FENOC™
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May 27, 2015
L-15-150

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Beaver Valley Power Station, Unit Nos. 1 and 2
Docket No. 50-334, License No. DPR-66
Docket No. 50-412, License No. NPF-73
Response to Request for Additional Information Regarding License Amendment Request to Adopt National Fire Protection Association Standard 805 (TAC Nos. MF3301 and MF3302)

By letter dated December 23, 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 (FENOC) submitted a license amendment request to change the Beaver Valley Power Station, Unit Nos. 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. The Nuclear Regulatory Commission (NRC) requested additional information in a letter dated March 4, 2015 to complete its review of the license amendment request (ADAMS Accession No. ML15049A507).

In accordance with Enclosure 2 to the March 4, 2015 letter, the FENOC response due within 60 days was submitted to the NRC in a letter dated April 27, 2015 (ADAMS Accession No. ML15118A484), and the response that is due within 90 days is attached. The remaining responses due within 120 days will follow. The probabilistic risk assessment (PRA) model will be updated at the conclusion of these responses to answer PRA questions 3 and 19. A supplement to the license amendment request with the changes described in the responses will then be submitted.

There are no regulatory commitments included in this submittal. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager - Fleet Licensing, at (330) 315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 27, 2015.

Sincerely,

Eric A. Larson

Attachment: Response to Request for Additional Information

cc: Regional Administrator, NRC Region I
NRC Resident Inspector
NRC Project Manager
Director BRP/DEP
Site BRP/DEP Representative

The Nuclear Regulatory Commission (NRC) staff provided a request for additional information (RAI) to FirstEnergy Nuclear Operating Company (FENOC) in a letter dated March 4, 2015 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML15049A507). The NRC requested information to complete its review of the FENOC license amendment request (LAR) for Beaver Valley Power Station (BVPS), Unit No. 1 (BVPS-1) and Unit No. 2 (BVPS-2). The LAR would change the fire protection program to one based on the National Fire Protection Association NFPA Standard 805 (NFPA 805), “Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants,” 2001 Edition. The NRC staff’s RAI questions are provided below in bold text followed by the corresponding FENOC response.

Fire Protection Engineering (FPE) Request for Additional Information (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.

<u>Response:</u>

The BVPS Attachment A Table B-1 records were sorted to identify those records that use “Complies by Previous Approval” as one of their compliance strategies; then those records were reviewed to provide the appropriate licensing citation [excerpts from NRC documents] to support the previous approval. The results of the review are provided below. This table indicates which attributes in the LAR are included in this review, and which of the following NRC document citations are provided for each one. Following the table are the numbered explanatory paragraphs.

Additionally, the review identified records that needed to be corrected from “Complies by Previous Approval” as the compliance strategy to another compliance strategy. Those records are listed in the table below with the correct compliance strategy.

Fire Compartment	**Attribute**	**Compliance Basis (number for explanatory paragraph following)**
N/A; LAR Attachment A1	NFPA 805 Section 3.5.15, Hydrants and Hose Houses	Complies by Previous Approval, Licensing Action 18 (14)
N/A; LAR Attachment A1	NFPA 805 Section 3.6.1, Standpipe and Hose Systems - Class II versus Class III Requirement	Complies by Previous Approval, Licensing Action 29 (16)
N/A; LAR Attachment A1	NFPA 805 Section 3.8.1, Fire Detection Power Supply System	Complies by Previous Approval, Licensing Action 26 (15)
N/A; LAR Attachment A1	NFPA 805 Section 3.11.1, Building Separation	Complies by Previous Approval, Licensing Action 03 (7)
N/A; LAR Attachment A1	NFPA 805 Section 3.11.4, Through Penetration Fire Stops	Complies by Previous Approval, Licensing Action 03 (7)
1-CR-2	Attribute 3.11.2 - Fire Barriers	Performance-based analysis, safe shutdown (SSD) RAI 06 response (1)
1-CR-2	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3) and Performance-based analysis, SSD RAI 06 response (1)
1-CR-3	Attribute 3.11.2 - Fire Barriers	Performance-based analysis, SSD RAI 06 response (1)
1-CR-3	Attribute 3.11.3 - Fire Barrier Penetrations	Performance-based analysis, SSD RAI 06 response (1)
1-CR-4	Attribute 3.11.2 - Fire Barriers	Performance-based analysis, SSD RAI 06 response (1)
1-CR-4	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3) and Performance-based analysis, SSD RAI 06 response (1)
1-CS-1	Attribute 3.11.2 - Fire Barriers	Performance-based analysis, SSD RAI 06 response (1)

Fire Compartment	Attribute	Compliance Basis (number for explanatory paragraph following)
1-CS-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3) and Performance-based analysis, SSD RAI 06 response (1)
1-CV-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3) and Performance-based analysis, Stairwell fire doors (17)
1-CV-2	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3) and Performance-based analysis, Stairwell fire doors (17)
1-CV-3	Attribute 3.10.1 - Gaseous Suppression	Complies by Existing Engineering Equivalency Evaluation (EEEE), fire protection engineering (FPE) RAI 01 response (5)
1-DG-1	Attribute 3.10.1 - Gaseous Suppression	Complies by Previous Approval, Appendix to June 6, 1979 Safety Evaluation (SE) (4)
1-DG-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Appendix to June 6, 1979 SE (4)
1-DG-2	Attribute 3.10.1 - Gaseous Suppression	Complies by Previous Approval, Appendix to June 6, 1979 SE (4)
1-DG-2	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Appendix to June 6, 1979 SE (4)
1-ES-1	Attribute 3.11.2 - Fire Barriers	Performance-based analysis, SSD RAI 06 response (1)
1-ES-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3)
1-ES-2	Attribute 3.11.2 - Fire Barriers	Performance-based analysis, SSD RAI 06 response (1)
1-ES-2	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3)

Fire Compartment	Attribute	Compliance Basis (number for explanatory paragraph following)
1-FB-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3)
1-MG-1	Attribute 3.11.2 - Fire Barriers	Performance-based analysis, SSD RAI 06 response (1)
1-MG-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3) and Performance-based analysis, SSD RAI 06 response (1)
1-MS-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3) and Performance-based analysis, Stairwell fire doors (17)
1-NS-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3) and Performance-based analysis, Stairwell fire doors (17)
1-PA-1E	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3) and Performance-based analysis, Stairwell fire doors (17)
1-PA-1G	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3) and Performance-based analysis, Stairwell fire doors (17)
1-PT-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3)
1-RC-1	Attribute 3.8.2 - Detection	Complies by Previous Approval, Licensing Action 11.02 (2) and Licensing Action 11.16 (2)
1-RC-1	Attribute 3.9.1 - Water-Based Suppression	Complies by Previous Approval, Licensing Action 11.02 (2) and Licensing Action 11.16 (2)
1-SGPD-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3)

Fire Compartment	Attribute	Compliance Basis (number for explanatory paragraph following)
1-TB-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3) and Performance-based analysis, Stairwell fire doors (17)
2-ASP	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6), and Complies by Previous Approval, Licensing Action 06 (10)
2-CB-1	Attribute 3.10.1 - Gaseous Suppression	Complies by Previous Approval, Licensing Action 06 (10)
2-CB-1	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6), and Complies by Previous Approval, Licensing Action 06 (10)
2-CB-4	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6)
2-CB-5	Attribute 3.11.2 - Fire Barriers	Request for NRC approval, SSD RAI 13(c) response (6)
2-CB-5	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6)
2-CB-6	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6), and Complies by Previous Approval, Licensing Action 06 (10)
2-CP-1	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6)
2-CV-1	Attribute 3.10.1 - Gaseous Suppression	Complies by Previous Approval, Licensing Action 06 (10)
2-CV-1	Attribute 3.11.2 - Fire Barriers	Request for NRC approval, SSD RAI 13(c) response (6)

Fire Compartment	Attribute	Compliance Basis (number for explanatory paragraph following)
2-CV-1	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6), and Complies by Previous Approval, Licensing Action 06 (10)
2-CV-2	Attribute 3.10.1 - Gaseous Suppression	Complies by Previous Approval, Licensing Action 06 (10)
2-CV-2	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6) and Complies by Previous Approval, Licensing Action 06 (10)
2-CV-3	Attribute 3.10.1 - Gaseous Suppression	Complies by Previous Approval, Licensing Action 06 (10)
2-CV-3	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6), and Complies by Previous Approval, Licensing Action 06 (10)
2-CV-4	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6)
2-CV-5	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6), and Complies by Previous Approval, Licensing Action 06 (10)
2-CV-6	Attribute 3.10.1 - Gaseous Suppression	Complies by Previous Approval, Licensing Action 06 (10)
2-CV-6	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6) and Complies by Previous Approval, Licensing Action 06 (10)
2-DG-1	Attribute 3.10.1 - Gaseous Suppression	Complies by Previous Approval, Licensing Action 06 (10)

Fire Compartment	**Attribute**	**Compliance Basis (number for explanatory paragraph following)**
2-DG-1	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6), and Complies by Previous Approval, Licensing Action 06 (10)
2-DG-2	Attribute 3.10.1 - Gaseous Suppression	Complies by Previous Approval, Licensing Action 06 (10)
2-DG-2	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6), and Complies by Previous Approval, Licensing Action 06 (10)
2-FB-1	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6), and Complies by Previous Approval, Licensing Action 06 (10)
2-MS-1	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6)
2-PA-3	Attribute 3.11.2 - Fire Barriers	Complies by Previous Approval, Licensing Action 05 (9), Licensing Action 06 (10), and Licensing Action 08 (11)
2-PA-3	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 04 (8), Licensing Action 05 (9), Licensing Action 06 (10), and Licensing Action 08 (11)
2-PA-3A	Attribute 3.11.2 - Fire Barriers	Complies by Previous Approval, Licensing Action 08 (11)
2-PA-3A	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 08 (11)
2-PA-3B	Attribute 3.11.2 - Fire Barriers	Complies by Previous Approval, Licensing Action 08 (11)

Fire Compartment	Attribute	Compliance Basis (number for explanatory paragraph following)
2-PA-3B	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 08 (11)
2-PA-3C	Attribute 3.11.2 - Fire Barriers	Complies by Previous Approval, Licensing Action 08 (11)
2-PA-3C	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 08 (11)
2-PA-4	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 04 (8), Licensing Action 05 (9), and Licensing Action 06 (10)
2-PA-5	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 04 (8), Licensing Action 05 (9), and Licensing Action 06 (10)
2-PT-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 04 (8), and Licensing Action 05 (9)
2-RC-1	Attribute 3.8.2 - Detection	Complies by Previous Approval, Licensing Action 08 (11)
2-RC-1	Attribute 3.9.1 - Water-Based Suppression	Complies by Previous Approval, Licensing Action 08 (11)
2-RC-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 31 (12)
2-S-1	Attribute 3.11.3 - Fire Barrier Penetrations	Performance-based analysis, Stairwell or modified fire doors (17)
2-SB-1	Attribute 3.11.2 - Fire Barriers	Complies by Previous Approval, Licensing Action 03 (7), and Request for NRC approval, SSD RAI 13(c) response (6)
2-SB-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 06 (10) and Request for NRC approval, SSD RAI 13(c) response (6)

Fire Compartment	Attribute	Compliance Basis (number for explanatory paragraph following)
2-SB-2	Attribute 3.11.2 - Fire Barriers	Request for NRC approval, SSD RAI 13(c) response (6)
2-SB-2	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 06 (10) and Request for NRC approval, SSD RAI 13(c) response (6)
2-SB-3	Attribute 3.10.1 - Gaseous Suppression	Complies by Previous Approval, Licensing Action 06 (10)
2-SB-3	Attribute 3.11.2 - Fire Barriers	Complies by Previous Approval, Licensing Action 03 (7),and Licensing Action 05 (9)
2-SB-3	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 04 (8), Licensing Action 05 (9), and Licensing Action 06 (10)
2-SB-4	Attribute 3.11.2 - Fire Barriers	Complies by Previous Approval, Licensing Action 03 (7), and Licensing Action 05 (9)
2-SB-4	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 04 (8), Licensing Action 05 (9), and Licensing Action 06 (10)
2-SB-5	Attribute 3.11.2 - Fire Barriers	Complies by Previous Approval, Licensing Action 03 (7), and Licensing Action 05 (9)
2-SB-5	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 04 (8), Licensing Action 05 (9), and Licensing Action 06 (10)
2-SB-6	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 06 (10) and Request for NRC approval, SSD RAI 13(c) response (6)

Fire Compartment	Attribute	Compliance Basis (number for explanatory paragraph following)
2-SB-7	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 06 (10) and Request for NRC approval, SSD RAI 13(c) response (6)
2-SB-8	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 06 (10) and Request for NRC approval, SSD RAI 13(c) response (6)
2-SB-9	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 06 (10) and Request for NRC approval, SSD RAI 13(c) response (6)
2-SB-10	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6)
2-SG-1N	Attribute 3.9.1 - Water-Based Suppression	Complies by EEEE, FPE RAI 01 response (5)
2-SG-1N	Attribute 3.11.3 - Fire Barrier Penetrations	Request for NRC approval, SSD RAI 13(c) response (6)
2-SG-1S	Attribute 3.9.1 - Water-Based Suppression	Complies by EEEE, FPE RAI 01 response (5)
2-SG-1S	Attribute 3.11.2 - Fire Barriers	Complies by Previous Approval, Licensing Action 05 (9)
2-SG-1S	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 04 (8), and Licensing Action 05 (9)
2-TR-1	Attribute 3.11.2 - Fire Barriers	Performance-based evaluation (13)
2-TR-2	Attribute 3.11.2 - Fire Barriers	Performance-based evaluation (13)
2-TR-3	Attribute 3.11.2 - Fire Barriers	Performance-based evaluation (13)

Fire Compartment	**Attribute**	**Compliance Basis (number for explanatory paragraph following)**
2-WH-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 06 (10) and Request for NRC approval, SSD RAI 13(c) response (6)
3-CR-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 06 (10), Licensing Action 11.18 (3) and Request for NRC approval, SSD RAI 13(c) response (6)
3-IS-1	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3)
3-IS-2	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3)
3-IS-3	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3)
3-IS-4	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3)
3-IS-6	Attribute 3.11.3 - Fire Barrier Penetrations	Complies by Previous Approval, Licensing Action 11.18 (3)

(1) The explicit prior approval from Licensing Action 11.17, “Cable Spreading Room (1-CS-1) - Lack of 3-Hour Fire Barriers (III.G.2 criteria)” is for the lack of 3-hour rated barriers for the cable spreading room (1-CS-1). Additional performance-based analysis in support of the response to SSD RAI 06 indicates that Licensing Action 11.17 will not be transitioned. The following attributes are affected:

- Fire Compartment 1-CR-2 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 1-CR-2 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-CR-3 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 1-CR-3 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-CR-4 Attribute 3.11.2 - Fire Barriers

- Fire Compartment 1-CR-4 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-CS-1 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 1-CS-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-ES-1 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 1-ES-2 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 1-MG-1 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 1-MG-1 Attribute 3.11.3 - Fire Barrier Penetrations

Additional performance based analysis has been performed in conjunction with SSD RAI 06(a) and (b) and will be documented within that response. The results of the performance based analysis determined the barriers are acceptable for the fire severities of the associated adjacent fire compartments. The Attachment T prior approval clarification request #6 will be withdrawn.

(2) The explicit prior approval from Licensing Action 11.02, “Reactor Containment (1-RC-1) - Lack of 20 foot Separation (III.G.2 criteria)” is for lack of 20 feet separation with no intervening combustible materials or fire hazards for redundant trains of safe shutdown cables and equipment inside a non-inerted containment. The explicit prior approval from Licensing Action 11.16, “Reactor Containment (1-RC-1) - Lack of 20 foot Separation of Redundant Trains of Circuits Associated with Source Range Monitoring Within Containment (III.G.2 criteria)” is for lack of 20 feet separation of redundant trains of circuits associated with source range monitoring within containment. The following licensing excerpts below the associated fire compartment attribute list apply:

- Fire Compartment 1-RC-1 Attribute 3.8.2 - Detection
- Fire Compartment 1-RC-1 Attribute 3.9.1 - Water-Based Suppression

Licensing Action 11.02, NRC SER titled “Beaver Valley Unit 1 - Transmittal of Fire Protection Technical Exemption (TAC 56566),” dated March 14, 1983, page 6, states:

> 3. Reactor Containment - RC-1
>
> This fire area includes the entire area inside containment. The redundant trains of safe shutdown components in this area include the containment ventilation, pressurizer pressure controls, pressurizer power operated relief valves, pressurizer relief blocking valves, pressurizer heaters, steam generator level transmitters, pressurizer level transmitters, reactor coolant hot and cold leg temperature instrumentation, pressurizer and reactor vessel vents, and associated cables.

The combustible loading in this area consists of approximately 48,000 pounds of cable insulation, 265 gallons of lubricating oil for each of the three reactor coolant pumps, and 200 pounds of charcoal in the containment air filter cubicles.

All cable insulation is qualified to a test comparable to IEEE Standard 383. The reactor coolant pumps are fitted with an oil collection system.

Smoke detection systems and water deluge systems are provided only in the cable penetration area and in the residual heat removal pump area. Portable fire extinguishers and manual hose stations are provided throughout the fire area.

Separation of redundant cables is as follows:

1. Pressurizer Power Operated Relief Valves

The Train A and Train B control cables are run from the valves (located above the pressurizer cubicle) in conduit, to points just outside the crane wall. Outside the crane wall, the control cables enter trays approximately 20 feet above the floor which run to the penetration area on either side of column 10 ¼. The control cables then drop down at the penetration area and are separated by approximately 25 feet. The cables are also separated by a fire barrier and a fire detection and suppression system at the penetration area.

2. Pressurizer Relief Blocking Valves

The power cables for both Train A and Train B are run in conduit approximately 20 feet above the floor and from the motor operated valves located in the pressurizer cubicles to the penetration area at column 10 ¼. In the penetration area, the cables enter vertical cable trays which drop down to the next level. The cable trays are separated by a fire barrier and are protected by automatic suppression and detection systems.

3. Pressurizer Heaters

The power cables of both trains are run entirely in tray from the pressurizer cubicle to either side of column 10 ¼. The trays run parallel to each other at a height of 20 feet, in close proximity until they reach either side of column 10 ¼. At this point, the cables turn down into four trays which run vertically, and are separated by 18 feet. The traverse runs of tray above the operating floor are covered trays.

4. Steam Generator Level

The instrument cables for Channels I, II and III are run in separate conduits from the penetration area where the trays are protected by suppression and detection. The conduit runs around the containment and returns to the penetration area from opposite directions; Channels I and III from the north and Channel II from the south.

5. Pressurizer Level Transmitters

The instrument cables for the two level transmitters are in close proximity at elevation 642' [feet] 11” [inches]. The cables are enclosed in conduit and continue in conduit with increasing separation. The cables eventually enter trays in the penetration areas which are separated by a fire barrier at column 10 ¼, and are protected by a fire detection and suppression system.

6. Reactor Coolant Hot and Cold Leg Temperature

Hot leg instruments comprise Channel I while cold leg instruments comprise Channel II. The conduit system for each channel approaches the penetration area from a different direction. The individual channels run around the containment to local pull boxes. From these boxes separate conduits continue to the temperature detectors.

Additionally, the remaining neutral temperature indication from the temperature detector bypass manifold is routed in conduit from each loop to the penetration area.

The protection for redundant trains of safe shutdown equipment inside containment does not meet the technical requirements of Section III.G because there is not twenty feet of separation between redundant power cables free of intervening combustibles. Due to their configuration and location within the containment and to the restricted access of these sub-areas during plant operations, an exposure fire involving the accumulation of significant quantities of transient combustible materials is unlikely. Because there are only a few cables in these sub-areas and all cables inside containment are qualified to a test comparable to that of IEEE Standard 383 and routed in conduit, a fire of sufficient magnitude to damage redundant cables or components is also unlikely.

Based on the above evaluation, the existing protection for the containment area provides a level of fire protection equivalent to the technical requirements of Section III.G of Appendix R. Therefore, the exemption should be granted.

Licensing Action 11.16, NRC SER titled “Beaver Valley Power Station, Unit 1 - Request for Additional Informations [sic] From Some Requirements of Appendix R To 10 CFR Part 50,” dated August 30, 1984, page 10, states:

8. Reactor Containment RC-1

An exemption is requested from Section III.G to the extent it requires the separation of redundant trains of the source range monitor within containment by greater than 20 feet.

This fire area includes the entire area inside containment. The redundant trains of safe shutdown components in this area include the containment ventilation, pressurizer pressure controls, pressurizer power operated relief valves, pressurizer relief blocking valves, pressurizer heaters, steam generator level transmitters, pressurizer level transmitters, reactor coolant hot and cold leg temperature instrumentation, and associated cables.

The combustible loading in this area consists of approximately 48,000 pounds of cable insulation, 265 gallons of lubricating oil for each of the three reactor coolant pumps, and 200 pounds of charcoal in the containment air filter cubicles.

All cable insulation is qualified to a test comparable to IEEE Standard 383. The reactor coolant pumps are fitted with an oil collection system. Smoke detection systems and water deluge systems are provided only in the cable penetration area and in the residual heat removal pump area. Portable fire extinguishers and manual hose stations are provided throughout the fire area.

We had previously approved an exemption for the separation of redundant equipment and cables inside containment. At our request, the licensee has added an additional channel of source range neutron detection. Due to the physical arrangement inside containment, separation of the redundant cables by more than 20-feet is not possible. A minimum separation of approximately five feet is maintained. Each channel of neutron detection is in a separate conduit.

The protection for redundant trains of safe shutdown equipment inside containment does not meet the technical requirements of Section III.G because redundant power cables are not separated by at least 20 feet free of combustibles. Due to the configuration and location of the cables within the containment and to the restricted access of these sub-areas during plant operation, an exposure fire involving the accumulation of significant quantities of transient combustible materials is unlikely. Because there are only a few cables in these sub-areas and all cables inside containment are qualified to a test comparable to that of IEEE Standard 383 and routed in conduit, a fire of sufficient magnitude to damage redundant cables or components is also unlikely.

Based on the above evaluation, the existing protection for the containment area provides a level of fire protection equivalent to the technical requirements of Section III.G of Appendix R. Therefore, the exemption should be granted.

(3) The explicit prior approval from Licensing Action 11.18, “Fire Doors - Lack of 3-Hour Fire Barriers (III.G.2 criteria)” is for the lack of 3-hour rated fire doors in BVPS-1. The following licensing excerpt below the associated fire compartment attribute list apply:

- Fire Compartment 1-CR-2 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-CR-4 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-CS-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-CV-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-CV-2 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-ES-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-ES-2 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-FB-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-MG-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-MS-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-NS-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-PA-1E Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-PA-1G Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-PT-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-SGPD-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-TB-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 3-CR-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 3-IS-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 3-IS-2 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 3-IS-3 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 3-IS-4 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 3-IS-6 Attribute 3.11.3 - Fire Barrier Penetrations

NRC SER, “Beaver Valley Unit 1 - Transmittal of Fire Protection Technical Exemption (TAC 56566),” dated December 4, 1986, Enclosure 2, page 3, states:

> 2.0 Fire Doors
>
> 2.1 Exemptions Requested
>
> Exemptions were requested from Section III.G.2 to the extent that it requires separation of cables and equipment and associated nonsafety circuits of redundant trains by a fire barrier having a 3-hour rating.

The licensee's exemption requests specifically pertained to fire door assemblies in walls identified as fire area boundaries.

Section III.G.2 of Appendix R to 10 CFR 50 contains requirements for the protection of hot shutdown components located within the same fire area. It does not apply to fire area boundaries. Acceptable guidelines for establishment of fire area boundaries are set forth in Section D.1.(j) of Appendix A to BTP APCSB 9.5-1. Therefore, the fire doors discussed in the licensee's request have been reviewed for conformance with Appendix A guidelines.

2.2 Discussion

The licensee has identified 24 fire areas whose boundaries contain fire door assemblies that do not have a fire resistance rating of 3 hours. A fire door assembly consists of the fire door(s), frame, and hardware. Some of these assemblies were designed and constructed as fire-rated assemblies but have been modified for security or flood control purposes, or have not been installed in strict compliance with nationally accepted standards. Other assemblies are not fire rated, but are similar to fire rated assemblies.

In all, one fire door and 10 door frames are not labeled, frames in 18 locations have been modified for security purposes, and frames in 8 locations have been otherwise penetrated by pipe or conduit. Several locations contain multiple deviations. A label is the identifying mark applied to a product as evidence that it complies with the specified standards of the Underwriters Laboratories (UL) or other approval agency.

Twenty-one of the 24 fire areas, where these doors are provided, contain safe shutdown equipment. Fire door assemblies serving the other three fire areas -- the PCA shop (Fire Area SB-1, the locker room (Fire Area SB-3). and the clean shop (Fire Area SH-1) -- have been modified for security purposes.

The combustible loading in 17 of these fire areas is 80,000 Btu per square foot or less, which is equivalent to a fire severity of up to 60 minutes based on the ASTM Standard E-119 time-temperature curve. Fire protection in these areas consists of portable extinguishers and manual hose stations. In addition, smoke detectors are installed in the following fire areas: the intake structure (Fire Areas IS-1 through IS-3), the control room complex (Fire Zones CR-1, -2, and -4), the emergency switchgear room (Fire Area ES-2), the motor generator room (Fire Area MG-1), and the normal switchgear room (Fire Area NS-1).

The combustible loading in five of the 24 fire areas is between 80,000 and 120,000 Btu [British thermal units] per square foot, which corresponds to a fire severity of 60 to 90 minutes. Fire protection in these fire areas consists of portable extinguishers and manual hose stations. In addition, sprinkler systems are installed in the PCA shop and the clean shop. Detectors are installed in the intake structure and detectors and a total flooding carbon dioxide system are installed in the cable spreading room.

The combustible loading in the remaining two fire areas is between 120,000 and 160,000 Btu per square foot, which corresponds to a fire severity of 90 to 120 minutes. Fire protection in these two areas (the east and west cable vaults, Fire Areas CV-1 and CV-2, respectively) consists of portable extinguishers, manual hose stations, heat and smoke detectors, and total flooding carbon dioxide systems.

At the licensee's request, a UL [Underwriters Laboratory] representative visited the plant and inspected typical examples of each identified deviation to evaluate each deviation's impact on the labeling of the doors. On the basis of the UL evaluation, the licensee has made corrective modifications to several of these assemblies.

The licensee has evaluated the affected fire door assemblies (with the corrective modifications) and determined that they provide an adequate margin of fire resistance considering the fire loading on both sides of each of the assemblies. This evaluation is described in Section 11.18 of the licensee's January 14, 1985 submittal.

The licensee chose not to make corrective modifications to the affected door assemblies in the intake structure. The deviations applicable to the fire door assemblies between Fire Areas IS-1 and IS-2, between Fire Areas IS-3 and IS-4, and from each of these fire areas to the exterior involve the installation of a pipe penetration through the frames.

UL recommended that the interior of all pipes and conduits penetrating fire door frames should be filled with a fire stop material. The pipes through the intake structure door frames convey pressurized air used to activate sliding flood doors located behind the fire door at each opening. The exterior of the pipe penetration has been made tight fitting, but the pipes cannot be sealed internally without interrupting the air supply.

Safe shutdown equipment in the intake structure consists of three river water pumps (in separate fire areas) of which only one is required for safe shutdown. In addition, two auxiliary river water pumps located in the separate auxiliary intake structure are available as backup systems. Two fire pumps are also located in the intake structure in Fire Areas IS-2 and IS-4.

In case of fire in one of Fire Areas IS-1 through IS-4, safe shutdown capability would not be affected because redundant systems are available in other fire areas. In addition, the solid wall between Fire Areas IS-2 and IS-3 would prevent a fire in Fire Areas IS-1 or IS-2 from spreading to Fire Areas IS-3 or IS-4.

2.3 Evaluation

The guidelines of Section D.1.(j) of Appendix A to BTP APCSB 9.5-1 are not met because a fire door is not labeled (1 location) or because fire door frames are not labeled (10 locations), fire doors have been modified for security purposes (18 locations), or fire doors have been penetrated by pipe or conduit (8 locations). Several locations contain multiple deviations.

However, the equivalent fire severity in each of the affected fire areas is less than 120 minutes and generally less than 60 minutes.

The staff has reviewed the licensee's evaluation and concurs with the licensee's assessment that the existing fire door assemblies with the corrective modifications provide an adequate margin of fire resistance compared to the combustible loading in the affected fire areas, with one exception.

The exception to the fire resistance discussed above is the doors located in the intake structure. Due to the functional restrictions, the corrective modifications required to upgrade these doors are not possible. However, these door assemblies, in conjunction with the resistance of the 3-hour fire-rated masonry walls, provide an adequate margin of fire resistance between redundant trains of safe shutdown systems. The staff therefore concludes that the intake structure door assemblies should be acceptable.

2.4 Conclusion

Based on the above evaluation, the staff concludes that the aforementioned fire door assemblies, combined with the licensee's modifications, provide an acceptable level of protection in accordance with the guidelines of Section D.1(j) of Appendix A to BTP APCSB 9.5-1.

(4) The explicit prior approval for the below-listed attributes is for usage of the fixed carbon dioxide (CO2) fire extinguishing system as the primary automatic suppression system in the Unit 1 diesel generator rooms, and for the doorway between the Unit 1 diesel generator rooms. The following licensing excerpt below the associated fire compartment attribute list applies:

- Fire Compartment 1-DG-1 Attribute 3.10.1 - Gaseous Suppression
- Fire Compartment 1-DG-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-DG-2 Attribute 3.10.1 - Gaseous Suppression
- Fire Compartment 1-DG-2 Attribute 3.11.3 - Fire Barrier Penetrations

Page 5-12 of the appendix to the “Safety Evaluation By The Office Of Nuclear Reactor Regulation Related To Amendment No. 18 To Facility Operating License No. DPR-66 Duquesne Light Company” dated June 6, 1979, states:

5.10 Diesel Generator Rooms

5.10.1 Safety-Related Equipment

Each of the two redundant diesel generator rooms contains a diesel engine driven air compressor, local control panels, cabling, and fuel day tank. At least one division of this equipment is necessary for safe shutdown upon loss of offsite power.

5.10.2 Combustible Materials

Combustibles in the diesel generator room area include diesel engine lubricating oil, diesel fuel in fuel lines, day tanks, and electrical cable insulation.

5.10.3 Consequences if No Fire Suppression

An unmitigated fire in one of the two diesel generator rooms could result in the loss of function of one unit with possible damage to the redundant diesel generator located in the adjacent fire area, by means of fuel passing under the communicating door or by breaching the fire door.

5.10.4 Fire Protection Systems

Early warning fire detection is provided by ionization type smoke detectors arranged to alarm in the control room. A total flooding CO2 extinguishing system automatically actuated by thermal detectors is provided in the diesel generator rooms. The CO2 system has reserve capacity for a second manually actuated discharge. Back up fire suppression capability consists of portable CO2 and dry chemical extinguishers located in each room. Additional manual firefighting capability is provided by yard hydrants.

The two diesel generator rooms are enclosed by 3-hour fire rated reinforced concrete walls and ceilings.

The doorway between the two rooms is provided with a 3 hour rated fire door.

5.10.5 Adequacy of Fire Protection

The existing ionization fire detection system, portable extinguishers and back up firefighting capability from the yard hydrant is considered acceptable.

The fixed CO2 fire extinguishing system is adequate as the primary automatic suppression system. The location of the manual pull stations inside the protected rooms is not acceptable. The intensity of a potential diesel fuel fire in one of the rooms could make it impossible to enter and reach the pull box.

Provisions are not adequate to insure a fire in one diesel generator room does not affect the redundant diesel generator room via oil seepage under the doorway. The manual control for stopping the diesel fuel transfer pump is located within the diesel generator rooms and could be inaccessible during a fire. A leak in the diesel fuel supply system could go undetected for a considerable period of time and accumulate on the floor. If significant quantities of fuel entered the floor drains, the possibility exists that fuel could communicate via the drainage system to the adjacent diesel generator room. The fire door between the two redundant diesel generator rooms may not be capable of withstanding a potential high intensity diesel fuel fire.

5.10.6 Modifications

In order to mitigate the possibilities of a fire affecting both redundant diesel generator rooms, the licensee will make the following modifications:

1. Curbing of sufficient height to prevent on [sic] oil leak in one room from entering the adjacent room will be provided at the doorway between the rooms.

2. An additional three (3) hour fire rated door and frame with self-closing hardware will be provided at the doorway between rooms. (also discussed under 4.9.1)

3. The manual actuation pull box for the CO2 extinguishing systems will be relocated outside the room it is designed to protect. (also discussed under 4.3-2)

4. A control for shutting off the diesel fuel transfer pump outside of the diesel generator rooms will be provided.

5. Floor drains in the diesel generator rooms will be plugged.

6. A fail safe level detecting device will be installed in a sump close to the day tank to detect an oil accumulation due to a leak. High sump level will be annuciated [sic] in the control room.

7. Fire barrier wall penetration between Diesel Generator rooms will be evaluated and up-graded to a 3 hr barrier.

We find that, upon implementation of the above described modifications, the Diesel Generator Room's fire protection satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

Modifications described in section 5.10.6 above have been installed.

(5) The compliance basis for these fire compartment attributes will be revised to "Complies by EEEE" in the response to FPE RAI 01:

- Fire Compartment 1-CV-3 Attribute 3.10.1 - Gaseous Suppression
- Fire Compartment 2-SG-1N Attribute 3.9.1 - Water-Based Suppression
- Fire Compartment 2-SG-1S Attribute 3.9.1 - Water-Based Suppression

(6) The compliance basis for these fire compartment attributes will be revised to request NRC approval based on the response to SSD RAI 13(c):

- Fire Compartment 2-ASP Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-CB-1 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-CB-4 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-CB-5 Attribute 3.11.2 – Fire Barriers
- Fire Compartment 2-CB-5 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-CB-6 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-CP-1 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-CV-1 Attribute 3.11.2 – Fire Barriers
- Fire Compartment 2-CV-1 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-CV-2 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-CV-3 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-CV-4 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-CV-5 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-CV-6 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-DG-1 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-DG-2 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-FB-1 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-MS-1 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-SB-1 Attribute 3.11.2 – Fire Barriers
- Fire Compartment 2-SB-1 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-SB-2 Attribute 3.11.2 – Fire Barriers
- Fire Compartment 2-SB-2 Attribute 3.11.3 – Fire Barrier Penetrations

- Fire Compartment 2-SB-6 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-SB-7 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-SB-8 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-SB-9 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-SB-10 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-SG-1N Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 2-WH-1 Attribute 3.11.3 – Fire Barrier Penetrations
- Fire Compartment 3-CR-1 Attribute 3.11.3 – Fire Barrier Penetrations

The response to SSD RAI 13(c) will include a request for NRC approval of instances where there are fire dampers installed in series and where ducts have fire wrap installed to meet the required barrier rating.

(7) The explicit prior approval from Licensing Action 03, "Conduits/Penetration Seals & Penetration Seal Design - BTP C.5.a(3)" is for qualified penetration seals for all fire-rated walls or floor/ceiling assemblies. The following licensing excerpt below the associated fire compartment attribute list applies:

- NFPA 805 Section 3.11.1, Building Separation
- NFPA 805 Section 3.11.4, Through Penetration Fire Stops
- Fire Compartment 2-SB-1 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-SB-3 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-SB-4 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-SB-5 Attribute 3.11.2 - Fire Barriers

NUREG-1057, Supplement No. 5 titled "Safety Evaluation Report related to the operation of Beaver Valley Power Station, Unit 2," dated May 1987, page 9-2, states:

> In the SER, the staff stated that the applicant would provide qualified penetration seals for all penetrations of fire-rated walls or floor/ceiling assemblies. In Amendment 14 of the FSAR, the applicant stated that because of installation problems, certain fire barrier penetrations could not be sealed per Section C.5.a(3) of BTP CMEB 9.5-1. The applicant identified approximately 18 penetrations, of 4-inch diameter or greater, which cannot be sealed at the barrier. The applicant proposed to seal these penetrations with fire-seal material at the first opening and wrap the conduit from the seal to the barrier with 1-hour fire-wrap material. Seventeen of the penetrations have detection and automatic suppression on both sides of the barrier. The remaining

penetration has detection on both sides with automatic suppression on one side. The applicant also stated that certain penetrations throughout the plant which are less than 4 inches in diameter and extend less than 5 feet on either side of the barrier cannot be sealed at the barrier. For these cases, the applicant proposed to seal the penetration at the first opening on both sides of the barrier with a fire-seal material. During the site audit on January 27-30, 1987, seals of both configurations were reviewed in the field and were found to provide an adequate measure of sealing for penetrations in fire barriers when the Standard Review Plan (SRP) (NUREG-0800) cannot be met because of installation difficulties. Therefore, the method for sealing penetrations as identified in Amendment 14 to the FSAR is an acceptable deviation from Section C.5.a(3) of BTP CMEB 9.5-1 when installation difficulties do not allow sealing at the barrier.

(8) The explicit prior approval from Licensing Action 04, "Ventilation Penetration Openings (Fire Dampers) - Lack of Appropriate Fire Dampers - BTP C.5.a(4)" is for usage of two 1.5-hour rated fire dampers in series instead of one 3-hour rated damper. The following licensing excerpt below the associated fire compartment attribute list applies:

- Fire Compartment 2-PA-3 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PA-4 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PA-5 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PT-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-3 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-4 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-5 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SG-1S Attribute 3.11.3 - Fire Barrier Penetrations

NUREG-1057, Supplement No. 3 titled "Safety Evaluation Report related to the operation of Beaver Valley Power Station, Unit 2," dated November 1986, page 9-1, states:

9.5.1.4 General Plant Guidelines

Building Design

In the SER, the staff stated that 3-hour fire-rated damper assemblies are provided in all ventilation ducts that penetrate 3-hour fire-rated barriers and that the damper assemblies are Underwriters Laboratories, Inc. (UL) labeled. By letter dated March 27, 1985, the applicant informed the staff that the 1 1/2-hour-rated fire damper assemblies are installed in series in each duct penetrating a 3-hour fire-rated barrier. Moreover, because the applicant redefined the fire area boundaries, some damper assemblies had to be installed within completed heating, ventilation, and air conditioning (HAVC [sic]) systems. These damper assemblies are located close to, but not within, the fire barrier penetration. To compensate for the damper location, the applicant enclosed the ductwork from the fire barrier to the damper assembly with 3-hour fire-rated barrier material.

In the March 27, 1985, letter, the applicant also informed the staff that although all of the fire damper assemblies were purchased as UL-labeled units, the manufacturer had removed the UL label from the assemblies because they were not tested in the series configuration, and because they were not tested with carbon dioxide fire-suppression-system-actuated release devices.

For a fire to spread between fire areas through an HVAC system duct, it would have to burn through the duct in one fire area, through two 1 1/2-hour fire-rated dampers, and finally, through the duct in the adjoining area. In the staff's opinion, the two 1 1/2-hour fire-rated dampers will provide the equivalent fire resistance of one 3-hour fire-rated damper. The 3-hour fire-rated wrap around the ducts constitutes continuous fire-rated construction which will prevent fire spread through the ductwork between the fire barrier and the fire dampers. The release device is a plunger-operated pin that is in addition to the fusible link for damper actuation. The device is UL-listed for this service and, in the staff's opinion, will not reduce the effectiveness of the dampers actuated by the devices. The staff concludes that the fire dampers, as installed, will prevent fire spread from one fire area to another. The damper installation is, therefore, an acceptable deviation from Section C.5.a(4) of BTP CMEB 9.5-1.

(9) The explicit prior approval from Licensing Action 05, "Fire Dampers and Ventilation Ductwork - Assembly Location and Deviation in Ductwork 1-Hour Fire Wrap - BTP C.5.a(4)" is for usage of 1-hour fire wrap for ductwork penetrations from the damper assemblies to the barriers. The following licensing excerpt below the associated fire compartment attribute list applies:

- Fire Compartment 2-PA-3 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-PA-3 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PA-4 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PA-5 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PT-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-3 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-SB-3 Attribute 3.11.3 - Fire Barrier Penetrations

- Fire Compartment 2-SB-4 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-SB-4 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-5 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-SB-5 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SG-1S Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-SG-1S Attribute 3.11.3 - Fire Barrier Penetrations

NUREG-1057, Supplement No. 5 titled “Safety Evaluation Report related to the operation of Beaver Valley Power Station, Unit 2,” dated May 1987, page 9-3, states:

> In SSER 3, the staff stated that some fire damper assemblies were located outside of the fire barrier because of a redefining of certain fire areas and that where this took place, the ductwork from the barrier to the fire damper assembly would be wrapped with 3-hour fire-rated material. Section C.5.a(4) of BTP CMEB 9.5-1 states that, 'penetration openings for ventilation systems should be protected by fire dampers having a rating equivalent to that required of the barrier.' In a meeting on November 5, 1986, the applicant stated that 3-hour wrap material could not be used because of weight limitations of the structural supports and stated that the ductwork would be wrapped with 1-hour rated material. This deviation was included in Amendment 14 to the FSAR following the meeting. Fire dampers requiring 1-hour wrap are used as fire barriers between Fire Areas PA-3 and PA-5, PA-4 and PA-5, SB-3 and SB-4, SB-4 and SB-5, and PT-1 and SG-1S. The fire loading is less than ½ hour on either side of the subject dampers. Smoke detection is provided in all areas where the 1-hour wrap will be installed and hose racks are provided for fire brigade use. It is expected that a fire would be detected in its incipient stage and the plant fire brigade would extinguish it using the installed hose racks. Providing additional structural support to the ductwork to accommodate 3-hour wrap would not significantly increase the level of fire safety. Therefore, wrapping ductwork from the barrier to the damper with 1-hour material is an acceptable deviation to Section C.5.a(4) of BTP CMEB 9.5-1.
>
> The applicant also identified one damper in Fire Area SB-4 in which a 2-inch portion of the ductwork could not be wrapped because of interferences and therefore constituted an additional deviation from Section C.5.a(4) of BTP CMEB 9.5-1. The fire loading in this area is less than 1/2 hour and detection is provided. The 2-inch portion of the ductwork is above one of the 1-1/2 hour dampers that are in series. Lack of wrap on this 2-inch ductwork section does not adversely affect plant fire safety and therefore, is an acceptable deviation from Section C.5.a(4) of BTP CMEB 9.5-1.

The applicant stated in Amendment 14 to the FSAR that ventilation ductwork for the battery room exhaust system and the emergency switchgear ventilation system pass through areas not serviced by the two systems. To ensure the operability of these systems in the event of a fire in an area not using these systems, the ductwork was wrapped with 1-hour material in areas not serviced by the ventilation systems. Battery room exhaust ducts run through Fire Areas SB-1, SB-2, and SB-4. Each of these areas has a fire loading of less than 1 hour and detection is provided. In the event of a fire in these areas, it is expected that the fire would be detected in its incipient stage and that the plant fire brigade would respond and extinguish the fire. Both the battery room exhaust ductwork and the emergency switchgear ventilation ductwork run through Fire Areas CV-1, CV-3, and SB-3. These fire areas have a combustible loading of less than 2 hours and are provided with detection and automatic suppression. It would be expected that a fire in these areas would be detected in its incipient stage and that the plant fire brigade would respond and control it. The automatic suppression provides added assurance that a fire would not jeopardize the integrity of the 1-hour wrapped ventilation ducts. On the basis of this evaluation, this method of ensuring continuous ventilation to the battery room and emergency switchgear is acceptable.

(10) The explicit prior approval from Licensing Action 06, “Fire Doors - Modification of Fire Door Assemblies - BTP C.5.a(5)” is for modification of fire door assemblies. The following licensing excerpt below the associated fire compartment attribute list applies:

- Fire Compartment 2-ASP Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-CB-1 Attribute 3.10.1 - Gaseous Suppression
- Fire Compartment 2-CB-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-CB-6 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-CV-1 Attribute 3.10.1 - Gaseous Suppression
- Fire Compartment 2-CV-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-CV-2 Attribute 3.10.1 - Gaseous Suppression
- Fire Compartment 2-CV-2 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-CV-3 Attribute 3.10.1 - Gaseous Suppression
- Fire Compartment 2-CV-3 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-CV-5 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-CV-6 Attribute 3.10.1 - Gaseous Suppression
- Fire Compartment 2-CV-6 Attribute 3.11.3 - Fire Barrier Penetrations

- Fire Compartment 2-DG-1 Attribute 3.10.1 - Gaseous Suppression
- Fire Compartment 2-DG-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-DG-2 Attribute 3.10.1 - Gaseous Suppression
- Fire Compartment 2-DG-2 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-FB-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PA-3 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-PA-3 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PA-4 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PA-5 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-2 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-3 Attribute 3.10.1 - Gaseous Suppression
- Fire Compartment 2-SB-3 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-4 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-5 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-6 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-7 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-8 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-SB-9 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-WH-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 3-CR-1 Attribute 3.11.3 - Fire Barrier Penetrations

NUREG-1057, Supplement No. 5 titled “Safety Evaluation Report related to the operation of Beaver Valley Power Station, Unit 2,” dated May 1987, page 9-4, states:

> In the SER, the staff stated that with the exception of two rolling fire doors, door openings are in compliance with Section C.5.a(5) of BTP CMEB 9.5-1, which states that 'door openings in fire barriers should be protected with equivalently rated doors, frames, and hardware that have been tested and approved by a nationally recognized laboratory.' The applicant stated in Amendment 14 to the FSAR that certain doors have been modified by the installation of security hardware and are no longer approved fire doors. The applicant also stated that there are 'special purpose' doors that are not approved by Underwriters

Laboratories (UL). During the site audit of January 27-30, 1987, the applicant identified 40 doors that were modified for security purposes. The applicant demonstrated that all modifications were made in accordance with recommendations supplied by UL. Although the applicant stated that all doors were originally purchased as UL-approved, it was noticed during the site visit that some UL labels were missing from doors. The applicant committed to have the doors relabeled by the manufacturer or to maintain on file documentation that individual doors are UL approved. This commitment will be implemented by fuel load. It was also observed that the security modifications consisted primarily of the addition of electric contact switches with a single conduit penetrating the frame. Installations appeared to be in accordance with design drawings, which were based on UL recommendations. Therefore, with the exception of the doors missing labels, the security-modified fire doors are an acceptable deviation from Section C.5.a(5) of BTP CMEB 9.5-1.

(11) The explicit prior approval from Licensing Action 08, "Safe Shutdown Components - Lack of Separation of Redundant Trains - BTP C.5.b" is for separation of redundant safe-shutdown components by 3-hour fire-rated barriers. The following licensing excerpts below the associated fire compartment attribute list apply:

- Fire Compartment 2-PA-3 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-PA-3 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PA-3A Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-PA-3A Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PA-3B Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-PA-3B Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-PA-3C Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-PA-3C Attribute 3.11.3 - Fire Barrier Penetrations
- re Compartment 2-RC-1 Attribute 3.8.2 - Detection
- Fire Compartment 2-RC-1 Attribute 3.9.1 - Water-Based Suppression

NUREG-1057, Supplement No. 3 titled "Safety Evaluation Report related to the operation of Beaver Valley Power Station, Unit 2," dated November 1986, page 9-2, states:

Safe-Shutdown Components

By letter dated March 27, 1985, the applicant requested a deviation from Section C.5.b of BTP CMEB 9.5-1 for fire area PA-3 to the extent that it requires the separation of redundant safe-shutdown components by 3-hour fire-rated barriers.

This fire area is located on auxiliary building elevation 735 feet 6 inches. The two redundant and one swing charging pumps are located in this area, one in each of three adjacent cubicles. The walls between cubicles are reinforced concrete with 3-hour fire-rated penetration seals. The west wall of each cubicle is concrete block with a small crane rail opening; the east wall of each cubicle is reinforced concrete with a labyrinth-type opening. A curb is provided across each opening and a drain is provided in each cubicle. The equivalent fire severity per cubicle is less than 1/2 hour. Existing fire protection consists of portable extinguishers, hose stations, and an area wide ionization-type smoke-detection system.

The staff was concerned that a fire originating either outside of or within one of the pump cubicles would result in loss of safe-shutdown capability. However, because the fuel load in each cubicle is low, the staff does not expect a fire of significant magnitude or duration to occur. If a fire occurs anywhere in the fire area, it would be detected by the ionization detectors and extinguished by the plant's fire brigade before spreading into or from a pump cubicle. In the staff's opinion, any fire would, at most, cause damage to one shutdown system, but would not propagate horizontally and damage the redundant pump before self-extinguishing or being extinguished by the plant's fire brigade.

On the basis of this evaluation, the staff concludes that the lack of complete 3-hour fire-rated barriers around each redundant charging pump is an acceptable deviation from Section C.5.b of BTP CMEB 9.5-1.

NUREG-1057, Supplement No. 5 titled "Safety Evaluation Report related to the operation of Beaver Valley Power Station, Unit 2," dated May 1987, page 9-5, states:

Safe Shutdown Capability

The staff review of the fire protection afforded the safe shutdown capability of Beaver Valley Unit 2 included the FSAR [Final Safety Analysis Report], up to and including Amendment 16, the fire protection safe shutdown report (FPSSR) provided by transmittal dated March 24, 1987 and additional information provided by letter dated May 11, 1987. FSAR Section 9.5.1 describes the overall fire protection program and the FPSSR discusses the safe shutdown capability, including the potential for spurious operation of equipment in each fire area. FSAR Section 7.4 provides additional information on safe and alternate shutdown system controls capability.

The applicant's safe shutdown analysis demonstrates that systems needed for hot and cold shutdown are redundant and that one of the redundant systems needed for safe shutdown would be free of fire damage because of separation, fire barriers, fire detection and suppression, or a combination of these and/or alternative shutdown capability. Alternative shutdown capability is provided for a fire in the instrumentation and relay room (CB-1), cable spreading room (CB-2), main control room (CB-3), west communication room (emergency shutdown panel station) (CB-6), and cable tunnel (CT-1) because these areas contain more than one division of safe shutdown cabling in close proximity to each other and in-place protection from fire cannot be provided.

For hot shutdown and for cooldown to cold shutdown conditions, at least one train of the following safe shutdown systems would be available: reactor coolant system (RCS), auxiliary feedwater system, main steam system (atmospheric dump valves) and chemical and volume control system (CVCS). For cold shutdown conditions, at least one train of the residual heat removal (RHR) system would be available for long-term decay heat removal. A single train provides the capability to achieve cold shutdown conditions within 72 hours with or without offsite power after a fire. The availability of these systems includes the components, cabling, electrical distribution panels, and support systems necessary to achieve cold shutdown. The support systems include the service water system; reactor plant component cooling water system; emergency diesel generator and its support systems; station service air system; filter water system; necessary heating, ventilation, and air conditioning systems; emergency ac and dc power systems; and necessary instrumentation to monitor plant parameters for safe shutdown. The above systems are used to achieve safe shutdown through various success paths, depending on the location of the fire. Reactivity control is accomplished through control rod insertion followed by boration provided by a charging pump (CVCS) drawing suction from borated water supplies from the refueling water storage tank or from the boric acid tanks through a boric acid transfer pump. RCS makeup/inventory control is provided by a charging pump combined with letdown. RCS pressure control is also accomplished by a charging pump combined with letdown, the power-operated relief valves, or the pressurizer heaters if available. RCS decay heat removal is accomplished initially using the steam generator safety relief valves and by the power-operated relief valves (atmospheric dump valves) during cooldown, and the auxiliary feedwater system, down to a temperature of 350 degree F, at which time the heat-removal function is transferred to the RHR system.

For certain fires outside the control room, cold leg temperature (T-cold) wide range indication may be lost because all T-cold indication in the control room is powered from train B. This is acceptable since alternate means for determining T-cold is available by use of steam generator pressure indication and other normal train A primary system instrumentation. Similarly for certain other fires outside the control room, the use of core exit thermocouples for T-hot indication and use of T-cold as an alternate to steam generator pressure indication are acceptable.

The applicant's fire protection safe shutdown analysis demonstrates that except for the instrument and relay room (CB-1), cable spreading room (CB-2), main control room (CB-3), west communication room (CB-6), and cable tunnel (CT-1), redundant systems and cabling needed for safe shutdown following a fire are separated in accordance with BTP CMEB 9.5-1, Positions C.5.b.1 and C.5.b.2 with some noted deviations that are evaluated elsewhere in Section 9.5.1 of the SER and its supplements. For Fire Areas CB-1, CB-2, CB-3, CB-6, and CT-1, the applicant has provided alternate shutdown capability independent of these areas in accordance with Position C.5.c of BTP CMEB 9.5-1.

NUREG-1057, Supplement No. 5 titled “Safety Evaluation Report related to the operation of Beaver Valley Power Station, Unit 2,” dated May 1987, page 9-10, states:

Safe Shutdown Components

Section C.5.b of BTP CMEB 9.5-1 identifies the separation criteria for redundant safe shutdown components. The applicant had originally intended to install new barriers for areas that do not meet these guidelines. By letter dated March 27, 1985, the applicant stated that installation of these barriers would not be possible and that an alternative means of separation would be required, which would necessitate deviations from the SRP. Amendment 14 to the FSAR identified 11 areas in which deviations from the separation criteria exist. One of these areas, the charging pump room, was approved in SSER 3. The remaining deviations have been evaluated through Amendment 14 and during a site audit of January 27-30, 1987. The 10 deviations were found to be acceptable as identified in the following evaluations.

Component Cooling Water Pumps

The component cooling water pumps (2CCP*P21A, B, and C) are located in the auxiliary building at elevation 735 feet, 6 inches. Pumps A and B are separated by 24 feet; however, the C swing pump is located between pumps A and B and is an intervening combustible. Each pump contains 1/2 gallon of lube oil and has combustible motor insulation. The combustible loading in the immediate area of the pumps is negligible and there is detection and automatic water suppression over each pump. There is reasonable assurance that a single fire could not jeopardize the operation of both pumps A and B. If a fire were to occur, the plant fire brigade would respond and control it. The automatic suppression would also limit the size and intensity of a fire. Therefore, the lack of at least 20 feet of separation of the component cooling pumps with no intervening combustibles is an acceptable deviation from Section C.5.b of BTP CMEB 9.5-1.

Boric Acid Transfer Pumps and Storage Tanks

Each of the boric acid pumps and tanks is located in a separate cubicle with 2-foot-thick reinforced concrete walls. The pumps and tanks do not meet the separation criteria because they are located within 20 feet of their redundant components and the cubicles are not totally enclosed. Each of the cubicles has a labyrinth-type opening for missile and radiation protection. Each cubicle will be provided with detection and the combustible loading is low. It is expected that a fire would be detected in its incipient stage and that the plant fire brigade would respond and control it. It is not probable that a fire in any cubicle could travel through the labyrinth opening and into the adjacent cubicle of the redundant component. Therefore, the arrangement of the boric acid transfer pumps and boric acid storage tanks is an acceptable deviation from BTP CMEB 9.5-1 Section C.5.b.

Charging System Suction Valves

There are four valves that can provide suction paths for the charging pumps during shutdown. All four valves are located in the same area; however, only one valve is necessary for safe shutdown. There is approximately 15 feet of separation between the farthest valves. The combustible loading in the area is negligible. Access to the area will be strictly controlled for radiation purposes and therefore, it is unlikely that transient combustibles would accumulate. The area is provided with detection and it is expected that a fire would be detected in its incipient stage and that the plant fire brigade would respond and extinguish it. There is reasonable assurance that a fire would not prevent the operation of at least one of the four valves. Therefore, the lack of charging system suction valve separation is an acceptable deviation from BTP CMEB 9.5-1, Section C.5.b.

Emergency Switchgear Room Supply and Exhaust Fans and Emergency Switchgear Room Supply Dampers

The emergency switchgear room supply and exhaust fans and emergency switchgear room supply dampers do not meet the criteria of the SRP because the redundant components are not separated from each other by a 3-hour barrier. The two supply fans and the two exhaust fans are located in Fire Area CV-4. All of the motors are totally enclosed and are located in separate ductwork. The control cable for supply fan A and exhaust fan A has been protected with 1-hour fire-wrap material in the fire area outside of the ductwork. The combustible loading in the fire area is negligible and detection has been provided. It is anticipated that if a fire were to occur, it would be detected in the incipient stage and the plant fire brigade would respond to extinguish it, using adjacent hose racks. There is reasonable assurance that a fire would not jeopardize both trains of supply fans and exhaust fans. The supply dampers are located in a plenum adjacent to the supply fans. The combustible loading in the plenum is negligible and there is limited access by plant personnel. The damper motors are totally enclosed, which would prevent the burnout of one motor from affecting the operation of the other. There is reasonable assurance that a fire would not affect the operation of both dampers. Therefore, the lack of separation between the emergency switchgear room supply fans and exhaust fans and the emergency switchgear room supply dampers is an acceptable deviation from Section C.5.b of BTP CMEB 9.5-1.

Charging Pump Emergency Exhaust Fans

The charging pump emergency exhaust fans are not in compliance with the SRP because they are not separated by a 3-hour barrier. The fans are located in Fire Area PA-4 and are in a configuration similar to the emergency switchgear supply and exhaust fans. Both fans and motors are totally contained within the ductwork. The combustible loading near the fans is low and detection is provided. Therefore, the lack of separation between the charging pump emergency exhaust fans is an acceptable deviations from Section C.5.b of BTP CMEB 9.5-1.

Auxiliary Feedwater Control Valves

The six auxiliary feedwater control valves are all located in Fire Area SG-1S, which deviates from the separation guidelines of the SRP. However, these valves are hydroelectrically operated, normally open valves, which fail “as is” on loss of electrical control. On loss of hydraulic oil, the auxiliary feedwater flow will open the valves. The applicant stated that auxiliary feedwater flow can be controlled manually throttling the discharge valve at the auxiliary feedwater pump. The combustible loading in fire area SG-1S is less than 1/2 hour and detection is provided. It is anticipated that a fire would be detected early and the plant fire brigade would respond and control it. Even if a fire were to disable all six valves, the plant could still be able to safely shut down. Therefore, the lack of separation between redundant auxiliary feedwater control valves is an acceptable deviation from Section C.5.b. of BTP CMEB 9.5-1.

Atmospheric Steam Dump Valves and Main Steam Isolation Valves

Atmospheric steam dump valves 2SVS*PCV 101 A, B, and C and main steam isolation valves (MSIVs) 2MSS*HYC 101 A, B, and C are located in the main steam valve house and are not separated in compliance with the SRP guidelines. The combustible loading in the valve house is less than 1/2 hour and the detection is provided. The steam dump valves are partially separated by concrete walls, which extend at least 2 feet beyond the valves. The MSIVs are spring-loaded valves, which are latched open during plant operation. Only one of the three solenoid-operated valves for each MSIV is required to operate to close the MSIV. Two of the solenoids are designed to de-energize and the third is designed to energize. There is reasonable assurance that a fire would not prevent the operation of the required steam dump valves or main steam isolation valves. By letter dated December 4, 1986, the staff granted an exemption for the Beaver Valley Unit 1 main steam valve room equipment separation. The configuration of the Unit 2 main steam valve room is equivalent to that of Unit 1. Therefore, the lack of separation between valves in the main steam valve room is an acceptable deviation from Section C.5.b of BTP CMEB 9.5-1.

Reactor Containment

Equipment inside containment is not in compliance with Section C.5.b of BTP CMEB 9.5-1 because redundant trains of safe shutdown components and circuitry are not separated by 3-hour walls or are not separated by 20 feet with no intervening combustibles. Generally, redundant cables inside the containment are run on opposite sides of the interior wall. Although this does not provide 3-hour separation, the wall is a significant barrier to fire and heat. Cables inside the containment are either qualified to IEEE Standard 383 or are run inside conduit. The only significant combustible loading other than cable is the oil inside the reactor coolant pumps, RHR pumps, and the charcoal filters. The reactor coolant pumps are provided with an oil collection system in compliance with the SRP, which reduces the potential for spread of combustible oil. Both the RHR pumps and the charcoal filters are provided with detection and suppression systems. The penetration area, where redundant divisions are separated by at least 18 feet, is provided with detection and automatic suppression. Because of the low in situ combustibles and the containment's large volume, it is expected that any fire would develop slowly with the heat dissipated to the large air space. In addition, because access to the area is tightly controlled, it is not expected that transient combustibles would contribute to the fire loading. Therefore, there is reasonable assurance that a fire inside the containment would not jeopardize both trains of redundant safe shutdown equipment, and lack of complete separation of redundant trains of safe shutdown components inside containment is an acceptable deviation from Section C.5.b of BTP CMEB 9.5-1.

Safe Shutdown Circuitry

In Amendment 14 to the FSAR, the applicant identified six fire areas where safe shutdown circuitry is not in compliance with Section C.5.b of BTP CMEB 9.5-1. The fire areas include cable vaults (CV-4 and CV-5), primary auxiliary building (PA-4), pipe tunnel (PT-1), south safeguards building (SG-1S), and the service building normal switchgear (SB-4). These fire areas deviate from the SRP because they do not contain automatic suppression in addition to detection and 1-hour separation. All six areas have a combustible loading of less than 1/2 hour and detection is provided. One train of circuitry is wrapped with 1-hour material in each of the six areas. It is expected that a fire would be detected in its incipient stage and the plant fire brigade would respond. All of the areas are provided with hose racks for fire brigade use. Providing automatic suppression in these areas would not significantly increase the level of fire protection. Therefore, the lack of area suppression for Fire Areas CV-4, CV-5, PA-4, PT-1, SG-1S, and SB-4 is an acceptable deviation from Section C.5.b of BTP CMEB 9.5-1.

Electrical Cable Construction, Cable Trays, and Cable Penetrations

In the SER, the staff identified three fire areas where cable tray separation did not meet the guidelines of Section C.5.e(2) of BTP CMEB 9.5-1. They include the containment (RC-1) and the primary auxiliary building (PA-3 and PA-4). In Amendment 14 to the FSAR, the applicant provided clarification of this deviation and stated that continuous line-type detection was not provided in any safety-related cable trays; however, all areas containing safety-related cables had general area detection and all areas with concentrated cables, except for RC-1, PA-3, and PA-4, were provided with automatic suppression. As identified previously in the SER, the addition of automatic suppression in these three areas would not significantly enhance fire safety. Also, the general area detection provides adequate assurance that a fire in any safety-related cable will be detected in its incipient stage, making line-type heat detection unnecessary. Therefore, the lack of automatic suppression in fire areas RC-1, PA-3, and PA-4 and the lack of continuous-line type of heat detection in safety-related cable trays are acceptable deviations from Section C.5.b of BTP CMEB 9.5-1.

(12) The explicit prior approval from Licensing Action 31, “Access Hatch - Unrated Containment Hatch - BTP C.5.a(5)” is for usage of an unrated Containment hatch. The following licensing excerpt below the associated fire compartment attribute list applies:

- Fire Compartment 2-RC-1 Attribute 3.11.3 - Fire Barrier Penetrations

NUREG-1057, Supplement No. 5 titled “Safety Evaluation Report related to the operation of Beaver Valley Power Station, Unit 2,” dated May 1987, page 9-4, states:

During the audit, the applicant also stated that the containment access hatch did not contain a UL label or certification of fire testing. The hatch was observed to be similar to air locks used at other facilities and was designed to meet multiple accident criteria. The combustible loading near the hatch is low; therefore, there is reasonable assurance that a fire of significant magnitude or duration will not occur near the air lock. If a fire does occur, it is probable that the substantial construction of the air lock will prevent fire propagation through the containment boundary. Therefore, an unrated containment access hatch is an acceptable deviation from Section C.5.a(5) of BTP CMEB 9.5-1.

(13) This item addresses the lack of 50’ separation from the outdoor station transformers TR-2A, TR-2C, TR-2D, and TR-MT-2 and the wall separating 2-TB-1, which is less than a three hour barrier. The correlation between transformer location identifications and fire compartments can be found in Attachment I, Definition of Power Block, Table I-2 – BVPS-2 Power Block Definitions. 2-TR-1 is the compartment for the Main Transformer (TR-MT-2). 2-TR-2 is the compartment for Unit Station Service Transformer (TR-2C). 2-TR-3 is the compartment for Unit Station Service Transformer (TR-2D).

This discussion applies to the following attributes and was evaluated through the variance from deterministic requirements (VFDR) through Action Item BV2-0793. The action item resolved this VFDR by determining through performance-based analysis that the non-rated portion of the fire barriers is adequate to withstand the fire effects of the potential hazard:

- Fire Compartment 2-TR-1 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-TR-2 Attribute 3.11.2 - Fire Barriers
- Fire Compartment 2-TR-3 Attribute 3.11.2 - Fire Barriers

The records for Fire Compartment 2-TR-1 Attribute 3.11.2 - Fire Barriers, Fire Compartment 2-TR-2 Attribute 3.11.2 - Fire Barriers and Fire Compartment 2-TR-3 Attribute 3.11.2 - Fire Barriers are revised to credit the performance based analysis.

(14) The explicit prior approval from Licensing Action 18, “Fire Hydrant - Deviation in Spacing - BTP C.6.b (7)” is for spacing between hydrants 15 and 16. The following licensing excerpt below the associated fire compartment attribute list applies:

- NFPA 805 Section 3.5.15, Hydrants and Hose Houses

Section 9.5.1.5, "Fire Detection and Suppression," of NUREG-1057, Supplement No. 5 titled “Safety Evaluation Report related to the operation of Beaver Valley Power Station, Unit 2,” dated May 1987 states:

> Fire Protection Water Supply System
> During the site audit, the applicant stated that fire hydrant 16, located at the southwest corner of the turbine building, was relocated because it interfered with the installation of the auxiliary boiler and the security perimeter fence, thus providing a 370-foot spacing indicated in Section C.6.b(7) of BTP CMEB 9.5-1. The area was observed during the audit and coverage for nearby hazards appeared adequate. Therefore, the spacing between hydrants 15 and 16 is an acceptable deviation from the SRP.

(15) The explicit prior approval from Licensing Action 26, “Fire Detection System Secondary Power Supplies - Use of Plant Emergency Power Supply - BTP

C.6.a(6)" is for fire detection power supply system. The following licensing excerpt below the associated fire compartment attribute list applies:

- NFPA 805 Section 3.8.1, Fire Detection Power Supply System

Section 9.5.1.5, "Fire Detection and Suppression," of NUREG-1057, Supplement No. 6 titled "Safety Evaluation Report related to the operation of Beaver Valley Power Station, Unit 2," dated August 1987 states:

> Fire Detection
>
> A fire detection system is provided for all areas containing safety-related equipment and for all areas that present a fire exposure to safety-related equipment.
>
> The system complies with NFPA [Standard] 72D for a Class A system, with detectors installed in accordance with NFPA [Standard] 72E.
>
> By letter dated May 23, 1984, the applicant committed to provide a reliable power supply for the fire detection system as follows:
>
> (1) The primary supply for the fire detection system and suppression systems is the normal offsite power supply system.
>
> (2) The secondary supply for the fire detection systems is a non-safety diesel generator. The switchover capability is an automatic function. The diesel generator supplies the 120-V ac [Volts alternating current] uninterruptible power supply system required for the detection system and the 125-V dc [Volts direct current] panels for the fire detection and suppression systems.
>
> (3) A battery backup system with a 2-hour rated capability is provided as a backup to the 125-V dc systems.
>
> A battery backup system with a 30-minute capability is provided as a backup to the 120-V ac systems. This is to provide electrical power continuity for the 10 seconds required to start the diesel and achieve rated voltage and frequency. The staff finds this an acceptable primary and secondary source of power.
>
> On the basis of its evaluation, the staff concludes that the fire detection system will meet Section C.6.a of BTP CMEB 9.5-1 and is, therefore, acceptable.

(16) The explicit prior approval from Licensing Action 29, "Standpipe and Hose Systems - Class II versus Class III Requirement - BTP C.6.c" is for the hose station system designed similar to a Class II type standpipe and hose system, in that it has 1.5"-size hose valves only, and does not have 2.5"-size hose valves as required for Class III systems. The following licensing excerpts below the associated fire compartment attribute list apply:

- NFPA 805 Section 3.6.1, Standpipe and Hose Systems - Class II versus Class III Requirement

The BVPS-2 "Updated Final Safety Analysis Report," BVPS-2 UFSAR, Section 9.5.1.7.3, states that:

> Compliance with hose rack spacing is met. The hose stations are designed for flow of at least 100 gpm through a 1.5" hose. The system is more similar to a Class II type standpipe and hose system in that it has 1.5"-size hose valves only, and does not have 2.5"-size hose valves as required for Class III systems."

Section 9.5.1.5, "Fire Detection and Suppression," of NUREG-1057, Supplement No. 6 titled "Safety Evaluation Report related to the operation of Beaver Valley Power Station, Unit 2," dated August 1987 states:

> Sprinkler and Standpipe Systems
> The wet pipe sprinkler systems, deluge systems, and pre-action systems meet the provisions of NFPA [Standard] 13 and NFPA [Standard] 15. The areas equipped with water suppression systems are listed in Table 1 of the applicant's fire protection evaluation report.
>
> Each automatic sprinkler system and interior hose standpipe is supplied through separate connections from the yard main or from the internal cross-connections through buildings to ensure that no single failure in the water supply system will impair both the primary and backup fire protection in building areas.
>
> Each sprinkler and standpipe system connection to the distribution system is equipped with an indicating gate valve so that groups of sprinkler systems and/or manual hose stations can be isolated without interrupting the supply to other sprinkler systems and manual hose stations connected to the same header.
>
> On the basis of its evaluation, the staff finds that sprinkler and standpipe systems have been provided in accordance with Section C.6.c of BTP CMEB 9.5-1, and are, therefore, acceptable.
>
> Manual hose stations are located throughout the plant in accordance with NFPA [Standard] 14. Standpipe system piping for hose stations protecting safe shutdown equipment has been analyzed for SSE loading and is provided with seismic supports. The staff concludes that the design of the standpipe system piping meets Section C.6.c of BTP CMEB-9.5-1, and is, therefore, acceptable.

(17) Where fire doors are not code compliant, such as a door in a fire barrier that separates a fire compartment from a stairwell, or doors that have been modified from the tested configuration, a performance based analysis of VFDR BV1-3120 and VFDR BV2-1633 resolves the fire door rating. This applies to the below fire compartment attributes:

- Fire Compartment 1-CV-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-CV-2 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-MS-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-NS-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-PA-1E Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-PA-1G Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 1-TB-1 Attribute 3.11.3 - Fire Barrier Penetrations
- Fire Compartment 2-S-1 Attribute 3.11.3 - Fire Barrier Penetrations

A revision to the LAR for items changed in this response will be provided in a future submittal.

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.

<u>Response:</u>

The response to NFPA 805 Section 3.4.2 compliance basis discussion of "Will Comply with the Use of Commitment" will be revised to clarify that the updates to the pre-fire plans will comply with the requirement in NFPA 805 Section 3.4.2.

The phrase "meet the intent of this" will be removed in Section 3.4.2 and replaced with "comply with." Additionally, a reference to LAR Attachment S, Table S-3 Action Item BV1-2371 for changes to pre-fire plans at both units will be added to the Compliance Basis. A revision to the LAR Attachment A, Table B-1, A1 record 3.4.2 for this changed item will be provided in a future transmittal.

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.

Response:

A review was performed of the BVPS LAR Attachment S, Table S-3, “Implementation Items.” Within the table below, the implementation item is listed, the applicable unit as submitted in the LAR, and the description to clarify which item is being reviewed.

Where the unit as listed in the submitted LAR does not require revision, the “Change to Unit” column is listed as “None.” Where changes are recommended, a clarifying explanation is provided.

Updates to LAR Attachment S, Tables S-2 and S-3 will be provided in a future submittal.

LAR Table S-3 Implementation Items:				
Item	Unit (as submitted in LAR)	Description	Change to Unit	Explanation
BV1-0714	1	Complete Penetration Seal Database	None	
BV1-1624	1	Update Calculation 8700-DEC-3574, Circuit Failure Task 9	None	
BV1-1633	1	Update Uncertainty & Sensitivity Analysis	None	There is a separate item for BVPS-2 (BV2-1580)
BV1-2358	1	Develop the BVPS-1 Fire Safety Analysis (FSA)	None	

LAR Table S-3 Implementation Items:				
Item	Unit (as submitted in LAR)	Description	Change to Unit	Explanation
BV1-2360	1	Update [fire protection plan, or] FPP procedures to reflect power block areas listed in Attachment I	1 & 2	Procedures are common to both units
BV1-2371	1	Update fire brigade pre-fire plans and training materials	1 & 2	Procedures are common to both units
BV1-2706	1	Track NRC Correspondence on the open CT secondary issue and evaluate their conclusions as they pertain to BVPS-1 and BVPS-2 and Update 2701.620-000-025, Revision A, "Current Transformer Investigation for Beaver Valley Power Station"	None	There is a separate item for BVPS-2 (BV2-1020)
BV1-2823	1	Update administrative process/engineering controls to address future installation of wiring above a suspended ceiling in accordance with NFPA 805	1 & 2	Wiring above suspended ceilings is common to both units.
BV1-2825	1	Beaver Valley [non-power operation, or] NPO Implementation Plan	1 & 2	NPO implementation procedures are common to both units
BV1-2826	1	Document results of walk down that was performed inside BVPS-1 reactor containment to evaluate fire detector spacing	None	
BV1-2828	1	Revise procedure 1OST-33.13B, Deluge Valve Fire Protection System Instrument Test, to define actuation criterion	None	

LAR Table S-3 Implementation Items:				
Item	Unit (as submitted in LAR)	Description	Change to Unit	Explanation
BV1-2833	1	Update the Fire Protection Program Change Evaluation associated with the hydraulic calculation for fire protection system water supply	1 & 2	Fire protection system water supply is common to both units.
BV1-2902	1	Procedure update 1/2-ADM-1901 to add reference to NFPA 805	1 & 2	The procedure is common to both units.
BV1-2903	1	Procedure update 1/2-ADM-1902 to meet requirements of NFPA 805	1 & 2	The procedure is common to both units.
BV1-2904	1	Procedure update 1/2-ADM-1903 to add reference to NFPA 805	1 & 2	The procedure is common to both units.
BV1-2905	1	Procedure update 1/2-ADM-1904 to enhance combustible controls program	1 & 2	The procedure is common to both units.
BV1-2906	1	Procedure update 1/2-ADM-1905 to enhance combustible controls program	1 & 2	The procedure is common to both units.
BV1-2907	1	Procedure update 1/2-ADM-1906, PIPS-M16 to meet requirements of NFPA 805	1 & 2	The procedure is common to both units.
BV1-2908	1	Procedure update 1/2-ADM-1900 to enhance controls of flammable gas	1 & 2	The procedure is common to both units.
BV1-2909	1	Procedure update 1/2OM-56B.4A.A to enhance controls of combustible liquids	1 & 2	The procedure is common to both units.
BV1-2974	1	Verify the Reported Change-in-Risk Upon Completion of probabilistic risk assessment, or PRA-Credited Implementation Items	1 & 2	This verification must be done for both units.

LAR Table S-3 Implementation Items:				
Item	Unit (as submitted in LAR)	Description	Change to Unit	Explanation
BV1-2975	1	Fire Protection Safe Shutdown Response Procedures must be updated for NFPA 805 implementation	None	There is a separate item for BVPS-2 (BV2-1365).
BV1-2989	1	Beaver Valley will implement a Fire Protection Monitoring Program in accordance with the NRC approved version of [frequently asked question, or] FAQ 10-0059	1 & 2	The monitoring program will be common to both units.
BV1-3018	1	Procedure updates associated with NFPA Standard 30 requirements	1 & 2	The affected procedures are on both units.
BV1-3019	1	Establish a minimum set of qualification criteria for proficiency associated with fire brigade qualifications	1 & 2	Brigade qualifications are common to both units.
BV1-3020	1	Fire Brigade Procedure changes related to NFPA Standard 600 requirements	1 & 2	Affected procedure is common to both units.
BV1-3026	1	Procedure update related to NFPA Standard 20 requirements.	1 & 2	Affected procedure is common to both units.
BV1-3027	1	BVPS-1 and BVPS-2 LAR Attachment G implementation activities	1 & 2	Applicable to both units.
BV1-3041	1	Update fire barrier surveillance procedures to include newly defined fire compartments	None	
BV1-3060	1	Review and Update [human reliability analysis, or] HRA once Final Fire Procedures are written	1 & 2	HRA review is applicable to both units.

LAR Table S-3 Implementation Items:				
Item	Unit (as submitted in LAR)	Description	Change to Unit	Explanation
BV1-3065	1	New NFPA 805 Control Procedures and Processes	1 & 2	Fire protection program procedures are common to both units.
BV1-3066	1	Maintaining appropriate compensatory measures	1 & 2	Compensatory measures affect both units.
BV2-0362	2	Update procedures to enhance guidance on containment and monitoring of potentially contaminated fire suppression water	None	
BV2-0487	2	Update the CO2 flow and time criteria for 2-CV-6	None	
BV2-0619	2	Develop the BVPS-2 Fire Safety Analysis (FSA)	None	
BV2-1020	2	Track NRC Correspondence on the open [current transformer, or] CT secondary issue and evaluate their conclusions as they pertain to BVPS-1 and BVPS-2 and Update 2701.620-000-025, Revision A, “Current Transformer Investigation for Beaver Valley Power Station”	None	There is a separate item for BVPS-1 (BV1-2706)
BV2-1022	2	Perform Procedural Enhancements to Pre-fire Plans for 2-DG-1, 2-DG-2 Control Circuits Vent Fans	None	
BV2-1157	2	Plant Boundary Definition and Partitioning Document will be enhanced to provide additional detail	1 & 2	The plant boundary definition and partitioning document is common to both units.

LAR Table S-3 Implementation Items:				
Item	Unit (as submitted in LAR)	Description	Change to Unit	Explanation
BV2-1166	2	Minor documentation updates to BVPS-1 and BVPS-2 Control Room Fire Model Analyses	1 & 2	Applicable to both units.
BV2-1169	2	Minor Documentation Updates to BVPS-1 and BVPS-2 Structural Steel Reviews	1 & 2	Applicable to both units.
BV2-1182	2	Minor Documentation Update to Task 13, Seismic Fire Interaction Reviews	1 & 2	Documents for both units are affected.
BV2-1294	2	Updates to Task 9 Calculation (10080-DEC-3575)	None	
BV2-1314	2	BVPS-2 procedure update 2OST-33.13I to include heat detection activation time	None	
BV2-1345	2	Procedure revision to include fire door OS52-21 inspection verification	1 & 2	Affected procedure is common to both units.
BV2-1365	2	Fire Protection Safe Shutdown Response Procedures must be updated for NFPA 805 implementation	None	There is a separate item for BVPS-1 (BV1-2975)
BV2-1369	2	Hydraulic calculations need reconstituted for the water-spray systems in 2-PA-3, 2-RC-1, 2-SG-1N, and 2-SG-1S	1 & 2	Hydraulic Calculation is applicable to both units.
BV2-1372	2	BVPS-2 procedure update 2OST-33.21 to include heat detector activation time	None	
BV2-1566	2	Add caution statement to Pre-Fire Plan for fire hose in 2-SB-4	None	
BV2-1570	2	Hydrogen signage update needed for NFPA Standard 55 requirements	None	

LAR Table S-3 Implementation Items:				
Item	Unit (as submitted in LAR)	Description	Change to Unit	Explanation
BV2-1576	2	Update fire barrier surveillance procedures to include newly defined fire compartments	None	
BV2-1580	2	Update Uncertainty and Sensitivity Analysis Task 15	None	There is a separate item for BVPS-1 (BV1-1633)

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:

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.**

Response:

The lack of a lube oil collection system in misting areas satisfies the nuclear safety performance goals, performance objectives, and performance criteria because redundant reactor coolant pumps exist that are separated from each other by reinforced concrete walls. The reactor coolant pumps are not required for post-fire safe shutdown. Therefore, the lack of a lube oil collection system in misting areas will not adversely impact the ability to achieve and maintain a safe and stable condition.

LAR Attachment L, Approval Request 2 will be revised to describe how the lack of a lube oil collection system in misting areas satisfies the nuclear safety performance goals, performance objectives, and performance criteria of NFPA 805 and how the configuration maintains safety margins and each element of fire protection defense-in-depth (DID).

The following explanation will be added to the nuclear safety and radiological release performance criteria section:

> The nuclear safety performance criteria are met because redundant reactor coolant pumps (RCPs) are available as necessary and the RCPs are not required to achieve or maintain post-fire safe shutdown.

The following explanation will be added to the safety margin and defense-in-depth section:

> The three echelons of DID are:
>
> (1) Prevent fires from starting (combustible/hot work controls);
>
> (2) Rapidly detect, control and extinguish fires that do occur, thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans);
>
> (3) Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions).
>
> Per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided.
>
> Echelon 1 is maintained by the oil collection system and by the reactor coolant pump design, and is not affected by this configuration. The introduction of small amounts of oil misting does not affect Echelons 2 and 3. The oil misting does not result in compromising fire detection, automatic or manual fire suppression functions, or post-fire safe shutdown capability. Since a balance of the elements is provided, DID is achieved.

An update to LAR Attachment L for this approval request will be provided in a future submittal.

FPE RAI 14

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.**

Response:

The lack of sectional isolation valves between the sprinkler system and hose station connections satisfies the nuclear safety performance goals, performance objectives, and performance criteria because existing compensatory measures ensure there is no impact on the ability to detect and suppress fires if sections of fire protection water supply piping are isolated.

LAR Attachment L, Approval Request 3 will be revised to describe how the lack of sectional isolation valves between the sprinkler system and hose station connections satisfies the nuclear safety performance goals, performance objectives, and performance criteria of NFPA 805 and how the configuration maintains each element of fire protection DID.

The following explanation will be added to the nuclear safety and radiological release performance criteria:

> Compensatory measures, such as equivalent capacity backup fire hose protection to restore suppression capabilities, and establishment of fire surveillance within the related area, ensure that there is no impact on the ability to detect and suppress fires. Addition of sectionalizing valves to separate the hose stations from the sprinkler systems in an area would not significantly improve the radiological release performance criteria or the nuclear safety performance criteria.

The following explanation will be added to the defense in depth discussion:

> The three echelons of DID are:
>
> (1) To prevent fires from starting (combustible/hot work controls)
>
> (2) Rapidly detect, control and extinguish fires that do occur, thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans)
>
> (3) Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions).

Per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided.

Echelon 1 is met through plant fire prevention procedures and is not affected by this configuration. Echelons 2 and 3 are met in performance evaluations through appropriate compensatory measures, such as the readiness of additional fire hose to reach the affected areas, and fire surveillances. The fire brigade is trained to rapidly respond to and extinguish fires with the tools provided to them, which include a standpipe and hose system. The lack of sectional isolation valves does not result in compromising fire suppression functions or post-fire safe shutdown capability. Since a balance of the elements is provided, DID is achieved.

An update to LAR Attachment L for this approval request will be provided in a future submittal.

FPE RAI 14

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.**

Response:

LAR Attachment L, Approval Request 4 will be revised to describe how the lack of electrical supervision for fire hydrant curb box type control valves will satisfy the radiological release performance goals, performance objectives, and performance criteria of NFPA 805.

For the nuclear safety and radiological release performance criteria section, BVPS has implemented administrative control for periodic surveillance of the box curb valves. The inaccessibility of the curb box valves, the required usage of a special T-wrench, and periodic surveillance by trained and authorized personnel ensures that the nuclear safety and radiological release performance goals, performance objectives, and performance criteria are not affected.

For the safety margin and defense-in-depth section, additional details will be provided to clarify how safety margin has been preserved. Echelon 1 is not affected since it entails plant procedures. Echelons 2 and 3 are met since the curb box valves do not adversely affect the system pressure or flow nor compromise fire suppression functions, manual fire suppression functions, or post-fire safe shutdown capability.

An update to LAR Attachment L for this approval request will be provided in a future submittal.

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:

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.**

Response:

e) The credit taken for the VEWFDS is in accordance with the simplified event tree as described in FAQ 08-0046.

f) In the letter dated April 27, 2015 (ADAMS Accession No. ML15118A484), the response to FPE RAI 15a stated that the VEWFDS will be connected to interface with the Control Room annunciation system, and that LAR Attachment S, Table S-2 will be revised to add this modification for both BVPS-1 and BVPS-2. Code compliance reports will be completed throughout the modification process, however, compliance of the VEWFDS with respect to NFPA 805 section 3.8 cannot be described until the detailed design is complete. As the modification design is not complete at this time, there are no changes to LAR Attachment A.

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.**

Response:

An engineering evaluation compared the BVPS ERFBS configuration to actual fire endurance tests performed in accordance with GL 86-10 Supplement 1 and determined the BVPS configuration to be equivalent to a 1-hour fire rating. The fire severity in 1-PA-1E and 1-PA-1G is less than the 1-hour fire endurance rating applied to the ERFBS.

The LAR Attachment A Table B-1 Section 3.11.5 records for fire compartments 1-PA-1E and 1-PA-1G will be updated with the above information to clarify how the ERFBS meets the requirements of NFPA 805 section 3.11.5.

An update to LAR Attachment A, Table B-1 will be provided in a future submittal.

FPE RAI 17

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.

Response:

Fire protection on ductwork is not considered an ERFBS, as ERFBS is referring to fire protection of electrical raceways. Fire protection on ductwork is considered fire barrier protection and is covered under the 3.11.2 "Fire Barrier" records.

An EEEE analyzed the use of the 3M Interam E-50 series blanket materials as fire barriers to protect ductwork and dampers and concluded that the installed configurations are equivalent to a 1-hour fire rating resistance for the ductwork and a 2-hour fire rating resistance for the specific fire dampers.

LAR Attachment A, Table B-1, Section 3.11.5 records for fire compartments 2-CB-1, 2-CV-1, 2-CV-3, 2-PA-3, 2-PA-4, 2-SB-3, and 2-SB-4 will be revised to delete references to fire barriers for ductwork. LAR Attachment A, Table B-1, Section 3.11.2 records for fire compartment 2-CB-1 will be revised to include the results of the engineering evaluation regarding fire barriers for ductwork. The Table B-1, Section 3.11.2 records for fire compartments 2-CV-1, 2-CV-3, 2-PA-3, 2-PA-4, 2-SB-3, and 2-SB-4 already include the engineering evaluation regarding fire barriers for ductwork.

An update to LAR Attachment A, Table B-1 will be provided in a future submittal.

FPE RAI 17

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.**

Response:

ERFBS installed on conduits at BVPS-2 originally consisted of Thermo-Lag 330-1 pre-shaped conduit sections having 0.50 inch nominal thickness with buttered joint construction. Following Generic Letter (GL) 92-08, "Thermo-Lag 330-1 Fire Barriers," and 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," fire endurance testing results were used to establish the fire endurance rating of Thermo-Lag 330-1 installation configurations. The fire endurance tests were conducted in accordance with GL 86-10 Supplement 1. The Thermo-Lag ERFBS(s) at BVPS-2 were modified, consistent with the industry test program results, in order to achieve a 1-hour fire rating. The modifications included the addition of 3/8 inch thick pre-formed conduit sections, stress skin, and Thermo-Lag trowel grade material over the existing conduit sections for conduits 1-1/2 inch to 2 inch in diameter, and the addition of stress skin with Thermo-Lag trowel grade material for conduits 3 inch to 6 inch in diameter.

An engineering evaluation performed an analysis of each section of protected conduit in comparison with the fire endurance test results and determined that the installed ERFBS meets the acceptance criteria of Section 3.11.5 of NFPA 805 (NRC GL 86-10 Supplement 1).

FPE RAI 17

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."**

Response:

The BVPS ERFBS uses several configurations in fire area 2-PA-4. Some configurations "Comply" by meeting an actual fire endurance test and some "Comply with the Use of EEEE," engineering evaluations for specific configurations determined that the ERFBS in 2-PA-4 is equivalent to a 1-hour fire rating. Previous NRC approval does not apply.

LAR Attachment A, Table B-1 Section 3.11.5 record for fire compartment 2-PA-4 will be corrected to delete the "Complies by previous NRC approval" statement. An update will be provided in a future submittal.

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.

Response:

A review of the Alignment Statements in LAR Attachment B, Table B-2 was performed to determine that the alignment statements that included “Not in Alignment, but Prior NRC approval” or “Not in Alignment with no adverse consequences” have been addressed. The review concluded that the following attributes utilize these compliance statements:

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

LAR Section 4.2.1.1 will be revised to include the following information:

3.1.1.9 - 72 hour Coping Period

The 72-hour coping period, as defined in NEI 00-01 section 3, is not applicable to plants transitioning to NFPA 805. As described in FAQ 07-0039, NFPA 805 does not require cooldown to cold shutdown. The assessment of accomplishment of performance goals should document the equipment required to achieve a safe and stable plant condition in accordance with NFPA 805 Section 1.3.

Safe and stable conditions for BVPS-1 and BVPS-2 are to maintain the plant in hot standby up to the point at which the residual heat removal (RHR) loop is placed into service as discussed in LAR section 4.2.1.2. NFPA 805 analysis determined that the plant no longer is required to reach cold shutdown as noted in NEI 00-01, section 3.1.1.9. Cold shutdown was previously required by 10 CFR 50, Appendix R. Based on this NFPA 805 analysis, there are no adverse consequences.

3.1.2.4 - Decay Heat Removal

Decay heat is removed by use of a natural circulation cooldown and steam release via the main steam safety valves and manual operation of atmospheric dump valves or residual heat removal. Auxiliary feed water (AFW) is credited to supply cooling water to the steam generators.

As described in FAQ 07-0039, NFPA 805 does not require cooldown to cold shutdown. The assessment of accomplishment of performance goals should document the equipment required to achieve ‘a safe and stable’ plant condition in accordance with NFPA 805 section 1.5. Through ‘safe and stable’ plant operation per the requirements of NFPA 805, decay heat will be removed using systems analyzed and procedures developed to support this transition. Although the requirements of NEI 00-01 section 3.1.2.4 for cold shutdown are not met, the new requirement associated with NFPA 805 is satisfied so there are no adverse consequences.

3.1.2.5 - Process Monitoring

Process monitoring instrumentation required to achieve and maintain a safe and stable plant condition post-fire is identified in LAR Attachment C, NEI 04-02 Table B-3, “Fire Area Transition.” This instrumentation is consistent with minimum process monitoring instrumentation expectations identified in NRC Information Notice (IN) 84-09, ”Lessons Learned from NRC Inspections of Fire Protection Safe Shutdown Systems (10 CFR 50, Appendix R)” and as described in the licensing bases for BVPS-1 and BVPS-2. The process monitoring instrumentation described below either aligns with IN 84-09, or has prior NRC approval. This instrumentation includes:

- Pressurizer pressure and level: In support of the inventory and pressure control nuclear safety performance criteria (NSPC) for pressurizer pressure, both units evaluate pressurizer level. BVPS-1 has exemption 11.24 to permit the use of Reactor Coolant System (RCS) pressure as an acceptable substitute. BVPS-2 evaluates the availability of pressurizer pressure.

- Reactor coolant temperature (T-hot / T-cold): In support of the decay heat removal NSPC for both units, T-hot is evaluated for the availability of either hot leg temperature indicators or incore thermocouples. T-cold is evaluated for the availability of T-cold temperature elements and the T-cold temperature recorder.

- Steam generator (SG) level and pressure: In support of the decay heat removal NSPC, BVPS-1 has exemption 11.24 to permit the use of narrow range steam generator level instrumentation. SG wide range pressure instruments are evaluated for availability after a fire. BVPS-2 evaluates availability of wide range SG pressure and wide range SG level, as well as narrow range SG level.

- Neutron flux monitoring (source range): In support of the reactivity control NPSC, BVPS-1 has exemption 11.24 to have a source range monitor operational within 80 minutes after the reactor is tripped in the event of a fire. BVPS-2 evaluates the availability of the source range detectors after a fire.

- Water level indication for the refueling water storage tank (RWST) and the primary plant demineralized water tank are not provided at the backup indicating panel (BIP) for BVPS-1 or at the alternate shutdown panel (ASP) for BVPS-2. This does not meet the requirements of Section 3.1.2.5 of NEI 00-01. However, each tank is of sufficient capacity that level monitoring is not critical to safe shutdown functions. This configuration was previously approved for BVPS-1 by letter dated January 5, 1983 from the NRC, and previously approved for BVPS-2 in section 9.5.1.4 General Plant Guidelines" of NUREG-1057 Supplement 5.

3.2.2.1 - Identify the System Flow Path for Each Shutdown Path

The BVPS-1 and BVPS-2 NFPA 805 safe shutdown analysis interim transition report, Attachment 1, "Safe Shutdown Performance Goal and System Logic Model Description" describe the systems that are required for post-fire safe shutdown.

The "Post-Fire SSD and PRA and Component Selection" procedure describes the methodology and documentation requirements associated with selection of post-fire safe shutdown systems and components which utilize process and instrumentation diagrams (P&IDs) to aid in creating the safe shutdown equipment lists for safe shutdown systems and associated support systems.

As part of the NFPA 805 transition, the post-fire safe shutdown analysis has been incorporated into a computerized safe shutdown analysis tool, SAFE, which maintains success path models of performance goals, systems, equipment, and cables. The markup and annotation of P&IDs are not required to support the SAFE analysis tool which does not meet the requirements of NEI 00-01 Section 3.2.2.1. Since SAFE software performs the function of the marked up P&ID, there are no adverse consequences.

Changes to the LAR Section 4.2.1.1, “Compliance with NFPA 805 Section 2.4.2” will be provided in a future submittal.

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.**

Response:

1) BVPS procedures direct the use of three electrical fans for BVPS-1 emergency switchgear room temporary ventilation, placed within the emergency switchgear rooms. The fans are powered by a gasoline engine-driven portable generator, which is placed in the yard with adequate separation and isolation from all identified NSCA systems, structures, and components (SSCs).

2) BVPS procedures direct the use of two gasoline engine-driven fans and two electrical fans for BVPS-1 diesel generator room temporary ventilation. The electrical fans are powered by a gasoline-driven portable generator. The two electrical fans are placed in the entrance to the diesel generator number 2 room, while the generator and the gasoline engine-driven fans are placed in the yard outside the diesel building with adequate separation and isolation from all identified NSCA SSCs.

3) Control room temporary ventilation procedures will be developed to direct the placement of one or more electric fans in the doorway from the outside, blowing into the common BVPS-1 and BVPS-2 control rooms, powered from local receptacles. LAR Attachment G will be revised to specify that the control room portable ventilation will be supplied by electrical fans, and to eliminate the notation of fan capacity. The required capacity will be determined as part of preparing the plant procedures. Revision to LAR Attachment G, Table G-1 for this changed item will be provided in a future submittal.

SSD RAI 05

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.

Response:

1) Fifteen (15) gallons of gasoline is kept ready for immediate use by the gasoline engine-driven portable generator, which is used to power the electric fans for either the BVPS-1 emergency switchgear rooms or the BVPS-1 diesel generator rooms. This gasoline is stored in the flammable storage cabinet at the BVPS-1 turbine deck and is inventoried periodically. The generator fuel tank has a 4 gallon capacity, which will run the generator for about 4.2 hours. Therefore, the available gasoline is enough to keep the generator running for about 15.75 hours. Additional fuel can be readily obtained from off-site before it is needed.

2) Five (5) additional gallons of gasoline/oil mixture is kept ready for immediate use by the two gasoline engine-driven fans used to ventilate the BVPS-1 diesel generator rooms. This gasoline is stored in the flammable storage cabinet at the BVPS-1 turbine deck and is inventoried periodically. Each fan has a one-quart capacity, which will run the fan for about an hour. Therefore, the available gasoline/oil mixture is enough to keep both fans running for about 10 hours. Additional fuel can be readily obtained from off-site before it is needed.

3) No fuel is required for the portable electric fans used to ventilate the control room.

SSD RAI 05

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

Response:

1) The generator powering the BVPS-1 emergency switchgear fans is located in the yard near the chemical addition building and is not in close proximity to any NSCA SSCs. Therefore, refueling does not present a fire exposure hazard to adjacent NSCA SSCs.

2) BVPS procedures direct a continuous fire watch for the gasoline engine-driven portable generator and fans for the BVPS-1 diesel generator room temporary ventilation. Furthermore, the portable generator and the fans are located in the yard outside the door to the diesel generator room number 2, and they are not in proximity to any NSCA SSCs. Therefore, refueling does not present a fire exposure hazard to adjacent NSCA SSCs.

3) Refueling is not required for the portable electric fans used to ventilate the control room.

SSD RAI 05

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

Response:

1) Per BVPS procedures, the BVPS-1 emergency switchgear room temporary ventilation flow path is provided by blocking open doors. One fan is placed in each of the two rooms, directing the hot air towards the third fan placed in the doorway to the normal switchgear room. The third fan exhausts through an outlet duct hose routed through the normal switchgear room to establish sufficient exhaust flow up the stairwell into the clean shop. Service building roof dampers are opened to allow the hot air to escape the building. Cool air from outside flows into the emergency switchgear rooms through doors blocked open for the electrical cords.

2) Per BVPS procedures, the BVPS-1 diesel generator room temporary ventilation flow path is provided by blocking open the security access doors to both rooms and the two doors between the rooms. The four fans are arranged in or just outside the security door for the operating diesel generator room door. Each fan is equipped with an “elephant trunk” led inside the room. Cool air from outside flows across the operating diesel generator, through the connecting doors, across the idle diesel generator and out the open security access door for the idle diesel generator room. Implementation item BV1-2975 in LAR Attachment S, Table S-3 will develop a temporary ventilation procedure for diesel generator number 1 when it is operating, similar to the existing procedures for diesel

generator number 2.

3) Implementation items BV1-2975 and BV2-1365 in LAR Attachment S, Table S-3 will develop control room temporary ventilation procedures to specify the required flow path, with supporting calculations as necessary. It is anticipated that this will require opening two exterior doors to the yard such that cool air is blown in through one door, flows across the control rooms for both units, and hot air exhausts out the other door.

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.**

Response:

LAR Attachment G describes a number of recovery actions that involve implementing repair procedures on valves that have been impacted by a combination of fire-induced and random failures.

The repair recovery actions listed in Attachment G were reviewed. Recovery actions associated with repairs are DID recovery actions and are not credited in the fire PRA. As such, these repairs are not required to be documented in Attachment G and will be removed. A revision to LAR Attachment G, Table G-1, and Attachment C, Table B-3, for these deleted and changed items will be provided in a future submittal.

SSD RAI 08

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.**

Response:

As specified in part a) above, recovery actions associated with repairs are DID recovery actions and are not credited in the fire PRA. As such, these repairs are not required to be documented in Attachment G and will be removed. A revision to LAR Attachment G, Table G-1, and Attachment C, Table B-3, for these deleted and changed items will be provided in a future submittal.

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.

b) **The licensee described the disposition of VFDR BV2-0411 as "Replace 120 VAC & 125 VDC 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.**

Response:

LAR Attachment C, Table B-3 was incorrect, and VFDR BV2-0411 will be removed from this table in a future submittal.

Radioactive Release (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.

Response:

BVPS has a procedure in place for fires in radiological controlled areas (RCAs). The procedure specifies corrective and protective measures to minimize the radiological consequences of the fire or the fire-fighting efforts. In order to minimize creation of large quantities of contaminated water and potential contamination of adjacent areas by runoff, use of carbon dioxide, dry chemical, or similar non-water extinguishing agents are instructed to be used. A radiation protection technician will also accompany the fire brigade to continuously monitor the radiation dose rate and make exposure and contamination control recommendations.

LAR Attachment S, Table S-3 item BV1-2371 will update the yard pre-fire plans to specify procedural controls such as the use of carbon dioxide or dry chemical extinguishing agents, which is consistent with current procedures, and to consider the use of engineering controls such as temporary damming to contain potentially-contaminated fire suppression water runoff if water is needed for fire suppression.

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.

Response:

The screening of radiological areas was initially performed by the radioactive release report preparer and reviewer. The report preparer was an engineer with more than 30 years of experience at BVPS, which included increasing responsibilities for engineering and oversight of the BVPS fire protection program. The report reviewer had more than 30 years of experience as a professional grade member of the Society of Fire Protection Engineers, and 29 years nuclear power plant experience as a fleet lead fire protection engineer and fire protection program owner.

Subsequent report updates were produced and reviewed by individuals whose qualifications include senior reactor operators, and electrical and licensing engineers.

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:

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.**

Response:

A review of installed cable insulation and jacket materials was performed at BVPS to determine the type (that is, thermoset or thermoplastic) in order to estimate the appropriate cable time to ignition, HRRPUA, and flame spread rate. When information regarding the insulation or jacket material was not readily available, the cable was conservatively considered thermoplastic.

In all cases, where the cable material review indicated any thermoplastic cables were present, the cable raceway (cable tray) was conservatively assumed to be thermoplastic when determining the time to ignition, HRRPUA and/or spread rate. No mass-weighted average approach was used for cable trays.

The ignition criteria for thermoset and thermoplastic cables provided in NUREG/CR-6850, Appendix H, Table H-1, were used for estimating ignition time for the first tray in the stack. Subsequent ignition timing of additional cable trays in the stack or adjacent stacks is consistent with or more conservative than the timing rules in section R.4.2.2 of NUREG/CR-6850 and section 9.2.1 of NUREG/CR-7010.

NUREG/CR-6850, Appendix R provides cable tray properties and guidance on determining the HRRPUA and spread rate for both thermoset and thermoplastic cable trays. For most areas, BVPS fire modeling analyses use the NUREG/CR-6850 spread rates and the most conservative NUREG/CR-6850 Table R-1 bench scale HRRPUAs (adjusted using the Lee correlation, shown in the table below) for each cable type in the fire growth analysis for cable trays.

For some risk-significant fire scenarios, subsequent fire modeling refinements utilize the refined HRRPUAs recommended by NUREG/CR-7010, “Cable Heat Release, Ignition, and Spread in Tray Installations During Fire (CHRISTIFIRE) - Phase 1: Horizontal Trays” (as shown in the table below).

Table FM RAI 01d: Cable Tray HRRPUA

	Thermoset	Thermoplastic/Unknown
NUREG/CR-6850	214 kW/m^2	270 kW/m^2
NUREG/CR-7010	150 kW/m^2	250 kW/m^2

The recommendations of NUREG/CR-7010 allow for the flame spread rate of the predominant cable type to be used for trays with a mixture of thermoplastic and thermoset cables. However, for BVPS, FENOC conservatively treated trays containing any thermoplastic cable as thermoplastic raceways for the purpose of flame spread rate.

FM RAI 01

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:

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).

Response:

Transient fires were evaluated based on the 98th percentile HRR specified in NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," Table G-1, except in fire compartments 1-CR-4, 1-CS-1, 2-CB-1, 2-CB-6, 2-CV-1, 2-CV-3, and 2-SB-3 which utilized reduced transient HRRs.

The 98th percentile HRR for transient fires listed in NUREG/CR-6850, Table G-1 is based on tested fuel package configurations identified in NUREG/CR-6850, Table G-7. The configurations tested are various solid fuel packages such as cardboard, paper, plastics, cotton rags, and acetone. The model assumptions regarding location and HRR of transient combustibles in a fire area or zone will not be violated due to BVPS procedure requirements that paper, cardboard, scrap wood, rags and other trash combustibles shall not be allowed to accumulate in any critical building or location except in metal containers with approved fire suppressive lids.

The guidance provided in 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. ML12171A583) allows the user to choose a lower screening HRR for transient fires in a fire compartment based on "the specific attributes and considerations applicable to that location." The guidance indicates that "plant administrative controls should be considered in the appropriate HRR for a postulated transient fire" and that "a lower screening HRR can be used for individual plant specific locations if the 317 kW value is judged to be unrealistic given the specific attributes and considerations applicable to that location."

Walkdowns were performed and the room usage and contents were considered when prescribing the transient HRR. This provided assurance that the HRRs used for the transient scenarios, modeled in the fire PRA, would be an appropriate representation of any potential transient fire in the area. All areas where a reduced transient HRR is utilized are safety related areas and are therefore regulated by the BVPS transient control program. The combination of transient controls and expected room usage and contents allow for an appropriate reduced transient HRR to be selected as follows.

In fire compartments 1-CR-4, 2-CB-1, 2-CV-1, and 2-CV-3, the 75th percentile transient HRR (142 kW) was used for the majority of transient fire scenarios. The HRR is reduced in these fire compartments for fire scenarios based on the following criteria:

- Large combustible liquid fires are not expected in the areas represented by the reduced HRR transient fire scenarios, since activities in these areas do not include maintenance of oil containing equipment. Any portion of a fire compartment where oil containing equipment is present (for example, 2-CV-3) will continue to utilize a 317 kW transient fire.

- The materials composing the fuel packages included in Table G-7 of NUREG/CR-6850 are not representative of the typical materials expected to be located in these areas. Untreated wood (typically prohibited at nuclear power plants), airline trash bags with over 2 kg of paper products or over 4 kg of straw, grass, or eucalyptus duff are unlikely to be present in 1-CR-4, 2-CB-1, 2-CV-1, or 2-CV-3. Since fires that are not bounded by the tests are not expected to occur in fire compartments 1-CR-4, 2-CB-1, 2-CV-1, or 2-CV-3, the 75th HRR was deemed appropriate for use.

In fire compartments 1-CS-1, 2-CB-6, and 2-SB-3, a 69 kW transient HRR was used for all transient fires. In addition to the justification provided above, a transient HRR may be further refined to 69 kW for select fire compartments based on the following criteria:

- A transient fire in an area of strict combustible controls, where only small amounts of contained trash are considered possible, is judged to be no larger than the 75th percentile fire in an electrical cabinet with one bundle of qualified cable.

- A review of the transient ignition source tests in Table G-7 of NUREG/CR-6850 indicates that of the type of transient fires that can be expected in these rooms (polyethylene trash can or bucket containing rags and paper) were measured at peak heat release rates of 50 kW or below.

Administrative controls were enhanced in fire compartments 1-CR-4, 1-CS-1, 2-CB-1, 2-CV-1, and 2-SB-3 to limit combustible transient material within the fire compartment by designating these compartments as “Transient Combustible Exclusion Areas.” Exclusion areas have localized visual warnings such as red painted floor areas or other signage such as marked floor mats at room entrances and exits, indicating transient combustibles are not permitted.

Fire compartments 2-CB-6 and 2-CV-3 will be designated as “Transient Combustible Exclusion Areas” as part of LAR Attachment S, Table S-3, Implementation Item BV1-2907 in a future submittal.

Additionally, condition reports dated between May 30, 2014 and April 10, 2015 identifying violations of transient combustible and flammable materials controls were reviewed. The condition reports initiated corrective actions for these violations, which have been completed. BVPS has escalated the level of concern with the control of transient combustibles, including the requirements of NFPA 805. This includes the added discussion of transient combustibles, transient combustible exclusion areas, NFPA 805, and the importance of fire protection for all site personnel into general access training or plant access training.

Therefore, based on the expected room usage and contents, administrative controls and procedures, transient combustible control program, and training emphasis for all site personnel, it is expected that the HRR selected for transient fire scenarios in the subject fire compartments will not be violated during and post-transition.

FM RAI 01

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:

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.**

Response:

The Consolidated Model of Fire and Smoke Transport (CFAST) was used at BVPS in lieu of the MQH method to provide a better representation of the post-fire conditions in fire compartments with complex or unique geometries and/or ventilation aspects, and to provide additional information not readily available from MQH, such as lower layer gas temperatures and hot gas layer (HGL) heights. The specific uses of CFAST at BVPS are provided below:

- CFAST was used for various fire compartments in the temperature sensitive equipment HGL study to calculate upper and lower gas layer temperatures, and the gas layer heights.

- CFAST was used in support of the multi-compartment analysis to calculate the HGL temperature and layer height in the exposed fire compartments.

- CFAST was used to calculate the HGL temperature for the bounding fire scenario (that is, fire scenario with the largest HRR) in 1-NS-1. CFAST was utilized because of its ability to calculate upper and lower gas layer temperatures as well as its ability to model unique geometrical configurations and ventilation aspects, such as modeling vents opening at a specific time (for example, door opening at 10 minutes).

- The main control room analysis utilized CFAST to calculate the HGL temperature, layer height, and smoke concentration, in order to determine when the habitability criteria would be reached and thus when abandonment would occur.

FM RAI 01

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:

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.

Response:

The sprinkler activation correlation was not used for transient fires and a transient fire growth profile was not necessary in the sprinkler activation correlation.

Detection timing, for both smoke and heat detectors, was determined using NUREG-1805 FDT 10 *Estimating Detector Response Time*. Using the physical parameters (radial distance from fire source to detector, height of ceiling above the fire source, and ambient temperature) required for each fire scenario, the minimum fire size required to activate the detector was determined.

If the minimum HRR required to activate the detector was less than the critical HRR evaluated for target damage, then detection may have been credited. In these cases, the time to detection was determined by using a standard t^2 fire growth profile, calculated for each detailed fire scenario.

When utilizing the t^2 fire growth profile for detection in transient scenarios, the guidance contained in NUREG/CR-6850, Supplement 1, Chapter 17, was used to determine the time to peak HRR of a transient fire. Chapter 17 states that a time-dependent fire growth model is appropriate for any situation where the basis of its use can be established. Three categories of transient growth profiles are provided with their respective times to peak heat release rate:

- Common trash can fire (8 minutes).
- Common trash bag fire (2 minutes).
- Spilled solvents or combustible liquids (0 minutes).

The profile that was selected for each transient ignition source was based on administrative controls and the expected contents within the compartment. Detection was assumed to occur when the minimum required HRR for detection was reached in the t^2 fire growth profile.

The delay to detector activation, as calculated by FDT10, was omitted for t^2 fire growth profiles. The FDT10 activation time assumes exposure to a steady HRR from time zero, with no regard for fire growth. Using a t^2 fire growth profile, the thermal response of the detector activation is considered to be accounted for, as the fire grows due to heat/smoke exposure. Therefore, no additional delay is considered necessary.

FM RAI 01

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:

i. **Specifically regarding the use of the algebraic models:**

   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.**

<u>Response:</u>

Small vent dimensions are conservative for HGL estimates when using the method of MQH. Plant walkdowns were conducted for each fire compartment to confirm that there was a door opening with dimensions of at least 0.9 meter (m) by 2.1 m. An exception is fire compartment 1-CV-3 which was modeled with its non-standard-sized door of 0.9 m by 1.5 m.

Once the fire is detected, fire brigade personnel will be dispatched to the room and are expected to open a door and perform suppression activities, which would provide the door opening assumed in the fire modeling analysis. Prior to this action, and in the early stages of the fire scenarios, a single door opening is considered an appropriate representation of the various natural ventilation openings within the room (for example, door gaps, HVAC ventilation openings, and so on). This single door opening is representative of the plant conditions and is conservative since most compartments have more than one door and have other natural and mechanical ventilation openings.

FM RAI 01

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:

i. **Specifically regarding the use of the algebraic models:**

   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.**

Response:

When the algebraic models were implemented for HGL calculations using the MQH method, all vents in the floor or ceiling, or in a wall at or near the ceiling of the compartment were disregarded and instead represented by a single door opening. This is considered conservative because the inclusion of these vents would result in additional room cooling and therefore lower predicted HGL temperatures. Even in fire compartments where the only vent in the fire compartment is at the ceiling (for example, 1-CV-3), the use of a single vertical vent is considered acceptable since in reality, the air entrainment from outside the compartment would be considerably reduced and would limit the oxygen supply available for combustion, and reduce the HGL temperature.

The single door opening was assumed open for the entire duration of the fire, providing an inlet for air, which is considered an appropriate representation of various natural ventilation openings in the room (for example, door gaps, and HVAC ventilation openings) in the early stages of the fire scenarios. It also reflects the actual ventilation area when the fire brigade opens a door to perform suppression activities in the latter stages of the fire scenarios.

Therefore, the method described above is a conservative approach for HGL calculations in compartments with vents in the floor or ceiling, or in a wall at or near the ceiling of the compartment.

FM RAI 01

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:

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

   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 [sic] 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.**

Response:

The copier, boxes with paper, and plastic trash can have been removed from behind the BVPS-2 vertical main control board (MCB) and placed against the wall near the alternate north MCR entrance. The copier, boxes of paper, and plastic trash can are examples of transient combustibles and the transient fires considered in the MCR abandonment calculations, based on the recommended NUREG/CR-6850 Table E-9 transient fire, would bound fires involving these transient combustibles. Further, the abandonment calculation showed a 98th percentile transient fire (317 kW) would still not lead to abandonment conditions. With the exception of the specific issue related to consideration of loose trash fires in the MCR being addressed in FM RAI 01(j)(ix) (response to be submitted at a later date), the transient fires considered in the MCR abandonment calculations are considered appropriate and representative.

The kitchen is a very small enclosed room, with access from the MCR via a single fire-rated door. The entire kitchen boundary, including door and walls, is 1 hour fire rated. The ignition sources in this room are typical small kitchen appliances. There are no fire PRA targets in the kitchen area and it is well separated from PRA targets found in the MCR. Due to the minimal combustible loading and ignition sources, a 1 hour rated fire barrier, and effective spatial and physical separation from MCR targets and secondary combustibles, the risk from kitchen fires is considered to be bounded by other fixed and transient combustible sources in the MCR. Therefore, it has not been explicitly considered in the MCR abandonment calculations.

All unscreened ignition sources identified in the BVPS-1 computer room have been included in the MCR component counts and considered in the MCR abandonment calculations.

The BVPS-2 computer room is not part of the MCR fire compartment. It is a separate fire compartment (2-CB-4), and consequently, computer room fires are not considered as part of the MCR abandonment calculations.

No significant fixed ignition sources above and beyond typical office equipment were identified in the office. Transient combustible sources that may be present in the office are considered to be captured and bounded by the transient fire modeling applied within the MCR.

FM RAI 01

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:

- **j) Specifically regarding the use of CFAST in the MCR abandonment calculations for Units 1 and 2:**
  - **vi. Confirm that all cabinets in the MCR with multiple bundles of unqualified cable indeed have closed doors as assumed in the CFAST calculations.**

Response:

It has been confirmed that all cabinets in the MCR with multiple bundles of unqualified cable have closed doors.

FM RAI 01

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:

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.

Response:

The MQH HGL calculation was used to determine the maximum HGL temperature in the exposing compartment and conservatively no inter-compartment openings between the exposing and exposed were considered at this stage of the MCA. To allow for natural ventilation, the MQH HGL calculation assumes an external ventilation opening represented by a single open door. If the HGL temperature in the exposing compartment did not exceed the critical temperature for damage to occur, then regardless of the openings in the barrier, it would not be possible for a damaging HGL to form in any exposed compartments. For cases where a damaging HGL could form in the exposing compartment, further detailed MCA CFAST fire modeling was performed, including consideration of openings between the exposed and exposing compartments. The openings in the CFAST HGL calculation between the exposing and exposed compartments were determined following a review of opening details gathered from drawings, walkdown information, and a propagation pathway credibility assessment. If a barrier contained any permanent opening, that opening size was used in the HGL calculation. For cases with no permanent openings, the worst-case remaining opening type (that is, fire doors, fire dampers, or penetrations) was applied. Generally, fire doors were assumed to be 0.9 m x 2.1 m openings, fire dampers to be 1 m x 1 m openings, and penetration seals to be 0.1 m x 0.1 m openings. However, larger areas may have been used as applicable. In all cases, the vent sizes modeled bound the existing plant conditions for a given fire compartment.

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).**

Response:

An investigation was performed to classify each of the various cable types used at BVPS as either thermoset (TS) or thermoplastic (TP) based upon cable jacket or insulation material. This information was combined with that in Appendix H of NUREG/CR-6850 to determine thermal damage criteria for TP targets (including raceways containing mixed or unknown cable types) as follows:

- Critical Temperature: 205 degrees Celsius (ºC), or 400 degrees Fahrenheit (ºF)
- Critical Heat Flux: 6 kW/,square-meter (m^2), or 0.5 British Thermal Unit per square-foot second (Btu/ft^2s)

Similarly, the thermal damage criteria for TS targets are as follows:

- Critical Temperature: 330 ºC (625 ºF)
- Critical Heat Flux: 11 kW/m^2 (1.0 Btu/ft^2s)

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.**

Response:

The Heskestad and Delichatsios smoke detection actuation correlation (the temperature to smoke density correlation) is based upon the ceiling jet temperature predicted by Alpert's ceiling jet temperature correlation; therefore, the normalized parameters for the ceiling jet temperature correlation are applicable. The normalized parameter that applies to the Alpert's ceiling jet temperature correlation is the ceiling jet distance ratio, and the validation range is 1.2-1.7, as provided in NUREG-1824. The Heskestad and Delichatsios smoke detection actuation correlation using Alpert's ceiling jet temperature correlation was either applied within the validated range or has been reviewed and justified as acceptable based on NUREG-1824. The justifications are documented in the BVPS fire modeling verification and validation documentation. Furthermore, all of the models fall within the acceptable validation range provided by Table 3-3 of the Supplement 1 Draft to NUREG-1824.

In addition, the smoke detection actuation correlation was applied to fuels, configurations, and environmental conditions consistent with those described in Chapter 4-1 of the Society of Fire Protection Engineers (SFPE) Handbook and NUREG-1805, "Fire Dynamics Tools (FDTs): Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Program." The correlation was also applied within the limitations described in these publications.

Heskestad and Delichatsios correlated a smoke temperature change of 10°C (18°F) based upon typical fire fuels. The materials tested to develop the Heskestad and Delichatsios smoke detection actuation correlation are representative of the fuels modeled for smoke detector activation. The tested materials include various plastics, foams, and paper, possessing smoke properties similar to the fires modeled at BVPS. Additionally, when implementing the Heskestad and Delichatsios smoke detection actuation correlation (that is, FDT10), the 10°C (18°F) ceiling jet temperature rise from ambient temperature is preserved by adjusting the activation temperature of the smoke detector accordingly.

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.**

Response:

Fire modeling calculations have been, and will be, performed by engineers who meet the qualification requirements of Section 2.7.3.4 of NFPA 805 (2001).

Fire modeling to support the LAR and fire PRA development was performed by FENOC and contract personnel using their respective companies' procedures and Quality Assurance programs. These procedures require that project personnel assigned to each task have the proper experience and training to perform the work. This is verified by FENOC and contractor company management. All contractor engineering procedures and quality assurance manuals have been reviewed for compliance with the FENOC Quality Assurance Program.

These FENOC and contractor personnel were chosen based on their experience and expertise in fire modeling. The qualifications needed to perform fire modeling related tasks depend, in part, on the specific role of the personnel. Appropriate qualifications for FENOC and contractor personnel using, applying, and approving fire modeling tools include required reading on fire modeling project instructions, relevant industry methodology and/or guidance documents such as NUREG/CR-6850, NUREG-1934, NUREG-1805, and applicable fire modeling software user's guide documents. Other requirements include training and/or mentoring in fire growth analysis, zone of influence (ZOI) calculations, and fire modeling tools. The qualification requirements to perform other fire modeling related tasks depend in part on the personnel's specific assigned role. Some sub-tasks of fire modeling may be assigned to other staff with experience and skill set commensurate with the task. Example tasks include walkdown data collection, raceway drawing reviews, and data entry.

In addition, as stated in LAR section 4.7.3, FENOC will develop qualification requirements for FENOC personnel to perform fire modeling. These qualification guides will be developed per applicable FENOC training program procedures and in accordance with the FENOC Quality Assurance Program.

Implementation item BV1-3117 has been created to develop position specific guides meeting the requirements of NFPA 805 Section 2.7.3.4, regarding personnel qualifications. A revision to the LAR Attachment S, Table S-3 for this added implementation item will be provided in a future submittal.

FM RAI 05

Regarding qualifications of users of engineering analyses and numerical models (i.e., fire modeling techniques):

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.**

Response:

Fire modeling to support the LAR and fire PRA development was performed by FENOC and contractor personnel using their respective companies' procedures and Quality Assurance programs. These procedures require that FENOC and any contractor management be responsible for the overall project performance of fire modeling tasks and for ensuring that project personnel assigned to each task have the proper experience and training to perform the work. Engineers performing fire modeling are required to perform their duties in accordance with the fire modeling procedure and Quality Assurance program. This process was followed to ensure the personnel performing fire modeling were qualified. All contractor engineering procedures and quality assurance manuals have been reviewed for compliance with the FENOC Quality Assurance Program.

During the transition, FENOC will continue to utilize qualified personnel to perform fire modeling and will continue to use the process described above. Additionally, qualification requirements and training will be created to provide a means of qualifying FENOC engineers to perform fire modeling. This requirement will be included as implementation item BV1-3117 in LAR Attachment S, Table S-3. To address this implementation item, qualification guides will be developed and implemented per applicable FENOC training program procedures and in accordance with the FENOC Quality Assurance Program.

When FENOC personnel perform fire modeling post transition, the FENOC processes for developing qualifications will be followed to ensure that assigned personnel are qualified. FENOC training procedures require that personnel be qualified to perform assigned tasks and managers and supervisors are responsible for ensuring that personnel are qualified. Once the fire modeling qualification guides are developed, the new guidance, in conjunction with existing FENOC training procedures will ensure personnel performing fire modeling are qualified and that their qualifications are adequately maintained.

Implementation item BV1-3117 has been created to develop position specific guides meeting the requirements of NFPA 805 Section 2.7.3.4, regarding personnel qualifications. A revision to the LAR Attachment S, Table S-3 for this added implementation item will be provided in a future submittal.

FM RAI 05

Regarding qualifications of users of engineering analyses and numerical models (i.e., fire modeling techniques):

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

Response:

Throughout the BVPS FPRA process, the fire modeling personnel and the FPRA personnel maintained frequent communications. Periodic meetings with the entire FPRA and fire modeling teams were held, as necessary to ensure proper communication. The fire modeling analyses were developed into approved vendor documents which were then used as input to the Fire PRA. These analyses are controlled under the vendor technical information review processes which require appropriate cross-disciplinary reviews are performed and impacted departments (such as the PRA group) are notified of the change.

FM RAI 05

Regarding qualifications of users of engineering analyses and numerical models (i.e., fire modeling techniques):

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.**

Response:

For consistency, each major fire modeling task (for example, scoping fire modeling, detailed fire modeling, multi-compartment analysis, and main control room analysis) was assigned to a single supporting consultant. Therefore, a single vendor procedure and a consistent methodology were utilized for all analyses within each major task. All applicable contractor engineering procedures and quality assurance manuals have been reviewed for compliance with the FENOC Quality Assurance Program to ensure consistency.

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.**

Response:

Fire modeling was performed in support of the BVPS fire PRA, utilizing codes and standards developed by industry and NRC and that were verified and validated in authoritative publications such as NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications." In general, the fire modeling was performed using conservative methods and input parameters that were based upon NUREG/CR-6850, "Fire PRA Methodology for Nuclear Power Facilities." This approach was used based upon the current state of knowledge regarding the uncertainties related to the application of the fire modeling tools and associated input parameters for specific plant configurations.

The detailed fire modeling task develops a probabilistic output in the form of target failure probabilities and are subject to both aleatory (statistical) and epistemic (systematic) uncertainty.

Appendix V of NUREG/CR-6850 recommends that to the extent possible, modeling parameters should be expressed as probability distributions and propagated through the analysis to arrive at target failure probability distributions. These distributions should be based on the variation of experimental results as well as the analyst's judgment. To the extent possible, more than one fire model can be applied and probabilities assigned to the outcome which describes the degree of belief that each model is the correct one.

Due to the uncertainty with each of these parameters, the fire modeling task has selected conservative values for some of key input parameters while utilizing the mean values for the rest to provide safety margin as described below. Per NEI 04-02, there is no clear definition of an adequate safety margin; however, the safety margin should be sufficient to bound the uncertainty within a particular calculation or application. The BVPS fire modeling documentation for each fire compartment provides a list of items that were modeled conservatively and that provide safety margin. Some examples include the following items:

- The majority of the BVPS fire PRA's scenarios involving electrical equipment (including the electrical split fraction of pump fires) utilize the 98th percentile HRR for the zone of influence. This is considered conservative.

- The HRR value for some cabinets was based upon non-qualified internal cable. This results in a conservative HRR as these cabinets likely contain some amount of qualified cable.

- The fire elevation in most cases is at the top of the cabinet or pump body. This is considered conservative, since the combustion process will occur where the fuel mixes with oxygen, which is not always at the top of the ignition source. Additionally, the guidance of FAQ 08-0043 recommends fire be modeled 1 foot below the top of the electrical cabinets that are sealed at the top, and reinforces that this method is conservative.

- The radiant fraction utilized is 0.4. This represents a 33 percent safety margin over the normally recommended value of 0.3. In addition, the convective heat release rate fraction utilized is 0.7. The normally recommended value is between 0.6 and 0.65, and thus the use of 0.7 is conservative.

- For transient fire impacts, a large bounding transient zone assumes all targets within its ZOI are affected by a fire. Time to damage is usually calculated based on the most severe (closest) target. This is considered conservative, since a transient fire would actually have a much smaller ZOI and varying damage times for the various HRR bins which make up the total HRR probability distribution. This approach is implemented to minimize the multitude of transient scenarios to be analyzed.

- In some fire compartments, transient fires assume damage to all targets from the floor to the ceiling. This is conservative since most transient fires are not expected to have a ZOI that would reach the ceiling.

- The fire elevation for transient fires was assumed to be 2 feet to account for any transient fires not occurring at floor level. This is conservative since most transient fires are expected to be below this height (that is, at floor level).

- For HGL calculations using the MQH correlation, no equipment or structural steel is credited as a heat sink, because the closed-form correlations used do not account for heat loss to these items.

- For the non-fire dynamics simulator (FDS) analyses, as the fire propagates to secondary combustibles, the fire is conservatively modeled as one single fire using the fire modeling closed-form correlations. The resulting plume temperature estimates used are therefore conservative, since the fire would actually be distributed over a large surface area, and would be less severe at the target location.

- For most scenarios, target damage is assumed to occur when the exposure environment meets or exceeds the damage threshold. No additional time delay due to thermal response is given.

- Oil fires are analyzed as both unconfined and confined spills with 20-minute durations. Unconfined spills result in large heat release rates, but usually burn for seconds. The oil fires in this compartment have been conservatively analyzed for 20 minutes to account for the uncertainty in the oil spill size.

- For many scenarios, automatic or manual detection and suppression are not credited which leads to conservative results.

- Scenarios that identify the time to automatic detection and suppression do not utilize the approach of adding the HGL temperature to the ceiling jet temperature. Including the effects of a HGL would result in shorter detection and suppression times; therefore, the use of the ceiling jet correlation is considered conservative.

- All fires modeled using FDS assume that the fire does not experience the effects of oxygen deprivation. This is a conservative assumption that enables the fire to continuously burn in environments with oxygen levels below that required to sustain the prescribed HRR.

- The fire dynamics tools (FDTs) generally over-predict hot gas layer temperatures and this over-prediction is expected to lead to conservative results.

- Not every cable tray is filled to capacity. In many cases, cable trays that are partially full have been assumed to be filled to capacity, which provided a conservative estimate of the surface area and corresponding fire severity.

- For some scenarios fire propagation to the first cable tray has been estimated to be one minute. In most cases, propagation to the first cable tray would be greater than one minute; therefore, this is considered conservative.

- Many cable trays have metal top or bottom covers which are mostly solid with the exception of infrequent small gaps (for example, less than 1 inch). A solid metal bottom cover would normally delay ignition and damage by 20 minutes. Metal top or bottom covers with small and infrequent gaps are not credited to delay damage of target cables, which is conservative. Additionally, based on FM RAI 2b, the fire modeling analysis for cable trays with perforated and corrugated tray covers is being updated to remove credit for a delay time to damage or ignition. In actuality, these covers would provide some delay to both damage and ignition. Therefore, assuming no delay is conservative.

- In most cases, credit was not given to cable tray covers for damage and fire spread to cable trays containing any thermoplastic or unknown cables. Not crediting the covers is considered conservative as the percentage of thermoplastic cables in these trays is often very low. In addition, the much more conservative thermoplastic fire growth characteristics were used for the majority of mixed thermoplastic and thermoset cable trays.

- Cable trays with any amount of thermoplastic cable, regardless of percentage were treated as thermoplastic for fire spread rate, even though NUREG/CR-7010 would allow the predominant type to be used.

- High energy arcing fault scenarios were conservatively assumed to be at peak fire intensity for 20 minutes from time zero (ignition), even though the initial arcing fault is expected to consume the contents of the cabinet and burn for only a few minutes.

- For many non-risk-significant scenarios, conduit elevations were assumed to be within the flame height such that they were subjected to damaging plume temperatures and a potential damaging radiant heat flux.

FM RAI 06

Regarding the uncertainty analysis for fire modeling:

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

Response:

In the area of the fire modeling, "model" uncertainties and associated assumptions can be introduced through two separate phases of the fire modeling; first from selection of fire modeling tools such as FDTs and CFAST, and secondly through their applications to the development of fire scenarios.

NUREG-1934 states that “model” uncertainties can be estimated using the processes of verification and validation. Model uncertainty is based primarily on comparisons of model predictions with experimental measurements as documented in NUREG-1824 "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," final report, dated May 2007 and other model validation studies.

All of the fire models used and listed in Attachment J of the BVPS NFPA 805 LAR were within or very near the experimental uncertainty, as determined by NUREG-1824. Where applicable, all fire models listed below were applied within the validation ranges or the use was justified as acceptable with a subsequent analysis. Each model is discussed below.

Hot Gas Layer Temperature using FDTs

The predictive capability of the hot gas layer temperature parameter using FDTs is characterized as YELLOW+ according to NUREG-1824, Volume 1, Table 3-1.

As stated in NUREG-1824, Volume 1, section 2.6.2, a YELLOW± characterization is assigned "If the first criterion is satisfied and the calculated relative differences are outside the experimental uncertainty but indicate a consistent pattern of model over-prediction or under-prediction, then the model predictive capability is characterized as YELLOW+ for over-prediction, and YELLOW- for under-prediction. The model prediction for the specific attribute may be useful within the ranges of experiments in this study, and as described in Tables 2-4 and 2-5, but the users should use caution when interpreting the results of the model. A complete understanding of model assumptions and scenario applicability to these V&V results is necessary. The model may be used if the grade is YELLOW+ when the user ensures that model over-prediction reflects conservatism. The user must exercise caution when using models with capabilities described as YELLOW±."

NUREG 1824, Volume 3, section 6.1 states that: "The FDTs models for HGL temperature capture the appropriate physics and are based on appropriate empirical data. FDTs generally over-predict HGL temperature, outside of uncertainty." The over prediction is expected to lead to conservative results and increased safety margin.

Hot Gas Layer Height and Temperature using FDS

The predictive capability of the hot gas layer height and temperature parameters in FDS is characterized as GREEN according to Table 3-1 of NUREG-1824.

A GREEN characterization is given “If both criteria are satisfied (that is, the model physics are appropriate for the calculation being made and the calculated relative differences are within or very near experimental uncertainty), then the V&V team concluded that the fire model prediction is accurate for the ranges of experiments in this study, and as described in Tables 2-4 and 2-5. A grade of GREEN indicates the model can be used with confidence to calculate the specific attribute. The user should recognize, however, that the accuracy of the model prediction is still somewhat uncertain and for some attributes, such as smoke concentration and room pressure, these uncertainties may be rather large. It is important to note that a grade of GREEN indicates validation only in the parameter space defined by the test series used in this study; that is, when the model is used within the ranges of the parameters defined by the experiments, it is validated.”

NUREG-1824, Volume 7, section 6.1, summary states: “FDS is suitable for predicting HGL temperature and height, with no specific caveats, in both the room of origin and adjacent rooms. In terms of the ranking system adopted in this report, FDS merits a Green for this category, based on… The FDS predictions of the HGL temperature and height are, with a few exceptions, within experimental uncertainty.”

Hot Gas Layer Temperature and Height using the Consolidated Model of Fire and Smoke Transport (CFAST)

The predictive capability of the hot gas layer height and temperature parameters in CFAST was characterized as GREEN according to NUREG-1824, Volume 1, Table 3-1. The GREEN designation is discussed above under the "Hot Gas Layer Height and Temperature using FDS" heading. Specifically, the GREEN designation was assigned to the CFAST HGL temperature parameter calculated in the fire compartment of origin. Compartments remote from the fire were assigned a YELLOW designation which “suggests that one exercise caution when using the model to evaluate this quantity – consider carefully the assumptions made by the model, how the model has been applied, and the accuracy of the results.”

As stated in NUREG-1824, Volume 1, section 2.6.2, a YELLOW characterization is assigned "If the first criterion is satisfied and the calculated relative differences are outside experimental uncertainty with no consistent pattern of over- or under-prediction, then the model predictive capability is characterized as YELLOW. A YELLOW classification is also used despite a consistent pattern of under or over-prediction if the experimental data set is limited. Caution should be exercised when using a fire model for predicting these attributes. In this case, the user is referred to the details related to the experimental conditions and validation results documented in Volumes 2 through 6.

The user is advised to review and understand the model assumptions and inputs, as well as the conditions and results to determine and justify the appropriateness of the model prediction to the fire scenario for which it is being used."

NUREG-1824, Volume 5, section 6.1 summary states: "The CFAST predictions of the HGL temperature and height are, with a few exceptions, within or close to experimental uncertainty. The CFAST predictions are typical of those found in other studies where the HGL temperature is typically somewhat over-predicted and HGL height somewhat lower than experimental measurements. These differences are likely attributable to simplifications in the model dealing with mixing between the layers, entrainment in the fire plume, and flow through vents. Still, predictions are mostly within 10 % [percent] to 20 % of experimental measurements."

Ceiling Jet Temperature using the Alpert Correlation

The predictive capability of the ceiling jet temperature parameter using the Alpert correlation in the fire-induced vulnerability evaluation (FIVE) fire model is characterized as YELLOW+ according to NUREG-1824, Volume 1, Table 3-1. The YELLOW+ designation is discussed above under the "Hot Gas Layer Temperature using FDTs" heading. Specifically, NUREG-1824, Volume 4, section 6.2 summary states:

> The Alpert correlation under-predicts ceiling jet temperatures in compartment fires with an established hot gas layer. This result is expected because the correlation was developed without considering HGL effects. The original version of FIVE accounted for HGL effects by adding the ceiling jet and HGL temperature. This practice results in consistent over-predictions of the ceiling jet temperature. The approach of adding ceiling jet temperatures to the calculated hot gas layer continues to be the recommended method for FIVE-Rev 1 users. Based on the above discussion, a classification of Yellow+ is recommended if HGL effects on the ceiling jet temperature are considered using the approach described in the above bullet. The Alpert correlation by itself is not intended to be used in rooms with an established hot gas layer.

The approach of adding the hot gas layer temperature to the ceiling jet temperature was not used in the BVPS fire modeling analysis. The primary application of the ceiling jet correlation at BVPS was the determination of detection and suppression timing, in which the ceiling jet velocity is a sub-model in the analysis. Including the effects of a hot gas layer would have resulted in shorter detection and suppression times, and therefore the BVPS approach is conservative. The use of the ceiling jet correlation for target damage was bounded by the use of the point source radiation model and is justified and discussed in the BVPS fire modeling V&V documentation.

Plume Temperature using FDTs

The predictive capability of the plume temperature parameter using FDTs is characterized as YELLOW- according to NUREG-1824, Volume 1, Table 3-1. The YELLOW- designation is discussed above under the "Hot Gas Layer Temperature using FDTs" heading.

NUREG-1824, Volume 3, section 6.2 summary states "The FDTs model for plume temperature is based on appropriate empirical data and is physically appropriate. FDTs generally under-predicts plume temperature, outside of uncertainty, because of the effects of the hot gas layer on test measurements of plume temperature. The FDTs model is not appropriate for predicting the plume temperatures at elevations within a hot gas layer."

The FDTs plume correlation for fire modeling applications was used within the limitations provided in NUREG-1824. The effects of the plume and hot gas layer interaction were analyzed and documented in the BVPS fire modeling verification and validation documentation.

Plume Temperature using FDS

The predictive capability of the plume temperature parameter using FDS is characterized as YELLOW according to NUREG-1824, Table 3-1. The YELLOW designation is discussed above under the “Hot Gas Layer Temperature and Height using the Consolidated Model of Fire and Smoke Transport (CFAST)” heading.

NUREG-1824, Volume 7, section 6.3 summary states: "The FDS hydrodynamic solver is well-suited for this application. FDS over-predicts the lower plume temperature in BE [benchmark exercise] #2 because it over-predicts the flame height. FDS predicts the FM/SNL [Factory Mutual and Sandia National Laboratories] plume temperature to within experimental uncertainty. The simulations of BE #2 and the FM/SNL series are the most time-consuming of all six test series, mainly because of the need for a fairly fine numerical grid near the plume. It is important that a user understand that considerable computation time may be necessary to well-resolve temperatures within the fire plume. Even with a relatively fine grid, it is still challenging to accurately predict plume temperatures, especially in the fire itself or just above the flame tip. There are only nine plume temperature measurements in the data set. A more definitive conclusion about the accuracy of FDS in predicting plume temperature would require more experimental data."

In accordance with the guidance provided in NUREG-1934, a dimensionless D*/ dx ratio between 5 to 10 produces favorable FDS results at moderate computational cost, where D* represents the fire’s characteristic diameter, and dx represents the size of a grid cell. This guidance was applied in the BVPS FDS applications that analyzed plume temperatures. The meshes used in BVPS fire modeling were considered to be sufficiently fine to analyze plume temperatures in each case. In addition, the plume temperatures within the flaming region are not the focal point of either study.

Flame Height using FDTs

The predictive capability of the flame height parameter using FDTs is characterized as GREEN according to NUREG-1824, Table 3-1. The GREEN designation is discussed above under the "Hot Gas Layer Height and Temperature using FDS" heading.

NUREG-1824, Volume 3, section 6.3 summary states "The FDTs model predicted flame heights consistent with visual test observations."

Smoke Concentration using CFAST

The predictive capability of the smoke concentration parameter in CFAST is characterized as YELLOW according to NUREG-1824, Volume 1, Table 3-1. The YELLOW designation is discussed above under the “Hot Gas Layer Temperature and Height using the Consolidated Model of Fire and Smoke Transport (CFAST)” heading.

NUREG-1824, Volume 5, section 6.6 summary states: "CFAST is capable of transporting smoke throughout a compartment, assuming that the production rate is known and that its transport properties are comparable to gaseous exhaust products. CFAST typically over-predicts the smoke concentration in all of the BE #3 tests, with the exception of Test 17. Predicted concentrations for open-door tests are within experimental uncertainties, but those for closed-door tests are far higher. No firm conclusions can be drawn from this single data set. The measurements in the closed-door experiments are inconsistent with basic conservation of mass arguments, or there is a fundamental change in the combustion process as the fire becomes oxygen-starved.”

The smoke concentration was analyzed and was used as one criterion to determine the probability of MCR abandonment at BVPS following a fire scenario in the MCR. Because the smoke concentration was over-predicted for both the open-door and closed-door test configurations as indicated in NUREG-1824, the BVPS CFAST results were considered conservative.

The smoke production rates used in the model were conservatively selected from Table 3-4.16 of the SFPE Handbook of Fire Protection Engineering, 4th Edition. Because transport properties of the smoke are expected to be comparable to gaseous exhaust products, the use of the model is within the limitations and the experimental uncertainty.

Radiant Heat using FDTs

The predictive capability of the radiant heat parameter of the FDTs is characterized as YELLOW according to NUREG-1824, Volume 1, Table 3-1. The YELLOW designation is discussed above under the “Hot Gas Layer Temperature and Height using the Consolidated Model of Fire and Smoke Transport (CFAST)” heading.

NUREG-1824, Volume 3, section 6.4 summary states: "The FDTs point source radiation and solid flame radiation model in general are based on appropriate empirical data and is physically appropriate with consideration of the simplifying assumptions. The FDTs point source radiation and solid flame radiation model are not valid for elevations within a hot gas layer. FDTs predictions had no clear trend. The model under- and over-predicted, outside uncertainty. The point source radiation model is intended for predicting radiation from flames in an unobstructed and smoke-clear path between flames and targets."

Only the FDTs point source radiation model was used in the BVPS fire modeling. NUREG-1824 states that there is no clear trend in under- or over-prediction for the point source model. The model over-predicted heat flux for locations immersed in a hot gas layer, which is likely due to smoke and the HGL preventing radiation from reaching the gauges. This over-prediction is expected to lead to conservative results and increased safety margin. In a smaller number of cases, the model under-predicted heat flux due to contribution of radiation from the HGL. In order to account for this potential under prediction, conservatism was built into the use of the radiation model at BVPS, including the use of a radiant heat release rate fraction of 0.4, as opposed to the normally recommended value of 0.3.

In addition, NUREG-1824 states that the point source model is not intended to be used for locations relatively close to the fire. In the BVPS fire modeling analysis, targets located close to the fire were conservatively failed within the early stages of fire growth.

<u>Radiant Heat using FDS</u>

The predictive capability of the radiant heat parameter in FDS is characterized as YELLOW according to NUREG-1824, Table 3-1. The YELLOW designation is discussed above under the “Hot Gas Layer Temperature and Height using the Consolidated Model of Fire and Smoke Transport (CFAST)” heading.

Even though the FDS radiant heat model was designated as Yellow, NUREG 1824, Volume 7, section 6.8 states that: "FDS has the appropriate radiation and solid phase models for predicting the radiative and convective heat flux to targets, assuming the targets are relatively simple in shape. FDS is capable of predicting the surface temperature of a target, assuming that its shape is relatively simple and its composition fairly uniform. FDS predictions of heat flux and surface temperature are generally within experimental uncertainty, but there are numerous exceptions attributable to a variety of reasons. The accuracy of the predictions generally decreases as the targets move closer to, or go inside of the fire. There is not enough near-field data to challenge the model in this regard."

FDS was used to calculate radiant heat exposure to determine the radiant heat exposure to an electrical cabinet from a transient fire. The limitations outlined in NUREG-1824 were not of concern based upon the following:

1) Heat flux was not calculated for any targets inside of the fire. For the FDS analyses performed, all potential radiant heat targets were located a minimum of 3 feet horizontally away from the fire.

2) All targets were simple in shape and not complex in nature. The targets analyzed were a flat sheet metal panel and heat flux monitoring devices located independent of obstructions. In both instances, the targets were of simple geometry and uniform composition.

Since the model was not used outside of the limitations identified, BVPS concluded that the FDS predictions of heat flux were within experimental uncertainty.

Completeness Uncertainties

Potential model uncertainties introduced as part of the use of the fire modeling tools in fire scenario selection and analysis are listed below. BVPS performed the characterization of such fire modeling model uncertainties and evaluated their impacts on the fire PRA model. The fire modeling at BVPS follows the guidance and requirements provided in NUREG/CR-6850 and other NRC accepted guidance documents and positions, which are generally prescriptive and conservative in nature. Since some of these uncertainties were characterized as conservatively biased or are judged to have insignificant impacts on the fire PRA model, or the approaches used by BVPS were the sole acceptable analysis method available to evaluate impacts in the fire modeling analyses, no further consideration was given to this type of model uncertainties.

- Heat release rates (peak HRR, time to reach peak, steady burning time, decay time)
- Number of cabinet cable bundles
- Ignition source fire diameter
- Room ventilation conditions
- Fire growth assumptions (cable tray empirical rule set, barrier delay, fire duration)
- Cable fire spread characteristics for horizontal and vertical trays
- Transient fires (peak HRR, time to reach peak, location factor, detection time)
- Oil fires (spill assumptions)
- Assumed target location
- Target damage threshold criteria
- Manual detection time
- Mean prompt suppression rate

- Manual suppression rate
- Welding and cutting target damage set
- Transient target impacts
- Superposition of damaging sources (for example, plume, radiant heat, and others)
- Crediting or not crediting conduit in time-to-damage

Model Completeness

Regarding “completeness" uncertainties, these refer to the fact that a model may not be a complete description of the phenomena it is designed to predict. Completeness uncertainty was addressed by the same process used to address the model uncertainty. Model and completeness uncertainty are closely related, and it would be impractical to evaluate them separately. Therefore, the discussion above for “model” uncertainties, as well as the conservative approaches discussed in the response to FM RAI 6a address “completeness” uncertainty.

For uncertainties specifically involved with ignoring the contents of a compartment, there were several areas of conservatism that mitigate the reduction in volume in HGL calculations. The following assumptions were utilized within the fire modeling which lead to conservatism or reduced the impact of ignoring the contents of a compartment in the fire modeling analysis:

- If equipment was included in HGL calculations, a large heat sink was provided in the fire compartment, which would have generated lower HGL temperatures.

- No heat passage through fire doors or dampers was considered in the HGL temperature calculations. The material properties of concrete were applied to all exterior boundaries of the fire compartment. Realistically, the heat from the HGL would be transferred to adjacent spaces more easily by a door or fire damper, which have a higher thermal conductivity than concrete. Including these passages to adjacent compartments would have generated lower HGL temperatures.

- Although obstructions within the room could reduce the effective volume when analyzing HGL temperatures, many of these obstructions (such as electrical cabinets and transformers) are not totally solid obstructions. Electrical cabinets are generally not full of electrical components on the inside (for example, they have large empty spaces within the cabinets). These empty spaces within the electrical cabinets reduce the impact of including obstructions for HGL temperature calculations.

- The volume of some fire compartments was reduced in the BVPS fire modeling analysis to meet the validation range for compartment aspect ratio.

For fire compartments having an aspect ratio outside the validated range where detailed fire modeling was performed and whole room damage was not postulated, the height, length, or width of the fire compartment was "shortened" to values that fall within the validation range. Shortening the dimensions of the fire compartment decreases the overall volume of the compartment and creates a more severe condition. The reduction in volume in these compartments bounds the obstructions that were not considered.

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:

d) **<u>FSS-D7-01</u> (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.**

<u>Response:</u>

The unavailability of any fire protection system is documented as part of the BVPS fire protection program and fire protection impairment process. BVPS plant-specific system unavailability data collected by the BVPS fire protection program will be incorporated into the fire PRA as follows:

1. Assume an unavailability probability of 0.01 for those systems with a historical unavailability of less than 0.01. This probability represents an unavailability of

approximately 80 hours per year, which is intended to capture any unplanned potential fire protection system impairments in the future.

2. For all systems with a historical unavailability exceeding 0.01, the actual unavailability probability will be used as an input to the FPRA analysis.

These plant-specific system unavailabilities will be factored into fire scenario frequency evaluations in detailed fire modeling, where fire protection systems are credited. These updates will be reflected in the updated fire risk results for both BVPS-1 and BVPS-2 that will be provided to the NRC as part of the integrated analysis performed in response to PRA RAI 03. To ensure these unavailability probabilities are adequately addressed, the unavailability of credited fire protection systems will be tracked as part of the BVPS monitoring program, as documented in LAR, Table S-3, Items BV1-2974 and BV1-2989.

PRA RAI 01

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:

f) <u>HRA-E1-01</u> (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 1 E-5. Table 4-3 of EPRI 1021081, "Establishing Minimum Acceptable Values for Probabilities of Human Failure Events," provides a lower limiting value of 1 E-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 1 E-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 [sic] was dispositioned. If the approach to performing HRA dependency analysis is not consistent with NRC guidance, justify this departure.**

Response:

F&O HRA-E1-01 addresses concerns over the lack of formality, rigor and defensibility of the HRA dependency analysis that was conducted, and inadequacy of the approach used for the consistency review. All issues associated with this F&O have been resolved and documented. The updated HRA dependency analysis for the BV2REV5F fire PRA model is documented in BVPS-2 PRA assessment PRA-BV2-12-002. This PRA assessment, as well as the consistency review, are referenced in the updated BVPS-2 fire HRA notebook, BV2REV5F Fire Human Reliability Analysis. The notebook was updated to address peer review F&Os and to reflect the final model for the NFPA 805 LAR.

The BVPS-2 PRA assessment PRA-BV2-12-002 was prepared to formally document the methodology, analysis, and results of potential HFE dependency issues among internal event, internal flooding, and fire operator actions in the BV2REV5A PRA model and the BV2REV5F fire PRA model. The BVPS PRA team used a systematic approach that investigated a comprehensive set of human action combinations to merit confidence that the impacts of all dependencies have been thoroughly assessed and adequately represented in the PRA models. It includes a systematic and comprehensive search for and evaluation of dependent human interactions that may play a significant role in the accident sequence frequency. The methods applied to evaluate the dependence and the probabilities of these dependent human actions are consistent with the state of the art as it is practiced in the domestic nuclear industry, and consistent with that described in NUREG-1921, EPRI/NRC-RES Fire Human Reliability Analysis Guidelines.

All operator action HEP values were increased to 0.8 probability, and the model quantified to address the concern of recognizing dependent HFEs in combination of multiple events in lower core damage frequency (CDF) and large early release frequency (LERF) sequences. The resulting sequences (in terms of the concurrent, failed split fractions) and the cutsets obtained for the individual top event split fractions (which account for all of the cutsets contributing more than 1.0E-3 percent to the split fraction values) were logically combined in a Microsoft Access database to identify the multiple HFEs in these accident sequences. These operator action combinations were initially evaluated for level of dependence through the use of a generic dependence evaluation tree logic addressing the similarities and differences in the following factors: crew, cognition, cues, locations, timing, and resources. Five qualitative dependency levels (zero, low, moderate, high, and complete dependence) were adopted for the treatment of human action dependence as developed in the technique for human error rate prediction (THERP). A review of the results of the initial dependence determination using the dependence tree logic was performed for every combination identified as described above. Those operator action combinations determined initially dependent were subsequently reviewed by an expert panel, and, where it was felt that adjustments were needed to the decisions made for selected attributes in the dependence tree logic, the reasons were documented and the dependency level between the affected operator actions were adjusted appropriately.

To further address this F&O, section 3.5 Consistency Review was added to the BVPS-2 fire HRA notebook, BV2REV5F Fire Human Reliability Analysis. This review provided the F&O-requested comparison of failure rates between different versions of the same operator action, and provided complete justification for any deviations from expected results and trends, in order to ensure that all HEPs were evaluated with appropriate consistency.

Beyond the scope of this F&O, a similar HRA dependency analysis and consistency review were conducted for BVPS-1. The HRA dependency analysis for the BV1REV5F fire PRA model is documented in BVPS PRA assessment PRA-BV1-13-025. The consistency review is documented in Section 3.5 of the BVPS-1 fire HRA notebook, BV1REV5F Fire Human Reliability Analysis.

PRA RAI 01

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:

f) **<u>HRA-E1-01</u> (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 1 E-5. Table 4-3 of EPRI 1021081, "Establishing Minimum Acceptable Values for Probabilities of Human Failure Events," provides a lower limiting value of 1 E-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 1 E-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:

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.**

Response:

In most cases, the structure of the BVPS RISKMAN fire PRA models preclude dependency concerns. Many operator actions are evaluated under multiple conditions in order to account for different potential plant states resulting from the success or failure of logically preceding actions or systems. The BVPS PRA models are built to specifically avoid issues with operator action dependencies. Hence, although extensive evaluations of potential HEP dependency issues were performed for the BV2REV5F and BV1REV5F fire PRA models in PRA assessments PRA-BV2-12-002 (BVPS-2 HRA dependency analysis) and PRA-BV1-13-025 (BVPS-1 HRA dependency analysis) in response to this F&O, the independence amongst most human actions is fundamentally already constructed into the BVPS RISKMAN fire PRA model logic and structures.

For the BVPS-2 fire PRA, 460 operator action pairings were identified as potentially dependent and 86 percent (395 pairs) had a joint HEP probability greater than 1.0E-05. The range of joint HEP probabilities spanned 3.0E-01 to 1.6E-07. Of the remaining 14 percent (65 pairs) that had a joint HEP probability less than 1.0E-05, 64 pairs were assessed as zero dependence based on the use of generic dependence evaluation logic tree, as described in the response to part (i) of this RAI, as well as individual review by the BVPS PRA team members (including a former BVPS-2 senior reactor operator, or SRO) to verify that they appropriately reflect the nature of the relationships among the HFEs in the context of the accident sequences in which they appear. Independence between actions was established via team review using such considerations as well-trained, rapid-response operator actions and long-time-window operator actions that afford significant recovery time if performed incorrectly, intervening successful operator actions that would break dependency, and an assessment of the time separation of subsequent actions from prior failed operator actions and when the consequences of the preceding failed operator actions are realized.

The remaining BVPS-2 operator action pairing with a joint HEP of 5.7E-06 (less than 1.0E-05) and complete dependence is OPRHH3F1-OPRHC1F1. Operator action OPRHH3F1 (in top event HH) is Operator Locally Align and Manual Start Backup HHSI [high head safety injection] Pump, and operator action OPRHC1F1 (in top event HC) is Operator Aligns The Alternate Cold Leg SI [safety injection] Path; SLOCA. The dependence between the two actions is accounted for within the BVPS-2 fire PRA model through the use of the no melt condition from injection phase (NMF) logic rule in the GTRECIRC event tree. This NMF split fraction rule guarantees early core melt in the model based on the failed state of either Top Event HH or Top Event HC in the GENTRANS event tree, given that a small LOCA, RCP seal LOCA, PORV LOCA, or a feed and bleed condition exists.

As another example of a BVPS-2 operator action pairing with a joint HEP less than 1.0E-05, the joint HEP operator action pairing OPRCD1F1 - OPRMU2F1 has a value of 2.5E-07. Operator action OPRCD1F1 is the action for operators cool down the primary system to less than 400 psig and to depressurize the secondary system, given a small LOCA before the RWST empties. Operator action OPRMU2F1 (in top event MU) is the action for operators to provide makeup to RWST, given a small LOCA and failure to successfully transfer to safety injection (SI) recirculation. Based on the use of the generic dependence evaluation logic tree, this pairing was deemed zero dependence based on the significant time windows to complete either action. The system time window of OPRCD1F1 is 519 minutes and OPRMU2F1 is 579 minutes. Additionally, in the scenario development for OPRCD1F1, it is already assumed that top event MU has failed, otherwise the RWST would not be emptied.

Note, for the BVPS-1 fire PRA, 295 operator action pairings were identified as potentially dependent and 84 percent (249 pairs) had a joint HEP probability greater than 1.0E-05. The range of joint HEP probabilities spanned 2.6E-02 to 5.4E-08. Of the remaining 16 percent (46 pairs) that had a joint HEP probability less than 1.0E-05, all 46 pairs were assessed as zero dependence based on the use of generic dependence evaluation logic tree, as well as individual review by the BVPS PRA team members (including a former BVPS-1 SRO) to verify that they appropriately reflect the nature of the relationships among the HFEs in the context of the accident sequences in which they appear. This was consistent with the approach discussed above for BVPS-2.

In addition to the evaluation of HFE pairs, for both BVPS-1 and BVPS-2 HRA dependency analyses, the quantified accident sequences for core damage and large early release were also used to generate a list of the HFE combinations involving more than 2 HFEs. These HFE combinations were derived based on the consideration of those confirmed, dependent HFE pairs. All of the HFE combinations that involve only independent HFE pairs were excluded. Those HFE combinations involving more than two HFEs were then evaluated to determine and identify the possibility of longer strings of dependent HFE combinations (that is, more than two HFEs). All such identified joint HFE combinations less than 1E-05 were evaluated as having their dependency properly accounted for, having their dependency broken by intervening successful actions, and so on, per the process described above.

Finally, the implementation of a joint HEP probability “floor” value of 1.0E-05 is not practical in the RISKMAN modeling environment as there are no means to incorporate it. When the BVPS PRA models were first developed, the fault trees and event trees were developed with great care to specifically preclude any potential operator action dependencies. Operator actions were developed to address very specific boundary conditions in the model, corresponding to very specific plant damage states in a given accident scenario. Operator actions contribute to the success or failure of their respective top event. Successive operator actions in the sequence are created to specifically address the success or failure of preceding top events, in all relevant combinations, including any appropriate adjustments to the success criteria or timing used in the evaluation of the HEP or any other pertinent factors. Many top events contain multiple versions of what is essentially the same operator action, to account for the ways in which different plant damage states may affect performance of the action. Hence, as first stated above and proved via the dependency analyses discussed herein, the structure of the BVPS RISKMAN fire PRA models were developed to preclude dependency concerns.

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.

Response:

The LAR Attachment G describes a number of recovery actions that involve implementing repair procedures on valves that have been impacted by fire-induced cable failures and fire**.** A repair is a recovery action performed on a component that is impacted by a combination of fire-induced and random failures, to ensure that the nuclear safety performance criteria are maintained. A repair is performed using a pre-approved step-by-step procedure to restore functionality of the component. The term “repair” was used instead of maintenance for the recovery actions since it is similarly used in section 4.2.4.1.6 of NFPA 805 in conjunction with credited success path(s) and recovery actions.

Recovery actions associated with repairs are DID recovery actions and are not credited in the fire PRA. The response to PRA RAI 18(b) specifies which actions in LAR Attachment G are risk-reduction (PRA-credited) actions and which are DID actions.

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.**

Response:

Reduced heat release rates for transient fires are credited in the following fire compartments:

- 1-CR-4: Process Instrument Room – Elevation (El.) 713' (142 kW)
- 1-CS-1: Cable Spreading Room 1 - El. 725'-6" (69 kW)
- 2-CB-1: Instrumentation and Relay Area (142 kW)
- 2-CB-6: West Communications Room - El. 707'-6" (69 kW)
- 2-CV-1: West Cable Vault - El. 735'-6" (142 kW)
- 2-CV-3: Cable Vault & Rod Control Area - El. 755'-6" (142 kW)
- 2-SB-3: Cable Spreading Room 1 - El. 745'-6" (69 kW)

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.

Response:

The additional risk of recovery actions (including previously-approved actions) has been evaluated in accordance with RG 1.205 and FAQ 07-0030.

For each fire compartment, the additional risk of recovery actions was calculated by summing the individual delta risk for those VFDRs where the fire PRA credits a recovery action as a means of compensating for the potential for fire damage to the credited success path. This value represents a fraction of the total delta risk for the compartment and was recorded in the conclusion of each compartment FRE as the compartment's "additional risk of recovery actions."

Recovery actions credited in the fire PRA for each compartment are listed in the first section (VFDR Recovery Actions (Local)) of Table 6-1 of each compartment FRE report. The VFDR(s) associated with the recovery action is also listed in this section.

The calculated additional risk of recovery actions for each compartment is not explicitly presented in Attachment W of the LAR. As discussed above, the additional risk of recovery actions are recorded in the individual FRE reports for each fire compartment. These values are provided in Tables 1 and 2 below.

Attachment W of the LAR does, however, include the following statement:

> The development of the Fire Risk Evaluations and data for Tables W-2a and W-2b treated all previously approved recovery actions as new. Thus, the ΔCDF (change in core damage frequency) and ΔLERF (change in large early release frequency) for all recovery actions are included in the Fire Risk Evaluation results presented in Tables W-2a and W-2b.

Thus, the fire risk evaluation delta risk presented in Tables W-2a and W-2b of the LAR bounds the additional risk of recovery actions.

Attachment W of the LAR will be updated as part of the response to PRA RAI 03, and columns will be added to Tables W-2a and W-2b presenting the additional risk of recovery actions.

The additional risk of recovery actions is presented below in Table 1 for BVPS-1 and Table 2 for BVPS-2. The values have been taken directly from the fire compartment FRE reports.

The total additional risk from recovery actions for BVPS-1 is 2.34E-04 per year and 8.66E-06 per year for CDF and LERF respectively, and for BVPS-2 the values are 3.38E-04 per year and 4.41E-06 per year for CDF and LERF, respectively. While these values are above the RG 1.174 guidelines for acceptable increases in risk (less than 1E-05 per year for CDF and 1E-06 per year for LERF), it should be noted these additional risk of recovery action values do not credit the risk offset or any risk reduction achieved through the plant modifications to install Westinghouse reactor coolant pump shutdown seals and the very early warning fire detection system.

RG 1.205 states that,

> The total increase or decrease in risk associated with the implementation of NFPA 805 for the overall plant should be calculated by summing the risk increases and decreases for each fire area (including any risk increases resulting from previously approved recovery actions). The total risk increase should be consistent with the acceptance guidelines in Regulatory Guide 1.174. Note that the acceptance guidelines of Regulatory Guide 1.174 may require the total CDF, LERF, or both, to evaluate changes where the risk impact exceeds specific guidelines.

Application of this guidance to recovery actions means that the proposed additional risk of recovery actions is acceptable if the net change in risk is risk-neutral or represents a risk decrease. Based on the negative net change in risk values (overall risk decrease) reported in Attachment W of the LAR, the additional risk of recovery actions, while independently exceeding the acceptance guidelines, is acceptable as part of the overall transition to NFPA 805 due to the offsetting risk decreases also associated with the transition.

Table 1 – Additional Risk of Recovery Actions for BVPS-1				
Fire Compartment	**Compartment Description**	**RAs (Y/N)**	**CDF (yr^{-1})**	**LERF (yr^{-1})**
1-CR-2	Control Room Heating, Ventilation, and Air Conditioning (HVAC) Equipment Room	Y	7.31E-09	7.31E-10
1-CR-3	Communications Equipment and Relay Room	Y	9.49E-08	5.71E-10
1-CR-4	Process Instrumentation Room	Y	1.99E-04	8.35E-06
1-CS-1	Cable Spreading Room	Y	1.57E-07	7.29E-08
1-CV-1	West Cable Vault	Y	7.22E-07	2.43E-09
1-CV-2	East Cable Vault	Y	2.87E-08	8.28E-11
1-DG-2	Diesel Generator Room Train B	Y	2.50E-08	6.64E-11
1-ES-1	Emergency Switchgear Train A	Y	8.52E-08	2.30E-10
1-ES-2	Emergency Switchgear Room Train B	Y	4.47E-06	2.61E-08
1-MG-1	Motor Generator Room	Y	1.59E-08	8.59E-10
1-NS-1	Normal Switchgear Room	Y	2.48E-05	1.55E-07
1-PA-1E	Primary Auxiliary Building 735' - 6"	Y	2.15E-07	3.45E-09
1-PA-1G	Primary Auxiliary Building 722'-6"	Y	5.63E-07	2.20E-09
1-PT-1	Pipe Tunnel	Y	5.40E-07	2.87E-09
1-QP-1	Quench Spray / AFW Pump Room	Y	8.23E-07	3.07E-09
1-RC-1	Reactor Containment Building	Y	2.24E-07	7.00E-10
1-TB-1	Turbine Building	Y	8.67E-08	2.11E-10
3-CR-1	Control Room	Y	1.96E-06	3.82E-08
3-YARD-1	Manholes and Ductlines in the Yard	Y	6.20E-09	3.07E-11
1-CTP-1	Cooling Tower Pump House and Cooling Tower	Y	4.20E-09	Epsilon
1-DG-1	Diesel Generator Cubicle A	Y	4.55E-	Epsilon

Table 1 – Additional Risk of Recovery Actions for BVPS-1				
Fire Compartment	**Compartment Description**	**RAs (Y/N)**	**CDF (yr^{-1})**	**LERF (yr^{-1})**
			09	
1-PA-1A	Primary Auxiliary Building (768'-7")	Y	5.51E-10	Epsilon
1-PA-1C	Primary Auxiliary Building (752'-6")	Y	4.80E-10	Epsilon
1-SB-GEN	Service Building and Pipe Chase	Y	1.24E-09	Epsilon
1-TO-1	Turbine Oil Storage Room	Y	2.41E-10	Epsilon
1-TR-1	Unit 1 - Main Transformer (TR-MT1)	Y	6.57E-10	Epsilon
1-TR-2	Unit 1 - Unit Station Service Transformer 1D	Y	5.65E-10	Epsilon
1-TR-3	Unit 1 - Unit Station Service Transformer 1C	Y	5.65E-10	Epsilon
1-TR-4	Unit 1 - System Station Service Transformer 1A	Y	1.56E-09	Epsilon
1-TR-5	Unit 1 - System Station Service Transformer 1B	Y	6.60E-10	Epsilon
1-WH-1	Unit 1 Warehouse and Shop Area	Y	5.70E-10	Epsilon
3-AIS-1	Alternate Intake Structure	Y	4.90E-10	Epsilon
3-ER-1	Emergency Response Facility (ERF) Substation	Y	2.60E-09	Epsilon
3-ER-2	ERF Diesel Generator Building	Y	5.23E-10	Epsilon
3-IS-1	Intake Structure Cubicle 1	Y	8.00E-10	Epsilon
3-IS-2	Intake Structure Cubicle 2	Y	Epsilon	Epsilon
3-IS-6	Intake Structure (all areas except 3-IS-1, 2, 3, 4)	Y	7.00E-10	Epsilon
3-RH-1	Switchyard Relay House	Y	4.20E-09	Epsilon
3-SY-1	Main Switch Yard	Y	Epsilon	Epsilon
1-CO-2	CO2 Storage and PG Water Pump Room	N	N/A	N/A
1-CV-3	Cable Tunnel	N	N/A	N/A
1-FB-1	Fuel Handling / Decon Buildings	N	N/A	N/A
1-H-1	Bulk Hydrogen Storage Tanks in BV1 Yard Area	N	N/A	N/A

Table 1 – Additional Risk of Recovery Actions for BVPS-1				
Fire Compartment	**Compartment Description**	**RAs (Y/N)**	**CDF (yr^{-1})**	**LERF (yr^{-1})**
1-MS-1	Main Steam Valve Room	N	N/A	N/A
1-PA-1GA	Charging Pump Cubicle 1A	N	N/A	N/A
1-PA-1GB	Charging Pump Cubicle 1B	N	N/A	N/A
1-PA-1GC	Charging Pump Cubicle 1C	N	N/A	N/A
1-SGPD-1	Steam Generator Blowdown Area (752'-6")	N	N/A	N/A
1-VP-1	River Water Valve Pit Train A	N	N/A	N/A
1-VP-2	River Water Valve Pit Train B	N	N/A	N/A
1-WT-1	Refueling Water Storage Tank Area (1QS-TK-1)	N	N/A	N/A
1-WT-10	Primary Plant Demineralized Water Storage Tank (1WT-TK-10)	N	N/A	N/A
1-WT-11	Turbine Plant Demineralized Water Storage Tank (1WT-TK-11)	N	N/A	N/A
1-WT-26	Auxiliary Demineralized Water Storage Tank (1WT-TK-26)	N	N/A	N/A
3-ER-3	Emergency Response Facility	N	N/A	N/A
3-IS-3	Intake Structure Cubicle 3	N	N/A	N/A
3-IS-4	Intake Structure Cubicle 4	N	N/A	N/A
3-TR-6	ERF Offsite Power Transformer (TRF-ERFS-3B)	N	N/A	N/A
3-TR-7	ERF Offsite Power Transformer (TRF-ERFS-3A)	N	N/A	N/A
Total			2.34E-04	8.66E-06

- Epsilon is used to represent the calculated delta risk for reported delta CDFs of less than 1E-10, and similarly for reported delta LERFs of less than 1E-11.
- N/A used for compartments with no credited recovery actions.

Table 2 – Additional Risk of Recovery Actions for BVPS-2				
Fire Compartment	**Compartment Description**	**RAs (Y/N)**	**CDF (yr^{-1})**	**LERF (yr^{-1})**
2-ASP	Alternate Shutdown Panel Room	Y	3.39E-08	3.83E-10
2-CB-1	Control Building (Instrument and Relay Room, Cable Spreading Room, Cable Tunnel)	Y	2.85E-04	3.72E-06
2-CB-6	West Communications Room	Y	1.42E-05	1.44E-07
2-CV-1	West Cable Vault & Rod Control Room	Y	9.38E-06	8.69E-08
2-CV-2	East Cable Vault & Rod Control Area	Y	1.14E-07	7.88E-10
2-CV-3	Cable Vault & Rod Control Area	Y	1.63E-06	7.29E-09
2-CV-6	Cable Vault & Rod Control Relay Room (755' - 6")	Y	2.11E-08	1.52E-10
2-DG-2	Diesel Generator Cubicle Train B	Y	2.48E-08	4.31E-10
2-MS-1	Main Steam Valve Area	Y	1.70E-10	Epsilon
2-PA-3	Auxiliary Building General Area (710'-6", 718'-6", 735'-6")	Y	2.24E-08	4.81E-10
2-RC-1	Reactor Containment Building	Y	4.53E-08	5.84E-10
2-SB-1	Service Building Emergency Switchgear Train A	Y	1.10E-07	3.53E-08
2-SB-2	Service Building Emergency Switchgear Train B	Y	7.06E-08	1.25E-09
2-SB-3	Service Building Cable Spreading Area	Y	4.93E-07	3.45E-09
2-SB-4	Service Building Normal Switchgear	Y	9.32E-08	1.87E-09
2-SB-8	Service Building Battery Room 2-2	Y	4.63E-10	9.57E-12
2-SG-1S	South Safeguards Area	Y	2.21E-10	1.96E-12
3-CR-1	Main Control Room	Y	2.62E-05	4.05E-07
2-DG-1	Diesel Generator Cubicle A	Y	9.35E-09	2.13E-10
2-TB-1	Turbine Building General Area	Y	6.81E-07	5.86E-09

Table 2 – Additional Risk of Recovery Actions for BVPS-2				
Fire Compartment	**Compartment Description**	**RAs (Y/N)**	**CDF (yr^{-1})**	**LERF (yr^{-1})**
2-TR-4	System Station Service Transformer 2B	Y	1.70E-08	2.53E-10
2-TR-5	System Station Service Transformer 2A	Y	1.70E-08	2.53E-10
3-IS-2	Intake Structure Cubicle 2	Y	2.97E-09	6.42E-11
3-RH-1	Switchyard Relay House	Y	2.76E-08	4.14E-10
3-SY-1	Main Switch Yard	Y	8.00E-10	1.05E-11
2-CB-5	Control Building Fan Room (735'-6")	Y	2.13E-08	2.13E-09
2-CB-4	Control Building Computer Room (735'-6")	N	N/A	N/A
2-CP-1	Condensate Polishing Building	N	N/A	N/A
2-CTP-1	Cooling Tower Pump House and Cooling Tower	N	N/A	N/A
2-FB-1	Fuel Handling & Decontamination Building	N	N/A	N/A
2-H-1	Bulk Hydrogen Storage Tanks in BV2 Yard Area	N	N/A	N/A
2-PA-5	Auxiliary Building General Area	N	N/A	N/A
2-SB-5	Service Building MFRV Room	N	N/A	N/A
2-SB-7	Service Building Battery Room 2-3	N	N/A	N/A
2-SB-9	Service Building Battery Room 2-4	N	N/A	N/A
2-TB-2	Turbine Building Battery Room 2-6	N	N/A	N/A
2-TR-1	Unit 2 Main Transformer (TR-MT-2)	N	N/A	N/A
2-TR-2	Unit 2 - Unit Station Service Transformer 2C	N	N/A	N/A
2-TR-3	Unit 2 - Unit Station Service Transformer 2D	N	N/A	N/A
2-VP-1	Service Water Valve Pit East Train A	N	N/A	N/A
2-VP-2	Service Water Valve Pit West Train B	N	N/A	N/A
2-WH-1	Unit 2 Waste Handling Building (All Levels)	N	N/A	N/A
2-WT-21	Refueling Water Storage Tank Area (2QSS-TK21)	N	N/A	N/A
2-WT-210	Primary Plant Demineralized Water Storage Tank	N	N/A	N/A
2-WT-211	Turbine Plant Demineralized Water Storage Tank (2WTD-TK211)	N	N/A	N/A
2-WT-23	Demineralized Water Storage Tank (2WTD-TK23)	N	N/A	N/A
3-AIS-1	Alternate Intake Structure	N	N/A	N/A
3-ER-1	ERF Substation	N	N/A	N/A

Table 2 – Additional Risk of Recovery Actions for BVPS-2				
Fire Compartment	**Compartment Description**	**RAs (Y/N)**	**CDF (yr^{-1})**	**LERF (yr^{-1})**
3-ER-2	ERF Diesel Generator Building	N	N/A	N/A
3-ER-3	Emergency Response Facility	N	N/A	N/A
3-IS-1	Intake Structure Cubicle 1	N	N/A	N/A
3-IS-4	Intake Structure Cubicle 4	N	N/A	N/A
3-IS-6	Intake Structure (All areas except 3-IS-1, 2, 3, 4)	N	N/A	N/A
3-TR-6	ERF Offsite Power Transformer (TRF-ERFS-3B)	N	N/A	N/A
3-TR-7	ERF Offsite Power Transformer (TRF-ERFS-3A)	N	N/A	N/A
2-CV-4	South Cable Vault and Rod Control Area (773'-6")	N	N/A	N/A
2-CV-5	North Cable Vault and Rod Control Area (773'-6")	N	N/A	N/A
2-PA-3A	Charging Pump Cubicle A (735'-6")	N	N/A	N/A
2-PA-3B	Charging Pump Cubicle B (735'-6")	N	N/A	N/A
2-PA-3C	Charging Pump Cubicle C (735'-6")	N	N/A	N/A
2-PA-4	Auxiliary Building General Area (755'-6")	N	N/A	N/A
2-PA-6	Auxiliary Building MCC Room Train A (755'-6")	N	N/A	N/A
2-PA-7	Auxiliary Building MCC Room Train B (755'-6")	N	N/A	N/A
2-PT-1	Pipe Tunnel Area	N	N/A	N/A
2-SB-10	Service Building Non-Safety Related Battery Room 2-5 (760'-6")	N	N/A	N/A
2-SB-6	Service Building Battery Room 2-1 (730'-6")	N	N/A	N/A
2-SG-1N	North Safeguards Area	N	N/A	N/A
3-IS-3	Intake Structure Cubicle 3	N	N/A	N/A
3-YARD-1	Manholes and Ductlines in the Yard	N	N/A	N/A
Total			3.38E-04	4.41E-06

- Epsilon is used to represent the calculated delta risk for reported delta CDFs of less than 1E-10, and similarly for reported delta LERFs of less than 1E-11.
- N/A used for compartments with no credited recovery actions.

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In light of these observations, address the following:

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.

<u>Response:</u>

As part of the LAR Attachment G feasibility assessment, the recovery actions (RA) were reviewed and classified based on whether they are credited for purposes of DID and/or risk reduction.

Tables 3 and 4 below list the RAs and primary control station (PCS) actions from Attachment G of the LAR for BVPS-1 and BVPS-2, respectively. The final column indicates whether the action is a PCS action (contains entry “PCS”), an RA credited for purposes of DID only (contains entry “DID”), credited for risk reduction only (contains entry “RR”), or credited for both DID and risk reduction (contains entry “RR and DID”). Note that Tables 3 and 4 below include a column specifying the affected components resulting in VFDRs, which is not strictly required for this response. However, Tables 3 and 4 will be referenced in the response to another RAI (SSD RAI 04(a), to be submitted at a later date) which requests the same differentiation between risk reduction actions and DID actions from LAR Attachment G that is supplied in this response. The response to SSD RAI 04(b) (to be submitted at a later date) will require the information in this additional column in order to expand on the details of certain actions.

Attachment G of the LAR will be updated as part of the response to PRA RAI 03, and as part of that update, a column will be added to Tables G-1 and G-2 to show whether the action is a PCS action, or an RA credited for RR, DID, or RR and DID.

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CR-2	LI-1FW-475BP LI-1RC-460BP PI-1RC-403BP TI-1RC-410BP BIP Power	Use supplementary controls and monitoring from the BIP.	BV1-2144	DID
1-CR-2	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B, & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2163	RR
1-CR-2	1VS-AC-1A 1VS-C-1A 1VS-E-4A 1VS-F-40A 1VS-P-3A	Install a 5000 CFM [cubic feet per minute] portable fan in the Control Room doorway to supply temporary ventilation.	BV1-2476	RR
1-CR-2	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2792	RR
1-CR-3	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B, & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2090	DID
1-CR-3	4KVS-1DF 4KVS-1D-1D10 4KVS-1F-1F7 1-EE-EG-2 PNL-DG-SEQ-2	Align AE and DF bus loads as required.	BV1-2094	RR
1-CR-3	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2785	RR
1-CR-4	4KVS-1A-1A1 4KVS-1B-1B1 4KVS-1C-1C1 4KVS-1D-1D1 HYV-1FW-100A HYV-1FW-100B HYV-1FW-100C	De-energize 1FW-P-1A at 4KVS-1A & 1B and de-energize 1FW-P-1B at 4KVS-1C & 1D to stop main feedwater flow to the steam generators.	BV1-2497	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CR-4	1CH-E-1MOV-1CH-378	De-energize MOV-1CH-381 at 480VUS-1-1P and manually close it OR Manually close 1CH-214 OR manually close 1CH-216 to isolate seal return.	BV1-2499	RR
1-CR-4	Spurious SI 4KVS-1AE-1E11-P 4KVS-1AE-1E15-P 4KVS-1DF-1F11-P 4KVS-1DF-1F15-P	De-energize 1CH-P-1A(C) at 4KVS-1AE OR De-energize 1CH-P-1B(C) at 4KVS-1DF to control charging/HHSI flow.	BV1-2500	DID
1-CR-4	4KVS-1AE 4KVS-1AE-1E7 4KVS-1AE-1E9 4KVS-1AE-1E12 4KVS-1AE-1E14-OCT 1EE-EG-1 PNL-DG-SEQ-1	Align AE and DF bus loads as required.	BV1-2501	RR
1-CR-4	4KVS-1AE-1E16 MOV-1FW-151B MOV-1FW-151D MOV-1FW-151F	Start 1FW-P-3A at 4KVS-1AE to provide train A AFW flow. De-energize MOV-1FW-151B, D & F at 480VUS-1-1N. Manually throttle MOV-1FW-151F to control SG A AFW flow. Manually throttle MOV-1FW-151D to control SG B AFW flow. Manually throttle MOV-1FW-151B to control SG C AFW flow.	BV1-2504	DID
1-CR-4	4KVS-1AE-1E16 MOV-1MS-105 4KVS-1DF-1F16 MOV-1FW-151A MOV-1FW-151B MOV-1FW-151C MOV-1FW-151D MOV-1FW-151E MOV-1FW-151F	De-energize 1FW-P-3B at 4KVS-1DF to stop train B AFW flow. De-energize MOV-1FW-151B, D & F at 480VUS-1-1N. Manually throttle MOV-1FW-151F to control SG A AFW flow. Manually throttle MOV-1FW-151D to control SG B AFW flow. Manually throttle MOV-1FW-151B to control SG C AFW flow.	BV1-2505	RR
1-CR-4	LT-1QS-100A LT-1QS-100B LT-1QS-100C LT-1QS-100D 1-MTR-SIGNAL	De-energize 1CH-P-1A(C) at 4KVS-1AE and De-energize 1CH-P-1B(C) at 4KVS-1DF to prevent pump damage on loss of suction. De-energize 1SI-P-1A at 4KVS-1AE and De-energize 1SI-P-1B at 4KVS-1DF to stop flow from the containment sump. De-energize MOV-1CH-115B at 480VUS-1-1N and open it to align suction to the charging pumps. Manually start 1CH-P-1A or 1CH-P-1C at 4KVS-1AE to provide RCS makeup flow.	BV1-2506	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/DID
1-CR-4	4KVS-1AE-1E2 4KVS-1AE-1E10 4KVS-1AE-1E14	Trip the #1 diesel to prevent damage. Align 4KVS-1AE for diesel start. Restart the #1 diesel. Manually start 1WR-P-1A or 1C at 4KVS-1AE. Start other AE bus loads as required.	BV1-2507	DID
1-CR-4	480VUS-1-8N12480VUS-1-9P12480VUS-1-1B7480VUS-1-8N13480VUS-1-9P13	De-energize the A and D group heaters at 480VUS-1-8-N, de-energize the control group heater at 480VUS-1-1B and de-energize the B and E group heaters at 480VUS-1-9-P to prevent RCS overpressure.	BV1-2508	DID
1-CR-4	480VUS-1-8N4 480VUS-1-9P5 1-CIB-SPUR	De-energize 1QS-P-1A at 480VUS-1-8N4 and de-energize 1QS-P-1B at 480VUS-1-9P5 to stop quench spray flow.	BV1-2510	RR
1-CR-4	4KVS-1A-1A5 4KVS-1B-1B5 4KVS-1C-1C5 PCV-1RC-455A PCV-1RC-455B	De-energize 1RC-P-1A at 4KVS-1A, de-energize 1RC-P-1B at 4KVS-1B and de-energize 1RC-P-1C at 4KVS-1C to prevent an RCP seal LOCA.	BV1-2511	RR
1-CR-4	PCV-1MS-101A-P PCV-1MS-101B-P PCV-1MS-101C-P HCV-1MS-104-P	Manually close PCV-1MS-101A to stop SG A steam flow. Manually close PCV-1MS-101B to stop SG B steam flow. Manually close PCV-1MS-101C to stop SG C steam flow. Manually close HCV-1MS-104 to stop SG A B & C steam flow.	BV1-2515	RR
1-CR-4	SOV-1RC-102B SOV-1RC-103B SOV-1RC-105 LI-1FW-475BP LI-1RC-460BP NI-1NI-32A PI-1RC-403BP TI-1RC-410BP TI-1RC-29BP BIP Power	Use supplementary controls and monitoring from the BIP.	BV1-2517	DID
1-CR-4	MOV-1CH-289	De-energize MOV-1CH-289 at 480VUS-1-1n and manually close it, OR Close manual valve 1CH-30 to stop excessive RCS makeup.	BV1-2518	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CR-4	MOV-1RW-103AMOV-1RW-103BMOV-1RW-103CMOV-1RW-103DMOV-1RW-106AMOV-1RW-106BMOV-1RW-114AMOV-1RW-114BMOV-1RW-104AMOV-1RW-104BMOV-1RW-104CMOV-1RW-104DMOV-1RW-1041-CIB-SPUR	De-energize MOV-1RW-103A at 480VUS-1-1N, de-energize MOV-1RW-103B at 480VUS-1-1P and close both valves.	BV1-2520	RR
1-CR-4	MOV-1RW-102A2 MOV-1RW-106A MOV-1RW-114A MOV-1RW-103A 1-CIB-SPUR	Trip the #1 diesel to prevent damage. De-energize MOV-1RW-106A at 480VUS-1-1P, de-energize MOV-1RW-114A at 480VUS-1-1N and open both valves. Align 4KVS-1AE for diesel start. Restart the #1 diesel. De-energize MOV-1RW-102C1 at MCC1-E2 and manually close it. Manually start 1WR-P-1C at 4KVS-1AE to provide River Water flow, OR De-energize MOV-1RW-102A2 at MCC1-E1 and manually throttle it 10% open THEN manually start 1WR-P-1A at 4KVS-1AE and manually open MOV-1RW-102A2 to provide River Water flow. Start other AE bus loads as required.	BV1-2521	RR
1-CR-4	MOV-1RW-113A MOV-1RW-113B	De-energize MOV-1RW-113A at MCC1-E7 and open it.	BV1-2522	RR
1-CR-4	MOV-1SI-836-P MOV-1SI-869A-P MOV-1SI-869B-P MOV-1SI-867A MOV-1SI-867B MOV-1SI-867C MOV-1SI-867D Spurious SI	De-energize 1CH-P-1A(C) at 4KVS-1AE and De-energize 1CH-P-1B(C) at 4KVS-1DF to stop excessive RCS makeup flow. De-energize MOV-1SI-836, 867A and 869A at 480VUS-1-1N, de-energize MOV-1SI-867B and 869B at 480VUS-1-1P and manually close the valves to isolate the SI flow paths. Manually start 1CH-P-1A or 1CH-P-1C at 4KVS-1AE to provide RCS makeup flow.	BV1-2523 BV1-2528	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CR-4	MOV-1SI-869B	De-energize MOV-1SI-869B at 480VUS-1-1P and manually throttle to provide an alternate makeup flow path.	BV1-2524	DID
1-CR-4	1WT-TK-10	Close 1IA-85-6 and open 1IA-85-53 and IA-85-54 to close the Main Steam Trip Valves.	BV1-2530	DID
1-CR-4	PCV-1RC-455C-P PCV-1RC-455D-P PCV-1RC-456-P PT-1RC-444 PT-1RC-445	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2534	RR
1-CR-4	1VS-AC-1A 1VS-C-1A 1VS-E-4A 1VS-F-40A 1VS-P-3A	Close PCV-1RC-455C, PCV-1RC-455D and PCV-1RC-456 at the keylock switches to stop RCS depressurization.	BV1-2535	RR
1-CR-4	MOV-1CH-115C-P MOV-1CH-115E-P MOV-1CH-115B 4KVS-1AE-1E11-P 4KVS-1AE-1E15-P 4KVS-1AE-1E11 4KVS-1AE-1E15	Install a 5000 CFM portable fan in the Control Room doorway to supply temporary ventilation.	BV1-2569	RR
1-CR-4	LCV-1CH-460A SW-ISO-CH460A	De-energize 1CH-P-1A(C) at 4KVS-1AE and De-energize 1CH-P-1B(C) at 4KVS-1DF to prevent pump damage on loss of suction. De-energize MOV-1CH-115B at 480VUS-1-1N and open it to align suction to the charging pumps. Manually start 1CH-P-1B or 1CH-P-1C at 4KVS-1DF to provide RCS makeup flow.	BV1-2571	RR
1-CR-4	LCV-1CH-460A SW-ISO-CH460A	Close LCV-1CH-460 at the keylock switch to isolate letdown.	BV1-2711	RR
1-CR-4	4KVS-1B-1B2 4KVS-1D-1D2	De-energize 1CN-P-1A at 4KVS-1B and de-energize 1CN-P-1A at 4KVS-1B to stop condensate flow to the steam generators.	BV1-2765	DID
1-CR-4	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2859	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CR-4	PCV-1RC-455DPCV-1RC-456	Transfer control of reactor head vent valves SOV-RC102B, 103B and 105 to the BIP and open the valves as necessary for RCS depressurization. To align Containment Sump recirculation to maintain long-term cooling, perform the following. De-energize MOV-1SI-860A and 863A at 480VUS-1-1N and open them, de-energize MOV-1SI-885A and 885C at 480VUS-1-1N and close them, de-energize MOV-1CH-115B at 480VUS-1-1N and close it and de-energize MOV-1SI-862A at 480VUS-1-1N and close it.	BV1-2886	DID
1-CR-4	MOV-1CH-115C	De-energize MOV-1CH-115C at 480VUS-1-1N and close it or De-energize MOV-1CH-115E at 480VUS-1-1P and close it to prevent hydrogen intrusion into the suction of the charging pumps.	BV1-2912	RR
1-CS-1	1VS-AC-1B 1VS-C-1B 1VS-E-4B 1VS-F-40B 1VS-P-3B	Install a 5000 CFM portable fan in the Control Room doorway to supply temporary ventilation.	BV1-2478	RR
1-CS-1	1CH-E-1 MOV-1CH-381	De-energize MOV-1CH-381 at 480VUS-1-P and manually close it OR Manually close 1CH-214 OR manually close 1CH-216 to isolate seal return.	BV1-2537	RR
1-CS-1	4KVS-1DF-1F16 MOV-1FW-151A MOV-1FW-151C MOV-1FW-151E	Manually start 1FW-P-3B at 4KVS-1DF. De-energize MOV-1FW-151A, C & E at 480VUS-1-P . Manually throttle MOV-1FW-151E to control SG A AFW flow. Manually throttle MOV-1FW-151C to control SG B AFW flow. Manually throttle MOV-1FW-151A to control SG C AFW flow.	BV1-2540	DID
1-CS-1	LT-1QS-100A LT-1QS-100B LT-1QS-100C LT-1QS-100D 1-MTR-SIGNAL	De-energize 1CH-P-1A(C) at 4KVS-1AE and De-energize 1CH-P-1B(C) at 4KVS-1DF to prevent pump damage on loss of suction. De-energize 1SI-P-1A at 4KVS-1AE and De-energize 1SI-P-1B at 4KVS-1DF to stop flow from the containment sump. De-energize MOV-1CH-115D at 480VUS-1-P and open it to align suction to the charging pumps. Manually start 1CH-P-1B or 1CH-P-1C at 4KVS-1DF to provide RCS makeup flow.	BV1-2541	DID
1-CS-1	4KVS-1DF-1F2 4KVS-1DF-1F10 4KVS-1DF-1F14	Trip the #2 diesel to prevent damage. Align 4KVS-1DF for diesel start. Restart the #2 diesel. Manually start 1WR-P-1B or 1C at 4KVS-1DF. Start other DF bus loads as required.	BV1-2542	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CS-1	480VUS-1-8N12 480VUS-1-9P12 480VUS-1-1B7 480VUS-1-8N13 480VUS-1-9P13	De-energize the A and D group heaters at 480VUS-1-8-N, de-energize the control group heater at 480VUS-1-1B and de-energize the B and E group heaters at 480VUS-1-9-P to prevent RCS overpressure.	BV1-2543	DID
1-CS-1	480VUS-1-8N4 480VUS-1-9P5 1-CIB-SPUR	De-energize 1QS-P-1A at 480VUS-1-8N4 and de-energize 1QS-P-1B at 480VUS-1-9P5 to stop quench spray flow.	BV1-2544	RR
1-CS-1	Spurious SI 4KVS-1AE-1E11-P 4KVS-1AE-1E15-P 4KVS-1DF-1F11-P 4KVS-1DF-1F15-P	De-energize 1CH-P-1A(C) at 4KVS-1AE OR De-energize 1CH-P-1B(C) at 4KVS-1DF to control charging/HHSI flow.	BV1-2545	DID
1-CS-1	4KVS-1DF 4KVS-1DF-1F1-OCT 4KVS-1DF-1F2-OCT 4KVS-1DF-1F5 4KVS-1DF-1F7 4KVS-1DF-1F8-OCT 4KVS-1DF-1F9 4KVS-1DF-1F13-OCT 4KVS-1DF-1F15-OCT 1EE-EG-2 4KVS-1DF-F12 PNL-DG-SEQ-2	Align AE and DF bus loads as required.	BV1-2546	RR
1-CS-1	FCV-1FW-103B	Isolate and vent the instrument air to fail FCV-1FW-103B closed to ensure adequate AFW flow.	BV1-2550	DID
1-CS-1	LCV-1CH-460A SW-ISO-CH460A	Close LCV-1CH-460 at the keylock switch to isolate letdown.	BV1-2552	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CS-1	MOV-1CH-115C-P MOV-1CH-115E-P MOV-1CH-115B 4KVS-1AE-1E11-P 4KVS-1AE-1E15-P 4KVS-1AE-1E11	De-energize 1CH-P-1A(C) at 4KVS-1AE and De-energize 1CH-P-1B(C) at 4KVS-1DF to prevent pump damage on loss of suction De-energize MOV-1CH-115D at 480VUS-1-P and open it to align suction to the charging pumps. Manually start 1CH-P-1B or 1CH-P-1C at 4KVS-1DF to provide RCS makeup flow.	BV1-2553	RR
1-CS-1	MOV-1CH-289	De-energize MOV-1CH-289 at 480VUS-1-N and manually close it, OR Close manual valve 1CH-30 to stop excessive RCS makeup.	BV1-2554	DID
1-CS-1	4KVS-1AE-1E16 MOV-1MS-105 4KVS-1DF-1F16 MOV-1FW-151A MOV-1FW-151B MOV-1FW-151C MOV-1FW-151D MOV-1FW-151E MOV-1FW-151F MOV-1MS-105	De-energize 1FW-P-3A at 4KVS-1AE and manually trip 1FW-P-2 to stop train A AFW flow. De-energize MOV-1FW-151A, C & E at 480VUS-1-P. Manually throttle MOV-1FW-151E to control SG A AFW flow. Manually throttle MOV-1FW-151C to control SG B AFW flow. Manually throttle MOV-1FW-151A to control SG C AFW flow.	BV1-2555	DID
1-CS-1	MOV-1RW-103A MOV-1RW-103B MOV-1RW-103C MOV-1RW-103D MOV-1RW-106A MOV-1RW-106B MOV-1RW-114A MOV-1RW-114B MOV-1RW-104A MOV-1RW-104B MOV-1RW-104C MOV-1RW-104D MOV-1RW-104 MOV-1RW-116A MOV-1RW-116B 1-CIB-SPUR	De-energize MOV-1RW-103C at 480VUS-1-N, de-energize MOV-1RW-103D at 480VUS-1-P and close both valves.	BV1-2557	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CS-1	MOV-1RW-102B1 MOV-1RW-106B MOV-1RW-114B MOV-1RW-103A 1-CIB-SPUR	Trip the #2 diesel to prevent damage. De-energize MOV-1RW-106B at 480VUS-1-P, de-energize MOV-1RW-114B at 480VUS-1-N and open both valves. Align 4KVS-1DF for diesel start. Restart the #2 diesel. De-energize MOV-1RW-102B2 at MCC1-E1 and manually close it. De-energize MOV-1RW-102B1 at MCC1-E2 and manually throttle it 10% open THEN manually start 1WR-P-1B at 4KVS-1DF and manually open MOV-1RW-102B1 to provide River Water flow, OR De-energize MOV-1RW-102C2 at MCC1-E1 and manually close it. De-energize MOV-1RW-102C1 at MCC1-E2 and manually throttle it 10% open THEN manually start 1WR-P-1C at 4KVS-1DF and manually open MOV-1RW-102C1 to provide River Water flow. Start other DF bus loads as required.	BV1-2558	DID
1-CS-1	MOV-1SI-836-P MOV-1SI-869A-P MOV-1SI-869B-P MOV-1SI-867A MOV-1SI-867B MOV-1SI-867C MOV-1SI-867D Spurious SI	De-energize 1CH-P-1A(C) at 4KVS-1AE and De-energize 1CH-P-1B(C) at 4KVS-1DF to stop excessive RCS makeup flow. De-energize MOV-1SI-836, 867A and 869A at 480VUS-1-N, de-energize MOV-1SI-867B and 869B at 480VUS-1-P and manually close the valves to isolate the SI flow paths. Manually start 1CH-P-1B or 1CH-P-1C at 4KVS-1DF to provide RCS makeup flow.	BV1-2559 BV1-2578	DID
1-CS-1	PCV-1MS-101A-P PCV-1MS-101B-P PCV-1MS-101C-P HCV-1MS-104-P	Manually close PCV-1MS-101A to stop SG A steam flow. Manually close PCV-1MS-101B to stop SG B steam flow. Manually close PCV-1MS-101C to stop SG C steam flow. Manually close HCV-1MS-104 to stop SG A B & C steam flow.	BV1-2560	DID
1-CS-1	PCV-1RC-455C-PPCV-1RC-455D-PPCV-1RC-456-P PT-1RC-444PT-1RC-445	Close PCV-1RC-455C, PCV-1RC-455D and PCV-1RC-456 at the keylock switches to stop RCS depressurization.	BV1-2561	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CS-1	TV-1BD-100A TV-1BD-100B TV-1BD-100C TV-1BD-101A1 TV-1BD-101A2 TV-1BD-101B1 TV-1BD-101B2 TV-1BD-101C1 TV-1BD-101C2 TV-1BD-107A TV-1BD-107B TV-1BD-107C	De-energize TV-1BD-100A, B & C at PNL-DC-3, de-energize TV-1BD-101A1, B1 & C1 at PNL-VITBUS-1 and de-energize TV-1BD-101A2, B2 & C2 at PNL-VITBUS-2 to stop blowdown flow.	BV1-2565	DID
1-CS-1	TV-1MS-101A TV-1MS-101B TV-1MS-101C	Close 1IA-85-6 and open 1IA-85-53 and IA-85-54 to close the Main Steam Trip Valves.	BV1-2566	DID
1-CS-1	4KVS-1A-1A1 4KVS-1B-1B1 4KVS-1C-1C1 4KVS-1D-1D1 HYV-1FW-100A HYV-1FW-100B HYV-1FW-100C	De-energize 1FW-P-1A at 4KVS-1A & 1B and de-energize 1FW-P-1B at 4KVS-1C & 1D to stop main feedwater flow to the steam generators.	BV1-2576	DID
1-CS-1	4KVS-1A-1A5 4KVS-1B-1B5 4KVS-1C-1C5 PCV-1RC-455A PCV-1RC-455B	De-energize 1RC-P-1A at 4KVS-1A, de-energize 1RC-P-1B at 4KVS-1B and de-energize 1RC-P-1C at 4KVS-1C to prevent an RCP seal LOCA.	BV1-2579	RR
1-CS-1	MOV-1RW-113C MOV-1RW-113D1	De-energize MOV-1RW-113B at MCC1-E8 and open it.	BV1-2586	DID
1-CS-1	MOV-1SI-869B	De-energize MOV-1SI-869B at 480VUS-1-P and manually throttle it to provide an alternate makeup flow path.	BV1-2587	DID
1-CS-1	4KVS-1B-1B2 4KVS-1D-1D2	De-energize 1CN-P-1A at 4KVS-1B and de-energize 1CN-P-1A at 4KVS-1B to stop condensate flow to the steam generators.	BV1-2764	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/DID
1-CS-1	PCV-1MS-101APCV-1MS-101BPCV-1MS-101CHCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2860	DID
1-CS-1	PCV-1RC-455C MOV-1RC-535-P	Transfer control of reactor head vent valves SOV-RC102B, 103B and 105 to the BIP and open the valves as necessary for RCS depressurization. To align Containment Sump recirculation to maintain long-term cooling, perform the following. De-energize MOV-1SI-860B and 863B at 480VUS-1-P and open them, de-energize MOV-1SI-885B and 885D at 480VUS-1-P and close them, de-energize MOV-1CH-115D at 480VUS-1-P and close it and de-energize MOV-1SI-862B at 480VUS-1-P and close it.	BV1-2887	DID
1-CS-1	MOV-1CH-115C	De-energize MOV-1CH-115C at 480VUS-1-N and close it or De-energize MOV-1CH-115E at 480VUS-1-P and close it to prevent hydrogen intrusion into the suction of the charging pumps.	BV1-2920	RR
1-CV-1	PCV-1MS-101A-P PCV-1MS-101B-P PCV-1MS-101C-P	Manually close PCV-1MS-101A to stop SG A steam flow. Manually close PCV-1MS-101B to stop SG B steam flow. Manually close PCV-1MS-101C to stop SG C steam flow.	BV1-2128	DID
1-CV-1	MOV-1CH-115C-P	De-energize MOV-1CH-115D at 480VUS-1-1P and open it to align suction to the charging pumps.	BV1-2129	DID
1-CV-1	MOV-1MS-105 4KVS-1AE-1E16 MOV-1FW-151A MOV-1FW-151B MOV-1FW-151C MOV-1FW-151D MOV-1FW-151E MOV-1FW-151F	De-energize 1FW-P-3A at 4KVS-1AE and manually trip 1FW-P-2 to stop train A AFW flow. De-energize MOV-1FW-151A, C & E at 480VUS-1-1P. Manually throttle MOV-1FW-151E to control SG A AFW flow. Manually throttle MOV-1FW-151C to control SG B AFW flow. Manually throttle MOV-1FW-151A to control SG C AFW flow.	BV1-2133	RR
1-CV-1	MOV-1SI-836-P MOV-1SI-869A-P MOV-1SI-867A MOV-1SI-867C Spurious SI	De-energize MOV-1SI-836, 867A and 869A at 480VUS-1-1N and manually close them to isolate the SI flow paths.	BV1-2135 BV1-2757	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CV-1	4KVS-1A-1A54KVS-1B-1B54KVS-1C-1C5PCV-1RC-455APCV-1RC-455B	De-energize 1RC-P-1A at 4KVS-1A, de-energize 1RC-P-1B at 4KVS-1B and de-energize 1RC-P-1C at 4KVS-1C to prevent an RCP seal LOCA.	BV1-2138	RR
1-CV-1	480VUS-1-8N4 480VUS-1-9P5 1-CIB-SPUR	De-energize 1QS-P-1A at 480VUS-1-8N4 and de-energize 1QS-P-1B at 480VUS-1-9P5 to stop quench spray flow.	BV1-2139	DID
1-CV-1	TV-1MS-101C	Close 1IA-85-6 and open 1IA-85-53 and IA-85-54 to close the Main Steam Trip Valve.	BV1-2140	DID
1-CV-1	MOV-1CH-289	De-energize MOV-1CH-289 at 480VUS-1-1N and manually close it, OR Close manual valve 1CH-30 to stop excessive RCS makeup.	BV1-2156	RR
1-CV-1	FCV-1FW-103B	Isolate and vent the instrument air to fail FCV-1FW-103B closed to ensure adequate AFW flow.	BV1-2158	DID
1-CV-1	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2739	RR
1-CV-1	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2861	RR
1-CV-1	MOV-1RW-103AMOV-1RW-103BMOV-1RW-103CMOV-1RW-103DMOV-1RW-104AMOV-1RW-104BMOV-1RW-104CMOV-1RW-104DMOV-1RW-1041-CIB-SPUR	De-energize MOV-1RW-103C at 480VUS-1-1N and close it. De-energize MOV-1RW-103D at MCC1-E4 and close it.	BV1-2874	DID
1-CV-1	MOV-1RW-114B 1-CIB-SPUR	De-energize MOV-1RW-114B at 480VUS-1-1N and open it. Align 4KVS-1DF for diesel start. Manually start 1WR-P-1B or 1C at 4KVS-1DF to provide River Water flow. Start other DF bus loads as required.	BV1-2876	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CV-1	MOV-1FW-151A MOV-1FW-151C MOV-1FW-151E	De-energize MOV-1FW-151A, C & E at 480VUS-1-1P. Manually throttle MOV-1FW-151E to control SG A AFW flow. Manually throttle MOV-1FW-151C to control SG B AFW flow. Manually throttle MOV-1FW-151A to control SG C AFW flow.	BV1-2929	DID
1-CV-2	MOV-1CH-115C-P MOV-1CH-115E-P MOV-1CH-115B	De-energize MOV-1CH-115B at MCC1-E3 and open it to align suction to the charging pumps.	BV1-2111	RR
1-CV-2	PCV-1MS-101B- PPCV-1MS-101C-P	Manually close PCV-1MS-101B to stop SG B steam flow. Manually close PCV-1MS-101C to stop SG C steam flow.	BV1-2114	DID
1-CV-2	480VUS-1-8N4 480VUS-1-9P5 1-CIB-SPUR	De-energize 1QS-P-1B at 480VUS-1-9P5 to stop quench spray flow.	BV1-2119	RR
1-CV-2	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2740	RR
1-CV-2	MOV-1SI-869B-P MOV-1SI-867A MOV-1SI-867B MOV-1SI-867D	De-energize MOV-1SI-867D and 869B at 480VUS-1-1P and manually close them to isolate the SI flow paths.	BV1-2120 BV1-2755	DID
1-CV-2	MOV-1SI-869B	De-energize MOV-1SI-869B at 480VUS-1-9P and manually throttle it to provide RCS makeup flow.	BV1-2756	DID
1-CV-2	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2862	RR
1-CV-2	MOV-1RW-103A MOV-1RW-103B MOV-1RW-103C MOV-1RW-103D MOV-1RW-104B MOV-1RW-104D MOV-1RW-104 MOV-1RW-106A MOV-1RW-114A MOV-1RW-106B MOV-1RW-114B 1-CIB-SPUR	De-energize MOV-1RW-103A at MCC1-E3, de-energize MOV-1RW-103B at MCC1-E4 and close both valves.	BV1-2877	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-CV-2	MOV-1RW-106AMOV-1RW-114AMOV-1RW-103AMOV-1RW-103B1-CIB-SPUR	De-energize MOV-1RW-106A at MCC1-E4, de-energize MOV-1RW-114A at MCC1-E3 and open both valves. Align 4KVS-1AE for diesel start. De-energize MOV-1RW-102C1 at MCC1-E2 and manually close it. Manually start 1WR-P-1C at 4KVS-1AE to provide River Water flow, OR De-energize MOV-1RW-102A2 at MCC1-E1 and manually throttle it 10% open THEN manually start 1WR-P-1A at 4KVS-1AE and manually open MOV-1RW-102A2 to provide River Water flow. Start other AE bus loads as required.	BV1-2878	RR
1-CV-2	4KVS-1A-1A5 4KVS-1B-1B5 4KVS-1C-1C5	De-energize 1RC-P-1A at 4KVS-1A, de-energize 1RC-P-1B at 4KVS-1B and de-energize 1RC-P-1C at 4KVS-1C to prevent an RCP seal LOCA.	BV1-2973	DID
1-CV-3	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2308	DID
1-CV-3	1VS-D-22-1B 1VS-D-22-2C 1VS-D-22-2D 1VS-F-22B	Install temporary ventilation for the running diesel.	BV1-2311	DID
1-CV-3	MOV-1MS-105 MOV-1FW-151B MOV-1FW-151D MOV-1FW-151F	Manually trip the Turbine Driven Auxiliary Feedwater Pump to prevent SG overfill.	BV1-2927	DID
1-DG-2	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2071	RR
1-DG-2	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2741	RR
1-ES-1	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-1810	RR
1-ES-1	480VUS-1-8N12 480VUS-1-8N13 480VUS-1-9P13	De-energize the A and D group heaters by manually stopping the #1 diesel generator and de-energizing off-site power to the AE bus at 4KVS-1A AND de-energize the E group heater at 480VUS-1-9-P to prevent RCS overpressure.	BV1-2052	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-ES-1	4KVS-1A-1A1 HYV-1FW-100A HYV-1FW-100B HYV-1FW-100C	De-energize 1FW-P-1A at 4KVS-1A to stop main feedwater flow to the steam generators.	BV1-2054	DID
1-ES-1	4KVS-1A-1A5	De-energize 1RC-P-1A at 4KVS-1A to prevent an RCP seal LOCA.	BV1-2055	DID
1-ES-1	4KVS-1AE-1E11-P 4KVS-1AE-1E15-P	De-energize 1CH-P1A and 1CH-P1C by manually stopping the #1 diesel generator and de-energizing off-site power to the AE bus at 4KVS-1A to stop excessive RCS makeup.	BV1-2131	DID
1-ES-1	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2742	RR
1-ES-1	MOV-1SI-867A MOV-1SI-867C Spurious SI	De-energize MOV-1SI-867A by manually stopping the #1 diesel generator and de-energizing off-site power to the AE bus at 4KVS-1A, then manually close MOV-1SI-867A to isolate the SI flow path.	BV1-3000	DID
1-ES-2	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2060	RR
1-ES-2	1VS-AC-1A 1VS-C-1A 1VS-E-4A 1VS-F-40A 1VS-P-3A	Install a 5000 CFM portable fan in the Control Room doorway to supply temporary ventilation.	BV1-2061	RR
1-ES-2	480VUS-1-9P12 480VUS-1-9P13	De-energize the B and E group heaters by manually stopping the #2 diesel generator and de-energizing off-site power to the DF bus at 4KVS-1D to prevent RCS overpressure.	BV1-2063	DID
1-ES-2	4KVS-1B-1B5	De-energize 1RC-P-1B at 4KVS-1B to prevent an RCP seal LOCA.	BV1-2066	RR
1-ES-2	4KVS-1DF-1F11-P 4KVS-1DF-1F15-P	De-energize 1CH-P1B and 1CH-P1C by manually stopping the #2 diesel generator and de-energizing off-site power to the DF bus at 4KVS-1D to stop excessive RCS makeup.	BV1-2108	DID
1-ES-2	4KVS-1DF-1F16 MOV-1FW-151A MOV-1FW-151C MOV-1FW-151E MOV-1MS-105	De-energize 1FW-P-3B at 4KVS-1DF to stop train B AFW flow.	BV1-2415	RR
1-ES-2	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2481	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-ES-2	4KVS-1AE 4KVS-1AE-1E7 4KVS-1AE-1E9 1EE-EG-1 PNL-DG-SEQ-1 4KVS-1AE-1E12	Align AE and DF bus loads as required.	BV1-2815	RR
1-ES-2	MOV-1SI-867B MOV-1SI-867D Spurious SI	De-energize MOV-1SI-867A by manually stopping the #1 diesel generator and de-energizing off-site power to the AE bus at 4KVS-1A, then manually close MOV-1SI-867A to isolate the SI flow path.	BV1-3001	DID
1-MG-1	1VS-AC-1A1VS-C-1A1VS-E-4A1VS-F-40A1VS-P-3A	Install a 5000 CFM portable fan in the Control Room doorway to supply temporary ventilation.	BV1-2479	RR
1-MG-1	PNL-DG- SEQ-1	Align AE and DF bus loads as required.	BV1-2597	RR
1-MG-1	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2743	RR
1-MG-1	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2900	RR
1-MS-1	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Initially, decay heat removal will be via the main steam code safeties. In the event that a main steam code safety sticks open, provide RCS makeup from the RWST to compensate from the reactivity change and RCS shrink. Actions to be performed in the Control Room.	BV1-2193	PCS
1-MS-1	TV-1MS-101A TV-1MS-101B TV-1MS-101C	Close 1IA-85-6 and open 1IA-85-53 and IA-85-54 to close the Main Steam Trip Valve.	BV1-2194	DID
1-MS-1	PCV-1MS-101A-P PCV-1MS-101B-P PCV-1MS-101C-P HCV-1MS-104-P	Provide RCS makeup from the RWST to compensate for reactivity change and RCS shrink. Actions to be performed in Control Room.	BV1-2965	PCS
1-MS-1	4KVS-1A-1A5 4KVS-1B-1B5 4KVS-1C-1C5	De-energize 1RC-P-1A at 4KVS-1A, de-energize 1RC-P-1B at 4KVS-1B and de-energize 1RC-P-1C at 4KVS-1C to prevent an RCP seal LOCA.	BV1-2971	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-NS-1	4KVS-1A-1A5 4KVS-1B-1B5 4KVS-1C-1C5	De-energize 1RC-P-1A, 1B and 1C by tripping OCB 83, OCB 92, PCB 331 AND PCB 341 at the Switchyard Relay Building to prevent an RCP seal LOCA.	BV1-2603	RR
1-NS-1	4KVS-1DF 4KVS-1DF-1F7 4KVS-1DF-1F9 PNL-DG-SEQ-2	Align AE and DF bus loads as required.	BV1-2606	RR
1-NS-1	4KVS-1AE-1E16 4KVS-1DF-1F16 MOV-1FW-151A MOV-1FW-151B MOV-1FW-151C MOV-1FW-151D M OV-1FW-151E MOV-1FW-151F	De-energize 1FW-P-3B at 4KVS-1DF to stop train B AFW flow. De-energize MOV-1FW-151B, D & F at MCC1-E5. Manually throttle MOV-1FW-151F to control SG A AFW flow. Manually throttle MOV-1FW-151D to control SG B AFW flow. Manually throttle MOV-1FW-151B to control SG C AFW flow.	BV1-2608	RR
1-NS-1	480VUS-1-8N12 480VUS-1-9P12 480VUS-1-1B7 480VUS-1-8N13 480VUS-1-9P13	De-energize the A and D group heaters at 480VUS-1-8-N, de-energize the control group heater by tripping OCB 83, OCB 92, PCB 331 AND PCB 341 at the Switchyard Relay Building and de-energize the B and E group heaters at 480VUS-1-9-P to prevent RCS overpressure.	BV1-2610	DID
1-NS-1	LI-1RC-460BP TI-1RC-410BP BIP Power	Energize the BIP and monitor the primary parameters remotely from the BIP.	BV1-2613	DID
1-NS-1	4KVS-1DF-1F11-P 4KVS-1DF-1F15-P	De-energize 1CH-P-1B and 1C at 4KVS-1DF to stop excessive RCS makeup flow.	BV1-2615	DID
1-NS-1	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2616	RR
1-NS-1	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2704	RR
1-NS-1	4KVS-1DF-1F10	Swap River Water pump breakers at 4KVS-1DF. Manually start 1WR-P-1C at 4KVS-1DF.	BV1-2708	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-NS-1	MOV-1SI-867A MOV-1SI-867B MOV-1SI-867C MOV-1SI-867D Spurious SI	De-energize 1CH-P-1B(C) at 4KVS-1DF to stop excessive RCS makeup flow. De-energize MOV-1SI-867A at MCC1-E5, de-energize MOV-1SI-867B at MCC1-E6 and manually close the valves to isolate the SI flow path. Manually start 1CH-P-1B or 1CH-P-1C at 4KVS-1DF to provide RCS makeup flow.	BV1-2872	DID
1-NS-1	4KVS-1DF-1F11 4KVS-1DF-1F15	Manually start 1CH-P-1B and 1C at 4KVS-1DF to provide RCS makeup flow.	BV1-2994	DID
1-PA-1E	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2009	RR
1-PA-1E	MOV-1CH-115C-P MOV-1CH-115E-P MOV-1CH-115B	De-energize MOV-1CH-115D at MCC1-E4 and open it to align suction to the charging pumps.	BV1-2012	DID
1-PA-1E	4KVS-1DF 4KVS-1DF-1F1-OCT 4KVS-1DF-1F4-OCT 4KVS-1DF-1F7 4KVS-1DF-1F9	Align AE and DF bus loads as required.	BV1-2013	RR
1-PA-1E	MOV-1RW-106B MOV-1RW-114B	De-energize MOV-1RW-106B at MCC1-E4, de-energize MOV-1RW-114B at MCC1-E3 and open both valves. Align 4KVS-1DF for diesel start. De-energize MOV-1RW-102B2 at MCC1-E1 and manually close it. De-energize MOV-1RW-102B1 at MCC1-E2 and manually throttle it 10% open THEN manually start 1WR-P-1B at 4KVS-1DF and manually open MOV-1RW-102B1 to provide River Water flow, OR De-energize MOV-1RW-102C2 at MCC1-E1 and manually close it. DE-energize MOV-1RW-102C1 at MCC1-E2 and manually throttle it 10% open THEN manually start 1WR-P-1C at 4KVS-1DF and manually open MOV-1RW-102C1 to provide River Water flow. Start other DF bus loads as required.	BV1-2016	RR
1-PA-1E	1VS-F-16B 1VS-F-55B	Install portable ventilation for Emergency Switchgear.	BV1-2017	RR
1-PA-1E	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2784	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-PA-1E	MOV-1RW-103A MOV-1RW-103B MOV-1RW-103C MOV-1RW-103D MOV-1RW-106A MOV-1RW-106B MOV-1RW-114A MOV-1RW-114B MOV-1RW-104A MOV-1RW-104C MOV-1RW-116A MOV-1RW-116B	De-energize MOV-1RW-103C at MCC1-E3, de-energize MOV-1RW-103D at MCC1-E4 and close both valves.	BV1-2999	DID
1-PA-1G	MOV-1CH-115C-P MOV-1CH-115E-P MOV-1CH-115B	Rack breaker for 1CH-P-1C off of 4KVS-1DF and rack breaker for 1CH-P-1B onto 4KVS-1DF to allow the pump to be started from the Control Room	BV1-2024	DID
1-PA-1G	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2020	RR
1-PA-1G	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2631	RR
1-PT-1	PCV-1MS-101A-P PCV-1MS-101B-P PCV-1MS-101C-P HCV-1MS-104-P	Manually close PCV-1MS-101A to stop SG A steam flow. Manually close PCV-1MS-101B to stop SG B steam flow. Manually close PCV-1MS-101C to stop SG C steam flow. Manually close HCV-1MS-104 to stop SG A B & C steam flow.	BV1-2177	RR
1-PT-1	480VUS-1-8N4 480VUS-1-9P5 1-CIB-SPUR	De-energize 1QS-P-1A at 480VUS-1-8N4 and de-energize 1QS-P-1B at 480VUS-1-9P5 to stop quench spray flow.	BV1-2179	DID
1-PT-1	MOV-1SI-867A MOV-1SI-867B MOV-1SI-867C MOV-1SI-867D	De-energize MOV-1SI-867A at MCC1-E5, de-energize MOV-1SI-867B at MCC1-E6 and manually close the valves to isolate the SI flow path.	BV1-2180	DID
1-PT-1	MOV-1CH-289	De-energize MOV-1CH-289 at MCC1-E5 and manually close it, OR Close manual valve 1CH-30 to stop excessive RCS makeup.	BV1-2181	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/DID
1-PT-1	LT-1QS-100A LT-1QS-100B LT-1QS-100C LT-1QS-100D	De-energize 1SI-P-1A at 4KVS-1AE and De-energize 1SI-P-1B at 4KVS-1DF to stop flow from the containment sump. De-energize MOV-1CH-115B at MCC1-E3 and open it to align suction to the charging pumps.	BV1-2183	DID
1-PT-1	FCV-1FW-103A	Isolate and vent the instrument air to fail FCV-1FW-103A closed to ensure adequate AFW flow.	BV1-2184	DID
1-PT-1	MOV-1RW-103A MOV-1RW-103B MOV-1RW-103C MOV-1RW-103D MOV-1RW-104A MOV-1RW-104B MOV-1RW-104C MOV-1RW-104D MOV-1RW-104 1-CIB-SPUR	De-energize MOV-1RW-103A at MCC1-E3, de-energize MOV-1RW-103B at MCC1-E4 and close both valves.	BV1-2185	DID
1-PT-1	MOV-1RW-106A MOV-1RW-114A 1-CIB-SPUR	De-energize MOV-1RW-106A at MCC1-E4, de-energize MOV-1RW-114A at MCC1-E3 and open both valves. Align 4KVS-1AE for diesel start. De-energize MOV-1RW-102C1 at MCC1-E2 and manually close it. Manually start 1WR-P-1C at 4KVS-1AE to provide River Water flow, OR De-energize MOV-1RW-102A2 at MCC1-E1 and manually throttle it 10% open THEN manually start 1WR-P-1A at 4KVS-1AE and manually open MOV-1RW-102A2 to provide River Water flow. Start other AE bus loads as required.	BV1-2186	DID
1-PT-1	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2746	RR
1-PT-1	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2863	RR
1-QP-1	4KVS-1AE-1E16 MOV-1FW-151B MOV-1FW-151D MOV-1FW-151F 1FW-P-3A	Open HYV-1FW-100A at 1FW-PNL-100A, open HYV-1FW-100B at 1FW-PNL-100B, open HYV-1FW-100C at 1FW-PNL-100C, manually open MOV-1FW-155A, manually open MOV-1FW-155B, manually open MOV-1FW-155C, manually open FCV-1FW-479, manually open FCV-1FW-489 and manually open FCV-1FW-499 to align the flow path from 1FW-P4 to the steam generators. Locally start 1FW-P-4, locally open MOV-1FW-160 and manually throttle FCV-1FW-479 to control SG A feed flow, manually throttle FCV-1FW-489 to control SG B and manually throttle FCV-1FW-499 to control SG C feed flow.	BV1-2236	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-QP-1	480VUS-1-8N4 480VUS-1-9P5	De-energize 1QS-P-1A at 480VUS-1-8N4 and de-energize 1QS-P-1B at 480VUS-1-9P5 to stop quench spray flow.	BV1-2237	DID
1-QP-1	4KVS-1AE-1E16-OCT	Align AE and DF bus loads as required.	BV1-2238	RR
1-QP-1	PCV-1MS-101A-P PCV-1MS-101B-P PCV-1MS-101C-P HCV-1MS-104-P	Manually throttle PCV-1MS-101A to control SG A steam flow. Manually throttle PCV-1MS-101B to control SG B steam flow. Manually throttle PCV-1MS-101C to control SG C steam flow. Manually throttle HCV-1MS-104 to control SG A B & C steam flow.	BV1-2241	DID
1-QP-1	4KVS-1AE-1E16 4KVS-1DF-1F16 MOV-1MS-105 MOV-1FW-151A MOV-1FW-151B MOV-1FW-151C MOV-1FW-151D MOV-1FW-151E MOV-1FW-151F	De-energize 1FW-P-3B at 4KVS-1DF to stop train B AFW flow. De-energize 1FW-P-3A at 4KVS-1AE and de-energize MOV-1MS-105 at MCC1-E6 and manually close it to stop train A AFW flow.	BV1-2242	RR
1-QP-1	MOV-1SI-867A MOV-1SI-867B MOV-1SI-867C MOV-1SI-867D	De-energize MOV-1SI-867A at MCC1-E5, de-energize MOV-1SI-867B at MCC1-E6 and manually close the valves to isolate the SI flow path.	BV1-2243	DID
1-QP-1	TV-1MS-101A TV-1MS-101B TV-1MS-101C	Close 1IA-85-6 and open 1IA-85-53 and IA-85-54 to close the Main Steam Trip Valves. They are in the fire. Att. S BV1-3039 will install valves to permit isolation of air from outside this fire compartment (RAI 03)	BV1-2644	RR
1-QP-1	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually close HCV-1MS-104 to stop SG A, B & C steam flow. Manually close PCV-1MS-101A to stop SG A steam flow, manually close PCV-1MS-101B to stop SG B steam flow and manually close PCV-1MS-101C to stop SG C steam flow.	BV1-2864	DID
1-QP-1	FCV-1FW-103A	De-energize 1FW-P-3B at 4KVS-1DF to stop train B AFW flow.	BV1-2972	RR
1-RC-1	4KVS-1A-1A5 4KVS-1B-1B5 4KVS-1C-1C5 PCV-1RC-455A PCV-1RC-455B	De-energize 1RC-P-1A at 4KVS-1A, de-energize 1RC-P-1B at 4KVS-1B and de-energize 1RC-P-1C at 4KVS-1C to prevent an RCP seal LOCA.	BV1-2149	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
1-RC-1	PCV-1RC-455C-P PCV-1RC-455D-P PCV-1RC-456-P PT-1RC-444 PT-1RC-445	Close PCV-1RC-455C, PCV-1RC-455D and PCV-1RC-456 at the keylock switches to stop RCS depressurization.	BV1-2150	DID
1-RC-1	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2152	RR
1-RC-1	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2835	RR
1-RC-1	Spurious SI	De-energize MOV-1SI-867A at MCC1-E5 and de-energize MOV-1SI-867B at MCC1-E6 and close both valves.	BV1-2873	DID
1-RC-1	PCV-1RC-455D PCV-1RC-456 MOV-1RC-536-P MOV-1RC-537-P	Transfer control of reactor head vent valves SOV-RC102B, 103B and 105 to the BIP and open the valves as necessary for RCS depressurization.	BV1-2888	DID
1-TB-1	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-1934	RR
1-TB-1	1WT-TK-10	To align River Water to AFW pump suction: Close 1RW-306. Open 1RW-206, 1RW-207, 1RW-208, 1RW-209 and 1RW-210. Close 1WT-225, 1WT-226 and 1WT-227. Locally monitor running AFW pump suction pressure at PI-1FW-156, PI-1FW-156A, or PI-1FW-156B, and if any running AFW pump suction pressure drops below 8 PSIG, flush strainer 1RW-YS-47 by opening 1RW-901, allowing the strainer to flush for several seconds, and closing 1RW-901.	BV1-2618	RR
3-CR-1	PCV-1MS-101A-P PCV-1MS-101B-P PCV-1MS-101C-P HCV-1MS-104-P	Manually close PCV-1MS-101A to stop SG A steam flow. Manually close PCV-1MS-101B to stop SG B steam flow. Manually close PCV-1MS-101C to stop SG C steam flow. Manually close HCV-1MS-104 to stop SG A B & C steam flow.	BV1-2251	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
3-CR-1	4KVS-1A-1A5 4KVS-1B-1B5 4KVS-1C-1C5 PCV-1RC-455A PCV-1RC-455B	De-energize 1RC-P-1A at 4KVS-1A, de-energize 1RC-P-1B at 4KVS-1B and de-energize 1RC-P-1C at 4KVS-1C to prevent an RCP seal LOCA.	BV1-2255	RR
3-CR-1	1CH-E-1 MOV-1CH-381	De-energize MOV-1CH-381 at MCC1-E6 and manually close it OR Manually close 1CH-214 OR manually close 1CH-216 to isolate seal return.	BV1-2257	RR
3-CR-1	MOV-1CH-115C-P MOV-1CH-115E-P MOV-1CH-115B 4KVS-1AE-1E11-P 4KVS-1AE-1E15-P 4KVS-1AE-1E11 4KVS-1AE-1E15	De-energize 1CH-P-1A(C) at 4KVS-1AE and De-energize 1CH-P-1B(C) at 4KVS-1DF to prevent pump damage on loss of suction. De-energize MOV-1CH-115D at 480VUS-1-P and open it to align suction to the charging pumps. Manually start 1CH-P-1B or 1CH-P-1C at 4KVS-1DF to provide RCS makeup flow.	BV1-2258	RR
3-CR-1	4KVS-1DF 4KVS-1DF-1F7 4KVS-1DF-1F9 1EE-EG-2 PNL-DG-SEQ-2 4KVS-1DF-1F12	Align AE and DF bus loads as required.	BV1-2259	RR
3-CR-1	LT-1QS-100A LT-1QS-100B LT-1QS-100C LT-1QS-100D 1-MTR-SIGNAL	De-energize 1CH-P-1A(C) at 4KVS-1AE and De-energize 1CH-P-1B(C) at 4KVS-1DF to prevent pump damage on loss of suction. De-energize 1SI-P-1A at 4KVS-1AE and De-energize 1SI-P-1B at 4KVS-1DF to stop flow from the containment sump. De-energize MOV-1CH-115D at 480VUS-1-P and open it to align suction to the charging pumps Manually start 1CH-P-1B or 1CH-P-1C at 4KVS-1DF to provide RCS makeup flow.	BV1-2261	DID
3-CR-1	480VUS-1-8N12 480VUS-1-9P12 480VUS-1-1B7 480VUS-1-8N13 480VUS-1-9P13	De-energize the A and D group heaters at 480VUS-1-8-N, de-energize the control group heater at 480VUS-1-1B and de-energize the B and E group heaters at 480VUS-1-9-P to prevent RCS overpressure.	BV1-2262	DID
3-CR-1	480VUS-1-8N4 480VUS-1-9P5 1-CIB-SPUR	De-energize 1QS-P-1A at 480VUS-1-8N4 and de-energize 1QS-P-1B at 480VUS-1-9P5 to stop quench spray flow.	BV1-2264	DID
3-CR-1	LCV-1CH-460A SW-ISO-CH460A	Close LCV-1CH-460 at the keylock switch to isolate letdown.	BV1-2268	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
3-CR-1	MOV-1RW-103A MOV-1RW-103B MOV-1RW-103C MOV-1RW-103D MOV-1RW-106A MOV-1RW-106B MOV-1RW-114A MOV-1RW-114B MOV-1RW-104A MOV-1RW-104B MOV-1RW-104C MOV-1RW-104D MOV-1RW-104 MOV-1RW-116A MOV-1RW-116B 1-CIB-SPUR	De-energize MOV-1RW-103C at MCC1-E3, de-energize MOV-1RW-103D at MCC1-E4 and close both valves.	BV1-2269	DID
3-CR-1	MOV-1RW-102B1 MOV-1RW-106B MOV-1RW-114B MOV-1RW-103B 1-CIB-SPUR	Trip the #2 diesel to prevent damage. De-energize MOV-1RW-106B at 480VUS-1-P, de-energize MOV-1RW-114B at 480VUS-1-N and open both valves. Align 4KVS-1DF for diesel start. Restart the #2 diesel. De-energize MOV-1RW-102B2 at MCC1-E1 and manually close it. De-energize MOV-1RW-102B1 at MCC1-E2 and manually throttle it 10% open THEN manually start 1WR-P-1B at 4KVS-1DF and manually open MOV-1RW-102B1 to provide River Water flow, OR De-energize MOV-1RW-102C2 at MCC1-E1 and manually close it. De-energize MOV-1RW-102C1 at MCC1-E2 and manually throttle it 10% open THEN manually start 1WR-P-1C at 4KVS-1DF and manually open MOV-1RW-102C1 to provide River Water flow. Start other DF bus loads as required.	BV1-2270	DID
3-CR-1	MOV-1SI-836-P MOV-1SI-869A-P MOV-1SI-869B-P MOV-1SI-867A MOV-1SI-867B MOV-1SI-867C MOV-1SI-867D Spurious SI	De-energize 1CH-P-1A(C) at 4KVS-1AE and De-energize 1CH-P-1B(C) at 4KVS-1DF to stop excessive RCS makeup flow. De-energize MOV-1SI-836, 867A and 869A at 480VUS-1-N, de-energize MOV-1SI-867B and 869B at 480VUS-1-P and manually close the valves to isolate the SI flow paths. Manually start 1CH-P-1B or 1CH-P-1C at 4KVS-1DF to provide RCS makeup flow.	BV1-2271 BV1-2272	DID
3-CR-1	MOV-1SI-869B	De-energize MOV-1SI-869B at 480VUS-1-1P and manually throttle to provide an alternate makeup flow path.	BV1-2274	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
3-CR-1	TV-1BD-100A TV-1BD-100B TV-1BD-100C TV-1BD-101A1 TV-1BD-101A2 TV-1BD-101B1 TV-1BD-101B2 TV-1BD-101C1 TV-1BD-101C2 TV-1BD-107A TV-1BD-107B TV-1BD-107C	De-energize TV-1BD-100A, B & C at PNL-DC-3, de-energize TV-1BD-101A1, B1 & C1 at PNL-VITBUS-1 and de-energize TV-1BD-101A2, B2 & C2 at PNL-VITBUS-2 to stop blowdown flow.	BV1-2276	DID
3-CR-1	TV-1MS-101A TV-1MS-101B TV-1MS-101C	Close 1IA-85-6 and open 1IA-85-53 and IA-85-54 to close the Main Steam Trip Valves.	BV1-2277	DID
3-CR-1	4KVS-1DF-1F16 MOV-1FW-151A MOV-1FW-151C MOV-1FW-151E	Manually start 1FW-P-3B at 4KVS-1DF. De-energize MOV-1FW-151A, C & E at 480VUS-1-P. Manually throttle MOV-1FW-151E to control SG A AFW flow. Manually throttle MOV-1FW-151C to control SG B AFW flow. Manually throttle MOV-1FW-151A to control SG C AFW flow.	BV1-2279	DID
3-CR-1	MOV-1CH-289	De-energize MOV-1CH-289 at MCC1-E5 and manually close it, OR Close manual valve 1CH-30 to stop excessive RCS makeup.	BV1-2282	RR
3-CR-1	4KVS-1A-1A1 4KVS-1B-1B1 4KVS-1C-1C1 4KVS-1D-1D1 HYV-1FW-100A HYV-1FW-100B HYV-1FW-100C	De-energize 1FW-P-1A at 4KVS-1A & 1B and de-energize 1FW-P-1B at 4KVS-1C & 1D to stop main feedwater flow to the steam generators.	BV1-2331	DID
3-CR-1	4KVS-1DF-1F2 4KVS-1DF-1F10 4KVS-1DF-1F14	Trip the #2 diesel to prevent damage. Align 4KVS-1DF for diesel start. Restart the #2 diesel. Manually start 1WR-P-1B or 1C at 4KVS-1DF. Start other DF bus loads as required.	BV1-2332	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
3-CR-1	PCV-1RC-455C-P PCV-1RC-455D-P PCV-1RC-456-P PT-1RC-444 PT-1RC-445	Close PCV-1RC-455C, PCV-1RC-455D and PCV-1RC-456 at the keylock switches to stop RCS depressurization.	BV1-2334	RR
3-CR-1	4KVS-1AE-1E16 MOV-1MS-105 4KVS-1DF-1F16 MOV-1FW-151A MOV-1FW-151B MOV-1FW-151C MOV-1FW-151D MOV-1FW-151E MOV-1FW-151F	De-energize 1FW-P-3A at 4KVS-1AE and manually trip 1FW-P-2 to stop train A AFW flow. De-energize MOV-1FW-151A, C & E at 480VUS-1-P. Manually throttle MOV-1FW-151E to control SG A AFW flow. Manually throttle MOV-1FW-151C to control SG B AFW flow. Manually throttle MOV-1FW-151A to control SG C AFW flow.	BV1-2416	RR
3-CR-1	1VS-F-16B 1VS-F-55B	Install portable ventilation for Emergency Switchgear.	BV1-2426	RR
3-CR-1	1VS-AC-1B 1VS-C-1B 1VS-E-4B 1VS-F-40B 1VS-P-3B	Install a 5000 CFM portable fan in the Control Room doorway to supply temporary ventilation.	BV1-2480	RR
3-CR-1	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2574	RR
3-CR-1	SOV-1RC-102B SOV-1RC-103B SOV-1RC-105 LI-1FW-475BP LI-1RC-460BP NI-1NI-32A PI-1RC-403B PTI-1RC-410B PTI-1RC-29BP BIP Power	Use supplementary controls and monitoring from the BIP.	BV1-2695	DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/DID
3-CR-1	Spurious SI 4KVS-1AE-1E11-P 4KVS-1AE-1E15-P 4KVS-1DF-1F11-P 4KVS-1DF-1F15-P	De-energize 1CH-P-1A(C) at 4KVS-1AE OR De-energize 1CH-P-1B(C) at 4KVS-1DF to control charging/HHSI flow.	BV1-2707	DID
3-CR-1	4KVS-1B-1B2 4KVS-1D-1D2	De-energize 1CN-P-1A at 4KVS-1B and de-energize 1CN-P-1A at 4KVS-1B to stop condensate flow to the steam generators.	BV1-2759	DID
3-CR-1	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2865	RR
3-CR-1	PCV-1RC-455C MOV-1RC-535-P	Transfer control of reactor head vent valves SOV-RC102B, 103B and 105 to the BIP and open the valves as necessary for RCS depressurization. To align Containment Sump recirculation to maintain long-term cooling, perform the following. De-energize MOV-1SI-860B and 863B at 480VUS-1-P and open them, de-energize MOV-1SI-885B and 885D at 480VUS-1-P and close them, de-energize MOV-1CH-115D at 480VUS-1-P and close it and de-energize MOV-1SI-862B at 480VUS-1-P and close it.	BV1-2889	DID
3-CR-1	MOV-1CH-115C	De-energize MOV-1CH-115C at 480VUS-1-N and close it or De-energize MOV-1CH-115E at 480VUS-1-P and close it to prevent hydrogen intrusion into the suction of the charging pumps.	BV1-2917	DID
3-YARD-1	4KVS-1AE 4KVS-1DF 1EE-EG-1 1EE-EG-2 1VS-D-22-1A 1VS-D-22-1B 1VS-D-22-2C 1VS-D-22-2D 1VS-F-22A 1VS-F-22B	Identify the emergency bus that is energized or that is to be recovered. Local manual operator action to remove all control power from the selected emergency bus, strip the emergency bus, verify that the Emergency Diesel Generator has automatically started, or manually start it, if required. Local manual operator action will be required to manually sequence on all necessary emergency bus loads, if required.	BV1-2493	RR
3-YARD-1	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction.	BV1-2657	RR

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
3-YARD-1	PCV-1MS-101A PCV-1MS-101B PCV-1MS-101C HCV-1MS-104	Manually throttle HCV-1MS-104 to control SG A, B, & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2901	RR
Generic 1-CTP-1 1-DG-1 1-PA-1A 1-PA-1C 1-SB-GEN 1-TO-1 1-TR-1 1-TR-2 1-TR-3 1-TR-4 1-TR-5 1-WH-1 3-AIS-1 3-ER-1 3-ER-2 3-IS-1 3-IS-2 3-IS-6 3-RH-1 3-SY-1		Manually throttle HCV-1MS-104 to control SG A, B, & C steam flow OR Manually throttle PCV-1MS-101A to control SG A steam flow, manually throttle PCV-1MS-101B to control SG B steam flow and manually throttle PCV-1MS-101C to control SG C steam flow.	BV1-2771	RR and DID

Table 3 – BVPS-1 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/DID**
Generic 1-CTP-1 1-DG-1 1-PA-1A 1-PA-1C 1-SB-GEN 1-TO-1 1-TR-1 1-TR-2 1-TR-3 1-TR-4 1-TR-5 1-WH-1 3-AIS-1 3-ER-1 3-ER-2 3-IS-1 3-IS-2 3-IS-6 3-RH-1 3-SY-1	1WT-TK-10	Manually open 1FW-643, manually close 1FW-639, manually open 1FW-660 and manually close 1FW-663 to align 1WT-TK-26 to the AFW pump suction	BV1-2772	RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-ASP	2CHS-AOV200A 2CHS-AOV200C 2CHS-LCV460B	De-energize 2CHS-AOV200A at PNL-DC2-11 and de-energize 2CHS-AOV200C at PNL-DC2-15 to isolate letdown flow. OR Isolate instrument air to containment to fail 2CHS-AOV200A, B and C closed to prevent loss of RCS inventory.	BV2-0765	RR
2-ASP	2SVS-PCV101A 2SVS-PCV101B	De-energize 2SVS-PCV101A at MCC2-E05 to stop SG A steam flow. De-energize 2SVS-PCV101B at MCC2-E13 to stop SG B steam flow.	BV2-1396	RR
2-ASP	4KVS-2AE-2E18 2FWE-HCV100A 2FWE-HCV100C 2FWE-HCV100E	De-energize 2FWE-P23A at 4KVS-2AE to stop train A AFW flow.	BV2-1364	RR
2-ASP	480VUS-2-8-7B 480VUS-2-8-7C	De-energize the A and D backup group heaters at 480VUS-2-8 to prevent RCS overpressure.	BV2-0768	DID
2-ASP	2FWE-TK210	Provide an alternate suction to the AFW pumps.	BV2-0779	RR
2-ASP	4KVS-2AE-2E12	De-energize the A Charging/HHSI Pump at 4KVS-2AE to stop excess charging/HHSI pump flow.	BV2-0769	DID
2-ASP	2RCS-PCV456	Close 2RCS-PCV456 at the keylock isolation switch. OR Perform repair procedure to allow the closing of 2RCS-MOV536 to isolate the PORV. OR To provide a flow path from the containment sump to Charging/HHSI pump 2CHS-P21B de-energize 2SIS-MOV8809B, 2SIS-MOV8887B, 2SIS-MOV8811B, 2RSS-MOV156D, 2SIS-MOV863B, 2RSS-MOV155D and 2SIS-MOV8890B at MCC2-E12 and then manually close 2SIS-MOV8809B, 2SIS-MOV8887B, 2RSS-MOV156D and 2SIS-MOV8890B, manually open 2SIS-MOV8811B, 2SIS-MOV863B and 2RSS-MOV155D.	BV2-0766	RR and DID
2-CB-1	2CHS-E21 2CHS-MOV378	Close 2CHS-214 to isolate seal water return heat exchanger flow.	BV2-0801	RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CB-1	2BDG-AOV100A1 2BDG-AOV100B1 2BDG-AOV100C1 2BDG-AOV101A1 2BDG-AOV101A2 2BDG-AOV101B1 2BDG-AOV101B2 2BDG-AOV101C1 2BDG-AOV101C2	De-energize 2BDG-AOV101A2, B2 and C2 at PNL-DC2-10 to isolate SG A, B and C blowdown flow.	BV2-0797	DID
2-CB-1	2SDS-AOV112A 2SDS-AOV112B 2SDS-AOV112C	De-energize 2SDS-AOV112A, B and C at PNL-AC2-03 to stop steam flow from SG A, B and C.	BV2-0815	DID
2-CB-1	2SVS-HCV104 2SVS-PCV101A 2SVS-PCV101B 2SVS-PCV101C	Throttle 2SVS-PCV101A from the ASP to control SG C pressure and throttle 2SVS-PCV101B from the ASP to control SG B pressure.	BV2-1397	PCS
2-CB-1	2SVS-HCV104 2SVS-PCV101A 2SVS-PCV101B 2SVS-PCV101C	De-energize 2SVS-HCV104 at MCC2-E14 to stop SG A, B and C steam flow. De-energize 2SVS-PCV101A at MCC2-E05 to stop SG A steam flow. De-energize 2SVS-PCV101B at MCC2-E13 to stop SG B steam flow. De-energize 2SVS-PCV101C at 480VUS-2-8 to stop SG C steam flow. THEN Manually throttle 2SVS-HCV104 to control SG A, B and C pressure. Manually throttle 2SVS-PCV101A to control SG A pressure. Manually throttle 2SVS-PCV101B to control SG B pressure. Manually throttle 2SVS-PCV101C to control SG C pressure.	BV2-1397	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CB-1	2SWS-MOV102A 2SWS-MOV106A 2-CIB-SPUR	If 2SWS-P21A and 2SWE-P21A are damaged, stop the 2-1 diesel to prevent overheating. De-energize 2SWS-MOV103A at MCC2-E03 and close it. De-energize 2SWE-MOV116A at MCC2-E03 and close if spuriously opened. De-energize 2SWS-MOV106A at MCC2-E03 and open it to align the A SWS flow path. De-energize 2SWS-MOV170A at MCC2-E01 and open it to align seal water to 2SWS-P21C. De-energize 2SWS-MOV102C1 at MCC2-E01, restart the diesel, manually start 2SWS-P21C while manually opening 2SWS-MOV102C1 to provide A SWS flow. Start other AE bus loads as required. OR If 2SWS-P21C and 2SWE-P21A are damaged, stop the 2-1 diesel to prevent overheating. De-energize 2SWS-MOV103A at MCC2-E03 and close it. De-energize 2SWE-MOV116A at MCC2-E03 and close if spuriously opened. De-energize 2SWS-MOV106A at MCC2-E03 and open it to align the A SWS flow path. De-energize 2SWS-MOV102A at MCC2-E01, restart the diesel, manually start 2SWS-P21A while manually opening 2SWS-MOV102A to provide A SWS flow. Start other AE bus loads as required.	BV2-0818	RR
2-CB-1	2SWS-MOV102A 2SWS-MOV106A 2-CIB-SPUR	If 2SWS-P21A and 2SWE-P21A are damaged, stop the 2-1 diesel to prevent overheating. De-energize 2SWS-MOV103A at MCC2-E03 and close it. De-energize 2SWE-MOV116A at MCC2-E03 and close if spuriously opened. De-energize 2SWS-MOV106A at MCC2-E03 and open it to align the A SWS flow path. De-energize 2SWS-MOV170A at MCC2-E01 and open it to align seal water to 2SWS-P21C. De-energize 2SWS-MOV102C1 at MCC2-E01, restart the diesel, manually start 2SWS-P21C while manually opening 2SWS-MOV102C1 to provide A SWS flow. Start other AE bus loads as required. OR If 2SWS-P21C and 2SWE-P21A are damaged, stop the 2-1 diesel to prevent overheating. De-energize 2SWS-MOV103A at MCC2-E03 and close it. De-energize 2SWE-MOV116A at MCC2-E03 and close if spuriously opened. De-energize 2SWS-MOV106A at MCC2-E03 and open it to align the A SWS flow path. De-energize 2SWS-MOV102A at MCC2-E01, restart the diesel, manually start 2SWS-P21A while manually opening 2SWS-MOV102A to provide A SWS flow. Start other AE bus loads as required.	BV2-0851	RR
2-CB-1	2MSS-AOV101A 2MSS-AOV101B 2MSS-AOV101C	De-energize 2MSS-AOV101A, B and C at PNL-DC2-10 to stop steam flow from SG A, B and C.	BV2-0809	RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CB-1	2FWE-HCV100A 2FWE-HCV100B 2FWE-HCV100C 2FWE-HCV100D 2FWE-HCV100E 2FWE-HCV100F	De-energize 2FWE-P23B at 4KVS-2DF to stop train B AFW flow. Manually throttle 2FWE-HCV100E to control A train SG A flow. Manually throttle 2FWE-HCV100C to control A train SG B flow. Manually throttle 2FWE-HCV100A to control A train SG C flow.	BV2-0808	RR
2-CB-1	2FWE-HCV100A 2FWE-HCV100B 2FWE-HCV100D 2FWE-HCV100F	Throttle 2FWE-HCV100E at the ASP to control SG A level. Throttle 2FWE-HCV100C at the ASP to control SG B level.	BV2-0808	PCS
2-CB-1	4KVS-1G-1G5 4KVS-2A-2A1 4KVS-2B-2B1 4KVS-2C-2C1 4KVS-2D-2D1 2FWS-HYV157A 2FWS-HYV157B 2FWS-HYV157C	De-energize 2FWS-P21A at 4KVS-2A & 4KVS-2B and de-energize 2FWS-P21B at 4KVS-2C & 4KVS-2D to stop main feedwater pump flow to the steam generators.	BV2-0821	DID
2-CB-1	480VUS-2-2-2C 480VUS-2-8-7B 480VUS-2-8-7C 480VUS-2-9-7B 480VUS-2-9-7C	De-energize the C control group heater at 480VUS-2-2, de-energize the A and D backup group heaters at 480VUS-2-8 and de-energize the B and E backup group heaters at 480VUS-2-9 to prevent RCS overpressure.	BV2-0820	DID
2-CB-1	480VUS-2-2-2C 480VUS-2-8-7B 480VUS-2-8-7C 480VUS-2-9-7B 480VUS-2-9-7C	Operate the A backup group heater at the ASP to control RCS pressure.	BV2-0820	PCS
2-CB-1	2HVC-ACU201A 2HVC-MOD205A 2HVC-MOD206A	Install a 5000 CFM portable fan in the Control Room doorway to supply temporary ventilation.	BV2-1329	RR
2-CB-1	2CHS-LCV115C	De-energize 2CHS-LCV115C at MCC2-E03 and manually close the valve OR De-energize 2CHS-LCV115E at MCC2-E04 and manually close the valve to prevent hydrogen intrusion into the charging pump suction.	BV2-0806	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
2-CB-1	2CHS-MOV289	Manually open 2CHS-477 to bypass the charging flow control valve. Manually close 2CHS-30 to isolate the charging flow control valve. Manually throttle 2CHS-477 to control charging flow.	BV2-0807	RR
2-CB-1	2RCS-PCV455C 2RCS-PCV455D 2RCS-MOV535 2RCS-MOV536 2RCS-MOV537	De-energize the C control group heater at 480VUS-2-2, de-energize the A and D backup group heaters at 480VUS-2-8 and de-energize the B and E backup group heaters at 480VUS-2-9 to prevent RCS overpressure.	BV2-1413	DID
2-CB-1	2RCS-PCV455C 2RCS-PCV455D 2RCS-MOV535 2RCS-MOV536 2RCS-MOV537	Attempt to control 2RCS-PCV456 at the ASP.	BV2-1413	PCS
2-CB-1	2RCS-SOV200A 2RCS-SOV200B 2RCS-SOV201A 2RCS-SOV201B 2RCS-HCV250A 2RCS-HCV250B	Perform repair procedure to provide power to the reactor vessel head vent valves.	BV2-1418	DID
2-CB-1	4KVS-2A-2A6 4KVS-2B-2B6 4KVS-2C-2C6 2RCS-PCV455A 2RCS-PCV455B	De-energize 2RCS-P21A at 4KVS-2A, de-energize 2RCS-P21B at 4KVS-2B and de-energize 2RCS-P21C at 4KVS-2C to prevent an RCP seal LOCA.	BV2-0812	RR
2-CB-1	Spurious SI 4KVS-2AE-2E12 4KVS-2AE-2E15 4KVS-2DF-2F12 4KVS-2DF-2F15	De-energize 2CHS-P21A(C) at 4KVS-2AE AND De-energize 2CHS-P21B(C) at 4KVS-2DF to control charging/HHSI flow.	BV2-0825	DID
2-CB-1	4KVS-2B-2B2 4KVS-2C-2C2 4KVS-2D-2D2 2FWS-HYV157A 2FWS-HYV157B 2FWS-HYV157C	De-energize 2CNM-P21A at 4KVS-2B, de-energize 2CNM-P21B at 4KVS-2C and de-energize 2CNM-P21C at 4KVS-2D to stop condensate flow to the steam generators.	BV2-1349	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CB-1	4KVS-2AE-2E2 4KVS-2DF-2F2 2-CIB-SPUR	Trip 2QSS-P21A at 4KVS-2AE to stop A train quench spray flow and trip 2QSS-P21B at 4KVS-2DF to stop B train quench spray flow.	BV2-0824	RR
2-CB-1	4KVS-2AE	Align AE and DF bus loads as required.	BV2-0823	RR
2-CB-1	2CHS-LCV115C 2CHS-LCV115E 2CHS-LCV115B 4KVS-2AE-2E12 4KVS-2AE-2E15 2QSS-LT104A 2QSS-LT104B 2QSS-LT104C 2QSS-LT104D 2-CVCS-RAS	De-energize 2CHS-P21A and 2CHS-P21C at 4KVS-2AE and de-energize 2CHS-P21B and 2CHS-P21C at 4KVS-2DF to prevent pump damage on loss of suction. De-energize 2CHS-LCV115B at MCC2-E03 and manually open it or open 2CHS-LCV115B from the ASP to align suction to the charging pumps. Manually start 2CHS-P21A or 2CHS-P21C at 4KVS-2AE to provide RCS makeup flow.	BV2-0796 BV2-0805	DID
2-CB-1	2QSS-LT104A 2QSS-LT104B 2QSS-LT104C 2QSS-LT104D 2-CVCS-RAS 2CHS-LCV115C 2CHS-LCV115E 2CHS-LCV115B 4KVS-2AE-2E12 4KVS-2AE-2E15 Spurious SI 2SIS-MOV836 2SIS-MOV840 2SIS-MOV867A 2SIS-MOV867B 2SIS-MOV867C 2SIS-MOV867D 2SIS-HCV868A 2SIS-HCV868B 2SIS-MOV869A 2SIS-MOV869B	Open 2CHS-LCV115B from the ASP to provide suction to Charging/HHSI pump 2CHS-P21A and start 2CHS-P21A from the ASP to provide RCS makeup.	BV2-0796 BV2-0805 BV2-0816 BV2-1390	PCS

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
2-CB-1	Spurious SI 2SIS-MOV836 2SIS-MOV840 2SIS-MOV867A 2SIS-MOV867B 2SIS-MOV867C 2SIS-MOV867D 2SIS-HCV868A 2SIS-HCV868B 2SIS-MOV869A 2SIS-MOV869B	De-energize 2CHS-P21A(C) at 4KVS-2AE AND De-energize 2CHS-P21B(C) at 4KVS-2DF to stop excessive RCS makeup flow. De-energize 2SIS-MOV836, 2SIS-MOV840, 2SIS-MOV867C and 2SIS-MOV869A at MCC2-E05 and manually close the valves and de-energize 2SIS-MOV867D and 2SIS-MOV869B at MCC2-E06 and close them to isolate spuriously opened SI flow paths. Manually start 2CHS-P21A or 2CHS-P21C at 4KVS-2AE to provide RCS makeup flow.	BV2-0816 BV2-1390	DID
2-CB-1	2RCS-PT444 2RCS-PT445 2RCS-PCV455C 2RCS-PCV455D	Close 2RCS-PCV455C and 2RCS-PCV455D at the keylock isolation switches. OR Perform repair procedure to allow the closing of 2RCS-MOV535 and 2RCS-MOV537 to isolate the PORVs. OR To provide a flow path from the containment sump to Charging/HHSI pump 2CHS-P21A de-energize 2SIS-MOV8809A, 2SIS-MOV8887A, 2SIS-MOV8811A, 2RSS-MOV156C, 2SIS-MOV863A, 2RSS-MOV155C and 2SIS-MOV8890A at MCC2-E11, de-energize 2CHS-LCV115B at MCC2-E03 and then manually close 2SIS-MOV8809A, 2SIS-MOV8887A, 2RSS-MOV156C and 2SIS-MOV8890A, manually open 2SIS-MOV8811A, 2SIS-MOV863A and 2RSS-MOV155C and then manually close 2CHS-LCV115B.	BV2-0813	RR and DID
2-CB-1	2FWE-TK210	Provide an alternate suction to the A AFW pump.	BV2-0798	RR
2-CB-1	2SWS-STRM47 2SWS-PT117A 2SWS-AOV130A	De-energize 2SWS-AOV130A at 480VUS-2-8 to restore the service water pump seal water supply.	BV2-0850	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
2-CB-1	4KVS-2AE-2E14 4KVS-2AE-2E18 2FWE-HCV100C 2FWE-HCV100E 480VUS-2-8-7B 2SVS-PCV101A 2SVS-PCV101B 4KVS-2AE-2E12 2CHS-FCV122 2RCS-PCV456 2CHS-LCV460A 2CHS-LCV460B 2CHS-P22A 2CHS-SOV206 2EGS-EG2-1 2FWS-LI477F 2FWS-LI487F 2MSS-PI475F 2MSS-PI485F 2RCS-LI459AF 2RCS-PI403F 2RCS-PI455F 2RCS-TI413F 2RCS-TI423F 2RCS-TI410F 2RCS-TI420F 2FWE-FI100AF 2FWE-FI100BF 2NMS-NI31BF 2NMS-NI31DF ACB-42A ACB-2A10 ACB-2E7 ACB-2E10 2SWS-MOV113A 2SWS-MOV102A 2CHS-LCV115B ASP Power Supply	Take the plant to "Safe and Stable" utilizing selected instruments and controls at the auxiliary shutdown panel, as directed.	BV2-0855	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
2-CB-5	2HVC-ACU201A 2HVC-MOD205A 2HVC-MOD206A	Install a 5000 CFM portable fan in the Control Room doorway to supply temporary ventilation.	BV2-1194	RR
2-CB-6	2SDS-AOV112A 2SDS-AOV112B 2SDS-AOV112C	De-energize 2SDS-AOV112A, B and C at PNL-AC2-03 to stop steam flow from SG A, B and C.	BV2-1031	DID
2-CB-6	2SVS-HCV104 2SVS-PCV101A 2SVS-PCV101B 2SVS-PCV101C	De-energize 2SVS-HCV104 at MCC2-E14 to stop SG A, B and C steam flow and manually throttle it to control SG A, B and C pressure. De-energize 2SVS-PCV101A at MCC2-E05 to stop SG A steam flow and manually throttle it to control SG A pressure. De-energize 2SVS-PCV101B at MCC2-E13 to stop SG B steam flow and manually throttle it to control SG B pressure. De-energize 2SVS-PCV101C at MCC2-E13 to stop SG C steam flow and manually throttle it to control SG C pressure.	BV2-1398	RR
2-CB-6	2SVS-HCV104 2SVS-PCV101A 2SVS-PCV101B 2SVS-PCV101C	Throttle 2SVS-PCV101A from the ASP to control SG C pressure and throttle 2SVS-PCV101B from the ASP to control SG B pressure.	BV2-1398	PCS
2-CB-6	2FWE-HCV100A 2FWE-HCV100B 2FWE-HCV100C 2FWE-HCV100D 2FWE-HCV100E 2FWE-HCV100F	De-energize 2FWE-P23B at 4KVS-2DF to stop train B AFW flow. Manually throttle 2FWE-HCV100E to control A train SG A flow. Manually throttle 2FWE-HCV100C to control A train SG B flow. Manually throttle 2FWE-HCV100A to control A train SG C flow.	BV2-1028	RR
2-CB-6	4KVS-2DF-2F18 2FWE-HCV100A 2FWE-HCV100B 2FWE-HCV100D 2FWE-HCV100F	Throttle 2FWE-HCV100E at the ASP to control SG A level. Throttle 2FWE-HCV100C at the ASP to control SG B level.	BV2-1028	PCS
2-CB-6	480VUS-2-2-2C 480VUS-2-8-7B 480VUS-2-9-7B 480VUS-2-9-7C	De-energize the C control group heater at 480VUS-2-2, de-energize the A backup group heater at 480VUS-2-8 and de-energize the B and E backup group heaters at 480VUS-2-9 to prevent RCS overpressure.	BV2-1034	DID
2-CB-6	2HVC-ACU201A 2HVC-MOD205A 2HVC-MOD206A	Install a 5000 CFM portable fan in the Control Room doorway to supply temporary ventilation.	BV2-1334	RR
2-CB-6	2FWE-TK210	Provide an alternate suction to the AFW pumps.	BV2-1356	RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CB-6	2CHS-LCV115C	De-energize 2CHS-LCV115C at MCC2-E03 and manually close the valve OR De-energize 2CHS-LCV115E at MCC2-E04 and manually close the valve to prevent hydrogen intrusion into the charging pump suction.	BV2-1026	RR
2-CB-6	4KVS-2A-2A6 4KVS-2B-2B6 2RCS-PCV455A 2RCS-PCV455B	De-energize 2RCS-P21A at 4KVS-2A and de-energize 2RCS-P21B at 4KVS-2B to prevent an RCP seal LOCA.	BV2-1029	RR
2-CB-6	4KVS-2AE-2E12 4KVS-2AE-2E15 4KVS-2DF-2F12 4KVS-2DF-2F15	De-energize 2CHS-P21A(C) at 4KVS-2AE AND De-energize 2CHS-P21B(C) at 4KVS-2DF to control charging/HHSI flow.	BV2-1037	DID
2-CB-6	2SIS-MOV867B 2SIS-MOV867D 2SIS-HCV868B 2SIS-MOV869B	De-energize 2CHS-P21A(C) at 4KVS-2AE AND De-energize 2CHS-P21B(C) at 4KVS-2DF to stop excessive RCS makeup flow. De-energize 2SIS-MOV867D and 2SIS-MOV869B at MCC2-E06 and close them to isolate spuriously opened SI flow paths. Manually start 2CHS-P21A or 2CHS-P21C at 4KVS-2AE and manually throttle 2SIS-MOV867D to control RCS makeup flow.	BV2-1032 BV2-1391	DID
2-CB-6	2CHS-LCV115C 2CHS-LCV115E 2CHS-LCV115B 4KVS-2AE-2E12 4KVS-2AE-2E15	De-energize 2CHS-P21A and 2CHS-P21C at 4KVS-2AE and de-energize 2CHS-P21B and 2CHS-P21C at 4KVS-2DF to prevent pump damage on loss of suction. De-energize 2CHS-LCV115B at MCC2-E03 and manually open it or open 2CHS-LCV115B from the ASP to align suction to the charging pumps. Manually start 2CHS-P21A or 2CHS-P21C at 4KVS-2AE to provide RCS makeup flow.	BV2-1024	RR
2-CB-6	2RCS-PT444 2RCS-PT445 2RCS-PCV455C 2RCS-PCV455D	Close 2RCS-PCV455C at the keylock isolation switch. OR Perform repair procedure to allow the closing of 2RCS-MOV535 to isolate the PORV. OR To provide a flow path from the containment sump to Charging/HHSI pump 2CHS-P21A de-energize 2SIS-MOV8809A, 2SIS-MOV8887A, 2SIS-MOV8811A, 2RSS-MOV156C, 2SIS-MOV863A, 2RSS-MOV155C and 2SIS-MOV8890A at MCC2-E11, de-energize 2CHS-LCV115B at MCC2-E03 and then manually close 2SIS-MOV8809A, 2SIS-MOV8887A, 2RSS-MOV156C and 2SIS-MOV8890A, manually open 2SIS-MOV8811A, 2SIS-MOV863A and 2RSS-MOV155C and then manually close 2CHS-LCV115B.	BV2-1030	RR and DID
2-CB-6	4KVS-2DF-2F2	Trip 2QSS-P21B at 4KVS-2DF to stop quench spray flow.	BV2-1038	RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CB-6	4KVS-2AE	Align AE and DF bus loads as required.	BV2-1353	RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CB-6	4KVS-2AE-2E14 4KVS-2AE-2E18 2FWE-HCV100C 2FWE-HCV100E 480VUS-2-8-7B 2SVS-PCV101A 2SVS-PCV101B 4KVS-2AE-2E12 2CHS-FCV122 2RCS-PCV456 2CHS-LCV460A 2CHS-LCV460B 2CHS-P22A 2CHS-SOV206 2EGS-EG2-1 2FWS-LI477F 2FWS-LI487F 2MSS-PI475F 2MSS-PI485F 2RCS-LI459AF 2RCS-PI403F 2RCS-PI455F 2RCS-TI413F 2RCS-TI423F 2RCS-TI410F 2RCS-TI420F 2FWE-FI100AF 2FWE-FI100BF 2NMS-NI31BF 2NMS-NI31DF ACB-42A ACB-2A10 ACB-2E7 ACB-2E10 2SWS-MOV113A 2SWS-MOV102A 2CHS-LCV115B ASP Power Supply	Take the plant to "Safe and Stable" utilizing selected instruments and controls at the auxiliary shutdown panel, as directed.	BV2-1354	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CV-1	2CHS-E21 2CHS-MOV381	Close 2CHS-214 to isolate seal water return heat exchanger flow.	BV2-0953	RR
2-CV-1	2BDG-AOV100A1 2BDG-AOV100B1 2BDG-AOV100C1 2BDG-AOV101A1 2BDG-AOV101A2 2BDG-AOV101B1 2BDG-AOV101B2 2BDG-AOV101C1 2BDG-AOV101C2	De-energize 2BDG-AOV101A2, B2 and C2 at PNL-DC2-10 to isolate SG A, B and C blowdown flow.	BV2-0952	DID
2-CV-1	2CHS-AOV200A 2CHS-AOV200B 2CHS-AOV200C 2CHS-LCV460B	De-energize 2CHS-AOV200A at PNL-DC2-11 and de-energize 2CHS-AOV200C at PNL-DC2-15 to isolate letdown flow. OR Isolate instrument air to containment to fail 2CHS-AOV200A, B and C closed to prevent loss of RCS inventory.	BV2-0959	RR
2-CV-1	2SWS-MOV102C1 2SWS-MOV102C2 2SWS-MOV103B 2-CIB-SPUR	If 2SWS-P21B and 2SWE-P21B are damaged, stop the 2-2 diesel to prevent overheating. De-energize 2SWS-MOV103B at MCC2-E04 and close it. De-energize 2SWE-MOV116B at MCC2-E04 and close if spuriously opened. De-energize 2SWS-MOV106B at MCC2-E04 and verify that it is open to align the B SWS flow path. De-energize 2SWS-MOV170B at MCC2-E02 and open it to align seal water to 2SWS-P21C. De-energize 2SWS-MOV102C2 at MCC2-E02, restart the diesel, manually start 2SWS-P21C while manually opening 2SWS-MOV102C2 to provide B SWS flow. Start other DF bus loads as required. OR If 2SWS-P21C and 2SWE-P21B are damaged, stop the 2-2 diesel to prevent overheating. De-energize 2SWS-MOV103B at MCC2-E04 and close it. De-energize 2SWE-MOV116B at MCC2-E04 and close if spuriously opened. De-energize 2SWS-MOV106B at MCC2-E04 and verify that it is open to align the B SWS flow path. Restart the diesel and start other DF bus loads as required.	BV2-0976	RR and DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
2-CV-1	2SWS-MOV106B 2-CIB-SPUR	If 2SWS-P21B and 2SWE-P21B are damaged, stop the 2-2 diesel to prevent overheating. De-energize 2SWS-MOV103B at MCC2-E04 and close if to spuriously opened. De-energize 2SWE-MOV116B at MCC2-E04 and close it and de-energize 2SWS-MOV106B at MCC2-E04 and open it to align the B SWS flow path. De-energize 2SWS-MOV170B at MCC2-E02 and open it to align seal water to 2SWS-P21C. De-energize 2SWS-MOV102C2 at MCC2-E02, restart the diesel, manually start 2SWS-P21C while manually opening 2SWS-MOV102C2 to provide B SWS flow. Start other DF bus loads as required. OR IF 2SWS-P21C and 2SWE-P21B are damaged, stop the 2-2 diesel to prevent overheating. De-energize 2SWS-MOV103B at MCC2-E04 and close if spuriously opened. De-energize 2SWE-MOV116B at MCC2-E04 and close it and de-energize 2SWS-MOV106B at MCC2-E04 and open it to align the B SWS flow path. Restart the diesel and start other DF bus loads as required.	BV2-0977	RR
2-CV-1	2MSS-AOV101A 2MSS-AOV101B 2MSS-AOV101C	De-energize 2MSS-AOV101A, B and C at PNL-DC2-10 to stop steam flow from SG A, B and C.	BV2-0964	RR
2-CV-1	2SDS-AOV112A 2SDS-AOV112B 2SDS-AOV112C	De-energize 2SDS-AOV112A, B and C at PNL-AC2-03 to stop steam flow from SG A, B and C.	BV2-0972	DID
2-CV-1	2SVS-HCV104 2SVS-PCV101A 2SVS-PCV101B 2SVS-PCV101C	De-energize 2SVS-HCV104 at MCC2-E14 to stop SG A, B and C steam flow. Manually close 2SVS-PCV101A to stop SG A steam flow. Manually close 2SVS-PCV101B to stop SG B steam flow. Manually close 2SVS-PCV101C to stop SG C steam flow. THEN Manually throttle 2SVS-HCV104 to control SG A, B and C pressure. Manually throttle 2SVS-PCV101A to control SG A pressure. Manually throttle 2SVS-PCV101B to control SG B pressure. Manually throttle 2SVS-PCV101C to control SG C pressure.	BV2-0974 BV2-1399	 DID RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CV-1	2FWE-HCV100A 2FWE-HCV100B 2FWE-HCV100C 2FWE-HCV100D 2FWE-HCV100E 2FWE-HCV100F	Manually throttle 2FWE-HCV100E and 2FWE-HCV100F to control SG A AFW flow. Manually throttle 2FWE-HCV100C and 2FWE-HCV100D to control SG B AFW flow. Manually throttle 2FWE-HCV100A and 2FWE-HCV100B to control SG C AFW flow.	BV2-0961 BV2-0962	DID RR
2-CV-1	4KVS-1G-1G5 4KVS-2A-2A1 4KVS-2B-2B1 4KVS-2C-2C1 4KVS-2D-2D1 2FWS-HYV157A 2FWS-HYV157B 2FWS-HYV157C	De-energize 2FWS-P21A at 4KVS-2A & 4KVS-2B and de-energize 2FWS-P21B at 4KVS-2C & 4KVS-2D to stop main feedwater pump flow to the steam generators.	BV2-0979	RR
2-CV-1	480VUS-2-2-2C 480VUS-2-8-7B 480VUS-2-8-7C 480VUS-2-9-7B 480VUS-2-9-7C	De-energize the C control group heater at 480VUS-2-2, de-energize the A and D backup group heaters at 480VUS-2-8 and de-energize the B and E backup group heaters at 480VUS-2-9 to prevent RCS overpressure.	BV2-0978	DID
2-CV-1	2HVC-ACU201B 2HVC-MOD205B 2HVC-MOD206B	Install a 5000 CFM portable fan in the Control Room doorway to supply temporary ventilation.	BV2-0963	RR
2-CV-1	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-0947	RR
2-CV-1	2CHS-LCV115E	De-energize 2CHS-LCV115C at MCC2-E03 and manually close the valve OR De-energize 2CHS-LCV115E at MCC2-E04 and manually close the valve to prevent hydrogen intrusion into the charging pump suction.	BV2-0957	DID
2-CV-1	2CHS-MOV289	Manually open 2CHS-477 to bypass the charging flow control valve. Manually close 2CHS-30 to isolate the charging flow control valve. Manually throttle 2CHS-477 to control charging flow.	BV2-0960	RR
2-CV-1	2RCS-PCV455D 2RCS-PCV456 2RCS-MOV535 2RCS-MOV536 2RCS-MOV537	Perform repair procedure to allow the opening of 2RCS-MOV536.	BV2-1414	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
2-CV-1	4KVS-2A-2A6 4KVS-2B-2B6 4KVS-2C-2C6 2RCS-PCV455A 2RCS-PCV455B	De-energize 2RCS-P21A at 4KVS-2A, de-energize 2RCS-P21B at 4KVS-2B and de-energize 2RCS-P21C at 4KVS-2C to prevent an RCP seal LOCA.	BV2-0971	RR and DID
2-CV-1	Spurious SI 4KVS-2AE-2E12 4KVS-2AE-2E15	De-energize 2CHS-P21A(C) at 4KVS-2AE to control charging/HHSI flow.	BV2-0980	DID
2-CV-1	4KVS-2B-2B2 4KVS-2C-2C2 4KVS-2D-2D2 2FWS-HYV157A 2FWS-HYV157B 2FWS-HYV157C	De-energize 2CNM-P21A at 4KVS-2B, de-energize 2CNM-P21B at 4KVS-2C and de-energize 2CNM-P21C at 4KVS-2D to stop condensate flow to the steam generators.	BV2-1367	RR
2-CV-1	Spurious SI 2SIS-MOV836 2SIS-MOV840 2SIS-MOV867A 2SIS-MOV867B 2SIS-MOV867C 2SIS-MOV867D 2SIS-HCV868A 2SIS-MOV869A 2SIS-MOV869B	De-energize 2CHS-P21A(C) at 4KVS-2AE and de-energize 2CHS-P21C at 4KVS-2DF to stop excessive RCS makeup flow. De-energize 2SIS-MOV836, 2SIS-MOV840, 2SIS-MOV867C and 2SIS-MOV869A at MCC2-E05 and manually close the valves and de-energize 2SIS-MOV867D and 2SIS-MOV869B at MCC2-E06 and close them to isolate spuriously opened SI flow paths. Start 2CHS-P21B or 2CHS-P21C at 4KVS-2DF to provide RCS makeup flow.	BV2-0973 BV2-1392	DID
2-CV-1	2CHS-LCV115C 2CHS-LCV115E 2QSS-LT104A 2QSS-LT104C 2-CVCS-RAS	De-energize 2CHS-P21A and 2CHS-P21C at 4KVS-2AE and de-energize 2CHS-P21C at 4KVS-2DF to prevent pump damage on loss of suction. De-energize 2CHS-LCV115D at MCC2-E04 and manually open it to align suction to the charging pumps. Manually start 2CHS-P21B or 2CHS-P21C at 4KVS-2DF to provide RCS makeup flow.	BV2-0951 BV2-0958	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
2-CV-1	2RCS-PT445 2RCS-PCV455D 2RCS-PCV456	Close 2RCS-PCV455D, 2RCS-PCV455D and 2RCS-PCV456 at the keylock isolation switches. OR Perform repair procedure to allow the closing of 2RCS-MOV537, 2RCS-MOV535 and 2RCS-MOV536 to isolate the PORVs. OR To provide a flow path from the containment sump to Charging/HHSI pump 2CHS-P21B de-energize 2SIS-MOV8809B, 2SIS-MOV8887B, 2SIS-MOV8811B, 2RSS-MOV156D, 2SIS-MOV863B, 2RSS-MOV155D and 2SIS-MOV8890B at MCC2-E12, de-energize 2CHS-LCV115D at MCC2-E04 and then manually close 2SIS-MOV8809B, 2SIS-MOV8887B, 2RSS-MOV156D and 2SIS-MOV8890B, manually open 2SIS-MOV8811B, 2SIS-MOV863B and 2RSS-MOV155D and then manually close 2CHS-LCV115D.	BV2-0981	RR and DID
2-CV-1	2SWS-STRM48	Manually backwash the service water seal water strainer in accordance with procedure instructions.	BV2-0982	DID
2-CV-1	4KVS-2AE-2E2 4KVS-2DF-2F2 2-CIB-SPUR	Trip 2QSS-P21A at 4KVS-2AE to stop A train quench spray flow and trip 2QSS-P21B at 4KVS-2DF to stop B train quench spray flow.	BV2-0950	RR
2-CV-2	2QSS-LT104B 2QSS-LT104D 2-CVCS-RAS 2CHS-LCV115E	Manually start 2CHS-P21A or 2CHS-P21C at 4KVS-2AE to provide RCS makeup flow.	BV2-1000 BV2-1001	DID
2-CV-2	2SVS-HCV104	Manually close 2SVS-HCV104 to stop SG A, B and C steam flow.	BV2-1006	DID
2-CV-2	4KVS-2DF-2F18 2FWE-HCV100B 2FWE-HCV100D 2FWE-HCV100F	De-energize 2FWE-P23B at 4KVS-2DF to stop train B AFW flow.	BV2-1351	RR
2-CV-2	480VUS-2-9-7B 480VUS-2-9-7C	De-energize the B and E backup group heaters at 480VUS-2-9 to prevent RCS overpressure.	BV2-1009	DID
2-CV-2	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-1014	RR
2-CV-2	4KVS-2B-2B6 4KVS-2C-2C6	De-energize 2RCS-P21B at 4KVS-2B and de-energize 2RCS-P21C at 4KVS-2C to prevent an RCP seal LOCA.	BV2-1012	RR
2-CV-2	Spurious SI 4KVS-2DF-2F12 4KVS-2DF-2F15	De-energize 2CHS-P21B(C) at 4KVS-2DF to control charging/HHSI flow.	BV2-1013	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CV-2	Spurious SI 2SIS-MOV867B 2SIS-MOV867D 2SIS-HCV868B 2SIS-MOV869B	De-energize 2CHS-P21B(C) at 4KVS-2DF to stop excessive RCS makeup flow. De-energize 2SIS-MOV867D and 2SIS-MOV869B at MCC2-E06 and close them to isolate spuriously opened SI flow paths. Manually throttle 2SIS-MOV867D to control RCS makeup flow.	BV2-1005 BV2-1393	DID
2-CV-2	2RCS-PCV455C	Close 2RCS-PCV455C at the keylock isolation switch. OR Perform repair procedure to allow the closing of 2RCS-MOV535 to isolate the PORV. OR To provide a flow path from the containment sump to Charging/HHSI pump 2CHS-P21A de-energize 2SIS-MOV8809A, 2SIS-MOV8887A, 2SIS-MOV8811A, 2RSS-MOV156C, 2SIS-MOV863A, 2RSS-MOV155C and 2SIS-MOV8890A at MCC2-E11, de-energize 2CHS-LCV115B at MCC2-E03 and then manually close 2SIS-MOV8809A, 2SIS-MOV8887A, 2RSS-MOV156C and 2SIS-MOV8890A, manually open 2SIS-MOV8811A, 2SIS-MOV863A and 2RSS-MOV155C and then manually close 2CHS-LCV115B.	BV2-1003	RR and DID
2-CV-2	4KVS-2AE-2E2 4KVS-2DF-2F2 2-CIB-SPUR	Trip 2QSS-P21A at 4KVS-2AE to stop A train quench spray flow and trip 2QSS-P21B at 4KVS-2DF to stop B train quench spray flow.	BV2-1011	DID
2-CV-3	2QSS-LT104B 2QSS-LT104D 2-CVCS-RAS 2CHS-LCV115E	Manually start 2CHS-P21A or 2CHS-P21C at 4KVS-2AE to provide RCS makeup flow.	BV2-0923 BV2-1316	DID
2-CV-3	2MSS-AOV101A 2MSS-AOV101B 2MSS-AOV101C	De-energize 2MSS-AOV101A, B and C at PNL-DC2-10 to stop steam flow from SG A, B and C.	BV2-0926	RR
2-CV-3	2SDS-AOV112A 2SDS-AOV112B 2SDS-AOV112C	De-energize 2SDS-AOV112A, B and C at PNL-AC2-03 to stop steam flow from SG A, B and C.	BV2-0933	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CV-3	2SVS-HCV104 2SVS-PCV101A 2SVS-PCV101B 2SVS-PCV101C	Manually close 2SVS-HCV104 to stop SG A, B and C steam flow. Manually close 2SVS-PCV101A to stop SG A steam flow. Manually close 2SVS-PCV101B to stop SG B steam flow. Manually close 2SVS-PCV101C to stop SG C steam flow. THEN Manually throttle 2SVS-HCV104 to control SG A, B and C pressure. Manually throttle 2SVS-PCV101A to control SG A pressure. Manually throttle 2SVS-PCV101B to control SG B pressure. Manually throttle 2SVS-PCV101C to control SG C pressure.	BV2-0936 BV2-1427	DID
2-CV-3	4KVS-2DF-2F18 2FWE-HCV100B 2FWE-HCV100D 2FWE-HCV100F	De-energize 2FWE-P23B at 4KVS-2DF to stop train B AFW flow.	BV2-1423	RR
2-CV-3	4KVS-1G-1G5 4KVS-2A-2A1 4KVS-2B-2B1 4KVS-2C-2C1 4KVS-2D-2D1 2FWS-HYV157A 2FWS-HYV157B 2FWS-HYV157C	De-energize 2FWS-P21A at 4KVS-2A & 4KVS-2B and de-energize 2FWS-P21B at 4KVS-2C & 4KVS-2D to stop main feedwater pump flow to the steam generators.	BV2-0941	DID
2-CV-3	480VUS-2-2-2C 480VUS-2-9-7B 480VUS-2-9-7C	De-energize the C control group heater at 480VUS-2-2 and de-energize the B and E backup group heaters at 480VUS-2-9 to prevent RCS overpressure.	BV2-0940	DID
2-CV-3	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-0993	RR
2-CV-3	2RCS-SOV200B 2RCS-SOV201B 2RCS-HCV250A 2RCS-HCV250B	Perform repair procedure to provide power to the reactor vessel head vent valves.	BV2-1420	DID
2-CV-3	4KVS-2A-2A6 4KVS-2B-2B6 4KVS-2C-2C6 2RCS-PCV455A 2RCS-PCV455B	De-energize 2RCS-P21A at 4KVS-2A, de-energize 2RCS-P21B at 4KVS-2B and de-energize 2RCS-P21C at 4KVS-2C to prevent an RCP seal LOCA.	BV2-0930	RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-CV-3	Spurious SI 4KVS-2DF-2F12 4KVS-2DF-2F15	De-energize 2CHS-P21B(C) at 4KVS-2DF to control charging/HHSI flow.	BV2-0943	DID
2-CV-3	4KVS-2B-2B2 4KVS-2C-2C2 4KVS-2D-2D2 2FWS-HYV157A 2FWS-HYV157B 2FWS-HYV157C	De-energize 2CNM-P21A at 4KVS-2B, de-energize 2CNM-P21B at 4KVS-2C and de-energize 2CNM-P21C at 4KVS-2D to stop condensate flow to the steam generators.	BV2-1348	DID
2-CV-3	Spurious SI 2SIS-MOV867B 2SIS-MOV867D 2SIS-HCV868A 2SIS-HCV868B 2SIS-MOV869B	De-energize 2CHS-P21B(C) at 4KVS-2DF to stop excessive RCS makeup flow. De-energize 2SIS-MOV867D and 2SIS-MOV869B at MCC2-E06 and close them to isolate spuriously opened SI flow paths. Manually throttle 2SIS-MOV867D to control RCS makeup flow.	BV2-0934 BV2-1394	DID
2-CV-3	2RCS-PT444 2RCS-PCV455C	Close 2RCS-PCV455C at the keylock isolation switch. OR Perform repair procedure to allow the closing of 2RCS-MOV535 to isolate the PORV. OR To provide a flow path from the containment sump to Charging/HHSI pump 2CHS-P21A de-energize 2SIS-MOV8809A, 2SIS-MOV8887A, 2SIS-MOV8811A, 2RSS-MOV156C, 2SIS-MOV863A, 2RSS-MOV155C and 2SIS-MOV8890A at MCC2-E11, de-energize 2CHS-LCV115B at MCC2-E03 and then manually close 2SIS-MOV8809A, 2SIS-MOV8887A, 2RSS-MOV156C and 2SIS-MOV8890A, manually open 2SIS-MOV8811A, 2SIS-MOV863A and 2RSS-MOV155C and then manually close 2CHS-LCV115B.	BV2-0931	RR and DID
2-CV-3	4KVS-2AE-2E2 4KVS-2DF-2F2 2-CIB-SPUR	Trip 2QSS-P21A at 4KVS-2AE to stop A train quench spray flow and trip 2QSS-P21B at 4KVS-2DF to stop B train quench spray flow.	BV2-0942	DID
2-CV-6	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-1051	RR
2-CV-6	4KVS-2A-2A6 4KVS-2B-2B6 4KVS-2C-2C6	De-energize 2RCS-P21A at 4KVS-2A, de-energize 2RCS-P21B at 4KVS-2B and de-energize 2RCS-P21C at 4KVS-2C to prevent an RCP seal LOCA.	BV2-1050	RR
2-DG-2	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-1487	RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
2-MS-1	2MSS-AOV101A 2MSS-AOV101B 2MSS-AOV101C	Close 2IAS-610-37 and open 2IAS-610-36 or 2IAS-39 to fail 2MSS-AOV101A, B and C closed to stop steam flow from SG A, B and C.	BV2-1149	DID
2-MS-1	2SDS-AOV112A 2SDS-AOV112B 2SDS-AOV112C	Close 2IAS-610-37 and open 2IAS-610-36 or 2IAS-39 to fail 2SDS-AOV112A, B and C closed to stop steam flow from SG A, B and C.	BV2-1151	DID
2-MS-1	2SVS-HCV104 2SVS-PCV101A 2SVS-PCV101B 2SVS-PCV101C	Initially, decay heat removal will be via the main steam code safeties. In the event that a main steam code safety sticks open, provide RCS makeup from RWST to compensate for reactivity change and RCS shrink. Actions to be performed in Control Room.	BV2-1152 BV2-1153	PCS
2-MS-1	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-1155	RR
2-PA-3	2CHS-LCV115C 2CHS-LCV115E 2CHS-LCV115B 2CHS-LCV115D	Open and rack out the breaker for failed charging pump 2CHS-P21B or 2CHS-P21C at 4KVS-2DF and rack in and close the DC control power for spare charging pump 2CHS-P21B or 2CHS-P21C at 4KVS-2DF to allow pump start from the Control Room.	BV2-0839 BV2-1467	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-PA-3	2SWS-MOV103A 2SWS-MOV103B 2SWS-MOV107A 2SWS-MOV107D	If 2SWS-P21B and 2SWE-P21B are damaged, stop the 2-2 diesel to prevent overheating. De-energize 2SWS-MOV103B at MCC2-E04 and close if spuriously opened. De-energize 2SWE-MOV116B at MCC2-E04 and close if spuriously opened. De-energize 2SWS-MOV106B at MCC2-E04 and open it to align the B SWS flow path. Manually throttle 2FWE-HCV100E to control SG A AFW flow. Manually throttle 2FWE-HCV100C to control SG B AFW flow. De-energize 2SWS-MOV102C2 at MCC2-E02, restart the diesel, manually start 2SWS-P21C while manually opening 2SWS-MOV102C2 to provide B SWS flow. Start other DF bus loads as required. OR If 2SWS-P21C and 2SWE-P21B are damaged, stop the 2-2 diesel to prevent overheating. De-energize 2SWS-MOV103B at MCC2-E04 to prevent spurious opening. De-energize 2SWE-MOV116B at MCC2-E04 and close it and de-energize 2SWS-MOV106B at MCC2-E04 and open it to align the B SWS flow path. Manually throttle 2FWE-HCV100E to control SG A AFW flow. Manually throttle 2FWE-HCV100C to control SG B AFW flow. De-energize 2SWS-MOV102B at MCC2-E02, restart the diesel, manually start 2SWS-P21B while manually opening 2SWS-MOV102B to provide B SWS flow. Start other DF bus loads as required.	BV2-0842	DID
2-PA-3	2SWS-MOV102A 2SWS-MOV106A 2SWS-MOV106B	If 2SWS-P21B and 2SWE-P21B are damaged, stop the 2-2 diesel to prevent overheating. De-energize 2SWS-MOV103B at MCC2-E04 and close if spuriously opened. De-energize 2SWE-MOV116B at MCC2-E04 and close if spuriously opened. De-energize 2SWS-MOV106B at MCC2-E04 and open it to align the B SWS flow path. Manually throttle 2FWE-HCV100E to control SG A AFW flow. Manually throttle 2FWE-HCV100C to control SG B AFW flow. De-energize 2SWS-MOV102C2 at MCC2-E02, restart the diesel, manually start 2SWS-P21C while manually opening 2SWS-MOV102C2 to provide B SWS flow. Start other DF bus loads as required. OR If 2SWS-P21C and 2SWE-P21B are damaged, stop the 2-2 diesel to prevent overheating. De-energize 2SWS-MOV103B at MCC2-E04 and close if spuriously opened. De-energize 2SWE-MOV116B at MCC2-E04 and close if spuriously opened. De-energize 2SWS-MOV106B at MCC2-E04 and open it to align the B SWS flow path. Manually throttle 2FWE-HCV100E to control SG A AFW flow. Manually throttle 2FWE-HCV100C to control SG B AFW flow. De-energize 2SWS-MOV102B at MCC2-E02, restart the diesel, manually start 2SWS-P21B while manually opening 2SWS-MOV102B to provide B SWS flow. Start other DF bus loads as required.	BV2-0841	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-PA-3	4KVS-2AE-2E18 2FWE-HCV100C 2FWE-HCV100E	De-energize 2FWE-P23A at 4KVS-2AE to stop train A AFW flow.	BV2-1444	RR
2-PA-3	480VUS-2-8-7B	De-energize the A backup group heater at 480VUS-2-8 to prevent RCS overpressure.	BV2-0844	DID
2-PA-3	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-0847	RR
2-PA-3	2CHS-LCV115C 2CHS-LCV115E	Isolate hydrogen to the Aux Building and Align and start B LHSI Pump	BV2-0838	DID
2-PA-3	4KVS-2AE	Align AE and DF bus loads as required.	BV2-1321	RR
2-PA-4	2CHS-LCV115C 2CHS-LCV115E	Manually rack in the breaker and turn on the breaker control DC for 2CHS-P21C at 4KVS-2DF to allow the pump to be started from the Control Room to restore normal charging flow.	BV2-0858	DID
2-PA-4	2SWE-MOV116A 2SWE-MOV116B 2SWS-MOV103A 2SWS-MOV103B 2SWS-MOV107A 2SWS-MOV107D	If 2SWS-P21A and 2SWE-P21A are damaged, stop the 2-1 diesel to prevent overheating. De-energize 2SWS-MOV103A and 2SWE-MOV116A at MCC2-E03 and close them to prevent pump runout. Restart the diesel and manually start 2SWS-P21C to provide A SWS flow. Start other AE bus loads as required. OR If 2SWS-P21C and 2SWE-P21A are damaged, stop the 2-1 diesel to prevent overheating. De-energize 2SWS-MOV103A and 2SWE-MOV116A at MCC2-E03 and close them to prevent pump runout. Restart the diesel and manually start 2SWS-P21A to provide A SWS flow. Start other AE bus loads as required.	BV2-0860	DID
2-PA-4	2CHS-LCV115C	De-energize 2CHS-LCV115C at MCC2-E03 and manually close the valve OR De-energize 2CHS-LCV115E at MCC2-E04 and manually close the valve to prevent hydrogen intrusion into the charging pump suction.	BV2-0857	DID
2-PA-6	2CHS-LCV115C	Manually rack in the breaker and turn on the breaker control DC for 2CHS-P21C at 4KVS-2AE to allow the pump to be started from the Control Room to restore normal charging flow.	BV2-1226	DID
2-PA-7	2CHS-LCV115E	Manually rack in the breaker and turn on the breaker control DC for 2CHS-P21C at 4KVS-2DF to allow the pump to be started from the Control Room to restore normal charging flow.	BV2-1234	DID
2-PT-1	2BDG-AOV100C1 2BDG-AOV101C1 2BDG-AOV101C2	De-energize 2BDG-AOV101C2 at PNL-DC2-10 to isolate SG C blowdown flow.	BV2-1080	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
2-PT-1	2QSS-LT104A 2QSS-LT104B 2QSS-LT104C 2QSS-LT104D 2-CVCS-RAS 2CHS-LCV115B	De-energize 2CHS-LCV115B at MCC2-E03 and manually open it to align suction to the charging pumps. Manually start 2CHS-P21A or 2CHS-P21C at 4KVS-2AE and De-energize MOV-2CHS-289 at MCC 2-E05 and manually open , then throttle 2CH-477, FCV-2CH-122 bypass valve, to control RCS makeup flow.	BV2-1079 BV2-1081	DID
2-PT-1	2FWE-HCV100A 2FWE-HCV100C 2FWE-HCV100E 2MSS-SOV102 4KVS-2AE-2E18	De-energize 2FWE-P23A at 4KVS-2AE and manually trip 2FWE-P22 to stop train A AFW flow. Manually throttle 2FWE-HCV100F to control B train SG A AFW flow. Manually throttle 2FWE-HCV100D to control B train SG B AFW flow. Manually throttle 2FWE-HCV100B to control B train SG C AFW flow.	BV2-1083 BV2-1379	DID
2-RC-1	4KVS-2AE 4KVS-2AE-2E4 4KVS-2DF 4KVS-2DF-2F4	Align AE and DF bus loads as required.	BV2-1046	RR
2-RC-1	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps..	BV2-0905	RR
2-RC-1	2RCS-PCV455C 2RCS-PCV455D 2RCS-PCV456 2RCS-MOV535 2RCS-MOV536 2RCS-MOV537	Perform repair procedure to allow the opening of 2RCS-MOV536.	BV2-1415	DID
2-RC-1	2RCS-SOV200A 2RCS-SOV200B 2RCS-SOV201A 2RCS-SOV201B 2RCS-HCV250A 2RCS-HCV250B	Perform repair procedure to provide power to the reactor vessel head vent valves.	BV2-0911	DID
2-RC-1	4KVS-2A-2A6 4KVS-2B-2B6 4KVS-2C-2C6 2RCS-PCV455A 2RCS-PCV455B	De-energize 2RCS-P21A at 4KVS-2A, de-energize 2RCS-P21B at 4KVS-2B and de-energize 2RCS-P21C at 4KVS-2C to prevent an RCP seal LOCA.	BV2-0914	RR and DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-RC-1	2CHS-AOV200A 2CHS-AOV200C 2CHS-LCV460B	De-energize 2CHS-AOV200A at PNL-DC2-11 and de-energize 2CHS-AOV200C at PNL-DC2-15 to isolate letdown flow. OR Isolate instrument air to containment to fail 2CHS-AOV200A, B and C closed to prevent loss of RCS inventory.	BV2-1359	RR
2-RC-1	2RCS-PT444 2RCS-PT445 2RCS-PCV455C 2RCS-PCV455D 2RCS-PCV456	Close 2RCS-PCV455C, 2RCS-455D and 2RCS-PCV456 at the keylock isolation switches. OR Perform repair procedure to allow the closing of 2RCS-MOV535, 2RCS-MOV536 and 2RCS-MOV537 to isolate the PORVs. OR To provide a flow path from the containment sump to Charging/HHSI pump 2CHS-P21A de-energize 2SIS-MOV8809A, 2SIS-MOV8887A, 2SIS-MOV8811A, 2RSS-MOV156C, 2SIS-MOV863A, 2RSS-MOV155C and 2SIS-MOV8890A at MCC2-E11, de-energize 2CHS-LCV115B at MCC2-E03 and then manually close 2SIS-MOV8809A, 2SIS-MOV8887A, 2RSS-MOV156C and 2SIS-MOV8890A, manually open 2SIS-MOV8811A, 2SIS-MOV863A and 2RSS-MOV155C and then manually close 2CHS-LCV115B.	BV2-0913	RR and DID
2-SB-1	2CHS-LCV115C 2CHS-LCV115E	De-energize 2CHS-P21A and 2CHS-P21C by manually stopping the 2-1 diesel generator and de-energizing off-site power to the AE bus at 4KVS-2A to prevent pump damage due to loss of pump suction.	BV2-0985	DID
2-SB-1	2SVS-PCV101A 2SVS-PCV101B 2SVS-PCV101C	Manually close 2SVS-PCV101A to stop SG A steam flow. Manually close 2SVS-PCV101B to stop SG B steam flow. Manually close 2SVS-PCV101C to stop SG C steam flow.	BV2-0988	RR
2-SB-1	2FWE-HCV100A 2FWE-HCV100C 2FWE-HCV100E	De-energize 2FWE-P23A by manually stopping the 2-1 diesel generator and de-energizing off-site power to the AE bus at 4KVS-2A to stop A train AFW flow.	BV2-1424	RR
2-SB-1	Spurious SI 4KVS-2AE-2E12 4KVS-2AE-2E15	De-energize 2CHS-P21A and 2CHS-P21C by manually stopping the 2-1 diesel generator and de-energizing off-site power to the AE bus at 4KVS-2A to control charging/HHSI flow.	BV2-0990	DID
2-SB-1	Spurious SI 2SIS-MOV867A 2SIS-MOV867C	De-energize 2CHS-P21A and 2CHS-P21C by manually stopping the 2-1 diesel generator and de-energizing off-site power to the AE bus at 4KVS-2A to control charging/HHSI flow. De-energize 2SIS-MOV867C at MCC2-E05 and close it to isolate the spuriously opened SI flow path.	BV2-1563	DID
2-SB-1	4KVS-2AE-2E2	De-energize 2QSS-P21A at 4KVS-2AE to stop quench spray flow.	BV2-0991	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-SB-1	480VUS-2-8-7B 480VUS-2-8-7C	De-energize the A and D backup group heaters by manually stopping the 2-1 diesel generator and de-energizing off-site power to the AE bus at 4KVS-2A to prevent RCS overpressure.	BV2-0989	DID
2-SB-1	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-0983	RR
2-SB-1	2RCS-PCV455D 2RCS-PCV456	Close 2RCS-PCV455D and 2RCS-PCV456 at the keylock isolation switches. OR Perform repair procedure to allow the closing of 2RCS-MOV537 and 2RCS-MOV536 to isolate the PORVs. OR To provide a flow path from the containment sump to Charging/HHSI pump 2CHS-P21A de-energize 2SIS-MOV8809A, 2SIS-MOV8887A, 2SIS-MOV8811A, 2RSS-MOV156C, 2SIS-MOV863A, 2RSS-MOV155C and 2SIS-MOV8890A at MCC2-E11, de-energize 2CHS-LCV115B at MCC2-E03 and then manually close 2SIS-MOV8809A, 2SIS-MOV8887A, 2RSS-MOV156C and 2SIS-MOV8890A, manually open 2SIS-MOV8811A, 2SIS-MOV863A and 2RSS-MOV155C and then manually close 2CHS-LCV115B.	BV2-0987	RR and DID
2-SB-1	2CHS-AOV200A 2CHS-AOV200C 2CHS-LCV460B	De-energize 2CHS-AOV200A at PNL-DC2-11 and de-energize 2CHS-AOV200C at PNL-DC2-15 to isolate letdown flow. OR Isolate instrument air to containment to fail 2CHS-AOV200A, B and C closed to prevent loss of RCS inventory.	BV2-0986	RR
2-SB-10	480VUS-2-2-2C	De-energize the C control group heater at 480VUS-2-2 to prevent RCS overpressure.	BV2-1243	DID
2-SB-10	4KVS-2A-2A6 4KVS-2B-2B6 4KVS-2C-2C6	De-energize 2RCS-P21A at 4KVS-2A, de-energize 2RCS-P21B at 4KVS-2B and de-energize 2RCS-P21C at 4KVS-2C to prevent an RCP seal LOCA.	BV2-1245	DID
2-SB-2	2CHS-LCV115E	De-energize 2CHS-P21B and 2CHS-P21C by manually stopping the 2-2 diesel generator and de-energizing off-site power to the DF bus at 4KVS-2D to pump damage due to loss of suction.	BV2-1339	DID
2-SB-2	2SVS-HCV104	Manually close 2SVS-HCV104 to stop SG A, B and C steam flow.	BV2-1095	RR
2-SB-2	2FWE-HCV100B 2FWE-HCV100D 2FWE-HCV100F	De-energize 2FWE-P23B by manually stopping the 2-2 diesel generator and de-energizing off-site power to the DF bus at 4KVS-2D to stop B train AFW flow.	BV2-1425	RR
2-SB-2	Spurious SI 4KVS-2DF-2F12 4KVS-2DF-2F15	De-energize 2CHS-P21B and 2CHS-P21C by manually stopping the 2-2 diesel generator and de-energizing off-site power to the DF bus at 4KVS-2D to control charging/HHSI flow.	BV2-1096	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
2-SB-2	Spurious SI 2SIS-MOV867B 2SIS-MOV867D	De-energize 2CHS-P21B and 2CHS-P21C by manually stopping the 2-2 diesel generator and de-energizing off-site power to the DF bus at 4KVS-2D to control charging/HHSI flow. De-energize 2SIS-MOV867D at MCC2-E06 and close it to isolate the spuriously opened SI flow path.	BV2-1564	DID
2-SB-2	4KVS-2DF-2F2	De-energize 2QSS-P21B by manually stopping the 2-2 diesel generator and de-energizing off-site power to the DF bus at 4KVS-2D to stop quench spray flow.	BV2-1098	RR
2-SB-2	480VUS-2-8-7B 480VUS-2-8-7C 480VUS-2-9-7B 480VUS-2-9-7C	De-energize the B and E backup group heaters by manually stopping the 2-2 diesel generator and de-energizing off-site power to the DF bus at 4KVS-2D, and de-energize the A and D backup group heaters at 480VUS-2-8 to prevent RCS overpressurization.	BV2-1097	DID
2-SB-2	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-1099	RR
2-SB-2	2RCS-PCV455C	Close 2RCS-PCV455C at the keylock isolation switch. OR Perform repair procedure to allow the closing of 2RCS-MOV535 to isolate the PORV. OR To provide a flow path from the containment sump to Charging/HHSI pump 2CHS-P21A de-energize 2SIS-MOV8809A, 2SIS-MOV8887A, 2SIS-MOV8811A, 2RSS-MOV156C, 2SIS-MOV863A, 2RSS-MOV155C and 2SIS-MOV8890A at MCC2-E11, de-energize 2CHS-LCV115B at MCC2-E03 and then manually close 2SIS-MOV8809A, 2SIS-MOV8887A, 2RSS-MOV156C and 2SIS-MOV8890A, manually open 2SIS-MOV8811A, 2SIS-MOV863A and 2RSS-MOV155C and then manually close 2CHS-LCV115B.	BV2-1092	RR and DID
2-SB-3	2CHS-LCV115E 4KVS-2AE-2E15	Manually start 2CHS-P21A or 2CHS-P21C at 4KVS-2AE to provide RCS makeup flow.	BV2-1054	DID
2-SB-3	2SVS-HCV104 2SVS-PCV101A 2SVS-PCV101B 2SVS-PCV101C	Manually close 2SVS-HCV104 to stop SG A, B and C steam flow and manually throttle it to control SG A, B and C pressure. De-energize 2SVS-PCV101A at MCC2-E05 to stop SG A steam flow and manually throttle it to control SG A pressure. De-energize 2SVS-PCV101B at MCC2-E13 to stop SG B steam flow and manually throttle it to control SG B pressure. De-energize 2SVS-PCV101C at MCC2-E13 to stop SG C steam flow and manually throttle it to control SG C pressure.	BV2-1063 BV2-1400	DID RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
2-SB-3	2FWE-HCV100A 2FWE-HCV100B 2FWE-HCV100C 2FWE-HCV100D 2FWE-HCV100E 2FWE-HCV100F	De-energize 2FWE-P23B at 4KVS-2DF to stop train B AFW flow. Manually throttle 2FWE-HCV100E to control A train SG A AFW flow. Manually throttle 2FWE-HCV100C to control A train SG B AFW flow. Manually throttle 2FWE-HCV100A to control A train SG C AFW flow.	BV2-1056 BV2-1426	RR DID
2-SB-3	480VUS-2-2-2C 480VUS-2-9-7B 480VUS-2-9-7C	De-energize the C control group heater at 480VUS-2-2 and de-energize the B and E backup group heaters at 480VUS-2-9 to prevent RCS overpressure.	BV2-1065	DID
2-SB-3	2HVC-ACU201A	Install a 5000 CFM portable fan in the Control Room doorway to supply temporary ventilation.	BV2-1057	RR
2-SB-3	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-1332	RR
2-SB-3	4KVS-2A-2A6 4KVS-2B-2B6 4KVS-2C-2C6	De-energize 2RCS-P21A at 4KVS-2A, de-energize 2RCS-P21B at 4KVS-2B and de-energize 2RCS-P21C at 4KVS-2C to prevent an RCP seal LOCA.	BV2-1066	RR
2-SB-3	Spurious SI 4KVS-2DF-2F12 4KVS-2DF-2F15 4KVS-2AE-2E15	De-energize 2CHS-P21C at 4KVS-2AE OR Trip 2CHS-P21B(C) at 4KVS-2DF to control charging/HHSI flow.	BV2-1067	DID
2-SB-3	Spurious SI 2SIS-MOV867B 2SIS-MOV867D 2SIS-HCV868A 2SIS-HCV868B	De-energize 2CHS-P21C at 4KVS-2AE OR Trip 2CHS-P21B(C) at 4KVS-2DF to stop excessive RCS makeup flow. De-energize 2SIS-MOV867D at MCC2-E06 and close it to isolate spuriously opened SI flow paths. Manually throttle 2SIS-MOV867D to control RCS makeup flow.	BV2-1062	DID
2-SB-3	2RCS-PCV455C 2RCS-PCV456	Close 2RCS-PCV455C at the keylock isolation switch. OR Perform repair procedure to allow the closing of 2RCS-MOV535 to isolate the PORV. OR To provide a flow path from the containment sump to Charging/HHSI pump 2CHS-P21A de-energize 2SIS-MOV8809A, 2SIS-MOV8887A, 2SIS-MOV8811A, 2RSS-MOV156C, 2SIS-MOV863A, 2RSS-MOV155C and 2SIS-MOV8890A at MCC2-E11, de-energize 2CHS-LCV115B at MCC2-E03 and then manually close 2SIS-MOV8809A, 2SIS-MOV8887A, 2RSS-MOV156C and 2SIS-MOV8890A, manually open 2SIS-MOV8811A, 2SIS-MOV863A and 2RSS-MOV155C and then manually close 2CHS-LCV115B.	BV2-1060	RR and DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
2-SB-3	4KVS-2DF-2F2	Trip 2QSS-P21B at 4KVS-2DF to stop quench spray flow.	BV2-1068	DID
2-SB-4	480VUS-2-2-2C	De-energize the C control group heater at The Switchyard.	BV2-0785	DID
2-SB-4	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-0784	RR
2-SB-4	4KVS-2A-2A6 4KVS-2B-2B6 4KVS-2C-2C6	De-energize 2RCS-P21A, 1B and 1C at the Switchyard to prevent an RCP seal LOCA.	BV2-0795	RR
2-SB-6	4KVS-2AE-2E18 2FWE-HCV100A 2FWE-HCV100C 2FWE-HCV100E	De-energize 2FWE-P23A at 4KVS-2AE to stop train A AFW flow.	BV2-1380	DID
2-SB-6	480VUS-2-8-7B 480VUS-2-8-7C	De-energize the A and D backup group heaters at 480VUS-2-8 to prevent RCS overpressure.	BV2-1250	DID
2-SB-8	480VUS-2-9-7B 480VUS-2-9-7C	De-energize the B and E backup group heaters at 480VUS-2-9 to prevent RCS overpressure.	BV2-1134	DID
2-SB-8	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-1136	RR
2-SG-1S	2MSS-SOV102 4KVS-2AE-2E18 2FWE-HCV100A 2FWE-HCV100C 2FWE-HCV100E 2FWE-HCV100B 2FWE-HCV100D 2FWE-HCV100F	De-energize 2FWE-P23A at 4KVS-2AE and manually close 2MSS-15 to trip 2FWE-P22 to stop train A AFW flow. Manually throttle 2FWE-38 to control B train AFW flow.	BV2-1126 BV2-1460	DID
2-SG-1S	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-1129	RR
3-CR-1	2CHS-E212CHS-MOV378	Close 2CHS-214 to isolate seal water return heat exchanger flow.	BV2-0866	RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)

Fire Compartment	Component ID	Recovery Actions	VFDR	PCS/RR/ DID
3-CR-1	2BDG-AOV100A1 2BDG-AOV100B1 2BDG-AOV100C1 2BDG-AOV101A1 2BDG-AOV101A2 2BDG-AOV101B1 2BDG-AOV101B2 2BDG-AOV101C1 2BDG-AOV101C2	De-energize 2BDG-AOV101A2, B2 and C2 at PNL-DC2-10 to isolate SG A, B and C blowdown flow.	BV2-0865	DID
3-CR-1	2CHS-LCV115C 2CHS-LCV115E 2CHS-LCV115B 4KVS-2AE-2E12 4KVS-2AE-2E15	De-energize 2CHS-P21A and 2CHS-P21C at 4KVS-2AE and de-energize 2CHS-P21B and 2CHS-P21C at 4KVS-2DF to prevent pump damage on loss of suction. De-energize 2CHS-LCV115B at MCC2-E03 and manually open it or open 2CHS-LCV115B from the ASP to align suction to the charging pumps. Manually start 2CHS-P21A or 2CHS-P21C at 4KVS-2AE to provide RCS makeup flow.	BV2-0873	RR
3-CR-1	2SWE-MOV116A 2SWE-MOV116B 2SWS-MOV102C1 2SWS-MOV102C2 2SWS-MOV103A 2SWS-MOV103B 2SWS-MOV107A 2SWS-MOV107D 2-CIB-SPUR	If 2SWS-P21A and 2SWE-P21A are damaged, stop the 2-1 diesel to prevent overheating. De-energize 2SWS-MOV103A at MCC2-E03 and close if spuriously opened. De-energize 2SWE-MOV116A at MCC2-E03 and close if spuriously opened. De-energize 2SWS-MOV106A at MCC2-E03 and verify that it is open to align the A SWS flow path. De-energize 2SWS-MOV170A at MCC2-E01 and open it to align seal water to 2SWS-P21C. De-energize 2SWS-MOV102C1 at MCC2-E01, restart the diesel, manually start 2SWS-P21C while manually opening 2SWS-MOV102C1 to provide A SWS flow. Start other AE bus loads as required. OR If 2SWS-P21C and 2SWE-P21A are damaged, stop the 2-1 diesel to prevent overheating. De-energize 2SWS-MOV103A at MCC2-E03 and close if spuriously opened. De-energize 2SWE-MOV116A at MCC2-E03 and close if spuriously opened. De-energize 2SWS-MOV106A at MCC2-E03 and verify that it is open to align the A SWS flow path. De-energize 2SWS-MOV102A at MCC2-E01, restart the diesel, manually start 2SWS-P21A while manually opening 2SWS-MOV102A to provide A SWS flow. Start other AE bus loads as required.	BV2-0883	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
3-CR-1	2SWS-MOV102A 2SWS-MOV106A 2-CIB-SPUR	If 2SWS-P21A and 2SWE-P21A are damaged, stop the 2-1 diesel to prevent overheating. De-energize 2SWS-MOV103A at MCC2-E03 and close if spuriously opened. De-energize 2SWE-MOV116A at MCC2-E03 and close if spuriously opened. De-energize 2SWS-MOV106A at MCC2-E03 and open it to align the A SWS flow path. De-energize 2SWS-MOV170A at MCC2-E01 and open it to align seal water to 2SWS-P21C. De-energize 2SWS-MOV102C1 at MCC2-E01, restart the diesel, manually start 2SWS-P21C while manually opening 2SWS-MOV102C1 to provide A SWS flow. Start other AE bus loads as required. OR IF 2SWS-P21C and 2SWE-P21A are damaged, stop the 2-1 diesel to prevent overheating. De-energize 2SWS-MOV103A at MCC2-E03 and close if spuriously opened. De-energize 2SWE-MOV116A at MCC2-E03 and close if spuriously opened. De-energize 2SWS-MOV106A at MCC2-E03 and open it to align the A SWS flow path. De-energize 2SWS-MOV102A at MCC2-E01, restart the diesel, manually start 2SWS-P21A while manually opening 2SWS-MOV102A to provide A SWS flow. Start other AE bus loads as required.	BV2-0894	DID
3-CR-1	2MSS-AOV101A 2MSS-AOV101B 2MSS-AOV101C	De-energize 2MSS-AOV101A, B and C at PNL-DC2-10 to stop steam flow from SG A, B and C.	BV2-0875	RR
3-CR-1	2SDS-AOV112A 2SDS-AOV112B 2SDS-AOV112C	De-energize 2SDS-AOV112A, B and C at PNL-AC2-03 to stop steam flow from SG A, B and C.	BV2-0880	DID
3-CR-1	2SVS-HCV104 2SVS-PCV101A 2SVS-PCV101B 2SVS-PCV101C	De-energize 2SVS-HCV104 at MCC2-E14 to stop SG A, B and C steam flow and manually throttle it to control SG A, B and C pressure. De-energize 2SVS-PCV101A at MCC2-E05 to stop SG A steam flow and manually throttle it to control SG A pressure. De-energize 2SVS-PCV101B at MCC2-E13 to stop SG B steam flow and manually throttle it to control SG B pressure. De-energize 2SVS-PCV101C at MCC2-E13 to stop SG C steam flow and manually throttle it to control SG C pressure.	BV2-0882	DID
3-CR-1	2SVS-HCV104 2SVS-PCV101A 2SVS-PCV101B 2SVS-PCV101C	Throttle 2SVS-PCV101A from the ASP to control SG C pressure and throttle 2SVS-PCV101B from the ASP to control SG B pressure.	BV2-0882	PCS

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
3-CR-1	2FWE-HCV100A 2FWE-HCV100B 2FWE-HCV100C 2FWE-HCV100D 2FWE-HCV100E 2FWE-HCV100F	De-energize 2FWE-P23B at 4KVS-2DF to stop train B AFW flow. Manually throttle 2FWE-HCV100E to control A train SG A flow. Manually throttle 2FWE-HCV100C to control A train SG B flow. Manually throttle 2FWE-HCV100A to control A train SG C flow.	BV2-0874	DID
3-CR-1	4KVS-1G-1G5 4KVS-2A-2A1 4KVS-2B-2B1 4KVS-2C-2C1 4KVS-2D-2D1 2FWS-HYV157A 2FWS-HYV157B 2FWS-HYV157C	De-energize 2FWS-P21A at 4KVS-2A & 4KVS-2B and de-energize 2FWS-P21B at 4KVS-2C & 4KVS-2D to stop main feedwater pump flow to the steam generators.	BV2-0888	DID
3-CR-1	480VUS-2-2-2C 480VUS-2-8-7B 480VUS-2-8-7C 480VUS-2-9-7B 480VUS-2-9-7C	De-energize the C control group heater at 480VUS-2-2, de-energize the A and D backup group heaters at 480VUS-2-8 and de-energize the B and E backup group heaters at 480VUS-2-9 to prevent RCS overpressure.	BV2-0884	DID
3-CR-1	2HVC-ACU201A	Install a 5000 CFM portable fan in the Control Room doorway to supply temporary ventilation.	BV2-1328	RR
3-CR-1	2FWE-TK210	Perform actions of procedure 2OM-53A.1.A-1.8 to provide an alternate suction to the AFW pumps.	BV2-0891	RR
3-CR-1	2CHS-LCV115C	De-energize 2CHS-LCV115C at MCC2-E03 and manually close the valve OR De-energize 2CHS-LCV115E at MCC2-E04 and manually close the valve to prevent hydrogen intrusion into the charging pump suction.	BV2-0871	DID
3-CR-1	2CHS-MOV289	Manually open 2CHS-477 to bypass the charging flow control valve. Manually close 2CHS-30 to isolate the charging flow control valve. Manually throttle 2CHS-477 to control charging flow.	BV2-0887	RR
3-CR-1	2RCS-PCV455C 2RCS-PCV455D 2RCS-MOV535 2RCS-MOV536 2RCS-MOV537	Perform repair procedure 2OM-56C.4.F-8 to allow the opening of 2RCS-MOV536. Open PORV 2RCS-PCV456 at the ASP.	BV2-1416	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
3-CR-1	2RCS-PCV455C 2RCS-PCV455D 2RCS-MOV535 2RCS-MOV536 2RCS-MOV537	Attempt to control 2RCS-PCV456 at the ASP.	BV2-1416	PCS
3-CR-1	2RCS-SOV200A 2RCS-SOV200B 2RCS-SOV201A 2RCS-SOV201B 2RCS-HCV250A 2RCS-HCV250B	Perform repair procedure 2OM-56C.4.F-19 to provide power to the reactor vessel head vent valves.	BV2-1422	DID
3-CR-1	4KVS-2A-2A6 4KVS-2B-2B6 4KVS-2C-2C6 2RCS-PCV455A 2RCS-PCV455B	De-energize 2RCS-P21A at 4KVS-2A, de-energize 2RCS-P21B at 4KVS-2B and de-energize 2RCS-P21C at 4KVS-2C to prevent an RCP seal LOCA.	BV2-0877	RR
3-CR-1	Spurious SI 4KVS-2AE-2E12 4KVS-2AE-2E15 4KVS-2DF-2F12 4KVS-2DF-2F15	De-energize 2CHS-P21A(C) at 4KVS-2AE AND De-energize 2CHS-P21B(C) at 4KVS-2DF to control charging/HHSI flow.	BV2-0886	DID
3-CR-1	4KVS-2B-2B2 4KVS-2C-2C2 4KVS-2D-2D2 2FWS-HYV157A 2FWS-HYV157B 2FWS-HYV157C	De-energize 2CNM-P21A at 4KVS-2B, de-energize 2CNM-P21B at 4KVS-2C and de-energize 2CNM-P21C at 4KVS-2D to stop condensate flow to the steam generators.	BV2-1350	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
3-CR-1	Spurious SI 2SIS-MOV836 2SIS-MOV840 2SIS-MOV867A 2SIS-MOV867B 2SIS-MOV867C 2SIS-MOV867D 2SIS-HCV868A 2SIS-HCV868B 2SIS-MOV869A 2SIS-MOV869B	De-energize 2CHS-P21A(C) at 4KVS-2AE AND De-energize 2CHS-P21B(C) at 4KVS-2DF to stop excessive RCS makeup flow. De-energize 2SIS-MOV836, 2SIS-MOV840, 2SIS-MOV867C and 2SIS-MOV869A at MCC2-E05 and manually close the valves and de-energize 2SIS-MOV867D and 2SIS-MOV869B at MCC2-E06 and close them to isolate spuriously opened SI flow paths. Manually start 2CHS-P21A or 2CHS-P21C at 4KVS-2AE and manually throttle 2SIS-MOV836 to control RCS makeup flow.	BV2-0881 BV2-1395	DID
3-CR-1	2RCS-PT444 2RCS-PT445 2RCS-PCV455C 2RCS-PCV455D	Close 2RCS-PCV455C and 2RCS-PCV455D at the keylock isolation switches. OR Perform repair procedure to allow the closing of 2RCS-MOV535 and 2RCS-MOV537 to isolate the PORVs. OR To provide a flow path from the containment sump to Charging/HHSI pump 2CHS-P21A de-energize 2SIS-MOV8809A, 2SIS-MOV8887A, 2SIS-MOV8811A, 2RSS-MOV156C, 2SIS-MOV863A, 2RSS-MOV155C and 2SIS-MOV8890A at MCC2-E11, de-energize 2CHS-LCV115B at MCC2-E03 and then manually close 2SIS-MOV8809A, 2SIS-MOV8887A, 2RSS-MOV156C and 2SIS-MOV8890A, manually open 2SIS-MOV8811A, 2SIS-MOV863A and 2RSS-MOV155C and then manually close 2CHS-LCV115B.	BV2-0878	RR and DID
3-CR-1	2SWS-STRM47 2SWS-PT117A 2SWS-AOV130A	De-energize 2SWS-AOV130A at 480VUS-2-8 to restore the service water pump seal water supply.	BV2-0893	DID
3-CR-1	4KVS-2AE-2E2 4KVS-2DF-2F2 2-CIB-SPUR	Trip 2QSS-P21A at 4KVS-2AE to stop A train quench spray flow and trip 2QSS-P21B at 4KVS-2DF to stop B train quench spray flow.	BV2-0890	RR
3-CR-1	4KVS-2AE	Align AE and DF bus loads as required.	BV2-1327	RR

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
3-CR-1	4KVS-2AE-2E14 4KVS-2AE-2E18 2FWE-HCV100C 2FWE-HCV100E 480VUS-2-8-7B 2SVS-PCV101A 2SVS-PCV101B 4KVS-2AE-2E12 2CHS-FCV122 2RCS-PCV456 2CHS-LCV460A 2CHS-LCV460B 2CHS-P22A 2CHS-SOV206 2EGS-EG2-1 2FWS-LI477F 2FWS-LI487F 2MSS-PI475F 2MSS-PI485F 2RCS-LI459AF 2RCS-PI403F 2RCS-PI455F 2RCS-TI413F 2RCS-TI423F 2RCS-TI410F 2RCS-TI420F 2FWE-FI100AF 2FWE-FI100BF 2NMS-NI31BF 2NMS-NI31DF ACB-42A ACB-2A10 ACB-2E7 ACB-2E10 2SWS-MOV113A 2SWS-MOV102A 2CHS-LCV115B ASP Power Supply	Take the plant to "Safe and Stable" utilizing selected instruments and controls at the auxiliary shutdown panel, as directed.	BV2-0892	DID

Table 4 – BVPS-2 PCS Actions and RAs Classified as Being Credited for Defense in Depth (DID) or Risk Reduction (RR)				
Fire Compartment	**Component ID**	**Recovery Actions**	**VFDR**	**PCS/RR/ DID**
3-YARD-1	2CHS-LCV115B 2CHS-LCV115D	De-energize 2CHS-LCV115B at MCC2-E03 and manually open it to align suction to the charging pumps. Manually start 2CHS-P21A or 2CHS-P21C at 4KVS-2AE to provide RCS makeup flow.	BV2-1109	DID
Generic 2-DG-1 2-TB-1 2-TR-4 2-TR-5 3-RH-1 3-IS-2 3-SY-1	2FWE-TK210	Provide an alternate suction to the AFW pumps.	BV2-1330	RR

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".

Response:

The BVPS fire PRA models take credit for a number of risk reduction modifications which are listed in Table S-2 of the LAR; however, the RCP shutdown seals and incipient detection are the only modifications credited to offset the risk increases of the NFPA 805 transition in the risk offset calculation. The other risk reduction modifications in LAR Table S-2 are credited in the fire PRA models for both the base case and compliant case when calculating delta risk, so they do not serve to offset any risk increase in the risk offset calculation.

There are two primary reasons the risk offset calculation only takes advantage of the new RCP shutdown seals and the incipient detection systems. First, these two modifications provide the greatest risk benefit of all the individual modifications being implemented as a result of the BVPS transition to NFPA 805. Since the new seals do not resolve any specific VFDR but result in a significant risk reduction across the model, extending to other initiators beyond fire, they seemed an obvious choice to use for the risk offset calculation in order to obtain full credit representing their overall benefit to the PRA model and the station’s safety posture as a whole. Incipient detection, on the other hand, benefits only fire initiators; however, it too is a very real safety improvement to the station which goes well beyond what is strictly required for compliance. The incipient detection systems being installed at BVPS are designed to reduce the risk of what would otherwise be, by a wide margin, the most significant fire scenarios at both units. Since incipient detection provides such a great improvement in the risk of some of the most significant fire sources without actually being required to resolve any particular VFDR, it seemed prudent to also credit this modification in the risk offset calculation.

Secondly, these two modifications are chosen for the risk offset calculation because they are among the easiest to remove from the FPRA models in order to actually perform the calculations. Other modifications such as fire-wrapping cables, moving detectors for code compliance, motor-operated valve (MOV) modifications to allow manual operation subsequent to spurious operation, and so on, are more fully integrated into the underlying assumptions and structure of the PRA model such that they would be difficult to remove in order to produce the baseline risk numbers necessary for calculating the risk offset. Conversely, the PRA modeling of the RCP shutdown seals and the incipient detections systems both include reliability variables which can be set to guaranteed failure (that is, 1.0) in order to easily remove credit for these modifications and simplify the process of calculating risk offset and overall delta risk.

Table 5 below lists the modifications in Table S-2 of the LAR which are categorized as VFDR or Risk Reduction modifications. The modifications listed as “VFDR” resolve a VFDR (or multiple VFDRs), but many of them also serve to reduce risk in some capacity. The modifications listed as “Risk Reduction” do not resolve any VFDR, and serve only to reduce the FPRA risk. Those modifications listed in Table S-2 of the LAR and not shown here are categorized as “Code Compliance” and serve to resolve a compliance issue with the relevant code of record.

Table 5: LAR Table S-2 Plant Modifications

Item	**Proposed Modification**	**Modification Type**	**Risk Offset Credit?**
BV1-0746	Manual isolation valves for each individual area will be added to permit lock out of local areas supplied by the CO2 systems	VFDR	No
BV1-1675	FPRA determined that affected cables are to be re-routed, or protected with fire barrier wrap	VFDR	No
BV1-2088	The proposed change will revise circuitry in order to ensure ventilation is available for the fire area thereby eliminating manual action	VFDR	No
BV1-2115	Change normal system alignment of these valves (MSIV bypass valves) to de-energized shut	VFDR	No
BV1-2283	Relocate temperature switch (TS-1HV-55B) and associated cable from 1-ES-1	VFDR	No

Table 5: LAR Table S-2 Plant Modifications			
Item	**Proposed Modification**	**Modification Type**	**Risk Offset Credit?**
	ventilation duct to 1-ES-2 fire compartment.		
BV1-2448	Installation of anti-motoring relays protected from fire will correct this issue (PCB-331 & PCB-341 fail to trip)	VFDR	No
BV1-2806	The control circuit associated with the offsite power feeder breakers and the EDG will be modified to allow manual alignment while preventing automatic transfer of the EDG to the bus while it is powered from offsite power	VFDR	No
BV1-3024	Retire the BVPS-1 Boron Injection Surge Tank (BIT) and associated piping and instrumentation by shutting TV-1SI-884A (BIT Recirc to Boron Inj Surge Tk Isol), B (BIT Recirc to Boron Inj Surge Tk Isol), and C (Boron Recirc to BIT Isol) and isolate the air supply to these valves. BIT heaters, 1SI-EH-1A and 1B, will also be permanently electrically disconnected.	VFDR	No
BV2-0378 / BV2-0401	Install an automatic fire suppression system in the Train B Emergency Switchgear fire compartment	VFDR	No
BV2-0406	Manual isolation valves for each individual area will be added to permit lock out of local areas supplied by the CO2 systems	VFDR	No
BV2-0511	Install fire barrier wrap on affected conduits (to eliminate a manual action transferring EDG ventilation control to the ASP for certain fires)	VFDR	No
BV2-0753	Installation of anti-motoring relays protected from fires will correct this issue (PCB-351 & PCB-362 fail to trip)	VFDR	No
BV2-1292	Once the loop fill valves 2RCS-MOV556A, B and C are in their normal system arrangement of shut during power operation, de-energize the power supply to these MOVs	VFDR	No
BV1-1875	Incipient detection will be installed in certain cabinets that potentially cause risk significant fires	Risk Reduction	Yes

Table 5: LAR Table S-2 Plant Modifications

Item	**Proposed Modification**	**Modification Type**	**Risk Offset Credit?**
BV1-2648	Modify MOVs to ensure manual operation capability after potential spurious operation	Risk Reduction	No
BV1-2854	Computer Inverter (INV-CMP) to be relocated to adjacent fire compartment (1-MG-1)	Risk Reduction	No
BV1-3039	Add an isolation valve and vent valve to the instrument air supply of each BVPS-1 Main Steam Isolation Valve (TV-1MS-101A, B, &C) operators in the Main Steam Valve House (MSVH) in order to shut the MSIVs by a Recovery Action for a fire in the quench spray / auxiliary feedwater pump room that prevents the MSIVs from shutting.	Risk Reduction	No
BV1-3062	Install a low leakage Reactor Coolant Pump seal for each pump	Risk Reduction	Yes
BV1-3064	Install a modification to reduce the cavitation that is reducing the service life of existing Motor Driven Fire PP Modulating Relief Valve, RV-1FP-201	Risk Reduction	No
BV2-0828	Install a low leakage Reactor Coolant Pump seal for each pump	Risk Reduction	Yes
BV2-0829	Incipient detection will be installed in certain cabinets that potentially cause risk significant fires	Risk Reduction	Yes
BV2-1018	Modify the PORV control circuits to provide a control switch located outside Containment that has capability to close the PORVs for fires located outside Containment. For a fire in the compartment containing the new PORV control switch protect cables associated with the PORV block valve to ensure the PORV can be isolated to mitigate the LOCA	Risk Reduction	No
BV2-1435	Modify MOVs to ensure manual operation capability after potential spurious operation	Risk Reduction	No

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.

<u>Response:</u>

The methodology that was used at BVPS to evaluate DID and safety margin includes:

<u>Defense in Depth Approach</u>

For a FRE, a review of the impact of the VFDR's on DID was performed addressing each of the elements below.

1. Evaluate the fire area for the impact of the VFDR's on fire protection DID. Fire protection DID is achieved when an adequate balance of each of the following elements is provided:

    a. Preventing fires from starting
    b. Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage; and
    c. Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent essential plant safety functions from being performed.

2. In general, the DID requirement is satisfied if the proposed change does not result in a substantial imbalance among those elements. Table 6: *Defense in*

Depth (DID) Review Summary and Table 7: *Defense in Depth (DID) Review Documentation* provide examples of the process used by the DID expert panel to review the balance between DID echelons to determine if a substantial imbalance exists.

In the event there was an imbalance in the DID echelons during the evaluation, an expert panel evaluated options available to reduce the imbalance and selected the optimum combination to address the issue. Examples of the types of changes to the fire protection program made in response to this assessment include:

a. Addition of transient combustible exclusion areas
b. Restriction of access to identified areas via a key control program
c. Updating the fire brigade pre-fire plans and training material

3. A review to evaluate the potential for risk significant fire scenarios impact on VFDRs was completed. A fire scenario is defined as a unique quantification of a fire damage state (which may include severity factors and probability of non-suppression) multiplied by a conditional core damage probability (CCDP) or conditional large early release probability (CLERP) to arrive at a CDF or LERF. For purposes of DID, “potentially risk significant” fire scenarios could be characterized as follows:

   a. A scenario in which the calculated risk is equal to or greater than 1E-6 per year for CDF and/or 1E-7 per year for LERF, could be characterized as “potentially risk significant.”
   b. A scenario in which the calculated risk falls between 1E-6 per year and 1E-8 per year for CDF, or between 1E-7 per year and 1E-9 per year for LERF, and where DID echelon 1 and 2 attributes are causing a significant reduction in risk, could be characterized as “potentially risk significant.”
   c. A scenario in which the calculated risk is less than 1E-8 per year for CDF and/or 1E-9 for LERF, regardless of reliance on DID echelon 1 and 2 attributes, may be characterized as “potentially not risk significant.” These values are considered “potentially not risk significant” based on being two to three orders of magnitude below the acceptance criteria of RG 1.174 as referenced by RG 1.205, Rev. 1.
   d. A scenario with a high consequence (that is, CCDP greater than E-1) could be considered “potentially risk significant.”

4. Fire protection features and systems relied upon to ensure DID are clearly identified in the assessment (that is, detection, suppression system, and so on).

5. Verify that DID is maintained by assessing and documenting that the balance is preserved among prevention of core damage, prevention of containment failure, and mitigation of consequences. Regulatory Guide 1.174 provides guidance on

maintaining the philosophy of nuclear safety defense-in-depth that is acceptable for NFPA 805 “Fire Risk Evaluations.”

6. Each fire area was evaluated for the need to incorporate DID enhancements to provide assurance that plant performance goals can be achieved and maintained. Documentation of these defense-in-depth enhancements are on a fire area basis and/or tied directly to a VFDR disposition, as appropriate.

7. The results of the DID review are in a tabular format, such as shown in Table 7: *Defense in Depth (DID) Review Documentation* that follows. DID attributes were evaluated for applicability to NFPA 805, Section 4.2.3 or 4.2.4.

    a. If a DID attribute is credited for NSCA deterministic criteria, licensing action or engineering equivalency evaluation, the system/feature should already be considered to form an integral part of defense-in-depth. The parent echelon of the system/feature was then evaluated against the process and considerations in Tables 6 and 7 to determine if any improvements or changes are necessary, such as to offset a weakness in another echelon.

    b. If the fire PRA credits any of the fire protection features or a recovery action to improve the risk profile, then these attributes or features should already be considered to form an integral part of DID. The parent echelon of the system/feature was then evaluated against the process and considerations in Tables 6 and 7 to determine if any improvements or changes are necessary, such as to offset a weakness in another echelon.

    c. DID attributes that go above and beyond the existing requirement(s) with the purpose of bolstering identified weaknesses within the defense-in-depth elements to maintain an overall balance should be designated as a change or improvement necessary for defense-in-depth.

        Note- this may or may not involve a physical improvement to the element, but by virtue of including an attribute that was not required for deterministic or risk reasons, defense-in-depth is considered enhanced.

    d. Features or enhancements required for DID warrant consideration for inclusion in the monitoring program.

Table 6: Defense in Depth (DID) Review Summary

Defense in Depth Expert Panel

Fire Compartment: ________________ Date: __________________

Members / Position:

____

____

PRA Document: ____________________ Detailed Fire Model: ____________________ Multi-Compartment Fire Analysis: ____________________

Section 1 **CDF, LERF and CCDP Screening**					
Initial Screening (Fire PRA Table 6-4A, Base Case OMA HEP Values sorted by CCDP):					
	List Applicable Fire Scenarios:				
Is CDF > 1E-06/year / LERF > 1E-07/year OR CCDP > 1E-01?	**Fire Scenario ID**	**Fire Scenario Description**	**CCDP**	**CDF**	**LERF**
NOTE: Fire scenario data is taken at the time of the DID review.					
OR					
Additional Screening (Fire PRA Table 6-4A, Base Case OMA HEP Values sorted by CCDP):					
	List Applicable Fire Scenarios:				
Echelon 1 and/or 2 credited for risk reduction? AND Is CDF >1E-08/year / LERF >1E-09/year?	**Fire Scenario ID**	**Fire Scenario Description**	**CCDP**	**CDF**	**LERF**

NOTE: Fire scenario data is taken at the time of the DID review.					

Section 2 **Echelon 1, 2 & 3 Elements**				
Element	**Method of providing DID**	**Potential Challenges**	**Changes**	**Net Effect**
Echelon 1 - Preventing fires from starting				
Echelon 2 - Detecting fires quickly and suppressing those that occur, thereby limiting damage				
Echelon 3 - Providing protection for systems and structures so that safe shutdown can be achieved				

Section 3 **Other DID Considerations**				
Consideration	**Method of providing DID**	**Potential Challenges**	**Changes**	**Net Effect**
Over-reliance and increased length of time or risk in performing programmatic activities to compensate for weaknesses in plant design is avoided.				
Pre-fire nuclear safety system redundancy, independence and diversity are preserved				

commensurate with the expected frequency and consequences of challenges to the system and uncertainties (e.g., no risk outliers). (*This should not be construed to mean that more than one safe shutdown train must be maintained free of fire damage*.)				
Independence of DID elements are not degraded.				
Defenses against human errors are preserved.				
The intent of the General Design Criteria in Appendix A to 10 CFR Part 50 is maintained.				
Recommended enhancements or insights gained by DID review.				
Operator Actions credited for DID, but not included in Fire PRA Table 6-1				

Table 7: Defense in Depth (DID) Review Documentation				
DID Impact Review for Fire Compartment ____________				
Method of Providing DID	**Required to Support Deterministic Analysis or Fire PRA?**	**Changes or Improvements Necessary**	**Additional details**	**Basis/Justification**
Echelon 1: Prevent fires from starting				
Combustible Control is implemented in accordance with Procedure 1/2-ADM-1906, "Control Of Transient Combustible and Flammable Materials."				
Hot Work Control is implemented in accordance with Procedure 1/2-ADM-1904, "Control of Ignition Sources (Hot Work) and Fire Watches."				
Echelon 2: Rapidly detect, control and extinguish promptly those fires that do occur thereby limiting fire damage				
Fire Detection System				
Automatic Fire Suppression				
Portable Fire Extinguishers				
Hose stations and hydrants located in the area(s)				
Fire Pre-Fire Plan				
Echelon 3: Provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed				

Table 7: Defense in Depth (DID) Review Documentation				
DID Impact Review for Fire Compartment ____________				
Method of Providing DID	**Required to Support Deterministic Analysis or Fire PRA?**	**Changes or Improvements Necessary**	**Additional details**	**Basis/Justification**
Walls, floors ceilings and structural elements are rated or have been evaluated as adequate for the hazard				
Openings in the fire barrier are rated or have been evaluated as adequate for the hazard				
Supplemental barriers (e.g., ERFBS, cable tray covers, etc.)				
Fire rated cable				
Guidance provided to operations personnel detailing the required success path(s) including recovery actions to achieve nuclear safety performance criteria				

Safety Margin Approach

A review of the impact of the change on safety margin was performed in the FREs. An acceptable set of guidelines for making that assessment is summarized below. Other equivalent acceptance guidelines may also be used.

1. Codes and standards or their alternatives accepted for use by the NRC are met, and
2. Safety analysis acceptance criteria in the licensing bases (that is, UFSAR, supporting analyses) are met or provide sufficient margin to account for analysis and data uncertainty.

The requirements related to safety margins for the change analysis are described for each of the specific analysis types used in support of the fire risk evaluation. These analyses can be grouped into four categories:

1. Fire Modeling
2. Plant System Performance
3. PRA Logic Model
4. A Required Review of Success Path

1. Fire Modeling: Document the results of the qualitative safety margin review. Include a review of the use of applicable codes and standards developed by industry and NRC staff to ensure realistic yet conservative results.

2. Plant System Performance: The development of the fire risk evaluation involved the re-examination of plant system performance, given the specific demands associated with the postulated fire event. The methods, input parameters, and acceptance criteria used in these analyses were reviewed against those used for the plant design basis events. This review served to establish that the safety margin inherent in the analyses for the plant design basis events has been preserved in the analysis for the fire event and therefore satisfies the requirements of this section.

   From a safety margin perspective, the evaluation of the plant system performance addressed the following topics:

   a. Were input parameters for plant performance analyses (that is, heat transfer coefficients, pump performance curves) altered from those used for plant design basis events such that the margin was lessened?
   b. Were codes and standards used to determine plant system performance acceptable to the NRC?

3. PRA Logic Model: The quantification for fire related CDF/LERF relies upon the fire PRA model. It is recognized that use of a fire PRA often requires model modifications to be performed to the internal events PRA. These modifications may include altering basic event failure probabilities, adding basic events, and changing the logic structure. These changes were evaluated against the methods and criteria for the overall fire PRA model development for consistency or confirmation of bounding treatment to confirm that the safety margin inherent in the PRA model is preserved.

   From a safety margin perspective, the evaluation of the PRA logic model addressed the following topics:

   a. Were the risk-informed, performance based processes utilized based upon NFPA 805, 2001 edition, endorsed by the NRC in 10 CFR 50.48(c)?
   b. Was the fire risk evaluation process in accordance with NEI 04-02, Revision 2, which is endorsed by the NRC in RG 1.205, Revision 1?
   c. Was the fire PRA developed in accordance with NUREG/CR-6850, which was developed jointly by the NRC and EPRI?

4. Success Path Review: Validate and document that the VFDRs have been evaluated as acceptable (with or without modifications) based upon the following:

   a. The measured change in CDF and LERF
   b. Adequate DID and safety margins are maintained
   c. That the results of this evaluation meet the requirements of NFPA 805 Section 4.2.4.2 and that a success path effectively remains free of fire damage and, therefore, the nuclear safety performance criteria of NFPA 805 are met.

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.**

Response:

a) Westinghouse letter "Fire PRA Peer Review Against the Fire PRA Standard Supporting Requirements From Section 4 of the ASME/ANS Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessments for Nuclear Power Plant Applications For The Beaver Valley Unit 1 Fire Probabilistic Risk Assessment" dated April 2009 lists the initial BVPS-1 peer review as being performed against ASME/ANS RA-S-2008a. The changes between the RA-S-2008 and RA-Sa-2009 standards were reviewed, and the RA-S-2008a standard used in the BVPS-1 2009 peer review was found to match the RA-Sa-2009 standard with respect to all the identified changes between RA-S-2008 and RA-Sa-2009. Additionally, the 2011 focused-scope peer review report presents a summary of all SRs and how they are met or not met. Any SR not reviewed as part of the focused-scope review was labeled as "[Initial Review]" and the summary of the SR from the 2009 peer review was carried forward into the 2011 report. All SRs bearing this "[Initial Review]" label were reviewed to confirm the requirement had not changed between versions of the standard, and to confirm that the model summary in the report continued to adequately address the RA-Sa-2009 version of the SR. It is therefore determined that the 2009 BVPS-1 peer review was effectively performed against the ASME/ANS RA-Sa-2009 standard even though this version was not officially published until after the peer review was performed, since the SRs in the RA-S-2008a standard which was used for the 2009 BVPS-1 peer review match the SRs in the RA-Sa-2009 standard.

b) RG 1.200, Revision 2, was followed by the BVPS-1 focused-scope peer review team in 2011, as well as by the BVPS-2 peer review team in 2012. In both cases the NRC's clarifications and qualifications in the Regulatory Guide were considered, and the NEI 07-12 peer review process was utilized.

   Westinghouse letter "Follow-on Fire PRA Peer Review Against the Fire PRA Standard Supporting Requirements From Section 4 of the ASME/ANS Standard For The Beaver Valley Unit 1 Fire Probabilistic Risk Assessment" dated April 2011 states in section 1.1 "The purpose of this report is to document the final results of the Focused scope follow-on Peer Review of Beaver Valley Power Station (BVPS) Unit 1 (BV1) Fire Probabilistic Risk Assessment (FPRA) against the requirements of Section 4 of the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) PRA Standard (Reference 1) and any Clarifications and Qualifications provided in the Nuclear Regulatory Commission (NRC) endorsement of the Standard contained in Revision 2 to Regulatory Guide (RG) 1.200 (Reference 9). This peer review was performed using the process defined in Nuclear Energy Institute (NEI) 07-12 (Reference 2)." Section 2.2 of the letter also further clarifies, "For a peer review of a Fire PRA against the ASME/ANS PRA Standard, the applicable portions of a host utility's Fire PRA are reviewed against the applicable ASME/ANS PRA Standard SRs in Section 4.2 of the ASME/ANS PRA Standard, following the guidance of Section 1.6 of the ASME/ANS PRA Standard. Where the NRC has provided a clarification or qualification for a given SR in RG 1.200, the NRC clarification/qualification is considered to govern and the review is conducted against the SR as clarified or qualified."

   For BVPS-2, Westinghouse letter "Fire PRA Peer Review Against the Fire PRA Standard Supporting Requirements From Section 4 of the ASME/ANS Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessments for Nuclear Power Plant Applications For the Beaver Valley Station Unit 2 Fire Probabilistic Risk Assessment" dated April 2012 states in section 1.1 "The purpose of this report is to document the final results of the Peer Review of the Beaver Valley Nuclear Station Unit 2 Fire Probabilistic Risk Assessment (Fire PRA) against the requirements of Section 4 of the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) Combined PRA standard RA-Sa-2009 (Reference 1). This peer review was performed using the process defined in Nuclear Energy Institute (NEI) 07-12 (Reference 2)." Although the use of RG 1.200, Revision 2, is not clearly specified in the methodology sections of this BVPS-2 peer review report, the clarifications and qualifications presented in the Regulatory Guide were considered in the review, as evidenced by a statement in Table 4-10: "The cumulative impact of the screened PAUs is small (less than 10 percent of fire CDF and LERF). The total CDF and LERF associated with the screened scenarios and PAUs are less than 10 percent of fire CDF and LERF (which meets the NRC clarification on QNS-C1 in RG 1.200, Rev. 2)." Additionally, the lead reviewer from the BVPS-2 FPRA peer review confirmed via email that "…yes, the BV-2 Fire PRA peer review was performed against the Reg Guide 1.200 Rev. 2 and ASME/ANS-RA-Sa-2009 PRA Standard and the clarifications/qualifications presented in the RG 1.200, Rev. 2 were considered in the review."