results was established using extensive, well formulated sensitivity studies to provide reasonable assurance that the performance criteria have been met as outlined in Section A of 2.7.3.5 of NFPA 805."

Regarding the uncertainty analysis for fire modeling:

a. Describe how the uncertainty associated with the fire model input parameters (compartment geometry, radiative fraction, etc.) was accounted for in the analysis?

b. Describe how the "model" and "completeness" uncertainties were accounted for in the analysis. An example of completeness an uncertainty issue is described in RAI 01, item b.

**Summer FM RAI 07**

Section 4.5.2.1, "Fire Modeling Approach" of the Transition Report discusses the performance-based approach via fire modeling. Reference is made to Attachment J, "Fire Modeling V&V," for a discussion of the acceptability of the fire models that were used.

Directly after this reference to Attachment J, there is a note, which states, "At VCSNS, the use of the fire modeling option (see NFPA 805, Section 4.2.4.1) to disposition potential variances from deterministic requirements follows a predefined process documented in the NFPA 805 project instructions or SCE&G design guides. The objective of these documents is to provide the framework for the use of fire modeling both during the NFPA 805 transition and in the future while the plant operates under NFPA 805 licensing basis. Consistent with the fire modeling requirements in NFPA 805, these documents allow for the use of fire models that are verified and validated within a range of applications. Consequently, the fire models available for use at VCSNS when operating under NFPA 805 are not limited to the ones selected for supporting the transition. Fire models that are verified and validated (e.g., FDS, CFAST, FDTs, etc.) and are exercised within the corresponding application range may be used in the future following the process outlined in the project instructions and in accordance with the requirements of NFPA 805."

The staff does not agree that a fire modeling methodology, which has not been previously reviewed by the NRC, can be used for a future plant change evaluation. The note in the Transition Report should be revised to only allow the future use of fire model methodologies that have been reviewed in the context of this license amendment request.

**Summer FM RAI 08**

NFPA 805, Section 2.4.4.3, "Safety Margins," states: "The plant change evaluation shall ensure that sufficient safety margins are maintained. The deterministic approach for meeting the performance criteria shall be deemed to satisfy this safety margins requirement."

NFPA 805, Section 4.2.4.1.5, "Protection of Required Nuclear Safety Success Path(s)" discusses the required safety margins in the context of the difference between the maximum expected fire scenario (MEFS) and the limiting fire scenario (LFS). This margin is to account for uncertainties and unknowns in the analytical process and to ensure adequate defense-in-depth is provided and nuclear safety performance criteria are met and maintained.

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Provide a discussion of the uncertainties and margin that exist for fire areas utilizing the performance-based approach and a technical justification for how the analysis meets the regulatory requirements.

**Summer FM RAI 09**

During discussions at the audit and based on review of the detailed fire modeling reports supporting the performance-based fire modeling approach in fire areas CB10, CB12, CB18 and IB11, the staff learned that the licensee has credited the use of a detailed administrative controls methodology in the performance-based fire modeling analyses.

However, it is not clear whether this approach has adequately considered all of the necessary aspects to ensure that a post-transition administrative controls program will be implemented such that the technical assumptions included in the fire modeling calculations are not violated. For instance, it is not clear whether a height limitation will be included in an administrative procedure to ensure that combustible materials stored in transient staging areas do not exceed the values used in the analysis.

Provide a discussion on the bases used to develop the performance-based fire modeling scenarios and a description of and a commitment for how the post-transition procedures will maintain a program that is consistent with the fire modeling calculations.

In addition, provide a discussion of the defense-in-depth concept that was applied in areas where performance-based fire modeling was used such that administrative control procedures are not the only form of protection in a given fire area.

Provide a discussion of what other features or circumstances exist, which would ensure safety in the event that an administrative control procedure is violated or unsuccessful.

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**Summer PRA RAI 01**

Describe how the evaluation includes the possible increase in heat release rate caused by the spread of a fire from the ignition source to other combustibles. Summarize how suppression is included in the evaluation.

**Summer PRA RAI 02**

Transient fires should at a minimum be placed in locations within the plant physical access units (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 (but not impossible), keeping in mind the same philosophy. Describe how transient and hot work fires are distributed within the PAUs. In particular, identify the criteria that determines where an ignition source is placed within the PAUs. Also, if there are areas within a PAU where no transient or hot work fires are located since those areas are considered inaccessible, define the criteria used to define "inaccessible." Note that an inaccessible area is not the same as a location where fire is simply unlikely, even if highly improbable.

**Summer PRA RAI 03**

Discuss the calculation of the frequencies of transient and hot work fires. Characterize the use of the influence factors for maintenance, occupancy, and storage, noting if the rating "3" is the most common, as it is intended to be representative of the "typical" weight for each influence factor. It is expected that the influence factor for each location bin associated with transient or hot work fires will utilize a range of influence factors about the rating "3," including the maximum 10 (or 50 for maintenance) and, if appropriate, even the rating "0." Note that no PAU may have a combined weight of zero unless it is physically inaccessible, administrative controls notwithstanding. In assigning influence factor ratings, those factors for the Control/Auxiliary/Reactor Building are distinct from the Turbine Building; thus, the influence factor ratings for each location bin are to be viewed according to the bin itself.

**Summer PRA RAI 04**

If any influence factors that were used were outside of the values identified in Table 6-3 of NUREG/CR-6850, identify the values used, identify the PAUs that use these factors, and justify the assigned factor(s).

**Summer PRA RAI 05**

Describe the methodology that was used to evaluate defense-in-depth and that was used to evaluate safety margins. 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 the philosophy of defense-in-depth or sufficient safety margins.

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**Summer PRA RAI 06**

The transition report describes and justifies an initial coping time of 24 (48, 72) hours, after which, actions are necessary to maintain safe and stable beyond 24 (48, 72) hours. Provide a discussion of the actions necessary during and beyond 24 (48, 72) hours to maintain safe and stable conditions beyond 24 (48, 72) hours such as refilling fluid tanks or re-aligning systems. Evaluate quantitatively or qualitatively the risk associated with the failure of actions and equipment necessary to extend safe and stable beyond 24 (48, 72) hours given the post-fire scenarios during which they may be required.

**Summer PRA RAI 07**

Section 10 of NUREG/CR-6850 Supplement 1 states that a sensitivity analysis should be performed when using the fire ignition frequencies in the Supplement instead of the fire ignition frequencies provided in Table 6-1 of NUREG/CR-6850. Provide the sensitivity analysis of the impact on using the Supplement 1 frequencies instead of the Table 6-1 frequencies on core damage frequency (CDF), large early release frequency (LERF), ΔCDF, and ΔLERF for all of those bins that are characterized by an alpha that is less than or equal to one. If the sensitivity analysis indicates that the change in risk acceptance guidelines would be exceeded using the values in Table 6-1, justify not meeting the guidelines.

**Summer PRA RAI 08**

Describe how CDF and LERF are estimated in main control room (MCR) abandonment scenarios. Describe if any fires outside of the MCR cause MCR abandonment because of loss of control and/or loss of control room habitability. Describe whether “screening” values for post MCR abandonment are used (e.g., conditional core damage probability of failure to successfully switch control to the Primary Control Station (PCS) and achieve safe shutdown of 0.1) or have detailed human error analyses been completed for this activity. Justify any screening value used.

**Summer PRA RAI 09**

It was recently stated at the industry fire forum that the Phenomena Identification and Ranking Table Panel (PIRT) being conducted for the circuit failure tests from the DESIREE-FIRE and CAROL-FIRE tests may be eliminating the credit for Control Power Transformers (CPTs) (about a factor 2 reduction) currently allowed by Tables 10-1 and 10-3 of NUREG/CR-6850, Vol. 2, as being invalid when estimating circuit failure probabilities. Provide a sensitivity analysis that removes this CPT credit from the PRA and provide new results that show the impact of this potential change on CDF, LERF, ΔCDF, and ΔLERF. If the sensitivity analysis indicates that the change in risk acceptance guidelines would be exceeded after eliminating CPT credit, please justify not meeting the guidelines.

**Summer PRA RAI 10**

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

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a) A summary of PRA model additions or modifications needed to determine the reported changes in risk. If any of these model additions used data or methods not included in the FPRA Peer Review please describe the additions.
b) Identification of new operator actions (not including post MCR abandonment which are addressed elsewhere) that have been credited in the change in risk estimates. If such actions are credited, how is instrument failure addressed in the HRA.

**Summer PRA RAI 11**

Describe whether the peer reviews for both the internal events and FPRAs consider the clarifications and qualifications from Regulatory Guide (RG) 1.200, Revision 2, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," March 2009 (ADAMS Accession No. ML09041 0014) to the ASME/AMS PRA Standard. If not, provide a self-assessment of the PRA model for the RG 1.200 clarifications and qualifications and indicate how any identified gaps were dispositioned.

**Summer PRA RAI 12**

Identify if any 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 the PRA modeling of these cables contributes to the VFDR delta-risk evaluations.

**Summer PRA RAI 13**

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

**Summer PRA RAI 14**

Identify any changes made to the internal events or FPRA since the last full-scope peer review of each of these PRA models that are consistent with the definition of a "PRA upgrade" in ASME/ANS-RA-Sa-2009, as endorsed by Regulatory Guide 1.200. Also, address the following:

a. If any changes are characterized as a PRA upgrade, identify if a focused-scope peer review was performed for these changes consistent with the guidance in ASME/ANS-RA-Sa-2009, as endorsed by Regulatory Guide 1.200, and describe any findings from that focused-scope peer review and the resolution of these findings for this application.
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 address this review deficiency.

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**Summer PRA RAI 15**

FSS-A4-01: According to DC000340-001, the multi-compartment analysis (MCA) postulated that a fire must burn 20 minutes to damage equipment across spatial separation or into an adjacent compartment. Provide justification for this assumption. Ensure that you discuss why damage may not occur in less than the time assumed, in this case 20 minutes.

**Summer PRA RAI 16**

FSS-A4-02: According to the plant disposition, the individual fire zones have been updated to address the peer review concern that suppression credit is not adequately justified. The plant disposition indicates that this discussion has been added, but provides no technical response about the various types of suppression included, the criteria for its credit, and how it is credited. As a result, provide a technical response which addresses these issues for your crediting of fire suppression in your FPRA.

**Summer PRA RAI 17**

FSS-C7-01: The peer review finding indicates that dependencies between automatic and manual suppression systems are not addressed in the FPRA. The plant disposition indicates this is addressed, but provides no technical response. Provide a technical justification that the dependency between automatic and manual suppression is addressed in the FPRA.

**Summer PRA RAI 18**

FSS-D3-01: The peer review indicated that in many cases detailed fire modeling was not performed, leading to conservative results. The plant disposition indicates that a set of scenarios in the auxiliary building (AB) had only received preliminary screening analysis at the time of the peer review, yet now has been done. No technical response has been provided in the plant disposition. As a result, describe those scenarios which were added to evaluate the AB, characterizing their ignition, damage, suppression, CCDP, and CDF/LERF.

**Summer PRA RAI 19**

FSS-D8-01: The peer review found that credit for detection and suppression was not documented and thus rendered a Not Met to the corresponding SR. Your response only references dispositions to other facts and observations (F&Os) which also need additional technical discussion added. Provide a general technical description of the extent of crediting these fire protection features.

**Summer PRA RAI 20**

FSS-D9-01: According to the plant disposition, the discussion on smoke effects treatment in the FPRA was expanded as a result of the peer review finding. Provide a more complete technical response identifying the short term damage which you included in your FPRA.

**Summer PRA RAI 21**

FSS-G2-01: The plant disposition indicates that damage to sensitive electronics has been incorporated in the FPRA. Indicate those components that meet the criteria for sensitive electronics and justify why this damage is not assumed beyond the control room and relay

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room. For example, in many cases, switchgear has electronic undervoltage, overvoltage, under/over frequency and other types of sophisticated relays that are just as temperature sensitive as control modules. In your response, indicate what other electrical cabinets are installed in plant areas other than the MCR and relay room.

**Summer PRA RAI 22**

FSS-H5-01: The peer review identified that parameter uncertainty evaluations were not performed. Counter to the plant disposition, discussions during the audit revealed that these evaluations were not performed. Since this analysis is needed to achieve CCII, perform these studies and provide the results to achieve CCII. If CCI is all that is desired, justify the adequacy of CCI. In this justification, explain why CCI does not lead to underestimation of $\Delta$CDF, $\Delta$LERF, CDF, and LERF.

**Summer PRA RAI 23**

CS-A10-01: Provide a discussion on when routing is assumed. In particular, what is the routing assumed between cable trays in a single PAU or between PAUs. Describe how the assumed routing is treated when establishing fire PRA targets.

**Summer PRA RAI 24**

PP-B2-01: This F&O is listed as a suggestion, but it is the only F&O describing PP-B3 which is attributed a “Not Met” by the peer review. The peer review suggestion identifies that spatial separation as a partitioning feature is not justified for certain cases. The justification is not provided in the plant partitioning document. Provide a description of the configurations for those configurations identified in the F&O, and justify spatial separation as a partitioning feature. The plant disposition does not address the partitioning, yet indicates that the multicompartment analysis takes into consideration scenarios which accounts for the interactions across this spatial separation.

**Summer PRA RAI 25**

ES-A6-01: Item 4, pg 14 of the FPRA plant final report indicates that at a maximum 2 spurious operations are included. With respect to ES-A6, this implies that CCII was not met. The peer review rating in table V-16 confirms that CCI was assigned, but the F&O ES-A6-01 is not provided in the LAR. Provide this F&O and the plant disposition. Justify the achieved capability category.

**Summer PRA RAI 26**

For F&O PRM-A4-01, provide a markup or show where appropriate documentation has been included in Task 5.2 and 5.5 to show that for a given fire scenario, the appropriate initiator is selected (due to impacted equipment) and the related mitigation system fault tree logic is valid.

**Summer PRA RAI 27**

F&O PRM-A4-02 identifies improper modeling of MSO scenarios. The disposition only states the model was reviewed for accuracy, but does not identify if the errors flagged by the peer review team are corrected, if other errors were corrected, etc. Clarify the disposition of this item.

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**Summer PRA RAI 28**

F&O PRM-A4-04 identifies MSO modeling errors based specifically on a sample and not a 100% review. The disposition of this item identifies correction of errors and a review of MSOs for additional issues. Describe the scope of the review performed to determine the extent of condition.

**Summer PRA RAI 29**

For F&O PRM-A4-05, provide the modified safety injection logic and demonstrate that it has been included in all areas of the tree as appropriate. Describe where this is documented in the Task 5.5 report. The disposition of this item only states that a particular set of logic was modified and included in the fault tree appropriately. Discuss how each technical point raised by the peer review team was addressed, as well as how the extent of condition was determined given that the peer review only identified an example.

**Summer PRA RAI 30**

For F&O CF-A1-02, describe where specific anomalies were addressed as part of revision to Attachment 8 to DC00340-001, Circuit Failure Mode Likelihood Analysis, Task 5.10.

**Summer PRA RAI 31**

IGN-B5-01. According to the peer review finding, a qualitative discussion of the sources of uncertainty is needed to address this SR. The peer review cites Appendices U and V of NUREG/CR-6850 as guidance for this issue. The plant disposition solely identifies the distributions used for the calculation, but does not address the peer review comment. Identify the assumptions and sources of uncertainty associated with the fire frequency analysis as required by IGN-B5.

**Summer PRA RAI 32**

For F&O HRA-B4-02, describe where temperature, level and pressure transmitters are modeled in Attachment 2 to DC00340-001.

**Summer PRA RAI 33**

For F&O HRA-C1-01, describe how dependencies were removed from the charging pump swap in the recovery action.

**Summer PRA RAI 34**

For F&O HRA-C1-02, provide the basis for the time required to perform a manual action inside and outside the CR for a fire, including validation or reference to an approved methodology. Describe when and where the basis will be documented.

**Summer PRA RAI 35**

Disposition in Attachment V, Table V-18 for supporting requirement SF-A4-01 indicates plant procedures for fire brigade drills and natural emergencies have not been updated to address seismically induced fire. Please confirm that procedures are now updated. The supporting

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requirement in the ASME/ANS Standard also requires a qualitative assessment of the potential that a seismically induced fire, or spurious operation of fire suppression systems, might compromise a post-earthquake plant response. Provide this assessment based on the updated procedures.

**Summer PRA RAI 36**

Finding in Attachment V, Table V-18 for supporting requirement ES-A4-01 establishes a deficiency in the linkage between the Component-BE table in the FRANX database and CAFTA fault tree for spurious operation of pressurizer spray valves. The response is not clear as to whether the spray valve failure mode was in the model (and the finding is invalid) or whether the model was corrected. Clarify this response. In addition, the disposition addresses one particular scenario the peer reviewer discovered and provides small confidence this problem will not appear again for other components. Describe the root cause of this problem and provide verification that this issue will not be repeated for other scenarios and that all pertinent components included in the FRANX database are linked to the CAFTA fault tree.

**Summer PRA RAI 37**

Finding in Attachment V, Table V-18 for supporting requirements ES-B1-01 and ES-B1-03 identify apparent significant errors in the underlying data used in quantification of fire risk. Specifically, the peer review identified records referring to nonexistent basic events in the PRA model, and PRA model basic events representing potentially legitimate fire failure modes which were never identified as being impacted. Concerns were also identified as to the manual methods of generating these files, as opposed to a database query method. While the disposition of these F&Os identifies a review of the mapping results and addition of documentation to any unmapped basic event, there is no discussion as to the impact of any corrections to the risk results. Further, the staff assumes that the original databases were reviewed, but the errors still were not found. It is not clear if the review conducted to resolve the F&Os was somehow more comprehensive than prior reviews to ensure identification of errors. Discuss the impact of these F&Os on the FPRA due to model changes resulting from the re-review of the mapping.

**Summer PRA RAI 38**

Finding in Attachment V, Table V-18 for supporting requirement ES-B3-01 identifies that containment penetrations screened in the internal events PRA based on small size were not fully reviewed for inclusion in the FPRA. It also identifies differences in the CDF model and the LERF model used for the FPRA, and changes needed to screening criteria for containment penetrations. The disposition only states that additional penetrations have been identified, but does not discuss either that the FPRA model has been revised to correct the issues or provide any basis for why the existing FPRA LERF model is adequate. It does not discuss if the CDF and LERF models remain different, nor does it discuss any changes to screening criteria. Discuss how this finding was addressed, including identifying if changes to the model were made, and justify the technical adequacy of the LERF model used for the FPRA.

**Summer PRA RAI 39**

Finding in Attachment V, Table V-18 for supporting requirement ES-B4-01 establishes a deficiency in modeling of support equipment whose fire-induced failure could adversely affect primary equipment. The disposition addresses one particular finding associated with power



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dependency and provides small confidence this problem will not appear again for other support equipment. Describe the root cause of this problem and provide verification that this issue will not be repeated for other support equipment listed in SR ES-B4.

**Summer PRA RAI 40**

Disposition in Attachment V, Table V-18 for supporting requirement CS-A8 identifies tasks to address the item, but there is nothing to indicate these items have been completed or what the resulting model impacts were, or if not completed why the deficiency is not significant to this application. Provide additional details for this item.

**Summer PRA RAI 41**

Finding in Attachment V, Table V-18 for supporting requirement CS-B1-01 identifies open items in Attachment D of a licensee report need to be addressed. The disposition does not state that these open items are addressed. Clarify the disposition of this item.

**Summer PRA RAI 42**

For F&O DA-02, the acceptable basis for using plant data only is that the quantity of data is sufficient to characterize the parameter value and its uncertainty. Provide confirmation that this is the basis for accepting plant data as a sole source and ignoring generic evidence, as required to conform to capability category II of the standard. Illustrate that this "does not impact the development of a FPRA" by performing a sensitivity analysis to demonstrate that the 3 cases identified by the peer review as having significant differences would not impact the FPRA results.

**Summer PRA RAI 43**

F&O DA-03 identifies that "non-fatal" common cause failures were added to the model, but does not affect the FPRA. If there are more than two components, then a fire-induced failure of one component combined with a non-fatal CCF of the remaining components would now be a possible fire failure scenario. Describe the basis as to why this resolution does not impact the FPRA.

**Summer PRA RAI 44**

For F&O DA-08, describe whether the first issue was resolved via a recovery action or data screening. Provide a description of the basis for the resolution. For the second issue, provide justification that a common suction path that may lead to steam binding, air binding or debris clogging of both pumps does not exist. Describe whether the approach in NUREG/CR-4780 was followed. If not, why not? Describe if there is some justification that can be provided to demonstrate that the generic data that is used to quantify the CCF parameters for these components is not applicable. For the third issue, data for this failure mode is in the INEEL CCF database. Provide justification for why it was not used. For the fourth issue, describe whether CCF for EDG fuel transfer pumps is included in the SBO model.

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**Summer PRA RAI 45**

For F&O HR-02, describe whether mis-calibration common cause events were added to the model.

**Summer PRA RAI 46**

For F&O HR-03, provide the justification and reference for the time window used in the HRA calculation for feed and bleed actions.

**Summer PRA RAI 47**

For F&O HR-05, provide a description of the revision made to the HRA calculation to address these issues, including the basis for assigning the level of dependency.

**Summer PRA RAI 48**

For F&O HR-06, provide the revised dependency levels and documentation of the associated bases.

**Summer PRA RAI 49**

For F&O HR-08, provide a description of the time-reliability models that were performed for HFEs with short time windows. Describe whether this is the same model used in the FPRA HRA. Provide a basis for why only one HRA probability had to be updated. Provide a sensitivity study using the 10-2 value if a value greater than 10-2 was used.

**Summer PRA RAI 50**

For F&O HR-01-2007, Supporting Requirement HR-01 requires that once the overall HRA has been completed, the plant should perform a review of their HEPs for internal consistency with respect to scenario, context, procedures and timing. Describe when this requirement will be incorporated into plant guidance. If it will not be incorporated into VCSNS guidance provide a basis for the statement, “This review is performed at each HRA update, although it is not currently a specific requirement in the guideline.”

**Summer PRA RAI 51**

For F&O QU-04, provide a reference and a description of the changes made to the PRA guidance to ensure multiple operator action strings are evaluated for dependence after each change in the PRA HRA.

**Summer PRA RAI 52**

For F&O QU-06, provide a basis for the conclusion that performing these updates after each major revision does not have a negative impact on the FPRA.

**Summer PRA RAI 53**

For F&O QU-07, the disposition does not address the documentation portion. Describe what actions have been taken to ensure that insights about the contributors to risk, key plant features

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that impact the results, any unique or specific modeling approaches that influence the results, and results of parametric uncertainty are included in this and future results summaries.

**Summer PRA RAI 54**

For F&O L2-02, it is not clear from the licensee's disposition whether the VCSNS PRA model includes early containment over pressure failures as discussed in NUREG/CR-6595. Describe what is so unique about the containment that this failure mode can be discounted. Provide a summary discussion of the plant-specific basis as to why this failure mode cannot occur (or is very unlikely to occur), and include a discussion of fire-induced core damage sequences and their relation to this containment failure mode.

**Summer PRA RAI 55**

For F&O HR-04-GA, describe where these documentation improvements exist. More specifically, describe where there is a discussion of the specific factors considered when evaluating the dependency between actions and the basis for assigning the dependency levels for the second and subsequent actions in a set, especially for the LD and ZD dependencies?

**Summer PRA RAI 56**

For F&O DA-01-GA, provide a markup of the revised data update guideline so that the reviewer may understand the redefined process and rules used.

**Summer PRA RAI 57**

For F&O DA-02-GA, describe where the data analysis assumptions are listed.

**Summer PRA RAI 58**

For F&O QU-01-GA, describe where the documentation of the review of cutsets can be found. Describe whether there are any cutsets containing multiple maintenance actions that were inappropriate. If so, describe what action was taken.

**Summer PRA RAI 59**

For F&O QU-02-GA, describe where the list of key sources of uncertainty can be found.

**Summer PRA RAI 60**

For F&O QU-03-GA, describe where the importance measures report is, in the update 4 report, DC00300-146.

**Summer PRA RAI 61**

For F&O QU-05-GA, describe where the definition of "significant" is in the quantification guideline. Describe whether the definition of "significant" is consistent with Section 2 of the Standard. Describe whether the definition of "significant" impacted guidance for documenting assumptions and sources of uncertainty as well as the review of significant cutsets and accident sequences. If so, describe how. If not, describe why not.

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**Summer PRA RAI 62**

Finding in Attachment U, for supporting requirement AS-01 identifies several deficiencies for the ISLOCA analysis centering around giving credit for successful prevention of core damage and large releases. Specifically, the F&O identified 1) crediting success of high pressure injection and recirculation given depressurization and makeup long term from an external source, 2) probabilistic treatment of low pressure piping failures with inadequate documentation, 3) non-piping failure modes not significant, 4) flooding impacts not considered, 5) open-ended makeup without sump recirculation, 6) credit of recirculation and containment cooling. The disposition of the finding states only that large pipe breaks were added to the analysis as going directly to core damage. This does not appear to address the above issues. Provide additional information that fully addresses the scope of the F&O.

**Summer PRA RAI 63**

Finding in Attachment U, for supporting requirement SY-07 identifies the CST capacity as not satisfying the 24-hour mission time, but no backup or alternate source being modeled. The disposition of this item only states that the licensee documented why this was not required. A further assessment identified (AS-01-GA of Attachment U-2 of the submittal) that the resolution was not sufficient. However, the disposition of this item does not appear to provide any further basis for this critical assumption. Provide additional justification for this item.

**Summer PRA RAI 64**

Disposition in Attachment U, Table U-2 for supporting requirement IE-01-GA indicates that the finding is not adequately addressed. The ISLOCA frequency calculated using the variance treatment resulted in a factor of twenty higher than the baseline; however, this updated frequency was not included in the model. Confirm that ISLOCA treatment, including frequency calculation and analysis, was revised following the RG 1.200 gap assessment and addresses the weaknesses for the ISLOCA model identified during the peer review.

**Summer PRA RAI 65**

Finding in Attachment U, Table U-2 for supporting requirement SY-01-GA indicates F&O TH-03 has not been resolved from the original peer review. Table U-1 does not list TH-03 as a finding. Provide the finding associated with TH-03 from the original peer review and the disposition including justification for why room heatup and credit for local operator actions are not modeled in the PRA for electrical equipment rooms IB-63-01 and AB-63-01. In addition, justify how the equipment in the room is deemed operational within the PRA mission time if the temperature in the room exceeds design conditions.

**Summer PRA RAI 66**

FSS-B2-01: It is not clear from the MCR abandonment document what the criteria are for CR abandonment for MCB fires. Secondly, from the MCB scenarios the CCDP does not appear correct for the specified number of panels as given in App B of the Fire Risk Quantification Task 14 document. For example, for scenario CB 17.01 MCB 11-10-1, 11-9-1, and 11-8-1, 2, 3, and 4 panels are failed respectively, yet the CCDP from the Quantification document specified that the CCDP is significantly largest when only 2 panels are damaged. Also for scenarios CB17.01 MCB 18-18-1, 18-17-1, 18-16-1, and 18-15-1 the CCDP is the same for each scenario even

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though 1, 2, 3, 4 panels are damaged respectively. Provide the criteria for CR evacuation for MCB fires, and justify the CCDPs provided for the various number of panels damaged. Your response should take into account a further examination of the CCDPs for MCB fires than identified in this question to evaluate if the CCDP problem is more extensive than discussed in this question. Provide updated CDF, LERF, ΔCDF, and ΔLERF values for MCB scenarios.

**Summer PRA RAI 67**

In Table W-3 of the LAR, Fire areas CB10, CB12, and IB11 contain VFDRs, yet the Delta CDF and LERF are listed as N/A. Since all VFDRs are supposed to have their Deltas calculated so that they can be summed and compared to R.G. 1.174 guidelines, explain the N/A.

**Summer PRA RAI 68**

In the Generic Fire Methodology report, the transient zone describes the zone of damage from the fixed or transient ignition source. According to p12 of 73 of this report, the transient zone bounds the effect of flame spread or propagation since an extended range of 4 feet beyond the transient zone boundaries was examined for PRA targets. For your plant, explain how the transient zone boundary takes into account fire growth over time, or propagation into adjacent transient zones via secondary combustible fires.

**Summer PRA RAI 69**

On page 34 of 73 of the Generic Fire Methodology report, it is assumed that the growth of electrical motor fires to peak is 6 minutes. Since it is acknowledged that no basis for this can be found in the literature, a sensitivity study should be performed evaluating different growth rates and its effects on the risk.

**Summer PRA RAI 70**

On page 60 of 73 in the Generic Fire Methodology report, a qualitative argument is made that the second cable tray will not get ignited for a fire in the initial cable tray from a hot work induced cable tray fire. Perform a quantitative calculation to verify this conclusion. The same type of conclusion is drawn for a junction box fire. Perform the same type of quantitative verification.

**Summer PRA RAI 71**

On page 64 of 73, of the Generic Fire Methodology report for transient fires, a HRR of 15kW and a time of 5 minutes is assumed to damage all targets within the ZOI. Justify that the 15 kW bounds all scenarios, (i.e. that the 15kW is the minimum transient HRR necessary to cause damage for all scenarios). If not, then adjust the minimum HRR for those scenarios which experience damage at less than 15kW and update your FPRA.

**Summer PRA RAI 72**

On pg 66 of 73 of the Generic Fire Methodology report, per incipient detection systems, the report indicates that credit for incipient detection systems apply to components in low voltage cabinets in selected areas, and to other components expected to demonstrate an incipient fire growth stage. It is further assumed that those low voltage cabinets to which credit is applied do not have fast acting components in them. FAQ 46 only allows credit for low voltage cabinets, providing those components inside are not a part of those fast acting components identified in

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the FAQ. A review of those cabinet components should be performed and the model modified if any of those components in the cabinets are fast acting. Discuss any variations from FAQ 46 in your treatment of incipient detection credit in the FPRA.

**Summer PRA RAI 73**

For the SUPP credit on the incipient detection system (ε2), 3.5 minutes is allowed for suppression. The assumption is that this is the time for a fire to grow 2.5 feet above the cabinet. Describe the height of target cables above the cabinets in which incipient detection is installed. Describe whether 2.5 feet is the minimum height. Describe the scenario assumed here, taking into account the assumed HRR and indicating its source.

**Summer PRA RAI 74**

On Step 3 on pg. F-2 of the LAR, it is stated that, "The inclusion of MSOs in the FPRA is still needed". Clarify that the LAR means that, although screening is not needed, MSOs are still included in the PRA as directed by FAQ 07-0038.

**Summer PRA RAI 75**

On page 9 of 60 in the Control Room (CR) Risk Calculation report, the HRR profile decays in 5 minutes. Provide justification for this decay time.

**Summer PRA RAI 76**

A fire brigade arrival time of 10 minutes is assumed in the non-suppression probability for CR abandonment in the CR Risk Calculation. Describe how the 10 minutes compares to the time identified in pre-fire plans for fire brigade arrival to the CR during a fire or during a fire brigade drill.

**Summer PRA RAI 77**

The Feb 2011 follow-on fire peer review F&Os are identified in Table V-18 as "DRAFT". Confirm the final versions are consistent with what is summarized in Table V-18 and that there are no additional F&Os.

**Summer PRA RAI 78**

The LAR states that the results of the 2005 review were " the VCSNS PRA [internal event PRA] was found to meet CC-II or better for 211 of the 271 SRs from the ASME PRA Standard, but 45 of the elements were found to either not meet the requirement or to meet the requirements at a CC-I level." Describe whether all 60 of the less than CC-II level SR's are included in the tables in Appendix U. If not, describe which ones are missing and why. Add any missing SRs to tables in Appendix U.

**Summer PRA RAI 79**

Attachment U, table V-18 does not identify a status of the F&Os as was done in Table U-1 for the internal events PRA peer review F&Os. In some instances the disposition states that the FPRA has been revised but does not confirm if the results presented in the submittal are based

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on the revised model. In other instances, the disposition indicates that the tasks are not complete. Clarify the status of each item in Table V-18.

**Summer PRA RAI 80**

Confirm that the revised internal events model which addresses the F&Os was used in the FPRA.

**Summer PRA RAI 81**

Attachment U, Table U-1 supporting requirement SY-01 addresses modeling of component cooling water support systems. The licensee's disposition indicates that service water and AC/DC power were added to the model; however, does not address loss of instrument air. Clarify how instrument air supports component cooling water system and how this relationship is modeled in the PRA.

**Summer PRA RAI 82**

In Fire Risk Evaluation A.1.2.33 in the analysis of Power to Bus XMC, it states that those scenarios which are qualitatively or quantitatively screened do not contribute to the ΔCDF or ΔLERF. It also states that those unscreened scenarios are treated in a bounding approach. Describe the meaning of quantitatively screened, and indicate if single or multicompartment contributions to CDF, LERF, ΔCDF, ΔLERF are screened. If these contributions are screened, quantitatively justify that these screened portions are insignificant with respect to the CDF, LERF, ΔCDF and ΔLERF. Otherwise, include the results in the baseline risk values and ΔCDF/ΔLERF. Perform a review of this issue for your full plant analysis.

**Summer PRA RAI 83**

In compartment AB01.03 of Attachment A of the Fire Modeling Scoping Report, pump fires from oil spills are assigned a HRR of 767 kW, regardless if the oil spill is 10% or 100% capacity of the pump. Explain why the HRR does not distinguish between oil spill sizes, or provide an updated analysis adjusting the HRR. Examine the rest of the pump oil spills to verify that this distinction is made in the compartment analyses, and correct if necessary.

**Summer PRA RAI 84**

FSS-D7-01 specifies that outlier experience was not examined for fire detection and suppression systems. The plant disposition indicates that generic values are larger than plant specific values and no outlier behavior exists. Justify the extent of the review of plant specific behavior. Provide a discussion of the plant specific results and a discussion of the comparison to the generic values.

**Summer PRA RAI 85**

The plant disposition for UNC-A2-01, 02, and 03 indicate that the peer review finding has been addressed. Provide a technical discussion or analysis, indicating how this issue has been addressed. In addition, provide a justification for those sensitivity studies that are not consistent with expected results as well as insights gained.

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**Summer RR RAI 01**

For areas where containment/confinement is relied upon:

a. Liquid
   1) Describe how the qualitative/quantitative assessment addressed capacities of sumps, tanks, transfer pumps, etc., as appropriate.
   2) Describe if there are plant features that may divert the effluent flow that were not taken into account (e.g., Aux. Bld. roll-up doors).

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

**Summer RR RAI 02**

For areas where containment/confinement is not available describe whether the assessment credits operator actions.

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