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

March 4, 2015

Mr. Eric A. Larson, Site Vice President
FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Mail Stop A-BV-SEB1
P.O. Box 4, Route 168
Shippingport, PA 15077

SUBJECT: BEAVER VALLEY POWER STATION, UNITS 1 AND 2 - REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST TO ADOPT NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805 (TAC NOS. MF3301 & MF3302)

Dear Mr. Larson:

By letter dated December 26, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14002A086), as supplemented by letter dated February 14, 2014 (ADAMS Accession No. ML14051A499), FirstEnergy Nuclear Operating Company (the licensee), submitted a license amendment request to change the Beaver Valley Power Station, Units 1 and 2, fire protection program to one based on the National Fire Protection Association Standard 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition, as incorporated into Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.48(c). To complete its review, the Nuclear Regulatory Commission staff requests a response to the enclosed Request for Additional Information questions.

The draft questions were sent to Mr. Phil Lashley, of your staff, to ensure that the questions were understandable, the regulatory basis for the questions was clear, and to determine if the information was previously docketed. Please respond to the enclosed questions appropriately, as indicated on Enclosue 2, Request for Additional Information Response Time Table.

If you have any questions regarding this matter, please contact me at (301) 415-7128.

Sincerely,

Taylor A. Lamb, Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-334 and 50-412

Enclosure:
1. Request for Additional Information
2. Request For Additional Information Response Time Table

cc w/encl: Distribution via Listserv

REQUEST FOR ADDITIONAL INFORMATION

LICENSE AMENDMENT REQUEST TO ADOPT

NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 805

PERFORMANCE BASED STANDARD FOR FIRE PROTECTION

FOR LIGHT WATER REACTOR GENERATING PLANTS

FIRSTENERGY NUCLEAR OPERATING COMPANY

BEAVER VALLEY POWER STATION, UNITS 1 AND 2

DOCKET NOS. 50-334 AND 50-412

By letter dated December 26, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14002A086), as supplemented by letter dated February 14, 2014 (ADAMS Accession No. ML14051A499), FirstEnergy Nuclear Operating Company (the licensee), submitted a license amendment request (LAR) to change the Beaver Valley Power Station, Units 1 and 2 (BVPS-1 and BVPS-2, respectively) fire protection program to one based on the National Fire Protection Association Standard 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition, as incorporated into Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.48(c). To complete its review, the Nuclear Regulatory Commission (NRC) staff requests a response to the Request for Additional Information (RAI) questions below.

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

National Fire Protection Association (NFPA) code compliances are referenced in LAR Attachment A, Table B-1 (ADAMS Accession No. ML14002A086). LAR Section 4.1 states, in part, that "Beaver Valley fire protection systems were installed based on design documents per NFPA codes and other applicable standards, but they do not have specific NFPA code evaluations." The LAR further states, in part, that "the Attachment A2 records evaluate the fire protection features for each fire compartment using the critical attributes of functionality from the applicable NFPA codes, and provide the detail necessary to meet the requirements of RAI 2-04 (Harris) and RAI 2-09 (Oconee)." It appears from these statements that NFPA code evaluations were not done to the complete code, but were done to only some "critical attributes" for functionality. For each code evaluation that is relied on for compliance with NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," Chapter 3 (e.g., NFPA 13, "Standard for the Installation of Sprinkler Systems"), and for which only critical attributes are identified, provide the following:

a) Describe the basis and methodology for selecting the elements of the code that are considered critical attributes;

b) Confirm that all critical attributes, as determined by this methodology, are identified in LAR Attachment A, Table B-1; and

c) Provide additional justification for concluding that compliance with NFPA 805, Chapter 3 is achieved using this methodology.

**FPE RAI 02**

LAR Attachment A, Table B-1, identifies several attributes as "Complies by Previous Approval." However, the compliance basis does not provide appropriate excerpts from the licensee's submittal or the NRC Safety Evaluation(s) approval documentation. Regulatory Guide (RG) 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," (ADAMS Accession No. ML092730314), Regulatory Position C.1.2, Paragraph m, states, in part, that "the NRC's acceptance should be demonstrated either by an explicit statement of the particular FPP [fire protection program] attribute, or by a demonstration that a specific FPP attribute was explicitly made known to the NRC and that the NRC's acceptance can reasonably be interpreted as including the specific FPP attribute." The NRC endorsed guidance in Nuclear Energy Institute (NEI) 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," (ADAMS Accession No. ML081130188), Attachment B, Section B.1 states,in part, that "for each Reference Document that is referenced as part of the transition review, provide sufficient documentation to provide traceability back to the determination. For example, provide, as appropriate, information such as revision number, date, and section/page number in order to make the statements as clear as possible to facilitate reviews and long term configuration management." There is insufficient information for the Chapter 3 attributes regarding prior approval.

Provide explicit evidence of previous NRC approval of the compliance conditions identified for these attributes and any other attributes in the LAR that cite previous NRC approval for which this information has not been provided. Examples of LAR Attachment A, Table B-1 entries that need more information include, but may not be limited to:

- Fire Compartment 1-CR-2 Attribute 3.11.2
- Fire Compartment 1-CR-3 Attribute 3.11.2
- Fire Compartment 1-CR-4 Attribute 3.11.2
- Fire Compartment 1-CR-4 Attribute 3.11.3
- Fire Compartment 1-CS-1 Attribute 3.11.2
- Fire Compartment 1-CS-1 Attribute 3.11.3
- Fire Compartment 1-CV-1 Attribute 3.11.3
- Fire Compartment 1-CV-2 Attribute 3.11.3
- Fire Compartment 1-CV-3 Attribute 3.10.1
- Fire Compartment 1-DG-1 Attribute 3.10.1
- Fire Compartment 1-DG-1 Attribute 3.11.3
- Fire Compartment 1-DG-2 Attribute 3.10.1
- Fire Compartment 1-ES-1 Attribute 3.11.2

Perform an additional review of all other attributes using "Complies by Previous Approval" as the compliance strategy and provide explicit evidence of previous NRC approval of the compliance conditions identified for those attributes as well.

**FPE RAI 03**

The compliance basis in LAR Attachment A, Table B-1 for NFPA 805, Section 3.6.4, regarding standpipe and hose stations states "Complies with Clarification." However, LAR Table 5-3 states compliance with NFPA 805, Section 3.6.4 is "via previous approval." Provide a clarification as to which compliance strategy is correct and revise the LAR as necessary.

**FPE RAI 04**

NFPA 805, Section 3.3.5.3, requires that electric cable construction comply with a flame propagation test acceptable to the authority having jurisdiction (AHJ). In LAR Table 5-3, the licensee stated that electrical cable construction complies with a flame propagation test found to be acceptable to the NRC as documented in NEI 04-02, Table B-1. In the LAR, the licensee provided several compliance strategies for this NFPA 805 attribute that will require additional information:

a) The "Compliance Basis" for NFPA 805, Section 3.3.5.3, in LAR Attachment A, Table B-1 states, in part, that "Submit for Approval," for unknown cable identified in the licensee's cable types report and analyzed as a fire initiating from non-qualified fire resistive cable. There is no LAR Attachment L approval request related to this attribute of NFPA 805. Provide an approval request in accordance with 10 CFR 50.48(c)(2)(vii) that describes the performance-based approach to compliance with NFPA 805, Section 3.3.5.3, for which NRC approval is requested or revise the compliance basis.

b) The licensee also stated that it "Complies with Clarification" for safety related cables. In LAR Attachment T, "Prior Approval Clarification Request 1," the licensee stated that the original submittal to the NRC in its letter dated October 27, 1976 (ADAMS Accession No. 4005005679) included all cable types used in cables trays, but the NRC Safety Evaluation Report (SER) dated June 6, 1979 (ADAMS Accession No. ML003766286), only addressed safety-related cables. The licensee requested in the clarification that the NRC's previous approval that cites "all safety-related cables" be extended to all cables installed in the plant. Provide the following additional information to support the review of the clarification request:

    i. Describe the flame propagation tests that were used to support acceptability of the non-safety related cables with thermoplastic or unknown insulation material, and discuss the results of the tests that demonstrate that extensive propagation does not occur.

    ii. State whether the population of these types of cables and configuration is the same as the configuration provided in the original submittal in the letter to the NRC dated October 27, 1976, or confirm that any

configuration changes since the original submittal do not invalidate the basis submitted by the licensee for the original NRC approval.

c) In LAR Attachment K, the licensee described Licensing Action #27, which is identified as being transitioned. The licensing action is associated with compliance with NFPA 805, Section 3.3.5.3, but not discussed in the compliance bases in LAR Attachment A. Clarify the applicability of Licensing Action #27 to LAR Attachment A.

**FPE RAI 05**

LAR Attachment A, Table B-1 uses the compliance strategy "Complies with Clarification" on numerous attributes. The NRC endorsed guidance in NEI 04-02, Section 4.3.1, Revision 2, describes this clarification strategy as items that are not in "literal compliance" with NFPA 805 but should be transitioned. The example given in NEI 04-02 illustrates this strategy is applied in circumstances such as compliance methods that could be considered editorial in nature. There are numerous applications of this compliance strategy in LAR Table B-1 that are not considered by the NRC staff to be of the same nature as an editorial clarification, such as described in NEI 04-02.

a) Provide a more suitable compliance strategy or additional justification for applying the "complies with clarification" strategy for the following attributes based on the issues identified:

i. The compliance basis for NFPA 805, Section 3.3.7.2, in LAR Attachment A, Table B-1, states that the hydrogen storage tanks are positioned so the long axis is pointed at buildings, and clarifies that compliance is achieved because the distance requirements of the applicable NFPA code is met. NFPA codes are not cited as the means of compliance for NFPA 805, Section 3.3.7.2; and therefore, their use is not a clarification.

ii. The compliance basis for NFPA 805, Section 3.4.1(a), in LAR Attachment A, Table B-1, states that "the station meets the intent of several sections of NFPA 600, as justified within the code compliance report." The use of a code compliance report to establish intent with regard to compliance with NFPA 805 does not appear to be a "clarification".

iii. The compliance basis for NFPA 805, Section 3.5.5, in LAR Attachment A, Table B-1, states that an assessment of fire pump control circuits concluded that the existing control circuits are acceptable for a fire that renders both fire pumps unavailable, considering prompt detection and the availability of alternate water supplies for manual firefighting. The use of an assessment of fire impacts on redundant pump control circuits to demonstrate acceptability of the design in meeting the separation requirements of NFPA 805, Section 3.5.5 does not appear to be a "clarification."

iv. The compliance basis for NFPA 805, Sections 3.5.15 and 3.5.16, in LAR Attachment A, Table B-1, appears to describe compliance issues as

opposed to clarifications. Simply describing deviations from the requirement without further justification for the acceptability of the deviations, relative to meeting the requirement, is not considered to be a clarification.

v. The compliance bases for NFPA 805, Sections 3.6.1, and 3.6.2, in LAR Attachment A, Table B-1, appears to address the results of code evaluations and previous NRC approval. These bases appear to be compliance strategies associated with engineering evaluations and previous approvals and do not appear to be merely clarifications.

vi. The compliance basis for NFPA 805, Section 3.7, in LAR Attachment A, Table B-1, appears to justify non-code compliances. Merely describing deviations from the requirement without further justification for the acceptability of the deviations, relative to meeting the requirement, is not considered to be a clarification.

vii. The compliance basis for NFPA 805, Section 3.8.2, in LAR Attachment A, Table B-1, identifies "Complies with Clarification" in numerous fire areas (e.g., 2-PA-3, 2-SG-1N, 2-SG-1S, and 2-PT-1). NFPA 805, Section 3.8.2 requires that fire detection be installed in accordance with NFPA 72, "National Fire Alarm Code," and its applicable appendixes. The licensee appears to justify code non-compliances with evaluations of individual compartment conditions such as "no fire hazard." Use of evaluations to justify deviations from code requirements are not considered clarifications.

viii. The compliance basis for NFPA 805, Section 3.9.4, in LAR Attachment A, Table B-1, identifies an SER, and LAR Attachment T clarification as prior approval of that configuration. This appears to be compliance based on previous NRC approval and not a clarification.

ix. The compliance basis for NFPA 805, Section 3.10.8, in LAR Attachment A, Table B-1, identifies "Complies with Clarification" for Fire Area 1-CR-4 for a Halon 1301 system; however, NFPA 805, Section 3.10.8 applies to carbon dioxide systems.

b) Based on the above examples, review all other compliance strategies that use the category "Complies with Clarification" and ensure the strategy is suitable in accordance with the guidance of NEI 04-02. Identify any additional changes needed.

**FPE RAI 06**

The compliance basis in LAR Attachment A, Table B-1, for NFPA 805, Section 3.3.3, states "Complies with Clarification;" however, the compliance basis states "the existing original interior wall, ceiling, and floor finish is considered to be compliant with NFPA 805 standards."

a) Provide more information with regard to what is being clarified.

b) NFPA 805, Section 3.3.3, states, in part, that "interior wall or ceiling finish classification shall be in accordance with NFPA 101, Life Safety Code, requirements for Class A materials. Interior floor finishes shall be in accordance with NFPA 101 requirements for Class I interior floor finishes." NFPA 101 Class A also requires a smoke developed index, which is not addressed in this attribute. Additionally, Class I for interior floor finish requirements is not mentioned. The LAR attribute states that the plant "is considered to be compliant with NFPA 805 standard." Explain how the plant meets the NFPA 805 requirements for interior floor, wall, and ceiling finish.

**FPE RAI 07**

LAR Attachment A, Table B-1 attributes 3.3.1.2(1), 3.3.1.2(3), 3.3.1.2(4), 3.3.1.3.4, 3.3.3, 3.3.4, 3.3.10, and 3.3.11 use the compliance strategy "Comply with the Use of Commitment." The commitments identify the need to update a plant procedure, procurement specification, or other document. However, the commitments contain the phrase, "...to be revised to more closely reflect the subject NFPA 805 requirements..." It is unclear whether this commitment means the revised documents will meet the applicable NFPA 805 requirement. For each applicable use of this phrase, "more closely reflect the subject NFPA 805 requirements," describe whether the revised procedure(s) and\or specification(s) will meet the applicable NFPA 805 code requirement.

**FPE RAI 08**

LAR Attachment A, Table B-1, Sections 3.2.2.4, 3.2.3(2), 3.3.1.2(5), 3.3.3, 3.3.4, 3.3.7.1, and 3.3.8 state, in part, that compliance will be achieved through completion of an update to Procedure 1/2-ADM-1900 and references Open Item BV1-2908. However, LAR Attachment S, Table S-3, Implementation Item BV1-2908, only addresses an update to enhance controls of flammable gas, which is associated with attribute 3.3.7.1. Explain the reason for not including the other attributes that cite BV1-2908 in the scope of the implementation item description in LAR Attachment S, Table S-3, or revise the scope of the implementation item.

**FPE RAI 09**

NFPA 805, Section 3.4.1(c), requires that the fire brigade leader and at least two brigade members have sufficient training and knowledge of nuclear safety systems to understand the effects of fire and fire suppressants on nuclear safety performance criteria. In Section 1.6.4.1, "Qualifications" of RG 1.189, "Fire Protection for Nuclear Power Plants", Revision 2, September 2009 (ADAMS Accession No. ML092580550), the NRC staff has acknowledged the following example for the fire brigade leader as sufficient:

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

In LAR Attachment A, the licensee stated that it complies and the compliance basis states that procedures state the Fire Brigade Chief and at least two fire brigade members shall be

operations personnel who have sufficient knowledge of safety-related systems to understand the effects of a fire and fire suppressants on the safe shutdown of the unit.

Provide additional detail regarding the training that is provided to the fire brigade leader and members that addresses their ability to assess the effects of fire and fire suppressants on nuclear safety performance criteria.

**FPE RAI 10**

The compliance basis for NFPA 805, Section 3.4.2, in LAR Attachment A, Table B-1, states that the licensee "will comply with the use of commitment" and after pre-fire plans are updated, the licensee will "meet the intent" of NFPA 805 requirement 3.4.2. Describe what is meant by the phrase "meet the intent" and how this will meet the requirements NFPA 805.

**FPE RAI 11**

The compliance basis for NFPA 805, Section 3.4.1(a) in LAR Attachment A, Table B-1, states that the station meets intent of several sections of NFPA 600, "Standard on Industrial Fire Brigades," as justified within the code compliance report. The licensee has stated that the plant complies with NFPA 805, Section 3.4.3(a) requirements. However, the compliance basis states that fire brigade training is performed, and the administrative procedure states that it meets the requirements of Occupational Safety and Health Administration Standard 29 CFR 1910.156(C), 29 CFR 1910.134(g)(4), 10 CFR 50.48, NFPA 27-1976, and the guidelines established in BTP [branch technical position] CMEB 9.5-1.

Describe how complying with these requirements meets the NFPA 600 requirements for brigade training.

**FPE RAI 12**

LAR Attachment L, "Approval Request 1," requests to provide a performance-based evaluation in place of the NFPA 805, Section 3.3.5.1 requirement that wiring above suspended ceiling shall be kept to a minimum and where installed, electrical wiring shall be listed for plenum use, routed in armored cable, routed in metallic conduit, or routed in cable trays with solid metal top and bottom covers. The LAR stated that the existing non-enclosed or non-plenum rated wiring located above suspended ceilings that may not comply with the requirements of NFPA 805, Section 3.3.5.1. The approval request provides examples of areas with suspended ceilings within the power block areas of BVPS-1 and BVPS-2. The approval request concludes that the existing wiring above suspended ceilings satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release, safety margins, and fire protection defense-in-depth (DID), and post-fire safe and stable capability.

Provide a complete list of areas in the power block where the licensee requests approval for wiring above the suspended ceiling, and if additional areas are added to the list of examples, provide sufficient justification for all areas being addressed by the performance-based alternative evaluation.

Describe the proximity of these unqualified cables to nuclear safety capability components or cables, and address the likelihood and significance of potential fires adjacent to those nuclear safety capability components or cables.

**FPE RAI 13**

In LAR Attachment S, Table S-3, "Implementation Items," each implementation item is assigned to either Unit 1 or Unit 2 even though it appears that many of these items should apply to both units, such as those that change plant-wide procedures.

For example, LAR Attachment L, "Approval Request 1," states that "plant procedures will be revised to require future cable installations above suspended ceilings to meet NFPA 805, Section 3.3.5.1 (LAR Table S-3)." While item BV1-2823 appears to address this action for Unit 1, there appears to be no LAR Attachment S, Table S-3 entry for this item to cover Unit 2.

Clarify the relationship between the implementation items and the individual Units.

**FPE RAI 14**

The regulations in 10 CFR 50.48(c)(2)(vii) state, in part, that performance based methods that are used to evaluate the fundamental fire protection program elements and minimum design requirements of NFPA 805, Chapter 3, must (A) satisfy the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; (B) maintain safety margins; and (C) maintain fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability). In LAR Attachment L, the licensee requested approval in accordance with 10 CFR 50.48(c)(2)(vii) for specific NFPA 805 Chapter 3 sections, and additional information is requested to support the review of the performance-based methods:

a) For Approval Request 1, provide additional information to demonstrate that the wiring routed above the suspended ceiling satisfies the radiological release performance goals, performance objective and performance criteria of NFPA 805, and provide additional information on how the configuration maintains safety margins and each element of fire protection DID.

b) For Approval Request 2, describe how the lack of lube oil collection system in misting areas will satisfy the nuclear safety performance goals, performance objectives and performance criteria of NFPA 805, and provide additional information on how the configuration will maintain safety margins and each element of fire protection DID.

c) For Approval Request 3, describe how the lack of sectional isolation valves between the sprinkler system and hose station connections will satisfy the nuclear safety performance goals, performance objectives and performance criteria of NFPA 805 and how the configuration maintains each element of fire protection DID.

d) For Approval Request 4, provide additional information to demonstrate that the lack of electrical supervision on fire hydrant curb box type control valves satisfies

the radiological release performance goals, performance objective and performance criteria of NFPA 805 and provide additional information on how the configuration will maintain safety margins and each element of fire protection DID.

**FPE RAI 15**

LAR Section 4.5.2.2, "Fire Risk Approach," states that Fire Risk Evaluations were performed in accordance with NFPA 805 Section 4.2.4.

NFPA 805, Section 2.4.3.3, states that the use of the Fire Risk Evaluation performance-based approach requires that "The PSA [probabilistic safety approach], methods and data shall be acceptable to the AHJ" (which is the NRC).

LAR Attachment S, Table S-2 identifies the installation of a Very Early Warning Fire Detection System (VEWFDS) in low voltage cabinets located in fire compartments 1-CR-4, 2-CB-1, and 2-CB-6 to reduce the likelihood of fire propagation outside the cabinets (i.e., Items BV1-1875 and BV2-0829). Provide more detailed description of the proposed modification including:

a) Identify the NFPA code(s) of record, the proposed installation configuration (inside cabinets or area-wide, common piping or individual cabinet piping), and the equipment manufacturers recommendations regarding design, installation, and piping.

b) Describe the acceptance testing, sensitivity and setpoint control(s), alarm response procedures and training, and routine inspection, testing, and maintenance that will be implemented to credit the VEWFDS.

c) Describe the configuration and design control process that will control and maintain the setpoints for both alert and alarm functions from the VEWFDS.

d) Describe the instructions that will be given to the first responders until the degrading component is repaired, the cabinet is de-energized, or the alarm is satisfactorily reset in the event of a VEWFDS actuation.

e) Compare the credit taken for its use in assessing the risk of various fire areas where it is credited to the credit described in Frequently Asked Question (FAQ) 08-0046, "Incipient Fire Detection Systems," (ADAMS Accession No. ML093220426), and provide a technical justification for any differences
.

f) Describe, in detail, the compliance of the VEWFDS systems with respect to NFPA 805, Section 3.8, and its subsections. Also, provide updated LAR Attachment A pages, if appropriate.

**FPE RAI 16**

In LAR Attachment T, "Clarification of Prior NRC Approvals," Prior Approval Clarification Request 14 for BVPS-2," the licensee requested that the configuration for the BVPS Unit 1 primary and secondary power supply system for the early warning fire detection system be

accepted as "prior approval" because a similar power supply arrangement for the BVPS Unit 2 early warning fire detection system was approved by the NRC in an NRC SE as discussed in detail LAR Attachment K, "Licensing Action 26."

BVPS-1 compliance with NFPA 805, Section 3.8.1 is described as "Complies with Clarification" in LAR Attachment A. The power supply arrangement for the fire alarm initiating devices for BVPS-1 does not appear to comply with NFPA 72, and taking credit for a BVPS-2 prior approved licensing action to apply to BVPS-1 is not within the guidance of NEI 04-02 with respect to "Complies with Clarification."

In accordance with RG 1.205, and the guidance of NEI 04-02, where compliance with Chapter 3 requirements cannot be demonstrated or prior NRC approval is not provided or adequately documented, the licensee may choose to comply with the deterministic requirement of NFPA 805, Chapter 3, comply with use of engineering evaluation or include a performance-based method in accordance with 10 CFR 50.48(c)(2)(vii).

Provide a compliance basis for the BVPS-1 fire alarm power supplies that will meet the requirements of NFPA 805, Section 3.8.1 in accordance with the requirements of 10 CFR 50.48(c) and the guidance of RG 1.205 and NEI 04-02.

**FPE RAI 17**

NFPA 805, Section 3.11.5, requires that electric raceway fire barrier system (ERFBS) required by NFPA 805 Chapter 4 shall be tested in accordance with and shall meet the acceptance criteria of NRC Generic Letter (GL) 86-10, Supplement 1, "Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used to Separate Safe Shutdown Trains within the Same Fire Area" (ADAMS Accession No. ML031150322). In LAR Table 4-3, the licensee stated that an ERFBS is credited to meet a Risk Criteria (R) and/or required for acceptability of an engineering evaluation (E) in certain fire areas, and in LAR Attachment A, the licensee stated for those fire areas that it complied with NFPA 805, Section 3.11.5 with the use of an engineering evaluation. Provide additional information to support the review of the ERFBS required by NFPA 805 Chapter 4.

a) In LAR Attachment A, Table B-1, the licensee stated that the ERFBS credited in Fire Areas 1-PA-1E and 1-PA-1G were either bounded by a qualified fire test or were expected to provide protection equivalent to a 1-hour fire endurance rating. If the ERFBS is not bounded by a qualified fire test, discuss the method used to determine that the ERFBS is "expected to provide protection equivalent to a 1-hour fire endurance rating" and clarify how it meets the requirements of NFPA 805, Section 3.11.5.

b) In LAR Attachment A, Table B-1, the licensee stated in Fire Areas 2-CB-1 and 2-PA-3 that the 3M Interam E-50 series blanket assemblies were evaluated in an engineering evaluation to provide a 1 hour fire resistance for ductwork and a 2-hour fire resistance for protection of the 1-1/2 hour fire dampers. Clarify how this use of ERFBS materials to protect dampers and ductwork meets the definition of ERFBS in NFPA 805 as a feature credited for NFPA 805 Chapter 4 to separate one success path of required cables and equipment to achieve and maintain the nuclear safety performance criteria, and justify the basis for qualification in the

existing engineering equivalency evaluation (EEEE) to the requirements of NFPA 805, Section 3.11.5.

c) In LAR Attachment A, Table B-1, the licensee stated in Fire Areas 2-CB-1, 2-CV-1, 2-CV-3, 2-PA-3, 2-PA-4, 2-SB-3 and 2-SB-4 that the thermo-lag panels and conduit sections having a 0.5 inch nominal thickness with pre-buttered or post-buttered joint construction were upgraded to be equivalent to a 1-hour fire rating by achieving a 1-inch thickness. Describe the method used to evaluate the ERFBS configuration and clarify how it meets the requirements of NFPA 805, Section 3.11.5.

d) In LAR Attachment A, Table B-1, the licensee stated that Fire Area 2-PA-4 contains 30-inch wide cable trays, which exceeds the limit of six 24-inch wide trays as defined in BTP CMEB 9.5-1. The licensee also stated that the required safe shutdown cables are adequately protected in place by a fire wrap material, and that this deviation was accepted in BVPS-2 SER dated October 1985 (ADAMS Accession No. 8510310355). Additional information is required to support the transition of this configuration as "Complies by previous NRC approval." In accordance with Figure 4-1 of the LAR, a verbatim excerpt from the BVPS-2 SER dated October 1985, as it relates to the fire wrap material and configuration credited to meet nuclear safety performance criteria is needed to support "Complies by previous NRC approval."

**Safe Shutdown Analysis (SSD) RAI 01**

NFPA 805, Section 2.4.2, "Nuclear Safety Capability Assessment," requires licensees to perform a nuclear safety capability assessment (NSCA). Regulatory Guide 1.205, endorsed the guidance in NEI 00-01 Chapter 3 as one acceptable approach to perform an NSCA.

LAR Section 4.2.1.1 stated that the safe shutdown analysis review "either meets the NRC endorsed guidance from NEI 00-01 Revision 1, Chapter 3 directly or [meets] the intent of the endorsed guidance with adequate justification with the following exception: Open-Circuited Current Transformers." However, in LAR Attachment B, Table B-2, the licensee identified several other NEI 00-01, "Guidance for Post Fire Safe Shutdown Circuit Analysis," (ADAMS Accession No. ML091770265), attributes that were either "Not in Alignment, but Prior NRC approval" or "Not in Alignment with no adverse consequences". These include, but may not be limited to, the following:

- 3.1.1.9 - 72 hour Coping Period
- 3.1.2.4 – Decay Heat Removal
- 3.1.2.5 – Process Monitoring
- 3.2.2.1 – Identify the System Flow Path for Each Shutdown Path

Clarify the discrepancy between the summary of results in LAR Section 4.2.1.1 and the Alignment Statement in LAR Attachment B, Table B-2.

**SSD RAI 02**

NFPA 805, Section 2.4.2, "Nuclear Safety Capability Assessment," requires licensees to perform a nuclear safety capability assessment (NSCA). RG 1.205, endorsed the guidance in NEI 00-01, Chapter 3, as one acceptable approach to perform an NSCA.

Attribute 3.5.2.1 of NEI 00-01 states that, "an open circuit on a high voltage (e.g., 4.16 kV) ammeter current transformer (CT) circuit may result in secondary damage." In LAR Attachment B, Table B-2, the licensee stated that the safe shutdown analysis is "Not in Alignment" with this guidance and referred to an analysis of high voltage current transformers. The licensee also stated that "any modifications required will be determined when the guidance is finalized as to which current transformers pose a credible risk of secondary damage upon an open circuit."

a) Describe the scope, assumptions, and results of the high voltage current transformers analysis, including the secondary fire areas of concern, and describe any potential methods of resolving the design concern due to open-circuited current transformers, including potential plant modifications.

b) Describe the NRC correspondence identified in LAR Attachment S, Table S-3, Implementation Items BV1-2706 and BV2-1020, and provide an implementation item to address the resolution of this issue.

**SSD RAI 03**

NFPA 805 Section 2.4.2, Nuclear Safety Capability Assessment, requires licensees to perform a nuclear safety capability assessment (NSCA). Regulatory Guide 1.205, endorsed the guidance in NEI 00-01 Chapter 3 as one acceptable approach to perform an NSCA.

LAR Section 4.2.1.1 and the alignment basis for NEI 00-01, Section 3.2.1.2 in LAR Attachment B, Table B-2, stated that where feasibility reviews called into question the use of manual valves in the fire compartment after the fire was extinguished, the recovery strategy was modified to ensure recovery actions (RAs) could be successfully and reliably credited. NEI 00-01, Attribute 3.2.1.2 requires that any post-fire operation of a rising stem valve should be well justified using an engineering evaluation. As such, provide the following clarifications:

a) Identify fire areas where RAs require manual operation of rising stem valves that may be subjected to the effect of fire exposure.

b) Describe the engineering analysis justifying the post-fire operation of these valves per the guidance of NEI 00-01 and the "modified" recovery strategy.

**SSD RAI 04**

RG 1.205, Section 2.4, states, in part, that:

> NFPA 805, Section 4.2.3.1, identifies recovery actions for which the additional risk must be evaluated, as required by NFPA 805, Section 4.2.4. These "success path" recovery actions are operator actions that, if not successful, would lead to the fire-induced failure of the "one success path of required cables and equipment to achieve and maintain the nuclear safety performance criteria." Other operator actions that do not involve the success path may be credited in plant procedures or the fire PRA to overcome a combination of fire-induced and random failures may also be recovery actions, but licensees do not need to evaluate the additional risk of their use.

In LAR Attachment C, the licensee identified a number of variances from deterministic requirements (VFDRs) that were evaluated in a fire risk evaluation (FRE) and determined that the risk, safety margin, and DID meet the acceptance criteria of NFPA 805, Section 4.2.4 with a RA credited. The licensee, however, did not specify whether the RAs are necessary for risk reduction or for DID in either LAR Attachment C or LAR Attachment G, Tables G-1 and G-2. Provide the following clarifications to address the methodology for evaluating RAs:

a) Differentiate the RAs identified in LAR Attachment G as those necessary to meet risk criteria, and therefore, included in the FPRA results reported in LAR Attachment W, and those necessary for DID.

b) In LAR Attachment G, the licensee stated that other RAs, whether credited for DID or credited to overcome a combination of fire-induced and random failures, but not involving the success path, are not evaluated for the additional risk of their use. Provide a detailed description of these RAs including:

i. How were these RAs originally identified;

ii. What nuclear safety performance goals are associated with these RAs;

iii. What fire safe shutdown functions do these RAs provided;

iv. Which of these RAs are listed in LAR Attachment G;

v. Which of these RAs will remain in the shutdown procedures, and describe the feasibility evaluations performed for these actions;

vi. Provide examples of these types of RAs (that is, the ones described in i. through v. above) and describe how it was determined which RAs are screened out and which are retained in the procedures.

**SSD RAI 05**

NFPA 805, Section 1.3.1, "Nuclear Safety Goal,:"states that "The nuclear safety goal is to provide reasonable assurance that a fire during any operational mode and plant configuration will not prevent the plant from achieving and maintaining the fuel in a safe and stable condition."

NFPA 805, Section 1.5.1(d), "Vital Auxiliaries," states that "Vital auxiliaries shall be capable of providing the necessary auxiliary support equipment and systems to assure that the systems required under (a), (b), (c) and (e) are capable of performing their required nuclear safety function."

In LAR Attachment G, the licensee identified several RAs using portable fans to provide temporary ventilation for the Emergency Switchgear room, Diesel Generator Room and the Control Room for Unit 1 (fire areas 1-CR-2, 1-CR-4, 1-CS-1, 1-CV-3, 1-ES-2, 1-MG-1, 1-PA-1E, and 3-CR-1) and for Unit 2 (fire areas 2-CB-1, 2-CB-5, 2-CB-6, 2-SB-3, and 3-CR-1). Provide the following additional information:

a) Describe the placement of the portable fans with respect to the location of adjacent nuclear safety capability assessment (NSCA) SSCs for each area.

b) Describe the type and quantity of fuel associated with the portable fans and the availability and the location(s) of sufficient fuel sources to support maintaining safe and stable conditions for the time period required.

c) Provide a justification that refueling the portable fans does not present a fire exposure hazard to adjacent NSCA SSCs.

d) Describe the analyzed ventilation flow path configuration for each area where the portable fans are used as the credited recovery action.

**SSD RAI 06**

RG 1.205, Section 2.2.1, states that a submittal addressing uncertain elements of the current fire protection program should include sufficient detail to allow the NRC to assess whether the licensee's treatment of these elements meet the 10 CFR 50.48(c) requirements.

In LAR Attachment T, 'Clarification Request 5," the licensee requested that the NRC document as "prior approval" with respect to Licensing Actions 11.10 and 11.18 for the increased combustible loading in Fire Area 1-CR-4 from an equivalent fire severity of 45 minutes to 1.38 hours. The licensee stated that the existing condition is acceptable since the increased combustible loading is still within the 1.5 hour fire barriers rating, a limit of less than 1.5 hours fire loading was established for the Process Instrumentation Room (1-CR-4), and the room will be provided with an incipient detection system as part of the NFPA 805 modifications. It appears that the bases for and continuing validity of the exemption, and the NRC staff's original evaluation or basis for approval of the exemption, has not been maintained. Therefore, this condition is not considered a "clarification" to the approved exemption. Provide the following:

a) The citation from the NRC SER dated August 30, 1984 (ADAMS Accession No. 8502220043), concludes that the 1.5 hour rated doors and ceiling exceed the combustible loading with a "considerable margin." Discuss how any administrative limit on combustible loading, the incipient detection system, and/or any other fire protection features are credited for offsetting the decrease in the safety margin.

b) Update LAR Attachment S, Table S-3, to include an administrative procedure update if a limit on combustible loading is credited for Fire Area 1-CR-4.

c) Discuss the impact on the Nuclear Safety Capability Assessment in meeting the nuclear safety performance criteria requirements of NFPA 805, Section 1.5, in the event that the 1.5 hour rated doors and ceiling were breached due to the increased combustible loading (e.g., risk, defense in depth, and safety margin).

d) Provide the appropriate updates to the LAR attachments.

**SSD RAI 07**

NFPA 805, Section 2.4.2, "Nuclear Safety Capability Assessment," requires licensees to perform a NSCA. RG 1.205 endorsed the guidance in NEI 00-01 Chapter 3 as one acceptable approach to perform an NSCA.

Attribute 3.1.2.5 of NEI 00-01 requires that the process monitoring function be provided for all safe shutdown paths, and in particular, neutron flux monitoring (source range) is identified as acceptable instrumentation to support monitoring reactivity control. In LAR Attachment B, Table B-2, the licensee stated that BVPS-1 has an approved exemption (Licensing Action 11.24) to have a source range monitor operational within 80 minutes of the event. However, in LAR Attachment K, "Licensing Action 11.24," the licensee stated that a portable drawer (for source range monitoring) can be hooked up within one hour (60 minutes). Clarify the discrepancy between the approved licensing action time frame of 60 minutes to have source range indication available, and the 80 minutes as described in LAR Attachment B, Table B-2.

**SSD RAI 08**

The definition of recovery actions in NFPA 805 Section 1.6.52, "Recovery Actions," includes "...the replacement or modification of components."

RG 1.205, Section 2.4, states, in part, that:

> NFPA 805, Section 4.2.3.1, identifies recovery actions for which the additional risk must be evaluated, as required by NFPA 805, Section 4.2.4. These "success path" recovery actions are operator actions that, if not successful, would lead to the fire-induced failure of the "one success path of required cables and equipment to achieve and maintain the nuclear safety performance criteria." Other operator actions that do not involve the success path may be credited in plant procedures or the fire PRA to overcome a combination of fire-induced and random failures may also be recovery actions, but licensees do not need to evaluate the additional risk of their use.

NFPA 805, Section 2.4.3.3, states that the use of the Fire Risk Evaluation performance-based approach requires that "The PSA [probabilistic safety assessment] approach, methods and data shall be acceptable to the AHJ" (which is the NRC).

LAR Attachment G identified many RAs that require equipment repair to resolve the VFDRs. Provide the following additional information related to the repair procedures:

a) Describe the specific repair activities that would need to be performed for each component.

b) Identify any tools or equipment required for the repair activities; clarify if this equipment needs to be staged; and discuss how the repair procedures will be performed, including the feasibility of the repair.

**SSD RAI 09**

NFPA 805, Section 2.4.2.4, requires that "An engineering analysis shall be performed in accordance with the requirements of Section [2.4] for each fire area to determine the effects of fire or fire suppression activities on the ability to achieve the nuclear safety performance criteria of Section 1.5." RG 1.205, Revision 1 endorsed NEI 04-02, Revision 2, as one acceptable approach to performing and documenting the engineering analyses required to transition to a risk-informed, performance-based fire protection program in accordance with 10 CFR 50.48(c) and NFPA 805. On a fire area basis, NEI 04-02 requires that the licensee document how the nuclear safety performance criteria are met. The guidance in NEI 04-02 recommends that this information be presented in Table B-3, "Fire Area Transition." In LAR Section 4.2.4, "Overview of the Evaluation Process," Step 5 - Disposition, the licensee states that the final disposition of VFDRs should be documented in Attachment C (NEI 04-02 Table B-3).

In LAR Attachment C, Table B-3, the licensee identified VFDR BV2-0411 as being applicable to Fire Area 2-WH-1 only. However, the FREs for Fire Areas 2-CV-1 and 2-MS-1 indicated that VFDR BV2-0411 is also applicable to these areas.

a) Discuss the basis for only identifying VFDR BV2-0411 for fire area 2-WH-1, and not for other fire areas whose FRE may include this VFDR in the engineering analysis (e.g., fire areas 2-CV-1 and 2-MS-1).

b) The licensee described the disposition of VFDR BV2-0411 as "Replace 120 VAC & 125VDC Breakers to Eliminate MHIF Operator Actions," and the licensee stated that the VFDR will be corrected by a plant modification. LAR Attachment S does not include a modification related to dispositioning VFDR BV2-0411. Provide the justification for not including the modification to replace 120 VAC & 125 VDC breakers in LAR Attachment S, or revise LAR Attachment S.

**SSD RAI 10**

NFPA 805, Section 2.4.2.4, requires that "An engineering analysis shall be performed in accordance with the requirements of Section [2.4] for each fire area to determine the effects of fire or fire suppression activities on the ability to achieve the nuclear safety performance criteria of Section 1.5." RG 1.205, Revision 1 endorsed NEI 04-02, Revision 2 as one acceptable approach to performing and documenting the engineering analyses required to transition to a risk-informed, performance-based fire protection program in accordance with 10 CFR 50.48(c) and NFPA 805. On a fire area basis, NEI 04-02 requires that the licensee document how the nuclear safety performance criteria are met. The guidance in NEI 04-02 recommends that this information be presented in Table B-3, "Fire Area Transition." In LAR Section 4.2.4, "Overview of the Evaluation Process," Step 5 - Disposition, the licensee states that the final disposition of VFDRs should be documented in Attachment C (NEI 04-02 Table B-3).

In LAR Attachment C, Table B-3, "Fire Compartment 2-CV-1," the licensee stated that VFDR BV2-0502 involves fire damage to power cables associated with high-low pressure interface valves 2RHS-MOV701A-PP, 2RHS-MOV701B-P, 2RHS-MOV702A-P and 2RHS-MOV702B-P due to three-phase hot shorts. The licensee further stated that the VFDR will be corrected by a plant modification. However, LAR Attachment S did not identify a modification associated with VFDR BV2-0502 or with the subject residual heat removal (RHR) valves. Describe the modification and include the modification item in LAR Attachment S, as appropriate.

**SSD RAI 11**

NFPA 805, Section 1.3.1, "Nuclear Safety Goal," states that "The nuclear safety goal is to provide reasonable assurance that a fire during any operational mode and plant configuration will not prevent the plant from achieving and maintaining the fuel in a safe and stable condition."

NFPA 805, Section 1.4.1, Nuclear Safety Objectives, states:

> In the event of a fire during any operational mode and plant configuration, the plant shall be as follows:
>
> (1) Reactivity Control. Capable of rapidly achieving and maintaining subcritical conditions
> (2) Fuel Cooling. Capable of achieving and maintaining decay heat removal and inventory control functions

(3) Fission Product Boundary. Capable of preventing fuel clad damage so that the primary containment boundary is not challenged.

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

a) During NPO modes, spurious actuation of valves can have a significant impact on the ability to maintain decay heat removal and inventory control. Describe any actions being credited to minimize the impact of fire-induced spurious actuations of power operated valves (e.g., AOVs and MOVs) during NPO (e.g., pre-fire rack-out, actuation of pinning valves, and isolation of air supplies).

b) Describe the recovery actions and instrumentation that are credited to achieve key safety functions (KSFs) during NPO and describe how these recovery actions will be evaluated for feasibility and factored into operating procedures.

**SSD RAI 12**

NFPA 805, Section 2.4.2, "Nuclear Safety Capability Assessment," requires licensees to perform a nuclear safety capability assessment (NSCA). RG 1.205, endorsed the guidance in NEI 00-01 Chapter 3 as one acceptable approach to perform an NSCA.

Attribute 3.5.2.5 of NEI 00-01 states that circuit failures due to common enclosure concerns could result in the possibility of causing secondary failures due to fire damage to a circuit either whose isolation device fails to isolate the cable fault or protect the faulted cable from reaching its ignition temperature, or the fire propagates along the cable into adjoining fire areas. LAR Attachment B stated that the plant has incorporated the post-fire safe shutdown analysis into SAFE, which identifies failed safe shutdown cables and equipment for each fire compartment through various software logics. Describe how this process addresses common enclosure concerns with respect to protective device coordination, fault protection, cable sizing, and barriers and penetration designs as described in the guidance of Attribute 3.5.2.5 of NEI 00-01.

**SSD RAI 13**

In LAR Attachment T, the licensee requested the NRC staff to document as a "prior approval" several clarifications of prior NRC approvals. RG 1.205, Section 2.2.1, states that a submittal addressing uncertain elements of the current fire protection program should include sufficient detail to allow the NRC to assess whether the licensee's treatment of these elements meets 10 CFR 50.48(c) requirements. The following summarizes the guidance in NEI 04-02, Section 2.3.1, for demonstrating that the NRC has been aware of the specific attribute being clarified and that plant conditions have not changed:

- Determine whether the NRC has explicitly accepted or approved the program attribute. If so, retain documentation.

- If final correspondence, such as an SER from the NRC, contains only general statements of acceptance or approval, it is necessary to find the related chain of supporting correspondence between the NRC and licensee and other related documentation. Where the available documentation indicates that the

NRC has been aware of and accepted a specific attribute of the fire protection program, but does not include an explicit NRC approval to that effect, the licensee should document its basis for that conclusion in the Transition documentation for explicit approval in the new licensing basis.

- If during a review to determine previously approved documents by the NRC, the licensee finds that a fundamental design requirement or a program element does not meet Chapter 3 and there is not "prior approval," a licensee shall 1) conform to specific requirements of Chapter 3, or 2) obtain a license amendment.

Accordingly, provide additional information to support the following clarification requests, and other similar conditions, that are included in LAR Attachment T:

a) Prior Approval Clarification Request 2: The licensee requested clarification of Licensing Action 11.02 for which the associated NRC SER dated March 14, 1983 (ADAMS Accession No. 8303290263), stated that all cables in containment are routed in conduit when in fact some cables are routed in covered cable trays. Provide specific excerpts from the original exemption request to demonstrate that the NRC was made aware of and accepted this specific attribute.

b) Prior Approval Clarification Requests 3, 4, 12 and 13: The licensee requested clarification of Licensing Actions 11.02 (Unit 1) and 08 (Unit 2), respectively, for approval of the deluge systems in the Unit 1 and Unit 2 Containments. However, Licensing Actions 11.02 and 08, as described in LAR Attachment K, did not include citations from licensee submittals regarding the configuration of the deluge systems. Clearly describe the scope of the clarification relative to the previously approved configuration, and provide the specific excerpts from applicable licensing basis documents to demonstrate that the NRC has been aware and accepted the specific attributes of the deluge systems.

c) Prior Approval Clarification Requests 8, 9, and 10: The licensee requested clarification of Licensing Actions 04 and 05 and stated that the original deviation requests were approved for specific fire areas, and that the licensee is requesting that this approval be applied to additional fire areas that were not part of the original deviation. The NRC staff does not consider the additional fire areas that were not part of the scope of the original deviation as a "Prior Approval Clarification". In accordance with 10 CFR 50.48(c)(2)(vii), RG 1.205, and the guidance of NEI 04-02, where prior NRC approval is not provided or adequately documented, the licensee may choose to comply with the deterministic requirement of NFPA 805, Chapter 3, comply with use of engineering evaluation or include a performance-based method in accordance with 10 CFR 50.48(c)(2)(vii). Provide the appropriate compliance basis for the additional fire areas in accordance with the requirements of 10 CFR 50.48(c) and the guidance of RG 1.205 and NEI 04-02.

d) Prior Approval Clarification Request 15: The licensee requested clarification of Licensing Action 30 because the previously approved exemption for the Intake

Structure did not specifically mention the non-safety related fire pump area or the sections of the regulations applicable to fire pump sprinkler protection. Provide the specific excerpts from licensing basis documents to demonstrate that the NRC has been aware and accepted the diesel fire pump room without sprinkler protection.

e) Prior Approval Clarification Request 16: The licensee requests that the NRC document as a "prior approval" the modified fire doors separating Fire Areas 2-WH-1 and 2-CP-1 from other compartments and recognize that these doors are still adequate with the removal of the requirement for automatic sprinklers from the original licensing basis. The NRC staff does not consider the removal of commitments from licensing basis documents as a "Prior Approval Clarification." In accordance with 10 CFR 50.48(c)(2)(vii), RG 1.205, and the guidance of NEI 04-02, where prior NRC approval is not provided or adequately documented, the licensee may choose to comply with the deterministic requirement of NFPA 805, Chapter 3, comply with use of engineering evaluation, or include a performance-based method in accordance with 10 CFR 50.48(c)(2)(vii). Provide the appropriate compliance basis for the removal of the automatic sprinklers in accordance with the requirements of 10 CFR 50.48(c) and the guidance of RG 1.205 and NEI 04-02.

f) Prior Approval Clarification Request 17: The licensee requests that the NRC document as a "prior approval" and recognize although the licensee discovered non-safety-related cables in Fire Area 1-CV-3 that are not fire retardant in contrary to the statements in the exemption request (Licensing Action 05), the existing condition is still acceptable based on the modification to install steel tray covers and to wrap exposed portions of cables to maintain the condition of low in-situ combustibles. The licensee also stated that cable tray enclosures prevent the 'nonfire-retardant' cables from being considered as an intervening combustible material. Clarify whether or not all 'nonfire-retardant' cables in Fire Area 1-CV-3 are placed in enclosed tray or wrapped. If not, provide a justification for the acceptability of exposed 'nonfire-retardant' cables with respect to flame spread, intervening combustible, and added combustible loading in Fire Area 1-CV-3. Also, provide a comparison between the amount of in-situ combustibles in the current configuration and in the original licensing basis, and if increased provide a technical basis for acceptability.

**Radioactive Release (RR) RAI 01**

NFPA 805, Section 1.5.2, states that "Radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable 10 CFR, Part 20, Limits."

LAR Section 4.4, "Radioactive Release Performance Criteria," and LAR Attachment E – "Radioactive Release Transition," indicate in the radioactive release analysis for the yard area (3-YARD-1) around the BVPS-1 and BVPS-2 complex that pre-fire plan guidance was developed to address radiological storage and sea-land type containers. Since this area is open to the atmosphere, provide an analysis for a fire occurring in the yard area to demonstrate that gaseous and liquid effluent releases will result in doses that are as low as is reasonable achievable (ALARA) and would not exceed applicable 10 CFR Part 20 limits. Describe the administrative controls (e.g., procedures and training) that will limit the amount of activity which may be present in these containers.

**RR RAI 02**

NFPA 805, Section 1.3.2, states that "The radioactive release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel, or the environment."

LAR Attachment E, Table E-2, states that yard drainage systems near radioactive storage tanks in the yard area (3-YARD-1) are designed to collect leakage into the catch basins for sampling, if necessary. Describe any other engineering controls such as storm drain covers, diversion equipment, or other means to prevent water runoff used to contain potentially contaminated fire suppression water runoff for radiological storage and sea-land containers in the yard area.

**RR RAI 03**

NFPA 805, Section 1.3.2, states that "The radioactive release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel, or the environment."

LAR Attachment E states in the radioactive release analysis for BVPS-1 and BVPS-2 that fire areas/compartments where radioactive materials are present or expected to be present were screened into the radioactive release review. In the pre-fire plans, areas where there is no possibility of radiological hazards were screened out from further review. Describe the qualifications of the personnel conducting the screening and whether the screening was conducted by an expert panel or a limited number of individuals.

**Fire Modeling (FM) RAI 01**

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

- The algebraic equations implemented in NUREG-1805, "Fire Dynamics Tools (FDTs): Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program," December 2004 (ADAMS Accession No. ML043290075), were used to characterize flame height, plume centerline temperature, flame radiation (heat flux), plume radius, hot gas layer (HGL) temperature, ceiling jet temperature, smoke and heat detector actuation, and sprinkler activation.
- The FLASH-CAT model was used to calculate the fire propagation in a vertical stack of horizontal cable trays.
- The Consolidated Model of Fire and Smoke Transport (CFAST) was used in HGL and multi-compartment analysis (MCA) calculations for various compartments, the Main Control Room (MCR) abandonment calculations, and the temperature sensitive equipment HGL study.
- Fire Dynamics Simulator (FDS) was used in the temperature sensitive equipment zone of influence (ZOI) and plume/HGL interaction studies.

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

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

a) Identify any applications of fire modeling tools or methods used in the development of the LAR that are not discussed in LAR Attachment J.

b) There appears to be some differences between BVPS Units 1 and 2 in the detailed fire modeling methodology applied in each fire area. For example, in BVPS Unit 1, targets were damaged up to the ceiling to bound plume/HGL interaction while in Unit 2 the results of the FDS plume/HGL interaction study were used to justify the application of Heskestad's plume temperature correlation to determine the vertical ZOI. Describe the differences between the fire modeling methodologies applied in the two units, and explain why different approaches were used.

c) The NRC staff notes that typically, during maintenance or measurement activities in the plant, electrical cabinet doors remain open for a certain period of time. Describe whether there are any administrative controls in place to minimize the likelihood of fires involving such a cabinet, and describe how cabinets with temporarily open doors were treated in the fire modeling analysis.

d) Describe and provide technical justification for the approach that was used in the FLASH-CAT model to determine the time to ignition, the heat release rate per unit area (HRRPUA), and the flame spread rate for cable trays that contain a mixture of thermoplastic and thermoset cables.

e) Describe how non-cable secondary combustibles were identified and accounted for in the fire modeling analyses. Also, specifically explain if and how the combustible loading of the array of batteries was accounted for in the fire modeling analyses in Fire Compartment 1-CR-4.

f) Explain how the model assumptions in terms of location and heat release rate (HRR) of transient combustibles in a fire area or zone will not be violated during and post-transition. Provide the technical justification for the assumption that in specific scenarios, the HRR of transient fires is less than 317 kW (e.g., 142 kW in Fire Compartment 1-CR-4).

g) Describe how high energy arcing fault initiated fires are treated in the HGL development timing.

h) Provide the reasons for using CFAST in lieu of the McCaffrey, Quintiere, and Harkleroad (MQH) method to perform the HGL temperature calculations in selected fire compartments.

i) Specifically regarding the use of the algebraic models:

   i. Explain and provide technical justification for the transient fire growth rate that was assumed in the smoke detectors actuation and sprinkler activation calculations.

   ii. Describe how the vent dimensions were determined for each compartment where the method of MQH was used to estimate the HGL temperature, and confirm that the assumed dimensions are consistent with plant conditions and/or lead to conservative HGL temperature estimates.

   iii. Provide technical justification for applying the MQH method in compartments with vents in the floor or ceiling, or in a wall at or near the ceiling of the compartment.

j) Specifically regarding the use of CFAST in the MCR abandonment calculations for Units 1 and 2:

   i. Provide technical justification for not excluding the volumes of the main-control boards (MCBs), electrical panels, raised platforms, ductwork in the interstitial space above the egg-crate ceiling, and other obstructions from the effective control room volume used in the CFAST calculations.

   ii. During the audit walkdown the NRC staff noted a copier, boxes with paper, and a plastic trash can in the corner behind the Unit 2 veritcal MCB. Confirm that a fire involving these transient combustibles is bounded by the transient fires that were considered in the MCR abandonment calculations. In addition, provide justification for not

considering fires that originate in the kitchen, computer room, or office in the MCR abandonment calculations.

iii. Explain why transient fires against a wall or in a corner were not considered in the Unit 1 and Unit 2 MCR abandonment calculations.

iv. The MCR abandonment calculations are based on the assumption that all doors would normally remain closed. In this case, explain what natural leakage vents were assumed in the analysis.

v. In the event of loss of both MCR Units and two HVAC systems, doors are assumed to be open. In this case, identify the MCR doors that are assumed to be open, explain whether they are assumed to open at a specific time, and, if so, provide the basis for this time (e.g., estimated fire brigade arrival time based on drill data).

vi. Confirm that all cabinets in the MCR with multiple bundles of unqualified cable indeed have closed doors as assumed in the CFAST calculations.

vii. Provide technical justification for not considering cabinet fires that spread to adjacent cabinets.

viii. For the case where a cabinet fire spreads to a vertical cable tray in the Unit 1 MCR, describe in detail how the time to ignition of the cable tray was calculated.

ix. Explain whether there are (or will be) any administrative controls in place to support the assumption that transient fires grow to peak HRR in 8 minutes (e.g., administrative controls that prohibit the accumulation of loose trash in the MCR area).

x. Describe the cabinet, cable tray and transient fire elevations and areas that were used in the CFAST calculations, and provide technical justification for the assumed values.

xi. Provide the results of the calculations that support the licensee's assertion that MCR abandonment will not be required if at least one of the HVAC systems is changed to smoke purge mode within 705 seconds (~12 minutes).

xii. Explain why there are slight differences in the calculated abandonment times and resulting probabilities for abandonment between BVPS Units 1 and 2 MCRs.

k) Specifically regarding the MCA:

i. Describe how the size of the opening between the exposing and exposed compartments assumed in the MQH and CFAST HGL calculations was

determined, and explain to what extent these vent sizes are representative of conditions in the plant.

**FM RAI 02**

LAR Section 4.5.1 states, in part, that "In accordance with the guidance in RG 1.205, Fire PRA (FPRA) models were developed for BVPS-1 and BVPS-2 in compliance with the requirements of Part 4 "Requirements for Fires at-Power PRA," of the ASME and ANS combined PRA Standard, ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Application . . ."

The American Society of Mechanical Engineers (ASME) and American Nuclear Society (ANS) standard ASME/ANS RA-Sa-2009, Part 4, requires damage thresholds be established to support the FPRA. Thermal impact(s) must be considered in determining the potential for thermal damage of SSCs and appropriate temperature and critical heat flux criteria must be used in the analysis.

a) Describe how the installed cabling in the power block was characterized, specifically with regard to the critical damage threshold temperatures and heat fluxes for thermoset and thermoplastic cables as described in NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities" (ADAMS Accession No. ML052580075).

b) Explain if and how solid cable tray covers and fire wraps or electrical raceway fire barrier systems were credited in any areas in terms of delaying or preventing damage, ignition and subsequent flame spread of cables. In addition, explain how perforated and corrugated cable tray covers were treated in this respect with regard to damage criteria, fire propagation, etc., in the fire modeling analyses.

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

**FM RAI 03**

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

LAR Section 4.5.1.2 states that fire modeling was performed as part of the FPRA development (NFPA 805, Section 4.2.4.2). Reference is made to LAR Attachment J, for a discussion of the verification and validation (V&V) of the fire models that were used. Furthermore, LAR Section 4.7.3 states that, "Calculational models and numerical methods used in support of compliance with 10 CFR 50.48(c) were verified and validated as required by Section 2.7.3.2 of NFPA 805."

Regarding the V& V of fire models:

a) LAR Attachment J states that the smoke detection actuation correlation (Method of Heskestad and Delichatsios) has been applied within the validated range reported in NUREG-1824, "Verification and Validation of Selected Fire Models for

Nuclear Power Plant Applications" (ADAMS Accession No. ML071650546). However, the latter reports a validation range only for Alpert's ceiling jet temperatures correlation. Provide technical details to demonstrate that the temperature to smoke density correlation has been applied within the validated range, or to justify the application of the correlation outside the validated range reported in the V&V basis documents.

b) For any tool or method identified in the response to FM RAI 01(a) above, provide the V&V basis if not already explicitly provided in the LAR (for example in LAR Attachment J).

**FM RAI 04**

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

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

Regarding the limitations of use:

a) Identify uses, if any, of algebraic models outside the limits of their applicability and for those cases explain how their use was justified.

b) Identify uses, if any, of fire scenarios outside the limits of applicability of the CFAST model and for those cases explain how the use of CFAST model was justified.

c) Identify uses, if any, of fire scenarios outside the limits of applicability of the FDS model and, for those cases, explain how the use of the FDS model was justified.

**FM RAI 05**

LAR Section 4.5.1.2 states that fire modeling was performed as part of the FPRA development (NFPA 805, Section 4.2.4.2). The NRC staff notes that this necessitates that qualified fire modeling and PRA personnel work together. Furthermore, LAR Section 4.7.3 states, in part, that:

> Post-transition, for personnel performing fire modeling or Fire PRA development and evaluation, BVPS-1 and BVPS-2 develop and maintain qualification requirements for individuals assigned various tasks. Position Specific Guides 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 (i.e., fire modeling techniques):

a) Describe the requirements to qualify personnel for performing fire modeling calculations in the NFPA 805 transition.

b) Describe the process for ensuring that fire modeling personnel have the appropriate qualifications, not only before the transition but also during and following the transition.

c) When fire modeling is performed in support of the FPRA, describe how proper communication between the fire modeling and FPRA personnel is ensured.

d) Explain how consistency was ensured between the multiple supporting consultants that were involved in the fire modeling analyses performed in support of the LAR development.

**FM RAI 06**

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

Regarding the uncertainty analysis for fire modeling:

a) Describe how the uncertainty associated with the fire model input parameters was addressed and accounted for in the fire modeling analyses.

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

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

Section 2.4.3.3 of NFPA 805 states that the PSA (PSA is also referred to as PRA) approach, methods, and data shall be acceptable to the AHJ, which is the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)", Revision 2 (ADAMS Accession No. ML081130188), as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. RG 1.200 describes a peer review process utilizing an associated ASME/ANS standard (currently ASME/ANS-RA-Sa-2009) as one acceptable approach for determining the technical adequacy of the PRA once acceptable consensus approaches or models have been established for evaluations that could influence the regulatory decision. The primary results of a peer review are the Facts and Observations (F&Os) recorded by the peer review and the subsequent resolution, or disposition, of these F&Os.

Clarify the following dispositions to Fire PRA F&Os and Supporting Requirements (SRs) assessment identified in LAR, Attachment V, that have the potential to impact the BVPS Unit 1 and 2 Fire PRA results and do not appear to be fully resolved:

a) CF-A1-01 (Circuit Failure Mode Likelihood Analysis)
The disposition states that the fire risk model was revised to use Option #2 from NUREG/CR-6850 to determine circuit failure mode likelihood. New guidance on using conditional probabilities of spurious operation for control circuits is in a letter from the NRC to NEI, "Supplemental Interim Technical Guidance on Fire-induced Circuit Failure Mode Likelihood Analysis," (ADAMS Accession Nos. ML14086A165 and ML14017A135) and in Section 7 of NUREG/CR-7150, Volume 2. This guidance includes: (1) replacement of the conditional hot short probability tables in NUREG/CR-6850 for Option #1 (including removal of credit for Control Power Transformers (CPTs) and conduit) with new circuit failure probabilities for single break and double break control circuits (Option #2 in NUREG/CR-6850 is no longer an adequate method and should not be used); (2) replacement of the probability of spurious operation duration figure in FAQ 08-0051 (NUREG/CR-6850 Supplement 1) for AC control circuits and additional guidance to address duration for DC control circuits; (3) a method for incorporation of the uncertainty values for the circuit failure probabilities and spurious operation duration in the state-of-knowledge correlation (SOKC) for developing the mean Core Damage Frequency/Large Early Release Frequency (CDF/LERF); and, (4) recommendations on the hot short probabilities to use for other cable configurations, including panel wiring, trunk cables, and instrument cables.

Provide an assessment of the assumptions used in the Fire PRA for Units 1 and 2 relative to the updated guidance in NUREG/CR-7150, Volume 2, specifically addressing each of these items. If the Fire PRA assumptions are not bounded by the new guidance provide a justification for each difference or provide updated risk results as part of the integrated analysis requested in PRA RAI 03, utilizing the guidance in NUREG/CR-7150, Volume 2. Justify the proposed treatment of circuit

failure probabilities during post transition for self-approval of risk-informed changes.

b) IGN-A1-01 (Sensitivity Analysis on FAQ 08-0048 Fire Bin Frequencies)
The F&O disposition indicates the final Fire PRA models used the updated fire ignition frequencies provided in NUREG/CR-6850, Supplement 1 (i.e., in FAQ 08-0048, ADAMS Accession No. ML092190457) were used in the Fire PRA. The guidance in FAQ 08-0048 states that a sensitivity study should be performed using the mean fire frequency for those bins in Section 6 of NUREG/CR-6850 with an alpha value less than or equal to one. Explain whether the acceptance guidelines of RG 1.174 may be exceeded if this sensitivity study would be applied to the integrated analysis requested in PRA RAI 3. If these guidelines may be exceeded, provide a description of fire protection, or related measures that can be taken to provide additional defense in depth, as discussed in FAQ 08-0048.

c) QNS-C1-01 (Quantitative Screening Based on Sample)
The disposition to this F&O states that a sample of the scenarios quantitatively screened on CDF were evaluated against LERF criteria and that all the scenarios also met LERF screening criteria. Explain how evaluating a sample of screened scenarios provides confidence that the CC-II requirements associated with LERF contribution for this SR are met (namely, that the sum of the LERF contributions for all screened fire scenarios is <10% of the estimated total LERF for fire events).

d) FSS-D7-01 (Fire Detection and Suppression System Unavailability)
The disposition to this F&O indicates that plant-specific unavailabilities for fire detection and suppression systems have been developed but suggests that they have not been reflected in the LAR Attachment W risk results. The NRC staff reviewed the licensee's sensitivity analyses and notes that the licensee's analysis states that there would be just a 4% increase in CDF and a 3% increase of in LERF if plant-specific fire detection and suppression unavailabilities were incorporated into the Fire PRA. Explain how plant-specific system unavailabilities will be addressed for the Fire PRA to be used for self-approval as part of the response to PRA RAI 03.

e) CS-B1-02 (Open Circuits)
The disposition to this F&O indicates that the evaluation of fire-induced open circuits on the secondary side of current transformers (CTs) has not been completed and refers to an on-going effort to track resolution of this industry issue (Implementation Item BV2-1020 in Table S-3 of the LAR). Explain how these fire-induced open circuits are treated in the Fire PRA. Specifically discuss if the issue is treated by postulating secondary fires in accordance with NUREG/CR-7150, Volume 2, concerning the turns-ratio in a CT. If not, provide justification for the treatment and discuss the impact on the Fire PRA results reported in the LAR.

f) HRA-E1-01 (HRA Dependency Analysis)
The disposition to this F&O explains that Human Reliability Analysis (HRA) dependency analysis was performed in response to this F&O, but does not

describe the method used to perform this analysis or explain how the specific deficiencies identified by the F&O were resolved.

For performing HRA dependency analysis, NUREG-1921, "EPRI [Electric Power Research Institute]/NRC-RES Fire Human Reliability Analysis Guidelines – Final Report," discusses the need to consider a minimum value for the joint probability of multiple human failure events (HFEs), and refers to NUREG-1792, "Good Practices for Implementing Human Reliability Analysis (HRA)," (Table 2-1) which recommends joint human error probability (HEP) values should not be below 1E-5. Table 4-3 of EPRI 1021081, "Establishing Minimum Acceptable Values for Probabilities of Human Failure Events," provides a lower limiting value of 1E-6 for sequences with a very low level of dependence. Therefore, the guidance in NUREG-1921 allows for assigning joint HEPs that are less than 1E-5 but only through assigning proper levels of dependency.

Given that the HRA dependency analysis was not described and the specific deficiencies identified in the F&O were not addressed in the disposition:

i. Describe the HRA dependency analysis performed in response to this F&O used in the Fire PRA and whether it is consistent with NRC-accepted guidance in NUREG-1921. In the response, specifically address how each of the issues identified by the peer reviewed was dispositioned. If the approach to performing HRA dependency analysis is not consistent with NRC guidance, justify this departure.

ii. Also, separately confirm that each joint HEP value used in the Fire PRA below 1.0E-05 includes its own justification that demonstrates the inapplicability of the NUREG-1792 lower value guideline (i.e., that the criteria for independent HFEs are met). Provide an estimate of the number of these joint HEPs below 1.0E-05, discuss the range of values, and provide at least two different examples where your justification is applied.

**PRA RAI 02 - Internal Events PRA F&Os**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. RG 1.200 describes a peer review process utilizing an associated ASME/ANS standard (currently ASME/ANS-RA-Sa-2009) as one acceptable approach for determining the technical adequacy of the PRA once acceptable consensus approaches or models have been established. The primary results of a peer review are the F&Os recorded by the peer review and the subsequent resolution of these F&Os.

Clarify the following dispositions to Internal Events F&Os and SRs assessment identified in the LAR supplement dated February 14, 2014 that have the potential to impact the Unit 1 and 2 Fire PRA results and do not appear to be fully resolved:

a) DA-09 (From Tables 1-1 and 2-1): (Common Cause Modeling of Diesels) The F&O states that: "[a] discussion of decoupling the Unit 2 diesels from the Unit 1 should be included", as part of documentation needed of Common Cause Failure (CCF) modeling. The F&O disposition does not address this specific concern of "decoupling" CCFs for the Unit 1 and 2 diesels. Describe the CCF modeling for the diesel generator, and justify "decoupling" CCF modeling for Unit 1 diesels from Unit 2 diesels.

b) SY-01 (from Tables 1-1 and 2-1): (Common cause failure of charging pumps) This F&O identifies potential common mode failure (CCF) of the charging pumps when seal heat exchanger cooling because of increased water temperature in the Volume Control Tank (VCT). It appears that "swap-over" from the VCT to the Refueling Water Storage Tank (RWST) will prevent a temperature increase (i.e., 123 °F) that would fail the charging pumps. Neither the operator actions to "swap-over" from the VCT to the RWST tank nor actions to monitor the temperature in the VCT are modeled in the Fire PRA. Provide further justification for not modeling this CCF failure in the Fire PRA or incorporate this CCF into the integrated analysis provided in response to PRA RAI 3.

c) TH-02 (From Tables 1-1 and 2-1): (MCR HVAC Dependency) The F&O disposition states that heat-up calculations for the common Main Control Room (MCR) indicate that if MCR HVAC fails it takes longer than 24 hours for the ambient air temperature to exceed 115 ° F when air mixing is assumed. To ensure air mixing, operators must immediately ("within 10 minutes") open all of the common doorways between the control rooms (and setting up portable fans is recommended). It is not clear whether opening all common doorways is a proceduralized action or whether there may other reasons to keep the doors shut. Provide justification for not modeling HVAC dependency or operator actions required to ensure air mixing. If justification cannot be provided, then model HVAC dependency as part of the integrated analysis provided in response to PRA RAI 3.

d) LE-D5 (From Tables 1-2 and 2-2): (Severe accident SGTR) The F&O disposition does not address the acceptability of the analysis of thermally induced SGTRs raised in the F&O. Provide a description of the analysis method used and a justification for the acceptability of the method.

e) SC-A5 (From Tables 1-2 and 2-2) and AS-10 (From Tables 1-1 and 2-1): (Modeling of actions needed after 24 hours to reach a stable state) The F&O disposition addresses evaluation of the potential need to refill the RWST after 24 hours to achieve a stable state but does not state whether additional evaluations may be needed for actions associated with other sequences. Justify that stable plant conditions for all sequences are achieved in the 24 hour mission time or that appropriate mission times are used for sequences that extend beyond 24 hours, in accordance with the PRA standard.

f) HR-PR-006 (From Tables 1-3 and 2-3): (Time window inconsistency) The F&O disposition indicates significantly different time windows for HFE ZHEMA2 for the two units (4.3 hours vs 13.26 hours). Explain the reason for this difference, and justify that this does not represent a modeling inconsistency.

**PRA RAI 03 – Integrated Analysis**

Section 2.4.4.1 of NFPA-805 states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on CDF and LERF, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified additional information that is required to fully characterize the risk estimates. The Unit 1 and 2 PRA methods currently under review in the LAR include:

- PRA RAI 1.a regarding circuit failure mode likelihood
- PRA RAI 1.d fire detection and suppression system unavailability
- PRA RAI 1.e regarding treatment of open circuits
- PRA RAI 1.f regarding HRA dependency analysis
- PRA RAI 2.b regarding common cause failure of charging pumps
- PRA RAI 2.c regarding MCR HVAC dependency
- PRA RAI 4 regarding deviations from acceptable PRA methods
- PRA RAI 5 regarding credit for repair
- PRA RAI 6 regarding Heat Release Rates lower than 317 kW for transient sources
- PRA RAI 7 regarding treatment of sensitive electronics
- PRA RAI 8 regarding transient fire placement
- PRA RAI 9 regarding propagation of fire from "well sealed" >440 V electrical cabinets
- PRA RAI 10 regarding dual MCR abandonment and CCDP
- PRA RAI 11 regarding crediting MCR abandonment
- PRA RAI 12 regarding incipient detection credit
- PRA RAI 13 regarding fire damage effects from the opposite unit
- PRA RAI 14 regarding state of knowledge correlation (SOKC)
- PRA RAI 15 regarding use of NUREG-1921
- PRA RAI 19 regarding large risk reduction credit
- PRA RAI 25 regarding treatment of welding and cutting cable fires
- PRA RAI 26 regarding modeling the Unit 1 Main Control Board (MCB) vertical boards
- FM RAI 1.e regarding secondary combustibles (e.g., in Fire Area 1-CR-4)
- FM RAI 1.j subparts i, ii, iii, and vii regarding fire modeling to determine time to MCR abandonment due to loss of habitability

Provide the following:

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

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

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

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

d) If any of the methods not accepted by the NRC staff will be retained in the PRA that will be used to estimate the change in risk of post-transition changes to support self-approval, explain how the quantification results for each future change will account for the use of these methods.

**PRA RAI 04 – Potential Use of Unacceptable Methods**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff require additional justification to allow the NRC staff to complete its review of the proposed method.

The LAR does not appear to state whether the Fire PRA includes deviations from NRC Accepted Fire PRA Methods (e.g., NUREG/CR-6850, FAQs or interim guidance). For the Unit 1 and 2 Fire PRAs, identity deviations from NRC accepted guidance, and if deviations were used, then justify them or replace them with another method and submit that method to the NRC for review. Also, determine the impact on Fire CDF, LERF, Δ CDF, and Δ LERF by including any new approaches as part of the integrated analysis performed in response to PRA RAI 3.

**PRA RAI 05 – Credit in the Fire PRA for Repair**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff require additional justification to allow the NRC staff to complete its review of the proposed method.

Attachment G of the LAR describes a number of recovery actions that involve implementing repair procedures on valves that have been impacted by fire-induced cable failure. The NRC staff notes per the PRA Standard, SR DA-C15 and SR DA-D9, that credit for repair should be based on plant-specific or industry data. Explain what the term "repair" means as it is used in recovery actions cited in Attachment G of the LAR. Also, explain whether repair-related recovery actions are credited in the Fire PRA for risk reduction. If repair is credited in the Unit 1 or 2 Fire PRA, then explain and justify the credit taken. If the repair credit cannot be justified, then remove credit for these actions in the integrated analysis provided in response to PRA RAI 3.

**PRA RAI 06 – Reduced Transient Heat Release Rates**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff require additional justification to allow the NRC staff to complete its review of the proposed method.
The licensee's analysis indicates that although a bounding 98% heat release rate (HRR) of 317 kW from NUREG/CR-6850 was typically used, reduced transient fire HRRs were applied as part of detailed fire modeling for some fire areas. Discuss the key factors used in Unit 1 and 2 Fire PRAs to justify the reduced rate below 317 kW per the guidance endorsed by the June 21, 2012, memo from Joseph Giitter to Biff Bradley, "Recent Fire PRA Methods review Panel Decisions and EPRI 1022993, 'Evaluation of Peak Heat Release Rates in Electrical Cabinets Fires'" (ADAMS Accession No. ML120172A406) and associated documentation (ADAMS Accession No. ML113130446). Include in this discussion:

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

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

required maintenance for ignition sources in each location, and types/quantities of combustibles needed to perform that maintenance. Also, discuss the personnel traffic that would be expected through each location.

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

d) Explanation of the impact of using reduced HRRs on the analysis.

**PRA RAI 07 – Sensitive Electronics**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

Neither the procedure for performing assessment of sensitive electronics nor Appendix H of the LAR refers to use of FAQ 13-0004, "Clarifications on Treatment of Sensitive Electronics," dated December 3, 2013 (ADAMS Accession No. ML13322A085). Describe the treatment of sensitive electronics for the Unit 1 and 2 Fire PRAs and explain whether it is consistent with the guidance in FAQ 13-0004, including the caveats about configurations that can invalidate the approach (i.e., sensitive electronic mounted on the surface of cabinets and the presence of louver or vents). If the approach is not consistent with FAQ 13-0004, justify the approach or replace the current approach with an acceptable approach into the integrated analysis performed in response to PRA RAI 3.

**PRA RAI 08 – Transient Fire Placement at Pinch Points**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The NRC staff could not find any description of how "pinch points" were modeled for transient fires. The fire modeling analysis indicates that fire compartment floor space is allocated into defined "transient areas" where transient fire scenarios appear to be postulated and into other areas where transient fire appears not to be postulated. Per the guidance provided in

NUREG/CR-6850, Section 11.5.1.6, transient fires should at a minimum be placed in locations within the plant physical analysis units (PAUs) where CCDPs are highest for that PAU ( i.e., at "pinch points"). The NRC staff notes that pinch points include locations of redundant trains or the vicinity of other potentially risk-relevant equipment. The NRC staff notes that hot work should be assumed to occur in locations where hot work is a possibility, even if improbable. For Unit 1 and 2 Fire PRAs, provide the following:

a) Explain how "pinch points" were identified and modeled for transient fires. Also, justify exclusion of any PAU locations from transient fire impact.

b) Include description of how transient and hot work fires are distributed within the PAUs, and the criteria used to determine where such ignition sources are placed within the PAUs.

c) Include explanation of how ignition frequency for transient fires is allocated to specific fire scenarios.

**PRA RAI 09 – Fire Propagation from Electrical Cabinets**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In a letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff require additional justification to allow the NRC staff to complete its review of the proposed method.

The fire modeling procedure states "[w]ell sealed cabinets with voltages >440 V should be counted but fire propagation excluded." For cabinets with circuits that are 440 V and higher, Section 6.5.6 of NUREG/CR-6850 states in part, that "panels that house circuit voltages of 440 V or greater are counted because an arcing fault could compromise panel integrity (an arcing fault could burn through the panel sides, but this should not be confused with the high energy arcing fault type fires)." Accordingly, propagation of fire outside the ignition source panel must be evaluated for Bin 15 electrical cabinets that contain circuits of 440 volts or greater. Describe for the Unit 1 and 2 Fire PRAs how fire propagation from well-sealed electrical cabinets greater than 440 V is evaluated. For Motor Control Centers (MCCs) include description of which cubicles are assumed to fail in a given fire. If your approach to evaluating fire propagation is not consistent with NUREG/CR-6850 guidance, then replace the current method with an acceptable method or address the impact of your proposed method as part of the integrated analysis performed in response to PRA RAI 3.

**PRA RAI 10 – Screening of MCR Abandonment Scenarios due to Loss of Habitability**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology

for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The Main Control Room (MCR) analysis and the response to F&O FSS-B2-01 for Unit 2 presented in Attachment V of the LAR appear to indicate that MCR abandonment scenarios due to loss of habitability (LOH) were "insignificant risk contributors" and were, therefore, quantitatively screened from the fire risk contribution. Two issues are relevant to this determination. First, the staff notes from the audit that MCR abandonment due to loss of habitability is caused by abandonment conditions produced for the combined Unit 1 and 2 MCR. However, MCR abandonment is only evaluated for a single unit at a time. Secondly, this screening analysis performed for both Units 1 and 2 appears to indicate that fire damage to the Main Control Board (MCB) is assumed to be non-recoverable, and therefore set to 1.0, and that the CCDP for non-MCB fires damage was set to 0.1. While setting the CCDP of MCB fires to a value of 1.0 is clearly a conservative, it is not clear that setting the CCDP associated with non-MCB fires to 0.1 is bounding. In light of these observations:

a) Clarify how MCR abandonment due to LOH was modeled in the Unit 1 and 2 Fire PRAs, and indicate how the range of fire-induced failures including spurious operations is accounted for.

b) Justify the reason for evaluating MCR abandonment for each unit separately.

c) If MCR abandonment scenarios due to LOH were screened, then describe and justify the process used to screen these scenarios. If MCR abandonment scenarios due to LOH were not screened, then discuss their risk contribution.

d) If modeling the MCR abandonment due to loss of habitability does not adequately address abandonment or if the CCDP is not realistic to conservative, adjust the integrated analysis provided in response to PRA RAI 3.

**PRA RAI 11 – Credit for MCR Abandonment for Loss of Control Scenarios**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

The MCR analysis appears to indicate that MCR abandonment was credited for loss of control (LOC) for certain scenarios. For LOC scenarios, the MCR analysis states, in part, that "[s]cenarios for which recovery actions from outside the MCR can be credited are modeled explicitly within the Fire PRA model ... and corresponding CDF and LEF values are calculated in Task 14 Fire Quantification)." Based on this statement, it appears that HRA was performed to credit "outside the MCR actions" for certain scenarios. It is not clear from the analyses how MCR abandonment was credited for LOC scenarios or why MCR abandonment was credited for certain scenarios and not others. Also, it is not clear how the CCDP for these scenarios was determined. The NRC staff notes that it can be difficult to establish the time associated with the decision to abandon the MCR and the time available for operators to perform required actions given that cues to abandon and available time is dependent on scenario-specific fire-induced impacts. In light of these observations, address for Units 1 and 2 the following:

a) Explain which LOC scenarios credit MCR abandonment and how those scenarios were modeled including the HRA that was performed for those scenarios.

b) Identify in Table G-1 of Appendix G recovery and primary control station (PCS) actions required for MCR abandonment due to loss of control (i.e., alternate shutdown actions), including those actions that must be performed before and after leaving the MCR. Note that operator actions taken at a PCS should be identified as PCS actions.

c) Indicate your criteria for abandoning the MCR due to LOC and how this is implemented in your fire PRA

d) Explain and justify how the times associated with cues in the HRA to abandon the MCR were established given the different combinations of component failures and spurious actions possible from fires that affect MCR function.

e) Explain and justify how the times available for operator actions outside the MCR in the PRA were established given the different combinations of component failures and spurious actions possible from fires that affect MCR function.

f) Explain how the CCDPs/CLERPs are estimated for fires that lead to MCR abandonment due to loss of control and how they address the range of possible fire-induced failures. Specifically include in this explanation, discussion of how the following scenarios are addressed:

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

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

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

g) Provide your range of CCDPs for abandonment due to LOC. If your maximum CCDP is not equal to 1.0, please provide a discussion as to why your CCDP maximum is less than 1.0.

h) For assessment of scenarios resulting in MCR abandonment due to loss of control, if the timing considerations associated with the cues to abandon the MCR or the times available to perform MCR abandonment actions cannot be justified or if the assessment does not address the range of possible fire-induced failures, then provide an alternate acceptable approach in the integrated analysis provided in response to PRA RAI 3.

**PRA RAI 12 – Use of Incipient Detection**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

Table S-2 of the LAR indicates that incipient detection will be installed in Unit 1 Process Rack cabinets in Fire Compartments 1-CR-4 and 2-CB-1 and in the Unit 2 Communications Room in Fire Compartment 2-CB-6. Table W-3 of the LAR indicates that these incipient detectors have an appreciable impact on reducing risk. Given the high risk significance of these incipient detection systems, explain the modeling performed in the Unit 1 and 2 Fire PRA to credit these detectors. Include discussion of whether these detectors were credited to reduce the risk of arcing fault fire scenarios. If incipient detection was used to reduce the risk of these scenarios, justify this treatment or remove this credit and evaluate its impact as part of the integrated analysis provided in response to PRA RAI 3. Explain how the approach to credit incipient detection system is consistent with existing guidance in FAQ 08-0046.

**PRA RAI 13 – PRA Treatment of Dependencies between Units 1 and 2**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

In Tables W-2a and W-2b of the LAR, with the exception of common fire compartments associated with the Intake Structure and the off-site power transformers, the risk associated with fire in Unit 1 fire compartments do not appear to contribute to Unit 2 fire risk, and risk associated fires in Unit 2 fire compartments do not appear to contribute to Unit 1 fire risk. Attachment B and K of the LAR indicate that systems are shared between units (e.g., fire pumps). It is not clear how the risk of fire in opposite unit and the risk associated with shared systems were addressed in the Fire PRA. Explain how the risk contribution of fires in one unit is addressed for the other unit due to the physical layout of the units and the interdependency of shared systems. Include identification of locations where fire in one unit can affect components in the other unit and a description of shared systems. Note that discussion in PRA RAI 10 which refers to dual unit MCR abaondonment is an example of this interdependency. If the contribution of fires originating in one unit is not addressed for the other unit, and/or if the interdependency of shared systems is not accounted for in the Fire PRA, provide justification to show there is no impact on the application or incorporate this modeling as part of the integrated analysis provided in response to PRA RAI 3.

**PRA RAI 14 – State of Knowledge Correlation (SOKC)**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

LAR Section 4.7.3 explains that sources of uncertainty in the Fire PRA were identified and specific parameters were analyzed for sensitivity in support of the NFPA 805 Fire Risk Evaluation process. It is further explained that the sensitivity to uncertainty associated with specific Fire PRA parameters was quantitatively addressed in stand-alone analyses for both Units 1 and 2. Based on this explanation it is appears that the risk results presented in Attachment W of the LAR are point estimates and do not include parameter uncertainty. Explain how state-of-knowledge correlations (SOKCs) were taken into account in the Unit 1 and 2 Fire PRA quantifications, including random failure probabilities, circuit failure likelihood and hot short duration, and non-suppression probabilities. Explain whether the LAR Attachment W risk estimates adequately account for the impact of SOKC on the mean results. If SOKC for these parameters were not accounted for in the Fire PRA quantification, then include the impact of the SOKC for these parameters in the integrated analysis performed in response to PRA RAI 3.

**PRA RAI 15 – Use of NUREG-1921**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program

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

LAR Section 4.5.1.2 indicates that a draft version of NUREG-1921 was used to develop the Unit 1 and 2 Fire PRAs. Discuss the impact of using the draft NUREG-1921 rather than the final NUREG-1921 on the risk results presented in the LAR. If necessary, include the impact in the integrated analysis performed in response to PRA RAI 3.

**PRA RAI 16 - Fire PRA Credit for Westinghouse RCP Seals**

NFPA 805 Section 2.4.3.3 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the AHJ. RG 1.174 provides quantitative guidelines on core damage frequency, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staffs review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

LAR Attachment S, Table S-2, presents a modification (i.e., BV1-3062 and BV2-0828) to install a low leakage reactor coolant pump (RCP) shutdown seals (SDS). The LAR indicates that the upgraded seals are credited in the Fire PRA and Attachment W shows that they have an appreciable impact on reducing risk. Given recent concerns about the operation of the new Westinghouse RCP shutdown seals, the risk reduction credit that might be taken in this application for upgraded RCP seals may be optimistic. The NRC is accepting models of SDS failure based on the best available information at the time of transition when accompanied by assurance that accepted models will be used when available. For Units 1 and 2:

a) Describe the RCP seal upgrade identified in Attachment S of the LAR;

b) Identify the technical basis (e.g., the topical report) and discuss the credit taken in the Fire PRA for the RCP seal upgrade. If the most recent topical report submitted to the NRC for the Westinghouse Gen III Shutdown Seals (i.e., PWROG-14001-P/NP) is not the basis for the credit taken, then justify the technical basis for credit taken in the Fire PRA; and,

c) Provide a Table S-3 implementation item stating that BVPS will use NRC accepted SDS failure models as these become available to confirm, as a minimum, that the transition change-in-risk estimates will not exceed the RG 1.205 acceptance guidelines. The implementation item should also clarify that self-approved changes that rely on the SDS failure model will not be undertaken before acceptable models have been developed.

**PRA RAI 17 - Calculation of VFDR ΔCDF and ΔLERF**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on core damage frequency, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

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

a) A detailed definition of both the post-transition and compliant plant models used to calculate the reported change-in-risk. Include description of the model adjustments made to remove VFDRs from the compliant plant model, such as adding events or logic, or use of surrogate events. Also, include explanation of how VFDR and non-VFDR modifications are addressed for both the post-transition and compliant plant models. Include explanation of whether the approach is consistent with guidance in FAQ 08-0054, "Demonstrating Compliance with Chapter 4 of NFPA 805," and FAQ 07-0030, "Establishing Recovery Actions."

b) A separate description of both the post-transition and compliant plant models used to calculate the change-in-risk for the MCR and other abandonment areas. Include a description of the model adjustments made to model the compliant plant and how modifications are credited in the post-transition and compliant plant models.

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

d) A description of the type of VFDRs identified, and discussion whether and how the VFDRs identified, but not modeled in the Fire PRA, impact the risk estimates. Explain whether VFDRs were identified differently for abandonment areas compared to non-abandonment areas, including, any qualitative rational for excluding VFDRs from the change-in-risk calculations.

**PRA RAI 18 – Additional Risk of Recovery Actions**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on core damage frequency, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed

changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

Section W.2 of the LAR indicates that the risk associated with recovery actions is evaluated in the change-in-risk calculations performed for the Fire Risk Evaluations (FREs). However, the results of those calculations do not appear to be presented in Tables W-2a and W-2b of the LAR. Section 2.4 of RG 1.205, states, in part, that "the licensee must address recovery actions, whether or not previously approved by the NRC, using the performance-based methods in Section 4.2.4, as required by NFPA 805, Section 4.2.3.1, and must evaluate the additional risk of their use according to NFPA 805, Section 4.2.4." Though the risk associated with recovery was considered in the change-in-risk calculations, it is not clear whether the additional risk of recovery actions was determined. FAQ 07-0030, Establishing Recovery Actions, states: "The set of recovery actions that are necessary to demonstrate the availability of a success path for the nuclear safety performance criteria ...should be evaluated for additional risk using the process described above and compared against the guidelines of RG 1.174 and RG 1.205. The additional risk should be provided in Attachment W of the LAR."

Also, Step 2 of Attachment G of the LAR indicates that there are recovery actions needed for both risk reduction and to meet a level of defense in depth. However, no recovery actions listed in Attachment G of the LAR are specifically marked as being credited for defense in depth only, and all recovery actions listed in Attachment G of the LAR are associated with fire compartments for which recovery actions are credited in Tables W-2a and W-2b of the LAR for risk reduction. Therefore, it is not clear whether any, or which, recovery actions listed in Attachment G of the LAR are credited for defense in depth only.

In light of these observations, address the following:

a) Explain how the additional risk of recovery action was calculated and how, or if, the additional risk of recovery actions is presented in Attachment W of the LAR. If the additional risk of recovery actions is not presented in Attachment W of the LAR, then provide those values and the results of comparing those values to RG 1.174 guidelines.

b) Explain which recovery actions identified in Attachment G of the LAR are credited for purposes of defense in depth only (if any) and which are credited for risk reduction.

**PRA RAI 19 – Large Reduction Credit for Modifications**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on core damage frequency, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

Appreciable risk reduction credit is presented in Attachment W of the LAR for non-VFDR risk reduction modifications. Section 3.2.5 of RG 1.205 states that risk decreases may be combined with risk increases for the purposes of evaluating combined changes in accordance with regulatory positions presented in Sections 1.1 and 1.2 of RG 1.174, Revision 2, and in this case the total increase and total decrease in the Δ CDF and Δ LERF should be provided. Tables W-2a and W-2b of the LAR report risk values for each fire area, both before and after crediting in-cabinet incipient detection and installation of RCP shutdown seals. These tables also present the corresponding "risk offsets" (i.e., total risk decrease) associated with these risk reduction modifications.

Conservative calculation of the compliant plant CDF and LERF can lead to a non-conservative calculation of the Δ CDF and Δ LERF (and overestimation of risk offset). The NRC staff acknowledges that installation of incipient detection and new RCP seals represent significant risk reduction. However, given the significance of the risk reduction credited for specific modifications, and the possibility of non-conservative calculation of the Δ CDF and Δ LERF, address the following for both Units 1 and 2:

a) Provide (or point out if already provided) the total risk increase associated with unresolved (i.e., retained) VFDRs.

b) Summarize the risk significant scenarios for fire areas in the compliant plant model that are most significantly impacted by the risk offset, and discuss the contribution of fire-induced failures for those scenarios.

c) Discuss the impact of any important modeling assumptions contributing to the risk significant scenarios for fire areas in the compliant plant model. Specifically address conservative modeling assumptions made in the compliant plant model that may artificially reduce the calculated change-risk-risk (or result in overestimating the risk offset).

d) If conservative modeling of the compliant plant is identified as contributing to under estimation of the total change-in risk, then demonstrate that the total risk increase associated with unresolved VFDRs is offset by the total risk decrease associated with risk reduction modifications even when conservative modeling is removed. Alternatively, replace the conservative modeling with realistic modeling that does not underestimate the total change-in-risk in the integrated analysis provided in response to PRA RAI 3.

**PRA RAI 20 – Risk Reduction Modifications**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on core damage frequency, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the

acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

Attachment W of the LAR seems to suggest that RCP seal installation and incipient detection are the only non-VFDR risk reduction modifications credited. Table S-2 of the LAR appears to identify other modifications credited for the purposes of reducing risk that do not resolve a VFDR (e.g., Item BV1-2854 removes a fire source from fire compartment 1-CR-4 but does not resolve a VFDR). For the Unit 1 and 2 Fire PRAs, identify which modifications resolve VFDRs and which modifications reduce risk but do not resolve a VFDR. Also, explain why only installation of RCP seals and incipient detection are included in calculation of the "risk offset".

**PRA RAI 21 – Defense in Depth (DID) and Safety Margin**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on core damage frequency, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

LAR Section 4.5.2.2 provides a high-level description of how DID and safety margin were reviewed to address the transition to NFPA 805. Provide further explanation of the method used to determine when a substantial imbalance between DID echelons existed in the FREs, and identify the types of plant improvements made in response to this assessment. Also, provide further discussion of the approach in applying the NEI 04-02, Revision 2 criteria for assessing safety margin in the FREs.

**PRA RAI 22 - Implementation Item Impact on Risk Estimates**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA-805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA-805 based program, and all future plant changes to the program, shall be acceptable to the NRC. RG 1.174 provides quantitative guidelines on core damage frequency, large early release frequency, and identifies acceptable changes to these frequencies that result from proposed changes to the plant's licensing basis and describes a general framework to determine the acceptability of risk-informed changes. The NRC staff review of the information in the LAR has identified the following information that is required to fully characterize the risk estimates.

Table S-3 of the LAR lists implementation items that will be completed prior to adopting the new NFPA 805 fire protection program. This list does not appear to include a commitment to update the Fire PRA for Units 1 and 2 following completion of modifications and other implementation items, and does not provide a plan of action if the updated as-built Fire PRA results in risk estimates that exceed RG 1.174, Revision 2, guidelines.

Provide an implementation item that commits to update the Fire PRA for Units 1 and 2 following completion of modifications and other implementation items, and provides a plan of action if the updated as-built Fire PRA results in risk estimates that exceed RG 1.174, Revision 2, guidelines, such as implementing additional modifications or refining the analytic estimates.

**PRA RAI 23 – Fire PRA Peer Reviews**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. RG 1.200 describes a peer review process utilizing an associated ASME/ANS standard (currently ASME/ANS-RA-Sa-2009) as one acceptable approach for determining the technical adequacy of the PRA once acceptable consensus approaches or models have been established.

LAR Attachment V explains that the full-scope peer review of the Unit 1 Fire PRA was performed in January 2009 against the ASME/ANS-RA-S-2008 PRA standard. A subsequent focused-scope peer review was then performed in January 2011 against the ASME/ANS-RA-Sa-2009 PRA standard. The scope of this latter review included (1) reviewing the responses to facts and observations (F&Os) from the original peer review for those elements which were complete at the time of the original peer review; and (2) re-assessing all supporting requirements (SRs) for those elements which were not complete at the time of or had undergone significant changes since the original peer review. Address the following:

a) Explain how changes in the SRs between the two versions of the PRA standard have been addressed in this peer review process. If not addressed, explain how the quality of the Unit 1 Fire PRA is assured for those SRs that have changed.

b) Explain if RG 1.200, Revision 2, was followed by the focused-scope peer review team. Specifically address if the clarifications and qualifications in Table A-4 of this regulatory guide were considered and if the NEI 07-12 peer review process was utilized. Also address this same question for the Unit 2 Fire PRA peer review performed in February 2012 against the ASME/ANS-RA-Sa-2009 PRA standard.

**PRA RAI 24 – Model Changes and Focused Scope Reviews after the Full Peer Review**

NFPA 805 Section 2.4.3.3 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. RG 1.200 describes a peer review process utilizing an associated ASME/ANS standard (currently ASME/ANS-RA-Sa-2009) as one acceptable approach for determining the technical adequacy of the PRA once acceptable consensus approaches or models have been established.

The NRC staff notes that a number of revisions and updates were made in response to peer review F&Os. Identify any changes made to the Internal Events PRA or Fire PRA since the last

full-scope peer review of each of these changes that are consistent with the definition of a "PRA upgrade" in ASME/ANS-RA-Sa-2009. If any changes are characterized as a PRA upgrade, indicate if a focused-scope peer review was performed for these changes consistent with the guidance in ASME/ANS-RA-Sa-2009 and describe any findings from that focused-scope peer review and the resolution of these findings. If a focused-scope peer review has not been performed for changes characterized as a PRA upgrade, describe what actions will be implemented to address this issue.

**PRA RAI 25 – Treatment of Welding and Cutting Cable Fires**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC staff or acceptable methods that appear to have been applied differently than described require additional justification to allow the NRC staff to complete its review of the proposed method.

During the audit, BVPS indicated that cable fires due to welding and cutting were analyzed in two ways. For some PAUs, fire was assumed to damage the highest CCDP tray in the PAU and the entire PAU frequency for cable fires due to welding and cutting was applied to this CCDP. For other PAUs, the fire frequency and location of hot work induced cable fires was applied according to a grid in the PAU. Given that the later approach deviates from accepted methods, please:

a) Confirm that NRC staff's understanding of BVPS's approach to hot work fires summarized above is correct. Otherwise, provide additional detail as warranted.

b) Justify the treatment of hot work induced cable fires.

c) Absent an adequate justification for treatment of hot work fires, incorporate an acceptable approach (i.e., FAQ 13-0005) in the integrated analysis provided in response to PRA RAI 3.

**PRA RAI 26 – Modeling MCR Vertical Boards**

Section 2.4.3.3 of NFPA 805 states that the PRA approach, methods, and data shall be acceptable to the NRC. RG 1.205 identifies NUREG/CR-6850 as documenting a methodology for conducting a Fire PRA and endorses, with exceptions and clarifications, NEI 04-02, Revision 2, as providing methods acceptable to the staff for adopting a fire protection program consistent with NFPA-805. In letter dated July 12, 2006, to NEI (ADAMS Accession No. ML061660105), the NRC established the ongoing FAQ process where official agency positions regarding acceptable methods can be documented until they can be included in revisions to RG 1.205 or NEI 04-02. Methods that have not been determined to be acceptable by the NRC

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

The NRC staff learned at the audit that the Unit 1 MCB vertical boards were analyzed using the Appendix L methodology. Inherent to the analysis was an assumption that an additional 15 minutes due to separation was added to the time allowable for suppression prior to damage of the Appendix L target sets. In absence of partitions in the MCB vertical boards, additional explanation is needed to support this credit. If this treatment cannot be justified, then replace this treatment with an acceptable method in the integrated analysis provided in response to PRA RAI 03.

## REQUEST FOR ADDITIONAL INFORMATION RESPONSE TIME TABLE

| Request for Additional Information | Response Date |
|---|---|
| **FPE** 3, 5.a(vii), 5.a(viii), 5.a(ix), 6, 7, 8, 15.a, 15.b, 15.c, 15.d<br>**SSD** 2, 3, 7, 9.a, 10, 12<br>**FM** 1.g, 1.j(viii), 1.j(x), 1.j(xii)<br>**PRA** 1.a, 1.b, 1.c, 1.e, 2, 6.d, 13, 14, 15, 16, 17, 22, 24 | 04/27/2015<br>(60 days*) |
| **FPE** 2, 10, 13, 14.b, 14.c, 14.d, 15.e, 15.f, 17<br>**SSD** 1, 5, 8, 9.b<br>**RR** 2, 3<br>**FM** 1.d, 1.f, 1.h, 1.i, 1.j(ii), 1.j(vi), 1.k, 2.a, 3.a, 5, 6<br>**PRA** 1.d, 1.f, 5, 6.a, 18, 20, 21, 23 | 05/27/2015<br>(90 days*) |
| **FPE** 1, 4, 5.a(i), 5.a(ii), 5.a(iii), 5.a(iv), 5.a(v), 5.a(vi), 5.b, 9, 11, 12, 14.a, 16<br>**SSD** 4, 6, 11, 13<br>**RR** 1<br>**FM** 1.a, 1.b, 1.c, 1.e, 1.j(i), 1.j(iii), 1.j(iv), 1.j(v), 1.j(vii), 1.j(ix), 1.j(xi), 2.b, 2.c 3.b, 4<br>**PRA** 3#, 4, 6.b, 6.c, 7, 8, 9, 10, 11, 12, 19#, 25, 26 | 06/26/2015<br>(120 days*) |

*from conclusion of audit on February 26, 2015
#responses to PRA RAI 3 and 19 may come later due to dependency on the acceptability of other RAI responses

Abbreviation Key:
FPE – Fire Protection Engineering
SSD – Safe Shutdown Analysis
FM – Fire Modeling
PRA – Probabilistic Risk Assessment
RR – Radioactive Release

If you have any questions regarding this matter, please contact me at (301) 415-7128.

Sincerely,

***/RA/***

Taylor A. Lamb, Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-334 and 50-412

Enclosure:
1. Request for Additional Information
2. Request For Additional Information Response Time Table

cc w/encl: Distribution via Listserv

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JRobinson, NRR

**ADAMS Accession No.: ML15049A507** ***via email dated**

| OFFICE | LPLI-2/PM | LPLI-2/LA | DRA/AFPB** | DRA/APLA** | LPLI-2/BC | LPLI-2/PM |
|---|---|---|---|---|---|---|
| NAME | TLamb | ABaxter | AKlein | HHamzehee | DBroaddus | TLamb |
| DATE | 02/27/15 | 02/20/15 | 02/27/15 | 02/27/15 | 03/02/15 | 03/04/15 |

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