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

January 22, 2018

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

SUBJECT: BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2 – ISSUANCE OF AMENDMENTS RE: TRANSITION TO NFPA 805, "PERFORMANCE-BASED STANDARD FOR FIRE PROTECTION FOR LIGHT WATER REACTOR ELECTRIC GENERATING PLANTS" (CAC NOS. MF3301 AND MF3302; EPID L-2013-LLF-0001)

Dear Mr. Bologna:

The U.S. Nuclear Regulatory Commission (Commission) has issued the enclosed Amendment No. 301 to Renewed Facility Operating License No. DPR-66 for the Beaver Valley Power Station (Beaver Valley), Unit No. 1, and Amendment No. 190 to Renewed Facility Operating License No. NPF-73 for the Beaver Valley, Unit No. 2. These amendments are in response to your application dated December 23, 2013, as supplemented by letters dated February 14, 2014; April 27, May 27, June 26, November 6, and December 21, 2015; February 24 and May 12, 2016; and January 30, April 21, June 23, August 22, October 25, and November 29, 2017.

The amendments revise the Renewed Facility Operating Licenses for Beaver Valley, Unit Nos. 1 and 2, to establish and maintain a risk-informed, performance-based fire protection program in accordance with the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.48(c).

A copy of our related safety evaluation is also enclosed. Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

Booma Venkataraman, Project Manager
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-334 and 50-412

Enclosures:
1. Amendment No. 301 to DPR-66
2. Amendment No. 190 to NPF-73
3. Safety Evaluation

cc w/Enclosures: Distribution via Listserv

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

FIRSTENERGY NUCLEAR OPERATING COMPANY

FIRSTENERGY NUCLEAR GENERATION, LLC

DOCKET NO. 50-334

BEAVER VALLEY POWER STATION, UNIT NO. 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 301
Renewed License No. DPR-66

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by FirstEnergy Nuclear Operating Company (FENOC)* acting on its own behalf and as agent for FirstEnergy Nuclear Generation, LLC (the licensees), dated December 23, 2013, as supplemented by letters dated February 14, 2014; April 27, May 27, June 26, November 6, and December 21, 2015; February 24 and May 12, 2016; and January 30, April 21, June 23, August 22, October 25, and November 29, 2017, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I.

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission.

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations.

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

   E. The issuance of this amendments is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. In addition, the Renewed Facility Operating License is amended as indicated in the attachment to this license amendment. Paragraph 2.C.(5) is amended as follows:

*FENOC is authorized to act as agent for FirstEnergy Nuclear Generation, LLC, and has exclusive responsibility and control over the physical construction, operation, and maintenance of the facility.

(5) Fire Protection Program

FENOC shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the license amendment request dated December 23, 2013 (as supplemented by letters dated February 14, 2014; April 27, May 27, June 26, November 6, and December 21, 2015; February 24 and May 12, 2016; and January 30, April 21, June 23, August 22, October 25, and November 29, 2017), and as approved in the safety evaluation dated January 22, 2018. Except where NRC approval for changes or deviations is required by 10 CFR 50.48(c), and provided no other regulation, technical specification, license condition, or requirement would require prior NRC approval, the licensee may make changes to the fire protection program without prior approval of the Commission if those changes satisfy the provisions set forth in 10 CFR 50.48(a) and 10 CFR 50.48(c), the change does not require a change to a technical specification or a license condition, and the criteria listed below are satisfied.

(a) Risk-Informed Changes that May Be Made Without Prior NRC Approval

A risk assessment of the change must demonstrate that the acceptance criteria below are met. The risk assessment approach, methods, and data shall be acceptable to the NRC and shall be appropriate for the nature and scope of the change being evaluated; be based on the as-built, as-operated, and maintained plant; and reflect the operating experience at the plant. Acceptable methods to assess the risk of the change may include methods that have been used in the peer-reviewed fire PRA model, methods that have been approved by NRC through a plant-specific license amendment or NRC approval of generic methods specifically for use in NFPA 805 risk assessments, or methods that have been demonstrated to bound the risk impact.

1. Prior NRC review and approval is not required for a change that results in a net decrease in risk. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

2. Prior NRC review and approval is not required if the change results in a risk increase less than 1E-7/yr for core damage frequency and less than 1E-8/yr for large early release frequency. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

(b) Other Changes that May be Made Without Prior NRC Approval

1. Changes to NFPA 805, Chapter 3, Fundamental Fire Protection Program

Prior NRC review and approval are not required for changes to the NFPA 805, Chapter 3, fundamental fire protection program elements and design requirements for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is functionally equivalent or adequate for the hazard. The licensee may use an engineering evaluation to demonstrate that a change to an NFPA 805, Chapter 3, element is functionally equivalent to the corresponding technical requirement. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

The licensee may use an engineering evaluation to demonstrate that changes to certain NFPA 805, Chapter 3, elements are acceptable because the alternative is "adequate for the hazard." Prior NRC review and approval would not be required for alternatives to four specific sections of NFPA 805, Chapter 3, for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is adequate for the hazard. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

The four specific sections of NFPA 805, Chapter 3, are as follows:

- Fire Alarm and Detection Systems (Section 3.8)
- Automatic and Manual Water-Based Fire Suppression Systems (Section 3.9)
- Gaseous Fire Suppression Systems(Section 3.10)
- Passive Fire Protection Features (Section 3.11)

This license condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

2. Fire Protection Program Changes that Have No More than Minimal Risk Impact

Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its

screening process as approved in the NRC SE dated January 22, 2018, to determine that certain fire protection program changes meet the minimal criterion. The licensee shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

(c) Transition License Conditions

1. Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change has been demonstrated to have no more than a minimal risk impact, as described in (2) above.

2. The licensee shall implement the Unit 1 modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," in FENOC letter L-17-122, dated April 21, 2017, to complete the transition to full compliance with 10 CFR 50.48(c), by the completion of the second Unit 1 refueling outage after issuance of the safety evaluation. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

3. The licensee shall implement the items listed in Attachment S, Table S-3, "Implementation Items," of FENOC letter L-17-268, dated August 22, 2017, by 12 months after issuance of the safety evaluation (with the exception of Items BV1-1633, BV1-2974, BV1-3060, BV1-3108, BV1-3109, BV2-1580, BV2-1622, BV2-1623, and BV2-1750, which are to be completed by the end of the second Unit 1 refueling outage after issuance of the safety evaluation).

3. This license amendment is effective as of its date of issuance and shall be implemented consistent with paragraph 2.C.(5) of the Renewed Facility Operating License.

FOR THE NUCLEAR REGULATORY COMMISSION

James G. Danna, Chief
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility
Operating License

Date of Issuance: January 22, 2018

ATTACHMENT TO LICENSE AMENDMENT NO. 301

BEAVER VALLEY POWER STATION, UNIT NO. 1

RENEWED FACILITY OPERATING LICENSE NO. DPR-66

DOCKET NO. 50-334

Replace the following pages of the Renewed Facility Operating License with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
4	4
5	5
6	6
7	7
8	8
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(3) Less Than Three Loop Operation

Deleted per License Amendment No. 239 .

(4) Steam Generator Water Rise Rate

Deleted per License Amendment No. 24.

(5) Fire Protection Program

FENOC shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the license amendment request dated December 23, 2013 (as supplemented by letters dated February 14, 2014; April 27, May 27, June 26, November 6, and December 21, 2015; February 24 and May 12, 2016; and January 30, April 21, June 23, August 22, October 25, and November 29, 2017), and as approved in the safety evaluation dated January 22, 2018. Except where NRC approval for changes or deviations is required by 10 CFR 50.48(c), and provided no other regulation, technical specification, license condition, or requirement would require prior NRC approval, the licensee may make changes to the fire protection program without prior approval of the Commission if those changes satisfy the provisions set forth in 10 CFR 50.48(a) and 10 CFR 50.48(c), the change does not require a change to a technical specification or a license condition, and the criteria listed below are satisfied.

(a) Risk-Informed Changes that May Be Made Without Prior NRC Approval

A risk assessment of the change must demonstrate that the acceptance criteria below are met. The risk assessment approach, methods, and data shall be acceptable to the NRC and shall be appropriate for the nature and scope of the change being evaluated; be based on the as-built, as-operated, and maintained plant; and reflect the operating experience at the plant. Acceptable methods to assess the risk of the change may include methods that have been used in the peer-reviewed fire PRA model, methods that have been approved by NRC through a plant-specific license amendment or NRC approval of generic methods specifically for use in NFPA 805 risk assessments, or methods that have been demonstrated to bound the risk impact.

1. Prior NRC review and approval is not required for a change that results in a net decrease in risk. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

2. Prior NRC review and approval is not required if the change results in a risk increase less than 1E-7/yr for core damage frequency and less than 1E-8/yr for large early release frequency. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

(b) Other Changes that May Be Made Without Prior NRC Approval

1. Changes to NFPA 805, Chapter 3, Fundamental Fire Protection Program

Prior NRC review and approval are not required for changes to the NFPA 805, Chapter 3, fundamental fire protection program elements and design requirements for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is functionally equivalent or adequate for the hazard. The licensee may use an engineering evaluation to demonstrate that a change to an NFPA 805, Chapter 3, element is functionally equivalent to the corresponding technical requirement. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

The licensee may use an engineering evaluation to demonstrate that changes to certain NFPA 805, Chapter 3, elements are acceptable because the alternative is "adequate for the hazard." Prior NRC review and approval would not be required for alternatives to four specific sections of NFPA 805, Chapter 3, for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is adequate for the hazard. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

The four specific sections of NFPA 805, Chapter 3, are as follows:

- Fire Alarm and Detection Systems (Section 3.8)
- Automatic and Manual Water-Based Fire Suppression Systems (Section 3.9)
- Gaseous Fire Suppression Systems (Section 3.10)
- Passive Fire Protection Features (Section 3.11)

This license condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

2. Fire Protection Program Changes that Have No More than Minimal Risk Impact

   Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC SE dated January 22, 2018, to determine that certain fire protection program changes meet the minimal criterion. The licensee shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

(c) Transition License Conditions

1. Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change has been demonstrated to have no more than a minimal risk impact, as described in (2) above.

2. The licensee shall implement the Unit 1 modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," in FENOC letter L-17-122, dated April 21, 2017, to complete the transition to full compliance with 10 CFR 50.48(c), by the completion of the second Unit 1 refueling outage after issuance of the safety evaluation. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

3. The licensee shall implement the items listed in Attachment S, Table S-3, "Implementation Items," of FENOC letter L-17-268, dated August 22, 2017, by 12 months after issuance of the safety evaluation (with the exception of Items BV1-1633, BV1-2974, BV1-3060, BV1-3108, BV1-3109, BV2-1580, BV2-1622, BV2-1623, and BV2-1750, which are to be completed by the end of the second Unit 1 refueling outage after issuance of the safety evaluation).

(6) Systems Integrity

FENOC shall implement a program to reduce leakage from systems outside containment that would or could contain highly radioactive fluids during a serious transient or accident to as low as practical levels. This program shall include the following:

1. Provisions establishing preventive maintenance and periodic visual inspection requirements, and
2. Integrated leak test requirements for each system at a frequency not to exceed refueling cycle intervals.

(7) Iodine Monitoring

FENOC shall implement a program which will ensure the capability to accurately determine the airborne iodine concentration in vital areas under accident conditions. This program shall include the following:

1. Training of personnel,
2. Procedures for monitoring, and
3. Provisions for maintenance of sampling and analysis equipment.

(8) Backup Method for Determining Subcooling Margin

FENOC shall implement a program which will ensure the capability to accurately monitor the Reactor Coolant System subcooling margin. This program shall include the following:

1. Training of personnel, and
2. Procedures for monitoring.

(9) Steam Generator Surveillance Interval Extension

Deleted per License Amendment No. 278.

(10) Additional Conditions

The Additional Conditions contained in Appendix C, as revised through Amendment No. 290, are hereby incorporated into this license. FENOC shall operate the facility in accordance with the Additional Conditions.

(11) Mitigation Strategy License Condition

The licensee shall develop and maintain strategies for addressing large fires and explosions and that include the following key areas:

(a) Fire fighting response strategy with the following elements:

1. Pre-defined coordinated fire response strategy and guidance
2. Assessment of mutual aid fire fighting assets
3. Designated staging areas for equipment and materials
4. Command and control
5. Training of response personnel

(b) Operations to mitigate fuel damage considering the following:

1. Protection and use of personnel assets
2. Communications
3. Minimizing fire spread
4. Procedures for implementing integrated fire response strategy
5. Identification of readily-available pre-staged equipment
6. Training on integrated fire response strategy
7. Spent fuel pool mitigation measures

(c) Actions to minimize release to include consideration of:

1. Water spray scrubbing
2. Dose to onsite responders

D. Physical Protection

FENOC shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority 10 CFR 50.90 and 10 CFR 50.54(p). The combined set of plans, which contains Safeguards Information protected under 10 CFR 73.21 is entitled: "Beaver Valley Power Station (BVPS) Physical Security Plan" submitted by letter September 9, 2004, and supplemented September 30, 2004, October 14, 2004, and May 12, 2006.

FENOC shall fully implement and maintain in effect all provisions of the Commission-approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The Beaver Valley Power Station CSP was approved by License Amendment No. 287, and amended by License Amendment No. 295.

E. All work and activities in connection with this project shall be performed pursuant to the provisions of the Commonwealth of Pennsylvania Clean Streams Acts of June 24, 1913, as amended and of June 22, 1937, as amended, and in accordance with all permits issued by the Department of Environmental Resources of the Commonwealth of Pennsylvania.

F. License Renewal Commitments – The UFSAR supplement, as revised, submitted pursuant to 10 CFR 54.21(d), describes certain future activities to be completed prior to and/or during the period of extended operation. FENOC shall complete these activities in accordance with Appendix A of NUREG-1929, Safety Evaluation Report Related to the Beaver Valley Power Station, Units 1 and 2, dated October 2009, and Supplement 1 of NUREG-1929, dated October 2009, and shall notify the NRC in writing when activities to be completed prior to the period of extended operation are complete and can be verified by NRC inspection.

G. UFSAR Supplement Changes – The information in the UFSAR supplement, as revised, submitted pursuant to 10 CFR54.21(d), shall be incorporated into the UFSAR as required by 10 CFR 50.71(e) following the issuance of this renewed operating license. Until that update is complete, FENOC may not make changes to the information in the supplement. Following incorporation into the UFSAR, the need for prior Commission approval of any changes will be governed by 10 CFR 50.59.

H. Capsule Withdrawal Schedule – For the renewed operating license term, all capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of American Society for Testing and Materials (ASTM) E 185-82 to the extent practicable for the configuration of the specimens in the capsule. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation.

I. Containment Liner Volumetric Inspection –

a) If degradation (greater than 10 percent of the nominal thickness not attributable to fabrication/erection practices) is identified in the non-random areas examined using ultrasonic testing (UT) as described in Supplement 1 of NUREG-1929, UT examinations shall be performed at additional non-random areas, to be selected based on this operating experience. Should additional degradation be identified, additional non-random areas shall be UT examined until no further degradation (greater than 10 percent of the nominal thickness) is identified. All areas with degradation shall be reexamined over at least the next three successive inspection periods to ensure that progression of the degradation is not occurring.

b) If degradation (greater than 10 percent of the nominal thickness not attributable to fabrication/erection practices) is identified in the random samples examined using ultrasonic testing (UT) as described in Supplement 1 of NUREG 1929, UT examinations shall be performed on additional random samples, to ensure a 95 percent confidence that 95 percent of the unexamined accessible containment liner is not degraded. If additional degradation is identified, the sample size for UT examinations shall be further expanded until the statistical sampling has achieved the 95 percent confidence goal described previously. All areas with degradation shall be reexamined over at least the next three successive inspection periods to ensure that progression of the degradation is not occurring.

3. This renewed operating license is effective as of the date of issuance and shall expire at midnight on January 29, 2036.

FOR THE NUCLEAR REGULATORY COMMISSION

ORIGINAL SIGNED BY:

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

Attachments:
1. Appendix A - Technical Specifications
2. Appendix C - Additional Conditions

Date of Issuance: November 05, 2009

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

FIRSTENERGY NUCLEAR OPERATING COMPANY

FIRSTENERGY NUCLEAR GENERATION, LLC

DOCKET NO. 50-412

BEAVER VALLEY POWER STATION, UNIT NO. 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 190
Renewed License No. NPF-73

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by FirstEnergy Nuclear Operating Company (FENOC)* acting on its own behalf and as agent for FirstEnergy Nuclear Generation, LLC (the licensees), dated December 23, 2013, as supplemented by letters dated February 14, 2014; April 27, May 27, June 26, November 6, and December 21, 2015; February 24 and May 12, 2016; and January 30, April 21, June 23, August 22, October 25, and November 29, 2017, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I.

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. In addition, the Renewed Facility Operating Licensee is amended as indicated in the attachment to this license amendment. Paragraph 2.F is amended as follows:

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*FENOC is authorized to act as agent for FirstEnergy Nuclear Generation, LLC, and has exclusive responsibility and control over the physical construction, operation, and maintenance of the facility.

(5) Fire Protection Program

FENOC shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the license amendment request dated December 23, 2013 (as supplemented by letters dated February 14, 2014; April 27, May 27, June 26, November 6, and December 21, 2015; February 24 and May 12, 2016; and January 30, April 21, June 23, August 22, October 25, and November 29, 2017), and as approved in the safety evaluation dated January 22, 2018. Except where NRC approval for changes or deviations is required by 10 CFR 50.48(c), and provided no other regulation, technical specification, license condition, or requirement would require prior NRC approval, the licensee may make changes to the fire protection program without prior approval of the Commission if those changes satisfy the provisions set forth in 10 CFR 50.48(a) and 10 CFR 50.48(c), the change does not require a change to a technical specification or a license condition, and the criteria listed below are satisfied.

(a) Risk-Informed Changes that May Be Made Without Prior NRC Approval

A risk assessment of the change must demonstrate that the acceptance criteria below are met. The risk assessment approach, methods, and data shall be acceptable to the NRC and shall be appropriate for the nature and scope of the change being evaluated; be based on the as-built, as-operated, and maintained plant; and reflect the operating experience at the plant. Acceptable methods to assess the risk of the change may include methods that have been used in the peer-reviewed fire PRA model, methods that have been approved by NRC through a plant-specific license amendment or NRC approval of generic methods specifically for use in NFPA 805 risk assessments, or methods that have been demonstrated to bound the risk impact.

1. Prior NRC review and approval is not required for a change that results in a net decrease in risk. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

2. Prior NRC review and approval is not required if the change results in a risk increase less than 1E-7/yr for core damage frequency and less than 1E-8/yr for large early release frequency. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

(b) Other Changes that May be Made Without Prior NRC Approval

1. Changes to NFPA 805, Chapter 3, Fundamental Fire Protection Program

Prior NRC review and approval are not required for changes to the NFPA 805, Chapter 3, fundamental fire protection program elements and design requirements for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is functionally equivalent or adequate for the hazard. The licensee may use an engineering evaluation to demonstrate that a change to an NFPA 805, Chapter 3, element is functionally equivalent to the corresponding technical requirement. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

The licensee may use an engineering evaluation to demonstrate that changes to certain NFPA 805, Chapter 3, elements are acceptable because the alternative is "adequate for the hazard." Prior NRC review and approval would not be required for alternatives to four specific sections of NFPA 805, Chapter 3, for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is adequate for the hazard. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

The four specific sections of NFPA 805, Chapter 3, are as follows:

- Fire Alarm and Detection Systems (Section 3.8)
- Automatic and Manual Water-Based Fire Suppression Systems (Section 3.9)
- Gaseous Fire Suppression Systems (Section 3.10)
- Passive Fire Protection Features (Section 3.11)

This license condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

2. Fire Protection Program Changes that Have No More than Minimal Risk Impact

Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in

the NRC SE dated January 22, 2018, to determine that certain fire protection program changes meet the minimal criterion. The licensee shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

(c) Transition License Conditions

1. Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change has been demonstrated to have no more than a minimal risk impact, as described in (2) above.

2. The licensee shall implement the Unit 2 modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," in FENOC letter L-17-122, dated April 21, 2017, to complete the transition to full compliance with 10 CFR 50.48(c), by the completion of the second Unit 2 refueling outage after issuance of the safety evaluation. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

3. The licensee shall implement the items listed in Attachment S, Table S-3, "Implementation Items," of FENOC letter L-17-268, dated August 22, 2017, by 12 months after issuance of the safety evaluation (with the exception of Items BV1-1633, BV1-2974, BV1-3060, BV1-3108, BV1-3109, BV2-1580, BV2-1622, BV2-1623, and BV2-1750, which are to be completed by the end of the second Unit 2 refueling outage after issuance of the safety evaluation).

3. This license amendment is effective as of its date of issuance and shall be implemented consistent with paragraph 2.F of the Renewed Facility Operating License.

FOR THE NUCLEAR REGULATORY COMMISSION

James G. Danna, Chief
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility
Operating License

Date of Issuance: January 22, 2018

ATTACHMENT TO LICENSE AMENDMENT NO. 190

BEAVER VALLEY POWER STATION, UNIT NO. 2

RENEWED FACILITY OPERATING LICENSE NO. NPF-73

DOCKET NO. 50-412

Replace the following pages of the Renewed Facility Operating License with the attached revised page. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
8	8
9	9
10	10
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(2) The facility requires an exemption from the requirements of 10 CFR 50, Appendix J, Section III.D.2(b)(ii). The justification of this exemption is contained in Section 6.2.6 of Supplement 5 to the Safety Evaluation Report and modified by a letter dated July 26, 1995. The staff's environmental assessment was published on May 12, 1987 (52 FR 17651) and on June 9, 1995 (60 FR 30611). Therefore, pursuant to 10 CFR 50.12(a)(1) and 10 CFR 50.12(a)(2)(ii) and (iii), Beaver Valley Power Station, Unit 2 is exempt from the quoted requirements and instead, is required to perform the overall air lock leak test at pressure P_a before establishing containment integrity if air lock maintenance has been performed that could affect the air lock sealing capability. Local leak rate testing at a pressure of not less than P_a may be substituted for an overall air lock test where the design permits.

E. Physical Security

FENOC shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority 10 CFR 50.90 and 10 CFR 50.54(p). The combined set of plans, which contains Safeguards Information protected under 10 CFR 73.21 is entitled: "Beaver Valley Power Station (BVPS) Physical Security Plan" submitted by letter September 9, 2004, and supplemented September 30, 2004, October 14, 2004, and May 12, 2006.

FENOC shall fully implement and maintain in effect all provisions of the Commission-approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The Beaver Valley Power Station CSP was approved by License Amendment No. 174, and amended by License Amendment No. 183.

F. Fire Protection Program

FENOC shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c) as specified in the license amendment request dated December 23, 2013 (as supplemented by letters dated February 14, 2014; April 27, May 27, June 26, November 6, and December 21, 2015; February 24 and May 12, 2016; and January 30, April 21, June 23, August 22, October 25, and November 29, 2017), and as approved in the safety evaluation dated January 22, 2018. Except where NRC approval for changes or deviations is required by 10 CFR 50.48(c), and provided no other regulation, technical specification, license condition, or requirement would require prior NRC approval, the licensee may make changes to the fire protection program without prior approval of the Commission if those changes satisfy the provisions set forth in 10 CFR 50.48(a) and 10 CFR 50.48(c), the change does not require a change to a technical specification or a license condition, and the criteria listed below are satisfied.

(a) Risk-Informed Changes that May Be Made Without Prior NRC Approval

A risk assessment of the change must demonstrate that the acceptance criteria below are met. The risk assessment approach, methods, and data shall be acceptable to the NRC and shall be appropriate for the nature and scope of the change being evaluated; be based on the as-built, as-operated, and maintained plant; and reflect the operating experience at the plant. Acceptable methods to assess the risk of the change may include methods that have been used in the peer-reviewed fire PRA model, methods that have been approved by NRC through a plant-specific license amendment or NRC approval of generic methods specifically for use in NFPA 805 risk assessments, or methods that have been demonstrated to bound the risk impact.

1. Prior NRC review and approval is not required for a change that results in a net decrease in risk. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

2. Prior NRC review and approval is not required if the change results in a risk increase less than 1E-7/yr for core damage frequency and less than 1E-8/yr for large early release frequency. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

(b) Other Changes that May be Made Without Prior NRC Approval

1. Changes to NFPA 805, Chapter 3, Fundamental Fire Protection Program

Prior NRC review and approval are not required for changes to the NFPA 805, Chapter 3, fundamental fire protection program elements and design requirements for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is functionally equivalent or adequate for the hazard. The licensee may use an engineering evaluation to demonstrate that a change to an NFPA 805, Chapter 3, element is functionally equivalent to the corresponding technical requirement. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

The licensee may use an engineering evaluation to demonstrate that changes to certain NFPA 805, Chapter 3, elements are acceptable because the alternative is "adequate for the hazard." Prior NRC review and approval would not be required for alternatives to four specific sections of NFPA 805, Chapter 3, for

which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is adequate for the hazard. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

The four specific sections of NFPA 805, Chapter 3, are as follows:

- Fire Alarm and Detection Systems (Section 3.8)
- Automatic and Manual Water-Based Fire Suppression Systems (Section 3.9)
- Gaseous Fire Suppression Systems (Section 3.10)
- Passive Fire Protection Features (Section 3.11)

This license condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

2. Fire Protection Program Changes that Have No More than Minimal Risk Impact

Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC SE dated January 22, 2018, to determine that certain fire protection program changes meet the minimal criterion. The licensee shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

(c) Transition License Conditions

1. Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change has been demonstrated to have no more than a minimal risk impact, as described in (2) above.

2. The licensee shall implement the Unit 2 modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," in FENOC letter L-17-122, dated April 21, 2017, to complete the transition to full compliance with 10 CFR 50.48(c), by the completion of the second Unit 2 refueling outage after issuance of the safety evaluation. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

3. The licensee shall implement the items listed in Attachment S, Table S-3, "Implementation Items," of FENOC letter L-17-268, dated August 22, 2017, by 12 months after issuance of the safety

evaluation (with the exception of Items BV1-1633, BV1-2974, BV1-3060, BV1-3108, BV1-3109, BV2-1580, BV2-1622, BV2-1623, and BV2-1750, which are to be completed by the end of the second Unit 2 refueling outage after issuance of the safety evaluation).

G. Reporting to the Commission

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H. Financial Protection

The licensee shall have and maintain financial protection of such type and in such amounts as the Commission shall require in accordance with Section 170 of the Atomic Energy Act of 1954, as amended, to cover public liability claims.

I. License Renewal Commitments - The UFSAR supplement, as revised, submitted pursuant to 10 CFR 54.21(d), describes certain future activities to be completed prior to and/or during the period of extended operation. FENOC shall complete these activities in accordance with Appendix A of NUREG-1929, Safety Evaluation Report Related to the Beaver Valley Power Station, Units 1 and 2, dated October 2009, and Supplement 1 of NUREG-1929, dated October 2009, and shall notify the NRC in writing when activities to be completed prior to the period of extended operation are complete and can be verified by NRC inspection.

J. UFSAR Supplement Changes - The information in the UFSAR supplement, as revised, submitted pursuant to 10 CFR 54.21(d), shall be incorporated into the UFSAR as required by 10 CFR 50.71(e) following the issuance of this renewed operating license. Until that update is complete, FENOC may not make changes to the information in the supplement. Following incorporation into the UFSAR, the need for prior Commission approval of any changes will be governed by 10 CFR 50.59.

K. Capsule Withdrawal Schedule - For the renewed operating license term, all capsules in the reactor vessel that are removed and tested must meet the test procedures and reporting requirements of American Society for Testing and Materials (ASTM) E 185-82 to the extent practicable for the configuration of the specimens in the capsule. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation.

L. Containment Liner Volumetric Inspection -

a) If degradation (greater than 10 percent of the nominal thickness not attributable to fabrication/erection practices) is identified in the non-random areas examined using ultrasonic testing (UT) as described in Supplement 1 of NUREG-1929, UT examinations shall be performed at additional non-random areas, to be selected based on this operating experience. Should additional degradation be identified, additional non-random areas shall be UT examined until no further degradation (greater than 10 percent of the nominal thickness) is identified. All areas with degradation shall be reexamined over at least the next three successive inspection periods to ensure that progression of the degradation is not occurring.

b) If degradation (greater than 10 percent of the nominal thickness not attributable to fabrication/erection practices) is identified in the random samples examined using ultrasonic testing (UT) as described in Supplement 1 of NUREG-1929, UT examinations shall be performed on additional random samples, to ensure a 95 percent confidence that 95 percent of the unexamined accessible containment liner is not degraded. If additional degradation is identified, the sample size for UT examinations shall be further expanded until the statistical sampling has achieved the 95 percent confidence goal described previously. All areas with degradation shall be reexamined over at least the next three successive inspection periods to ensure that progression of the degradation is not occurring.

3. Expiration

This renewed operating license is effective as of the date of issuance and shall expire at midnight on May 27, 2047.

FOR THE NUCLEAR REGULATORY COMMISSION

ORIGINAL SIGNED BY:

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

Attachments:
1. Appendix A - Technical Specifications
2. Appendix B - Environmental Protection Plan
3. Appendix D - Additional Conditions

Date of Issuance: November 05, 2009

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 301 AND 190 TO RENEWED

FACILITY OPERATING LICENSES NOS. DPR-66 AND NPF-73

FIRSTENERGY NUCLEAR OPERATING COMPANY

FIRSTENERGY NUCLEAR GENERATION, LLC

BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-334 AND 50-412

Enclosure 3

Table of Contents

ATTACHMENTS

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 301 AND 190 TO RENEWED

FACILITY OPERATING LICENSES NOS. DPR-66 AND NPF-73

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1.0 INTRODUCTION

1.1 Background

The U.S. Nuclear Regulatory Commission (NRC or the Commission) started developing fire protection requirements in the 1970s. In 1976, the NRC published comprehensive fire protection guidelines in the form of Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants" (Reference 1), and Appendix A to BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976" (Reference 2). Subsequently, the NRC performed fire protection reviews for the operating reactors and documented the results in safety evaluations (SEs) or supplements to SEs.

In 1980, to resolve issues identified in those reports, the NRC amended its regulations for fire protection in operating nuclear power plants (NPPs) and published its Final Rule, Fire Protection Program for Operating Nuclear Power Plants, in the *Federal Register* on November 19, 1980 (45 FR 76602), adding Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.48, "Fire Protection," and Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," to 10 CFR Part 50.

Section 50.48(a)(1) of 10 CFR requires each holder of an operating license and holders of a combined operating license issued under 10 CFR Part 52 to have a fire protection plan that satisfies General Design Criterion (GDC) 3 of Appendix A to 10 CFR Part 50 and states that the fire protection plan must describe the overall fire protection program (FPP); identify the positions responsible for the program and the authority delegated to those positions; and outline the plans for fire protection, fire detection and suppression capability, and limitation of fire damage. Section 50.48(a)(2) of 10 CFR states that the fire protection plan must describe the specific features necessary to implement the program described in paragraph (a)(1), including administrative controls and personnel requirements for fire prevention and manual suppression activities; automatic and manual fire detection and suppression systems; and the means to limit fire damage to structures, systems, and components (SSCs) to ensure the capability to safely shut down the plant. Section 50.48(a)(3) of 10 CFR requires that the licensee retain the fire protection plan and each change to the plan as a record until the Commission terminates the license, and that the licensee retain each superseded revision of the procedures for 3 years.

In the 1990s, the NRC worked with the National Fire Protection Association (NFPA) and industry to develop a risk-informed (RI)/performance-based (PB), consensus standard for fire protection. In 2001, the NFPA Standards Council issued NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants" (Reference 3), which describes a methodology for establishing fundamental FPP design requirements and elements, determining required fire protection systems and features, applying PB requirements, and administering fire protection for existing light water reactors during operation, decommissioning, and permanent shutdown. It provides for the establishment of a minimum set of fire protection requirements but allows PB or deterministic approaches to be used to meet performance criteria.

NRC Regulatory Guide (RG) 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Revision 1 (Reference 4), states:

> On March 26, 1998, the NRC staff sent to the Commission SECY-98-058, "Development of a Risk-Informed, Performance-Based Regulation for Fire Protection at Nuclear Power Plants" (Reference 5), in which it proposed to work with the NFPA and the industry to develop a risk-informed, performance-based consensus standard for nuclear power plant fire protection. This consensus standard could be endorsed in a future rulemaking as an alternative set of fire protection requirements to the existing regulations in 10 CFR 50.48. In SECY-00-0009, "Rulemaking Plan, Reactor Fire Protection Risk-Informed, Performance-Based Rulemaking," dated January 13, 2000 (Reference 6), the NRC staff requested and received Commission approval to proceed with rulemaking to permit operating reactor licensees to adopt an NFPA standard as an alternative to existing fire protection requirements. On February 9, 2001, the NFPA Standards Council approved the 2001 Edition of NFPA 805 as an American National Standard for performance-based fire protection for light-water nuclear power plants.

A licensee that elects to adopt NFPA 805 must meet the performance goals, objectives, and criteria that are itemized in Chapter 1 of NFPA 805 through the implementation of PB or deterministic approaches. The goals include ensuring that reactivity control, inventory and pressure control, decay heat removal, vital auxiliaries, and process monitoring are achieved and maintained. The licensee then must establish plant fire protection requirements using the methodology in Chapter 2 of NFPA 805 such that the minimum FPP elements and design criteria contained in Chapter 3 of NFPA 805 are satisfied. Next, the licensee identifies fire areas and fire hazards through a plant-wide analysis, and then applies either a PB or a deterministic approach to meet the performance criteria. As part of a PB approach, the licensee will use engineering evaluations, probabilistic safety assessments (PSAs), and fire modeling (FM) calculations to show that the criteria are met. Chapter 4 of NFPA 805 establishes the methodology to determine the fire protection systems and features required to achieve the performance criteria. It also specifies that at least one success path to achieve the nuclear safety performance criteria (NSPC) shall be maintained free of fire damage by a single fire. RG 1.205 also states:

> Effective July 16, 2004, the Commission amended its fire protection requirements in 10 CFR 50.48 to add 10 CFR 50.48(c), which incorporates by reference the 2001 Edition of NFPA 805, with certain exceptions, and allows licensees to apply for a license amendment to comply with the 2001 Edition of NFPA 805

> (69 FR 33536). NFPA has issued subsequent editions of NFPA 805, but the regulation does not endorse them.

Throughout this safety evaluation (SE), where the NRC staff states that the licensee's FPP element is in compliance with (or meets the requirements of) NFPA 805, the NRC staff is referring to NFPA 805 with the exceptions, modifications, and supplementation described in 10 CFR 50.48(c)(2).

RG 1.205 also states:

> In parallel with the Commission's efforts to issue a rule incorporating the risk-informed, performance-based fire protection provisions of NFPA 805, NEI [Nuclear Energy Institute] published implementing guidance for the specific provisions of NFPA 805 and 10 CFR 50.48(c) in NEI 04-02 ["Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," Revision 2 (Reference 7)].

RG 1.205 provides the NRC staff's position on NEI 04-02, Revision 2, and offers additional information and guidance to supplement the NEI document and assist licensees in meeting the NRC's regulations in 10 CFR 50.48(c) related to adopting a risk-informed/performance-based (RI/PB) FPP. RG 1.205 endorses the guidance of NEI 04-02, Revision 2, subject to certain exceptions, as providing methods acceptable to the staff for adopting an FPP consistent with the 2001 Edition of NFPA 805 and 10 CFR 50.48(c).

Accordingly, FirstEnergy Nuclear Operating Company (FENOC, the licensee) requested license amendments to allow it to establish and maintain the Beaver Valley Power Station (Beaver Valley), Unit Nos. 1 and 2, FPP in accordance with 10 CFR 50.48(c) and change the Renewed Facility Operating Licenses.

1.2 Requested Licensing Action

By letter dated December 23, 2013 (Reference 8), as supplemented by letters dated February 14, 2014 (Reference 9); April 27, 2015 (Reference 10); May 27, 2015 (Reference 11); June 26, 2015 (Reference 12); November 6, 2015 (Reference 13); December 21, 2015 (Reference 14); February 24, 2016 (Reference 15); May 12, 2016 (Reference 16); January 30, 2017 (Reference 17); April 21, 2017 (Reference 18); June 23, 2017 (Reference 19); August 22, 2017 (Reference 20); October 25, 2017 (Reference 21); and November 29, 2017 (Reference 22), the licensee submitted an application for license amendments to transition the Beaver Valley FPP from 10 CFR 50.48(b) to 10 CFR 50.48(c), NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition. The supplemental letters were in response to the NRC staff's requests for additional information (RAIs) dated March 4, 2015 (Reference 23); May 11, 2015 (Reference 24); October 9, 2015 (Reference 25); November 24, 2015 (Reference 26); March 30, 2016 (Reference 27); April 7, 2016 (Reference 28); December 2, 2016 (Reference 29); and August 8, 2017 (Reference 30). The licensee's supplemental letters dated April 27, May 27, June 26, November 6, and December 21, 2015; February 24 and May 12, 2016; and January 30, April 21, June 23, August 22, October 25, and November 29, 2017, provided additional information that clarified the application, but did not expand the overall scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on September 9, 2014 (79 FR 53458).

The licensee requested amendments to the Beaver Valley Renewed Facility Operating Licenses in order to establish and maintain an RI/PB FPP in accordance with the requirements of 10 CFR 50.48(c).

Specifically, the licensee requested to transition from the existing deterministic fire protection licensing basis established in accordance with the Updated Final Safety Analysis Report (UFSAR) for Beaver Valley, Unit No. 1, and in accordance with the Final Safety Analysis Report through Amendment No. 17, and submittals dated May 18 (Reference 31), May 20 (Reference 32), May 21 (Reference 33), June 24 (Reference 34), and July 6, 1987 (Reference 35), and as described in the Safety Evaluation Report (SER) dated October 1985 (Reference 36), and Supplements 1 through 6 to SER (Reference 37), (Reference 38), (Reference 39), (Reference 40), (Reference 41), and (Reference 42), for Unit No. 2, to an RI/PB FPP in accordance with 10 CFR 50.48(c) that uses risk information, in part, to demonstrate compliance with the fire protection and nuclear safety goals, objectives, and performance criteria of NFPA 805. As such, the proposed FPP at Beaver Valley is referred to as RI/PB throughout this SE.

In its license amendment request (LAR), the licensee provided a description of the revised FPP for which it is requesting NRC approval to implement, a description of the FPP that it will implement under 10 CFR 50.48(a), and (c), and the results of the evaluations and analyses required by NFPA 805.

This SE documents the NRC staff's evaluation of the licensee's LAR and the NRC staff's conclusions that:

1. The licensee has identified any orders, license conditions, and the technical specifications (TSs) that must be revised or superseded, and that any necessary revisions are adequate, as required by 10 CFR 50.48(c)(3)(i);

2. The licensee has completed its implementation of the methodology in Chapter 2, "Methodology," of NFPA 805 (including all required evaluations and analyses), and the NRC staff has approved the licensee's modified fire protection plan, which reflects the decision to comply with NFPA 805, as required by 10 CFR 50.48(a); and

3. The licensee will modify its FPP, as described in the LAR, in accordance with the implementation schedule set forth in this SE and the accompanying license condition, as required by 10 CFR 50.48(c)(3)(ii).

The licensee proposed a new fire protection license condition reflecting the new RI/PB FPP licensing basis that addresses this change to the current FPP basis. SE Sections 2.4.2 and 4.0 discuss in detail the license condition. SE Section 2.4.3 discusses that there are no TS changes.

2.0 REGULATORY EVALUATION

Section 50.48, "Fire protection," of 10 CFR provides the NRC requirements for NPP fire protection. Section 50.48 includes specific requirements for requesting approval for an RI/PB FPP based on the provisions of NFPA 805 (Reference 3). Paragraph 50.48(c)(3)(i) of 10 CFR states, in part:

> A licensee may maintain a FPP that complies with NFPA 805 as an alternative to complying with paragraph (b) of this Section [10 CFR 50.48(b)] for plants licensed to operate before January 1, 1979, or the fire protection license conditions for plants licensed to operate after January 1, 1979. The licensee shall submit a request to comply with NFPA 805 in the form of an application for license amendment under [10 CFR] 50.90. The application must identify any orders and license conditions that must be revised or superseded, and contain any necessary revisions to the plant's technical specifications and the bases thereof.

In addition, 10 CFR 50.48(c)(3)(ii) states:

> The licensee shall complete its implementation of the methodology in Chapter 2 of NFPA 805 (including all required evaluations and analyses) and, upon completion, modify the fire protection plan required by paragraph (a) of this section to reflect the licensee's decision to comply with NFPA 805, before changing its fire protection program or nuclear power plant as permitted by NFPA 805.

The intent of 10 CFR 50.48(c)(3)(ii) is given in the statement of considerations for the Final Rule, "Voluntary Fire Protection Requirements for Light Water Reactors; Adoption of NFPA 805 as a Risk-Informed, Performance-Based Alternative," as published in the *Federal Register* on June 16, 2004 (69 FR 33536, 33548). The statement of considerations states, in part:

> This paragraph requires licensees to complete all of the Chapter 2 methodology (including evaluations and analyses) and to modify their fire protection plan before making changes to the fire protection program or to the plant configuration. This process ensures that the transition to an NFPA 805 configuration is conducted in a complete, controlled, integrated, and organized manner. This requirement also precludes licensees from implementing NFPA 805 on a partial or selective basis (e.g., in some fire areas and not others, or truncating the methodology within a given fire area).

As stated in 10 CFR 50.48(c)(3)(i), the Director of the Office of Nuclear Reactor Regulation (NRR), or a designee of the Director, may approve the application if the Director or designee determines that the licensee has identified orders, license conditions, and the TSs that must be revised or superseded, and that any necessary revisions are adequate.

The regulations also allow for flexibility that was not included in the NFPA 805 standard. Licensees who choose to adopt 10 CFR 50.48(c) but wish to use the PB methods permitted elsewhere in the standard to meet the fire protection requirements of NFPA 805, Chapter 3, "Fundamental Fire Protection Program and Design Elements," must submit an LAR in accordance with 10 CFR 50.48(c)(2)(vii). This regulation further provides that:

> The Director of the Office of Nuclear Reactor Regulation, or a designee of the Director, may approve the application if the Director or designee determines that the performance-based approach:
>
> (A) Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release;

(B) Maintains safety margins; and

(C) Maintains fire protection defense-in-depth (DID) (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown (SSD) capability).

Alternatively, licensees may choose to use RI or PB alternatives to comply with NFPA 805 by submitting an LAR in accordance with 10 CFR 50.48(c)(4), which states:

> The Director of the Office of Nuclear Reactor Regulation, or designee of the Director, may approve the application if the Director or designee determines that the proposed alternatives:
>
> (i) Satisfy the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release;
>
> (ii) Maintain safety margins; and
>
> (iii) Maintain fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

In addition to the conditions outlined by the rule that require licensees to submit an LAR for NRC review and approval in order to adopt an RI/PB FPP, a licensee may also submit additional elements of its FPP for which it wishes to receive specific NRC review and approval, as set forth in Regulatory Position C.2.2.1 of RG 1.205 (Reference 4). Inclusion of these elements in the NFPA 805 LAR is meant to alleviate uncertainty in portions of the current FPP licensing bases as a result of the lack of specific NRC approval of these elements. RGs are not substitutes for regulations and compliance with them is not required. Methods and solutions that differ from those set forth in RGs will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission. Accordingly, any submittal addressing these additional FPP elements needs to include sufficient detail to allow the NRC staff to assess whether the licensee's treatment of these elements meets 10 CFR 50.48(c) requirements.

The purpose of the FPP established by NFPA 805 is to provide assurance, through a DID philosophy that the NRC's fire protection objectives are satisfied. NFPA 805, Section 1.2, "Defense-in-Depth," states:

> Protecting the safety of the public, the environment, and plant personnel from a plant fire and its potential effect on safe reactor operations is paramount to this standard. The fire protection standard shall be based on the concept of defense-in-depth. Defense-in-depth shall be achieved when an adequate balance of each of the following elements is provided:
>
> (1) Preventing fires from starting;
>
> (2) Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage; and

(3) Providing an adequate level of fire protection for SSCs important to safety, so that a fire that is not promptly extinguished will not prevent essential plant safety functions from being performed.

2.1 Other Applicable Regulations

The following regulations address fire protection:

- GDC 3, "Fire protection," to 10 CFR Part 50, Appendix A, states:

  > Structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. Noncombustible and heat resistant materials shall be used wherever practical throughout the unit, particularly in locations such as the containment and control room. Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems, and components important to safety. Firefighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these structures, systems, and components.

- GDC 5, "Sharing of structures, systems, and components," to 10 CFR Part 50, Appendix A, states:

  > Structures, systems, and components important to safety shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

- 10 CFR 50.48(a)(1) requires that each holder of an operating license have a fire protection plan that satisfies GDC 3 of Appendix A to 10 CFR Part 50.

- 10 CFR 50.48(c) incorporates NFPA 805 (2001 Edition) (Reference 3) by reference, with certain exceptions, modifications, and supplementation. This regulation establishes the requirements for using an RI/PB FPP in conformance with NFPA 805 as a voluntary alternative to the requirements in 10 CFR 50.48(b) and Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," to 10 CFR Part 50, or the specific plant fire protection license condition.

- 10 CFR Part 20, "Standards for protection against radiation," establishes the radiation protection limits used as NFPA 805 radioactive release performance criteria, as specified in NFPA 805, Section 1.5.2, "Radioactive Release Performance Criteria."

2.2 Applicable Guidance

The NRC staff's review also relied on the following additional codes, RGs, and standards:

- RG 1.205, Revision 1, issued December 2009 (Reference 4), which provides guidance for use in complying with the requirements that the NRC has promulgated for RI/PB FPPs that comply with 10 CFR 50.48 and the referenced 2001 Edition of the NFPA standard. It endorses portions of NEI 04-02, Revision 2 (Reference 7), where it has been found to provide methods acceptable to the NRC for implementing NFPA 805 and complying with 10 CFR 50.48(c). The regulatory positions in Section C of RG 1.205 include clarification of the guidance provided in NEI 04-02, as well as NRC exceptions to the guidance. RG 1.205 sets forth regulatory positions, emphasizes certain issues, clarifies the requirements of 10 CFR 50.48(c) and NFPA 805, clarifies the guidance in NEI 04-02, and modifies the NEI 04-02 guidance where required. Should a conflict occur between NEI 04-02 and this RG, the regulatory positions in RG 1.205 govern. This RG also indicates that Chapter 3 of NEI 00-01, "Guidance for Post-Fire Safe Shutdown Circuit Analysis," Revision 2, issued May 2009, when used in conjunction with NFPA 805 and the RG, provides one acceptable approach to circuit analysis for a plant implementing an FPP under 10 CFR 50.48(c).

- The 2001 Edition of NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants" (Reference 3), which specifies the minimum fire protection requirements for existing light water NPPs during all phases of plant operations, including shutdown, degraded conditions, and decommissioning. NFPA 805 was developed to provide a comprehensive RI/PB standard for fire protection. The NFPA 805 Technical Committee on Nuclear Facilities is composed of nuclear plant licensees, the NRC, insurers, equipment manufacturers, and subject matter experts. The standard was developed in accordance with NFPA processes, and consisted of a number of technical meetings and reviews of draft documents by committee and industry representatives. The scope of NFPA 805 includes goals related to nuclear safety, radioactive release, life safety, and plant damage/business interruption. The standard addresses fire protection requirements for nuclear plants during all plant operating modes and conditions, including shutdown and decommissioning, which had not been explicitly addressed by previous requirements and guidelines. NFPA 805 became effective on February 9, 2001.

- NEI 04-02, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)" (Reference 7), which provides guidance for implementing the requirements of 10 CFR 50.48(c) and represents methods for implementing in whole or in part an RI/PB FPP. This implementing guidance for NFPA 805 has two primary purposes: (1) provide direction and clarification for adopting NFPA 805 as an acceptable approach to fire protection, consistent with 10 CFR 50.48(c), and (2) provide additional, supplemental technical guidance and methods for using NFPA 805 and its appendices to demonstrate compliance with fire protection requirements. Although there is a significant amount of detail in NFPA 805 and its appendices, clarification and additional guidance for select issues help ensure consistency and effective utilization of the standard. The NEI 04-02 guidance focuses attention on the RI/PB fire protection goals, objectives, and performance criteria contained in NFPA 805 and the RI/PB tools considered acceptable for demonstrating compliance. Revision 2 of NEI 04-02 incorporates guidance from RG 1.205 and approved Frequently Asked Questions (FAQs).

- NEI 00-01, "Guidance for Post Fire Safe Shutdown Circuit Analysis," Revision 2 (Reference 43), provides a deterministic methodology for performing post-fire safe shutdown analysis (SSA). In addition, NEI 00-01 includes information on RI methods (when allowed within a plant's licensing basis) that may be used in conjunction with the deterministic methods for resolving circuit failure issues related to multiple spurious operations (MSO). The RI method is intended for application by licensees to determine the risk significance of identified circuit failure issues related to MSO. RG 1.205 indicates that Chapter 3 of Nuclear Energy Institute (NEI) 00-01, Revision 2, when used in conjunction with NFPA 805 and RG 1.205, provides one acceptable approach to circuit analysis for a plant implementing an FPP under 10 CFR 50.48(c).

- RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2, issued May 2011 (Reference 44), which provides the NRC staff's recommendations for using risk information in support of licensee-initiated licensing basis changes to an NPP that require such review and approval. The guidance provided does not preclude other approaches for requesting licensing basis changes. Rather, RG 1.174 is intended to improve consistency in regulatory decisions in areas in which the results of risk analyses are used to help justify regulatory action. As such, the RG provides general guidance concerning one approach that the NRC has determined to be acceptable for analyzing issues associated with proposed changes to a plant's licensing basis and for assessing the impact of such proposed changes on the risk associated with plant design and operation.

- RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Revision 2, issued March 2009 (Reference 45), which provides guidance to licensees for use in determining the technical adequacy of the base probabilistic risk assessment (PRA) used in an RI regulatory activity and endorses standards and industry peer review guidance. The RG provides guidance in four areas:

  1. A definition of a technically acceptable PRA;

  2. The NRC's position on PRA consensus standards and industry PRA peer review program documents;

  3. Demonstration that the baseline PRA (in total or specific pieces) used in regulatory applications is of sufficient technical adequacy; and

  4. Documentation to support a regulatory submittal.

  It does not provide guidance on how the base PRA is revised for a specific application or how the PRA results are used in application-specific decisionmaking processes.

- American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications" (Reference 46), which provides guidance PRAs used to support RI decisions for commercial light water reactor NPPs and prescribes a method for applying these

requirements for specific applications. The standard gives guidance for a Level 1 PRA of internal and external hazards for all plant operating modes. In addition, the standard provides guidance for a limited Level 2 PRA sufficient to evaluate large early release frequency (LERF). The only hazards explicitly excluded from the scope are accidents resulting from purposeful human-induced security threats (e.g., sabotage). The standard applies to PRAs used to support applications of RI decisionmaking related to design, licensing, procurement, construction, operation, and maintenance.

- RG 1.189, "Fire Protection for Nuclear Power Plants," Revision 2, issued October 2009 (Reference 47), provides guidance to licensees on the proper content and quality of engineering equivalency evaluations used to support the FPP. The NRC staff developed the RG to provide a comprehensive fire protection guidance document and to identify the scope and depth of fire protection that the staff would consider acceptable for NPPs.

- NUREG-0800, Section 9.5.1.2, "Risk-Informed, Performance-Based Fire Protection Program," Revision 0, issued December 2009 (Reference 48), provides the NRC staff with guidance for evaluating LARs that seek to implement an RI/PB FPP in accordance with 10 CFR 50.48(c).

- NUREG-0800, Section 19.1, "Determining the Technical Adequacy of Probabilistic Risk Assessment for Risk-Informed License Amendment Requests After Initial Fuel Load," Revision 3, issued September 2012 (Reference 49), provides the NRC staff with guidance for evaluating the technical adequacy of a licensee's PRA results when used to request RI changes to the licensing basis.

- NUREG-0800, Section 19.2, "Review of Risk Information Used to Support Permanent Plant-Specific Changes to the Licensing Basis: General Guidance," Revision 0, issued June 2007 (Reference 50), provides the NRC staff with guidance for evaluating the risk information used by a licensee to support permanent RI changes to the licensing basis.

- NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," Volume 1 (Reference 51), Volume 2 (Reference 52), and Supplement 1 (Reference 53), which presents a compendium of methods, data, and tools to perform a fire probabilistic risk assessment (FPRA) and develop associated insights. In order to address the need for improved methods, the NRC Office of Nuclear Regulatory Research (RES) and Electric Power Research Institute (EPRI) embarked upon a program to develop state-of-art FPRA methodology. Both RES and EPRI have provided specialists in fire risk analysis, FM, electrical engineering, human reliability analysis (HRA), and systems engineering for methods development. A formal technical issue resolution process was developed to direct the deliberative process between RES and EPRI. The process ensures that divergent technical views are fully considered, yet encourages consensus at many points during the deliberation. Significantly, the process provides that each party maintain its own point of view if consensus is not reached. Consensus was reached on all technical issues documented in NUREG/CR-6850. The methodology documented in this report reflects the current state-of-the-art in FPRA. These methods are expected to form a basis for RI analyses related to the plant FPP. Volume 1, the Executive Summary, provides general background and overview information, including both programmatic and technical and project insights and conclusions. Volume 2 provides the detailed discussion of the recommended approach, methods, data, and tools for conduct of an FPRA. Supplement 1 provides clarifications

and additional information on recommended approaches, methods, and data for conduct of an FPRA.

- Memorandum from Richard P. Correia, RES, to Joseph G. Giitter, NRR, titled, "Interim Technical Guidance on Fire-Induced Circuit Failure Mode Likelihood Analysis," dated June 14, 2013 (Reference 54), notes that based on new experimental information documented in NUREG/CR-6931, "Cable Response to Live Fire (CAROLFIRE)," issued April 2008 (Reference 55), and NUREG/CR- 7100, "Direct Current Electrical Shorting in Response to Exposure Fire (DESIREE-Fire): Test Results," issued April 2012 (Reference 56), the reduction in hot short probabilities for circuits provided with control power transformers identified in NUREG/CR-6850 cannot be repeated in experiments, and therefore, may be too high and should be reduced.

- NUREG-1805, "Fire Dynamics Tools (FDTs): Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program" (Reference 57), which provides quantitative methods known as "Fire Dynamics Tools (FDTs)" to assist regional fire protection inspectors in performing fire hazard analysis. The FDTs are intended to assist fire protection inspectors in performing RI evaluations of credible fires that may cause critical damage to essential SSD equipment, as required by the new reactor oversight process defined in the NRC's inspection manual.

- NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," Volumes 1 through 7 (Reference 58), and Supplement 1 (Reference 59), which provides technical documentation regarding the predictive capabilities of a specific set of fire models for the analysis of fire hazards in NPP scenarios. This report is the result of a collaborative program with EPRI and the National Institute of Standards and Technology (NIST). The selected models are:

  1. FDTs developed by NRC (Volume 3),

  2. Fire-Induced Vulnerability Evaluation Methodology-Rev. 1 developed by EPRI (Volume 4),

  3. The zone model Consolidated Model of Fire and Smoke Transport (CFAST) developed by NIST (Volume 5),

  4. The zone model MAGIC developed by Électricité de France (Volume 6), and

  5. The computational fluid dynamics model fire dynamics simulator developed by NIST (Volume 7).

  In addition to the fire model volumes, Volume 1 is the comprehensive main report and Volume 2 is a description of the experiments and associated experimental uncertainty used in developing this report. Supplement 1 evaluated the latest versions of the five fire models at the time, which included additional test data for validation of the models.

- NUREG/CR-7010, "Cable Heat Release, Ignition, and Spread in Tray Installations during Fire (CHRISTIFIRE), Phase 1: Horizontal Trays," Volume 1 (Reference 60), describes Phase 1 of the CHRISTIFIRE testing program conducted by NIST. The overall goal of

this multiyear program is to quantify the burning characteristics of grouped electrical cables installed in cable trays. This first phase of the program focuses on horizontal tray configurations. CHRISTIFIRE addresses the burning behavior of a cable in a fire beyond the point of electrical failure. The data obtained from this project can be used for the development of fire models to calculate the heat release rate (HRR) and flame spread of a cable fire.

- NUREG-1855, Volume 1, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making" (Reference 61), provides guidance on how to treat uncertainties associated with PRA in RI decisionmaking. The objectives of this guidance include fostering an understanding of the uncertainties associated with PRA and their impact on the results of PRA and providing a pragmatic approach to addressing these uncertainties in the context of the decisionmaking. To meet the objective of the NUREG, it is necessary to understand the role that PRA results play in the context of the decision process. To define this context, NUREG-1855 provides an overview of the RI decisionmaking process itself.

- NUREG-1921, "EPRI/NRC-RES Fire Human Reliability Analysis Guidelines - Final Report" (Reference 62), which presents the state-of-the-art in fire HRA practice. This report was developed jointly between RES and EPRI to develop the methodology and supporting guidelines for estimating human error probabilities (HEPs) for human failure events (HFEs) following the fire-induced initiating events of an FPRA. The report builds on existing HRA methods and is intended primarily for practitioners conducting a fire HRA to support an FPRA.

- NUREG-1934, "Nuclear Power Plant Fire Modeling Analysis Guidelines (NPP FIRE MAG)" (Reference 63), describes the implications of the verification and validation (V&V) results from NUREG-1824 for fire model users. The features and limitations of the fire models documented in NUREG-1824 are discussed relative to their use to support NPP fire hazard analyses. The report also provides information to assist fire model users in applying this technology in the NPP environment.

- NUREG-2180, "Determining the Effectiveness, Limitations, and Operator Response for Very Early Warning Fire Detection Systems in Nuclear Facilities (Delores-VEWFIRE), Final Report" (Reference 64), provides an evaluation of VEWFDS and conventional spot-type smoke detection system performance, operating experience, and fire PRA quantification for applications in NPPs where these systems are expected to detect fires in their incipient (pre-flaming) stage. The repost also provides an updated approach to quantify the performance of these systems in Fire PRA for in-cabinet and area-wide applications in non-continuously occupied NPP areas.

- Generic Letter (GL) 2006-03, "Potentially Nonconforming Hemyc and MT Fire Barrier Configurations" (Reference 65), which requested that licensees evaluate their facilities to confirm compliance with the existing applicable regulatory requirements in light of the information provided in this GL and, if appropriate, take additional actions.

- NFPA 101, "Life Safety Code" (Reference 66), provides the minimum requirements for egress; features of fire protection, sprinkler systems, alarms, emergency lighting, smoke barriers; and special hazard protection.

- NFPA 30, "Flammable and Combustible Liquids Code" (Reference 67), provides requirements for the safe storage, handling, and use of flammable and combustible liquids.

- NFPA 51B, "Standard for Fire Prevention During Welding, Cutting, and Other Hot Work" (Reference 68), provides requirements for preventing injury, loss of life, and loss of property from fire or explosion as a result of hot work projects such as welding, heat treating, grinding, and similar applications producing or using sparks, flames, or heat.

- NFPA 72, "National Fire Alarm and Signaling Code" (Reference 69), provides requirements for the application, installation, location, performance, inspection, testing, and maintenance of fire alarm systems, supervising station alarm systems, public emergency alarm reporting systems, fire warning equipment and emergency communications systems, and their components.

- NFPA 76, "Standard for the Fire Protection of Telecommunications Facilities" (Reference 70), provides requirements for fire protection of telecommunications facilities providing telephone, data, internet transmission, wireless, and video services, as well as life safety for the occupants, plus protection of equipment and service continuity.

- NFPA 241, "Standard for Safeguarding Construction, Alteration, and Demolition Operations" (Reference 71), provides requirements for preventing or minimizing fire damage to structures, including those in underground locations, during construction, alteration, or demolition.

- NFPA 262, "Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces" (Reference 72), provides a test procedure to evaluate the potential for smoke and fire spread along cables and wires housed in a plenum or other air transport spaces.

2.3 NFPA 805 Frequently Asked Questions

In the LAR, the licensee proposed to use a number of documents commonly known as NFPA 805 FAQs. The following table provides the set of FAQs the licensee used that the NRC staff referenced in the preparation of this SE, as well as the SE sections to which each FAQ is referenced.

Table 2.3-1: NFPA 805 Frequently Asked Questions

FAQ #	FAQ Title and Summary	Reference	SE Section
06-0008	"Fire Protection Engineering Analyses" • This FAQ provides a general description of the fire protection engineering evaluation process, the different types of fire protection engineering evaluations that may be used under NFPA 805 when prior NRC approval is needed, and how that approval is to be obtained.	(Reference 73)	3.1.1.2 3.1.3.3 3.5.2
06-0022	"Electrical Cable Flame Propagation Tests" • This FAQ provides a list of acceptable electrical cable flame propagation tests.	(Reference 74)	3.1.1.2 3.5.1.3

FAQ #	FAQ Title and Summary	Reference	SE Section
07-0030	"Establishing Recovery Actions" • This FAQ provides an acceptable process for determining the recovery actions (RAs) for NFPA 805, Chapter 4 compliance. The process includes: ▪ Differentiation between RAs and activities in the main control room (MCR) or at primary control station(s) (PCS). ▪ Determination of which RAs are required by the NFPA 805 FPP. ▪ Evaluate the additional risk presented by the use of RAs. ▪ Evaluate the feasibility of the identified RAs. ▪ Evaluate the reliability of the identified RAs.	(Reference 75)	3.2.5 3.4.4 3.5.1.7
07-0038	"Lessons Learned on Multiple Spurious Operations (MSOs)" • This FAQ reflects an acceptable process for the treatment of MSOs during transition to NFPA 805: ▪ Step 1 – Identify potential MSO combinations of concern. ▪ Step 2 – Expert panel assesses plant-specific vulnerabilities and reviews MSOs of concern. ▪ Step 3 – Update the FPRA and Nuclear Safety Capability Assessment (NSCA) to include MSOs of concern. ▪ Step 4 – Evaluate for NFPA 805 compliance. ▪ Step 5 – Document the results.	(Reference 76)	3.2.4 3.2.7
07-0039	"Incorporation of Pilot Plant Lessons Learned – Table B-2" • This FAQ provides additional detail for the comparison of the licensee's safe shutdown strategy to the endorsed industry guidance, NEI 00-01 "Guidance for Post-Fire Safe Shutdown Circuit Analysis," Revision 1 (Reference 77). In short, the process has the licensees: ▪ Assemble industry and plant-specific documentation; ▪ Determine which sections of the guidance are applicable; ▪ Compare the existing safe shutdown methodology to the applicable guidance; and ▪ Document any discrepancies.	(Reference 78)	3.2.1 3.2.1.4

FAQ #	FAQ Title and Summary	Reference	SE Section
07-0040	"Non-Power Operations (NPOs) Clarifications" • This FAQ clarifies an acceptable NFPA 805 NPO program. The process includes: ▪ Selecting NPOs equipment and cabling. ▪ Evaluation of NPOs Higher Risk Evolutions (HRE). ▪ Analyzing NPO Key Safety Functions (KSFs). ▪ Identifying plant areas to protect or "pinch points" during NPOs HREs and actions to be taken if KSFs are lost.	(Reference 79)	3.5.3 3.5.4
08-0046	"Incipient Fire Detection Systems" • This FAQ provides guidance for modeling non-suppression probability when an incipient fire detection system is installed in electrical cabinets outside the MCR.	(Reference 80)	3.1.3.2 3.2.7
08-0048	"Revised Fire Ignition Frequencies" • This FAQ provides an acceptable method for using updated fire ignition frequencies in the licensee's fire PRA. The method involves the use of sensitivity studies when the updated fire ignition frequencies are used.	(Reference 81)	3.4.2.2 3.4.7
08-0052	"Transient Fires - Growth Rates and Control Room Non-Suppression" • This FAQ clarifies and updates the treatment of transient fires in terms of both manual suppression and time-dependent fire growth modeling.	(Reference 82)	3.4.2.3.2
08-0054	"Compliance with Chapter 4 of NFPA 805" • This FAQ provides an acceptable process to demonstrate Chapter 4 compliance for transition: ▪ Step 1 – Assemble documentation ▪ Step 2 – Document Fulfillment of NSPC ▪ Step 3 – Variance From Deterministic Requirements (VFDR) Identification, Characterization, and Resolution Considerations ▪ Step 4 – Performance-Based Evaluations ▪ Step 5 – Final VFDR Evaluation ▪ Step 6 – Document Required Fire Protection Systems and Features	(Reference 83)	3.4.3 3.5.1.4
09-0056	"Radioactive Release Transition" • This FAQ provides an acceptable level of detail and content for the radioactive release Section of the LAR. It includes: ▪ Justification of the compartmentation, if the radioactive release review is not performed on a fire area basis. ▪ Pre-fire plan and fire brigade training review results. ▪ Results from the review of engineering controls for gaseous and liquid effluents.	(Reference 84)	3.6

FAQ #	FAQ Title and Summary	Reference	SE Section
10-0059	"Monitoring Program" • This FAQ provides clarification regarding the implementation of an NFPA 805 monitoring program for transition. It includes: ▪ Monitoring program analysis units; ▪ Screening of low safety significant SSCs; ▪ Action level thresholds; and ▪ The use of existing monitoring programs.	(Reference 85)	3.7.1 3.7.2
12-0062	"Updated Final Safety Analysis Report (UFSAR) Content" • This FAQ provides the necessary level of detail for the transition of the fire protection sections within the UFSAR.	(Reference 86)	2.4.4
12-0064	"Hot Work/Transient Fire Frequency Influence Factors" • This FAQ clarifies and updates the treatment of hot work and transient fire frequency influence factors. The updated treatment involves the use of sensitivity studies when the updated influence factors are used.	(Reference 87)	3.4.2.2
13-0004	"Clarifications on Treatment of Sensitive Electronics" • This FAQ provides supplemental guidance for application of the damage criteria provided in Sections 8.5.1.2 and H.2 of NUREG/CR 6850 for solid state components.	(Reference 88)	3.4.2.3.2
13-0005	"Cable Fires Special Cases: Self-Ignited and Caused by Welding and Cutting" • This FAQ provides additional guidance for detailed FPRA/FM concerning self-ignited cable fires and cable fires caused by welding and cutting.	(Reference 89)	3.1.4.6 3.4.2.2
13-0006	"Modeling Junction Box Scenarios in a Fire PRA" • This FAQ provides a definition for junction boxes that allow the characterization and quantification of junction box fire scenarios in plant physical analysis units (PAUs) requiring detailed FPRA/FM analysis and also describes a process for quantifying the risk associated with junction box fire scenarios in such plant locations.	(Reference 90)	3.4.2.2
14-0009	"Treatment of Well-Sealed Motor Control Center (MCC) Electrical Panels Greater Than 440V" • This FAQ provides clarification for the treatment of fire propagation from well-sealed MCC electrical cabinets with voltage levels at 440 (volts) V or greater.	(Reference 91)	3.4.2.2

2.4 Orders, License Conditions, and Technical Specifications

Paragraph 50.48(c)(3)(i) of 10 CFR states, in part, that the LAR, "... must identify any orders and license conditions that must be revised or superseded, and contain any necessary revisions to the plant's TSs and the bases thereof."

2.4.1 Orders

The NRC staff reviewed LAR Section 5.2.3, "Orders and Exemptions," and LAR Attachment O, "Orders and Exemptions," regarding NRC-issued orders pertinent to Beaver Valley that are being revised or superseded by the NFPA 805 transition process. The LAR stated that the licensee conducted a review of its docketed correspondence to determine if there were any orders or exemptions that needed to be superseded or revised. The LAR also stated that the licensee conducted a review to ensure that compliance with the physical protection requirements, security orders, and adherence to those commitments applicable to Beaver Valley is maintained. The licensee discussed the affected orders and exemptions in LAR Attachment O.

The licensee requested that 26 exemptions be rescinded for Beaver Valley, Unit No. 1. Since Beaver Valley, Unit No. 2, was licensed to operate after January 1, 1979, licensing actions associated with 10 CFR 50, Appendix R, were not issued as exemptions to the regulation, and therefore, the licensee did not request that any exemptions be rescinded for Beaver Valley, Unit No. 2. The licensee also determined that no orders need to be superseded or revised to implement an FPP that complies with 10 CFR 50.48(c).

Based on its review, the NRC staff accepts the licensee's determination that 26 exemptions should be rescinded for Beaver Valley, Unit No. 1, and that no orders need to be superseded or revised to implement NFPA 805 at Beaver Valley. (See SE Section 2.5 for the NRC staff's detailed evaluation of the exemptions being rescinded.)

The licensee also performed a specific review of the license amendments that incorporated the mitigation strategies required by Section B.5.b of Commission Order EA-02-026 (subsequently incorporated into 10 CFR 50.54(hh)(2)) to ensure that any changes being made in order to comply with 10 CFR 50.48(c) do not invalidate existing commitments applicable to Beaver Valley. The licensee's review of the order confirmed that changes to the FPP during transition to NFPA 805 will not affect the measures required by Section B.5.b of Commission Order EA-02-026 (10 CFR 50.54(hh)(2)). The licensee will continue to have strategies that address large fires and explosions including a firefighting response strategy, operations to mitigate fuel damage, and actions to minimize release upon transition to NFPA 805. The NRC staff concludes that the licensee's determination regarding Commission Order EA-02-026 (10 CFR 50.54(hh)(2)) is acceptable.

2.4.2 License Conditions

The NRC staff reviewed LAR Section 5.2.1, "License Condition Changes," and LAR Attachment M, "License Condition Changes," as supplemented, regarding changes the licensee seeks to make to the Beaver Valley fire protection license conditions in order to adopt NFPA 805, as required by 10 CFR 50.48(c)(3).

The NRC staff reviewed the proposed revisions to license conditions, which supersede the current Beaver Valley fire protection license conditions, for consistency with the format and content guidance described in Regulatory Position C.3.1 of RG 1.205, Revision 1, and with the proposed plant modifications identified in the LAR.

The NRC staff determined that the proposed revisions to license conditions provide a structure and detailed criteria to allow self-approval for RI/PB, as well as other types of changes to the FPP. The structure and detailed criteria result in a process that meets the requirements in

NFPA 805, Sections 2.4, "Engineering Analyses"; 2.4.3, "Fire Risk Evaluations"; and 2.4.4, "Plant Change Evaluation of NFPA 805." These sections establish the requirements for the content and quality of the engineering evaluations to be used for approval of changes.

The NRC staff determined that the license's proposed revisions to license conditions also define the limitations imposed on the licensee during the transition phase of plant operations when the physical plant configuration does not fully match the configuration represented in the fire risk analysis. The limitations on self-approval are required because NFPA 805 requires that the risk analyses be based on the as-built, as-operated and maintained plant, and reflect the operating experience at the plant. Until the proposed implementation items and plant modifications are completed, the risk analysis is not based on the as-built, as-operated and maintained plant.

The NRC staff determined that overall, the licensee's proposed revised license conditions would provide structure and detailed criteria to allow self-approval for FPP changes that meet the requirements of NFPA 805 regarding engineering analyses, fire risk evaluations (FREs), and plant change evaluations (PCEs). The NRC staff's evaluation of the self-approval process for FPP changes (post-transition) is contained in SE Section 2.6. The license conditions also reference the plant-specific modifications and associated implementation schedules that must be accomplished at Beaver Valley to complete transition to NFPA 805 and comply with 10 CFR 50.48(c). The license conditions also include a requirement that appropriate compensatory measures will remain in place until implementation of the specified plant modifications is completed. These modifications and implementation schedules are identical to those identified elsewhere in the LAR, as discussed in SE Section 2.7.

SE Section 4.0 provides the NRC staff's review of the proposed Beaver Valley FPP license conditions.

2.4.3 Technical Specifications

The NRC staff reviewed LAR Section 5.2.2, "Technical Specifications," and LAR Attachment N, "Technical Specification Changes," regarding proposed changes to the Beaver Valley TSs that are being revised or superseded during the NFPA 805 transition process. According to the LAR, the licensee conducted a review of the Beaver Valley TSs to determine which, if any, TS sections will be impacted by the transition to an RI/PB FPP based on 10 CFR 50.48(c). The NRC staff found that the licensee had previously requested and obtained NRC approval for removal of fire protection requirements from the Beaver Valley, Unit No. 1, TSs, in Amendment No. 136 (Reference 92). The fire protection requirements for Beaver Valley, Unit No. 2, were not originally included in its TSs. The licensee did not identify any needed changes to the TSs as a result of the transition to NFPA 805.

Although the licensee did not identify any needed changes to the TSs, the NRC staff found that TS 5.4.1.d requires that written procedures be established, implemented, and maintained for FPP implementation, which is redundant to the NFPA 805, Section 3.2.3, requirement to establish FPP procedures. Because the licensee chose not to delete TS 5.4.1.d, after transition to the NFPA 805 licensing basis, the requirement for establishing, implementing, and maintaining fire protection procedures will be contained in the regulations (10 CFR 50.48(a); 10 CFR 50.48(c); and NFPA 805, Chapter 3), and also the licensee's TSs. Failure by the licensee to establish FPP procedures would result in noncompliance with 10 CFR 50.48(c)(1), which is part of the licensee's fire protection licensing basis, and also noncompliance with the licensee's TS.

2.4.4 Updated Final Safety Analysis Report

In LAR Section 5.4, "Revision to the UFSAR," the licensee stated that after approval of the LAR in accordance with 10 CFR 50.71(e), the Beaver Valley, Unit Nos. 1 and 2, UFSAR will be revised. The licensee also stated that the format and content will be consistent with FAQ 12-0062 (Reference 86).

The NRC staff concludes that the licensee's method to update the UFSAR is acceptable because the licensee updates its UFSAR in accordance with 10 CFR 50.71(e) and has stated that the format and content of the update will be consistent with the guidance provided in FAQ 12-0062.

2.5 Rescission of Exemptions

Since Beaver Valley, Unit No. 1, was licensed to operate on July 2, 1976, and Beaver Valley, Unit No. 2, was licensed to operate on August 14, 1987, the Beaver Valley FPPs are based on compliance with 10 CFR 50.48, Parts (a) and (b) (Appendix R, Sections III.G, III.L, and III.O), GDC-3, BTP CMEB 9.5-1 (NUREG-0800) (Reference 93), and the Beaver Valley fire protection license conditions.

The NRC staff reviewed LAR Section 5.2.3, "Orders and Exemptions"; LAR Attachment O, "Orders and Exemptions"; and LAR Attachment K, "Existing Licensing Action Transition," as supplemented, regarding previously-approved exemptions to Appendix R to 10 CFR Part 50, which the transition to an FPP licensing basis in conformance with NFPA 805 will supersede. These exemptions will no longer be required because upon approval of the RI/PB FPP in accordance with NFPA 805, Appendix R will not be part of the licensing basis for Beaver Valley.

The licensee previously requested and received NRC approval for 26 exemptions from 10 CFR Part 50, Appendix R. These exemptions were discussed in detail in LAR Attachment K, as supplemented. The licensee requested that the exemptions be rescinded and that the underlying engineering evaluations for 6 of the 26 exemptions be transitioned to the new licensing basis under 10 CFR 50.48(a) and 50.48(c), as previously approved (NFPA 805, Section 2.2.7), and compliant with the new regulation.

Disposition of Appendix R exemptions may follow two different paths during transition to NFPA 805:

- The exemption was found to be unnecessary because the underlying condition has been evaluated using RI/PB methods FM and/or FRE and found to be acceptable, and no further actions are necessary by the licensee.

- The exemption was found to be appropriate as a qualitative engineering evaluation that meets the deterministic requirements of NFPA 805 and is carried forward as part of the engineering analyses supporting NFPA 805 transition.

The following exemptions are rescinded as requested by the LAR. The underlying condition has been evaluated using RI/PB methods and found to be acceptable with no further actions, because the philosophy of DID and sufficient safety margins are maintained (numbering scheme provided by the licensee):

- Licensing Action 11.01, Exemption from the Appendix R, Section III.G.3 requirement to provide automatic suppression in the control room.

- Licensing Action 11.03, Exemption from the Appendix R, Section III.G.2 requirement to provide 20-foot separation and automatic suppression and detection in the blender room.

- Licensing Action 11.04, Exemption from the Appendix R, Section III.G.2 requirement to provide 20-foot separation and automatic suppression and detection in the pipe tunnel.

- Licensing Action 11.06, Exemption from the Appendix R, Section III.G.2 requirement to provide 20-foot separation and automatic suppression and detection in the primary auxiliary building.

- Licensing Action 11.07, Exemption from the Appendix R, Section III.G.3 requirement to provide automatic suppression and detection in the primary auxiliary building, 768-foot floor level.

- Licensing Action 11.08, Exemption from the Appendix R, Section III.G.3 requirement to provide automatic suppression in the control room heating, ventilating, and air conditioning (HVAC) equipment room, and exemption from the Appendix R, Section III.G.2 requirement to provide a 3-hour rate boundary in the control room HVAC equipment room.

- Licensing Action 11.09, Exemption from the Appendix R, Section III.G.3 requirement to provide automatic suppression in the emergency switchgear rooms, and exemption from the Appendix R, Section III.G.2 requirement to provide a 3-hour rate boundary in the emergency switchgear rooms.

- Licensing Action 11.10, Exemption from the Appendix R, Section III.G.3 requirement to provide automatic suppression in the process instrumentation room, and exemption from the Appendix R, Section III.G.2 requirement to provide a 3-hour rate boundary in the process instrumentation room.

- Licensing Action 11.11, Exemption from the Appendix R, Section III.G.3 requirement to provide automatic suppression in the computer equipment and relay panel room, and exemption from the Appendix R, Section III.G.2 requirement to provide a 3-hour rate boundary in the communication equipment and relay panel room.

- Licensing Action 11.12, Exemption from the Appendix R, Section III.G.3 requirement to provide automatic suppression in the normal switchgear room, and exemption from the Appendix R, Section III.G.2 requirement to provide a 3-hour rate boundary in the normal switchgear room.

- Licensing Action 11.13, Exemption from the Appendix R, Section III.G.2.a requirement to provide protection for structural steel in the service building.

- Licensing Action 11.14, Exemption from the Appendix R, Section III.G.3 requirement to provide automatic suppression in the carbon dioxide storage/PG pump room.

- Licensing Action 11.15, Exemption from the Appendix R, Section III.G.3 requirement to provide automatic suppression in the pipe tunnel.

- Licensing Action 11.17, Exemption from the Appendix R, Section III.G.2 requirement to provide 3-hour rated barriers in the cable spreading room.

- Licensing Action 11.19, Exemption from the Appendix R, Section III.G.2 requirement to provide 3-hour rate barriers. This request concerned the unlabeled or field fabricated fire dampers.

- Licensing Action 11.20, Exemption from the Appendix R, Section III.G.2 requirement to provide 20-foot separation in the primary auxiliary building/charging pump cubicles. The request modified the requests in Licensing Actions 11.03, 11.06, and 11.07.

- Licensing Action 11.21, Exemption from the Appendix R, Section III.G.2 requirement to provide 20-foot separation in the control room. This request modified the requests in Licensing Actions 11.01 and 11.08.

- Licensing Action 11.22, Exemption from the Appendix R, Section III.G.2 requirement to provide 3-hour rate barriers in the main steam valve room.

- Licensing Action 11.23, Exemption from the Appendix R, Section III.L requirement to provide 72-hour cold shutdown.

- Licensing Action 11.25, Exemption from the Appendix R, Section III.J requirement to provide 8-hour battery powered emergency lighting.

The following exemptions are rescinded, but the engineering evaluation of the underlying condition will be used as a qualitative engineering evaluation for transition to NFPA 805 (see SE Section 3.5.1.3):

- Licensing Action 11.02, Exemption from the Appendix R, Section III.G.2 requirement to provide 20-foot separation in containment.

- Licensing Action 11.05, Exemption from the Appendix R, Section III.G.2 requirement to provide 20-foot separation and automatic suppression in the cable tunnel.

- Licensing Action 11.16, Exemption from the Appendix R, Section III.G.2 requirement to provide 20-foot separation for the source range nuclear instrumentation in the containment.

- Licensing Action 11.18 Exemption from the Appendix R, Section III.G.2 requirement to provide 3-hour rated fire barriers. This request concerned the lack of Underwriters Laboratories (UL) labels on fire doors or modifications made to rated fire doors.

- Licensing Action 11.24, Exemption from the Appendix R, Section III.G.3 and Section III.L requirements to provide alternate shutdown capability.

- Licensing Action 11.26, Exemption from the Appendix R, Section II.C.3 to provide portable extinguishers in the cable tray mezzanine of the cable spreading room.

2.6 Self-Approval Process for FPP Changes (Post-Transition)

Upon completion of the implementation of the RI/PB FPP and issuance of the license condition discussed in SE Section 2.4.2, changes to the approved FPP must be evaluated by the licensee to ensure that they are acceptable.

NFPA 805, Section 2.2.9, "Plant Change Evaluation," states:

> In the event of a change to a previously approved fire protection program element, a risk-informed plant change evaluation shall be performed and the results used as described in 2.4.4 to ensure that the public risk associated with fire-induced nuclear fuel damage accidents is low and that adequate defense-in-depth and safety margins are maintained.

NFPA 805, Section 2.4.4, "Plant Change Evaluation," states, in part:

> A plant change evaluation shall be performed to ensure that a change to a previously approved fire protection program element is acceptable. The evaluation process shall consist of an integrated assessment of the acceptability of risk, defense-in-depth, and safety margins.

2.6.1 Post-Implementation Plant Change Evaluation Process

The NRC staff reviewed LAR Section 4.7.2, "Compliance with Configuration Control Requirements in Sections 2.7.2 and 2.2.9 of NFPA 805," for compliance with the NFPA 805 PCE requirements to address potential changes to the NFPA 805 RI/PB FPP after implementation is completed. The licensee will develop a change process that is based on the guidance provided in NFPA 805, Sections 2.2(h), 2.2.9, 2.4.4, A.2.2(h), A.2.4.4, and D.5; NEI 04-02 (Reference 7), Section 5.3, "Plant Change Process," as well as Appendices B, I, and J; and RG 1.205 (Reference 4), Regulatory Positions 2.2.4, 3.1, 3.2, and 4.3.

LAR Section 4.7.2 states that the PCE process consists of four steps:

1. Defining the Change,

2. Performing the Preliminary Risk Screening,

3. Performing the Risk Evaluation, and

4. Evaluating the Acceptance Criteria.

In the LAR, the licensee stated that the PCE process begins by defining the change or altered condition in the LAR to be examined and the baseline configuration. The baseline is defined by the design basis and licensing basis. The licensee also stated that the baseline is defined as that plant condition or configuration that is consistent with the licensing basis and that the

changed or altered condition or configuration that is not consistent with the licensing basis is defined as the proposed alternative.

The licensee stated that once the definition of the change is established, a screening is then performed to identify and resolve minor changes to the FPP, and the screening is consistent with fire protection regulatory review processes currently in place at nuclear plants under traditional licensing bases. The licensee further stated that the screening process is modeled after NEI 02-03, "Guidance for Performing a Regulatory Review of Proposed Changes to the Approved Fire Protection Program," June 2003 (Reference 94), and that the process will address most administrative changes (e.g., changes to the combustible control program, organizational changes, etc.).

The licensee stated that the screening is followed by engineering evaluations that may include FM and risk assessment techniques, and the results of these evaluations are then compared to the acceptance criteria. The licensee further stated that changes that satisfy the acceptance criteria of NFPA 805, Section 2.4.4 and the license condition (see LAR Attachment M, as supplemented) can be implemented within the framework provided by NFPA 805, and that the changes that do not satisfy the acceptance criteria cannot be implemented within this framework. The licensee further stated that the acceptance criteria require that the resultant change in core damage frequency (CDF) and LERF be consistent with the license condition, and the acceptance criteria also include consideration of DID and safety margin, which would typically be qualitative in nature.

The licensee stated that the risk evaluation involves the application of FM analyses and risk assessment techniques to obtain a measure of the changes in risk associated with the proposed change and that in certain circumstances, an initial evaluation in the development of the risk assessment could be a simplified analysis using bounding assumptions, provided the use of such assumptions does not unnecessarily challenge the acceptance criteria.

The licensee stated that the PCEs are assessed for acceptability using the ΔCDF (change in core damage frequency) and ΔLERF (change in large early release frequency) criteria from the license condition and that the proposed changes are also assessed to ensure they are consistent with the DID philosophy, and sufficient safety margins were maintained.

The licensee stated its FPP configuration is defined by the program documentation and, to the greatest extent possible, the existing configuration control processes for modifications, calculations and analyses, and FPP license basis reviews will be utilized to maintain configuration control of the FPP documents. The licensee further stated the configuration control procedures, which govern the various Beaver Valley documents and databases that currently exist, will be revised to reflect the new NFPA 805 licensing bases requirements. This action is included in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-3065. The NRC staff concludes that this action is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

The licensee stated that several NFPA 805 document types, such as nuclear safety capability assessment (NSCA) supporting information and non-power operations (NPOs) mode NSCA treatment, etc., require new control procedures and processes to be developed since they are new documents and databases created as a result of the transition to NFPA 805. The licensee further stated the new procedures will be modeled after the existing processes for similar types of documents and databases, and system level design-basis documents will be revised to

reflect the NFPA 805 role that the system components now play. This action is included in Implementation Item BV1-3065, which is included in LAR Attachment S, Table S-3, as supplemented. The NRC staff concludes that this action is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

The licensee stated that the process for capturing the impact of proposed changes to the plant as part of the FPP will continue to be a multiple step review and that the first step of the review is an initial screening for process users to determine if there is a potential to impact the FPP, as defined under NFPA 805, through a series of screening questions/checklists contained in one or more procedures, depending upon the configuration control process being used. The licensee further stated reviews that identify potential FPP impacts will be sent to qualified individuals (e.g., fire protection, SSD/NSCA, FPRA, etc.) to ascertain the program impacts, if any, and that if FPP impacts are determined to exist as a result of the proposed change, the issue would be resolved by one of the following:

- Deterministic Approach: Comply with NFPA 805, Chapter 3, and Section 4.2.3 requirements; or

- PB Approach: Utilize the NFPA 805 change process developed in accordance with NEI 04-02, RG 1.205, and the NFPA 805 fire protection license condition to assess the acceptability of the proposed change. This process will be used to determine if the proposed change could be implemented "as is" or whether prior NRC approval of the proposed change is required.

The licensee stated that this process follows the requirements in NFPA 805 and the guidance outlined in RG 1.174 (Reference 44), which require the use of qualified individuals and procedures that require calculations be subject to independent review and verification, record retention, peer review, and a corrective action program that ensure appropriate actions are taken when errors are discovered.

Since NFPA 805 always requires the use of a PCE regardless of what element requires the change, the NRC staff concludes that in accordance with the requirements of NFPA 805, if FPP impacts are determined to exist as a result of the proposed change, the issue would be resolved by utilizing the NFPA 805 change process developed in accordance with NEI 04-02, RG 1.205, and the Beaver Valley NFPA 805 fire protection license condition to assess the acceptability of the proposed change. This process will be used to determine if prior NRC approval of the proposed change is required.

Based on its review of the information provided by the licensee, the NRC staff concludes that the licensee's PCE process is acceptable because it meets the guidance in NEI 04-02, Revision 2 (Reference 7), as well as RG 1.205, Revision 1 (Reference 4), and addresses attributes for using FREs in accordance with NFPA 805. NFPA 805, Section 2.4.4 requires that PCEs consist of an integrated assessment of risk, DID, and safety margins. NFPA 805, Section 2.4.3.1 requires that the PSA use CDF and LERF as measures for risk. NFPA 805, Section 2.4.3.3 requires that the risk assessment approach, methods, and data be acceptable to the authority having jurisdiction (AHJ), which is the NRC. NFPA 805, Section 2.4.3.3 also requires that the PSA be appropriate for the nature and scope of the change being evaluated, be based on the as-built and as-operated and maintained plant, and reflect the operating experience at the plant.

The licensee's PCE process includes the required delta risk calculations, uses risk assessment methods acceptable to the NRC, uses appropriate risk acceptance criteria in determining acceptability, involves the use of an FPRA of acceptable quality, and includes an integrated assessment of risk, DID, and safety margins as discussed above.

2.6.2 Requirements for the Self-Approval Process Regarding Plant Changes

Risk assessments performed to evaluate PCEs must use methods that are acceptable to the NRC staff. Acceptable methods to assess the risk of the proposed plant change may include methods that have been (1) used in developing the peer-reviewed FPRA model, (2) approved by the NRC by a plant-specific license amendment or through NRC approval of generic methods specifically for use in NFPA 805 risk assessments, or (3) demonstrated to bound the risk impact.

Based on the information provided by the licensee in the LAR, the NRC staff finds that the process established to evaluate post-transition plant changes meets the guidance in NEI 04-02, Revision 2 (Reference 7), as well as RG 1.205, Revision 1 (Reference 4). The NRC staff concludes that the proposed PCE process at Beaver Valley, which includes defining the change, a preliminary risk screening, a risk evaluation, and an acceptability determination as described in SE Section 2.6.1 is acceptable because it addresses the required delta risk calculations; uses risk assessment methods acceptable to the NRC; uses appropriate risk acceptance criteria in determining acceptability; involves the use of an FPRA of acceptable quality; and includes an integrated assessment of risk, DID, and safety margins.

However, before achieving full compliance with 10 CFR 50.48(c) by implementing the plant modifications discussed in SE Section 2.7.1 (i.e., during full implementation of the transition to NFPA 805), the proposed license conditions would provide that RI changes to the licensee's FPP may not be made without prior NRC review and approval, unless the changes have been demonstrated to have no more than a minimal risk impact using the screening process discussed above, because the risk analysis is not consistent with the as-built, as-operated and maintained plant since the modifications have not been completed. In addition, the conditions require the licensee to ensure that fire protection DID and safety margins are maintained during the transition process. The "Transition License Conditions" in the proposed NFPA 805 license conditions include the appropriate acceptance criteria and other attributes to form an acceptable method for meeting Regulatory Position C.3.1 of RG 1.205, Revision 1 (Reference 4) with respect to the requirements for FPP changes during transition, and therefore, demonstrate compliance with 10 CFR 50.48(c).

The proposed NFPA 805 license conditions also include a provision for self-approval of changes to the FPP that may be made on a qualitative rather than RI basis. Specifically, the license conditions state that prior NRC review and approval are not required for changes to the NFPA 805, Chapter 3, fundamental FPP elements and design requirements for which an engineering evaluation demonstrates that the alternative to the NFPA 805, Chapter 3, element is functionally equivalent or adequate for the hazard. The licensee may use an engineering evaluation to demonstrate that a change to an NFPA 805, Chapter 3, element is functionally equivalent to the corresponding technical requirement. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement (i.e., has not impacted its contribution toward meeting the nuclear safety and radioactive release performance criteria) using a relevant technical requirement or standard.

Use of this approach does not fall under NFPA 805, Section 1.7, "Equivalency," because the condition can be shown to meet the NFPA 805, Chapter 3, requirement. Section 1.7 of NFPA 805 is a standard format used throughout NFPA standards. It is intended to allow owner/operators to use the latest state-of-the art fire protection features, systems, and equipment, provided the alternatives are of equal or superior quality, strength, fire resistance, durability, and safety. However, the intent is to require approval from the AHJ because not all of these state-of-the-art features are in current use or have relevant operating experience. This is a different situation than the use of functional equivalency because functional equivalency demonstrates that the condition meets the NFPA 805 code requirement.

Alternatively, the licensee may use an engineering evaluation to demonstrate that changes to certain NFPA 805, Chapter 3, elements are acceptable because the changes are "adequate for the hazard." Prior NRC review and approval would not be required for alternatives to four specific sections of NFPA 805, Chapter 3, listed below for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is adequate for the hazard. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement (with respect to the ability to meet the nuclear safety and radioactive release performance criteria) using a relevant technical requirement or standard. NFPA 805, Section 2.4 states that engineering analysis is an acceptable means of evaluating an FPP against performance criteria. Engineering analyses shall be permitted to be qualitative or quantitative. Use of qualitative engineering analyses by a qualified fire protection engineer to determine that a change has not affected the functionality of the component, system, procedure, or physical arrangement is allowed by NFPA 805, Section 2.4.

The four specific sections of NFPA 805, Chapter 3, for which prior NRC review and approval are not required to implement alternatives that an engineering evaluation has demonstrated are adequate for the hazard are:

1. "Fire Alarm and Detection Systems" (Section 3.8),

2. "Automatic and Manual Water-Based Fire Suppression Systems" (Section 3.9),

3. "Gaseous Fire Suppression Systems" (Section 3.10), and

4. "Passive Fire Protection Features" (Section 3.11).

The engineering evaluations described above (i.e., functionally equivalent and adequate for the hazard) are engineering analyses governed by the NFPA 805 guidelines. In particular, this means that the evaluations must meet the requirements of NFPA 805, Section 2.4, "Engineering Analyses," and NFPA 805, Section 2.7, "Program Documentation, Configuration Control, and Quality." Specifically, the effectiveness of the fire protection features under review must be evaluated and found acceptable in relation to their ability to detect, control, suppress, and extinguish a fire and provide passive protection to achieve the performance criteria and not exceed the damage threshold for the plant being analyzed. The associated evaluations must also meet the documentation content (as outlined by NFPA 805, Section 2.7.1, "Content") and quality requirements (as outlined by NFPA 805, Section 2.7.3, "Quality") of the standard in order to be considered adequate. The NRC staff's review of the licensee's compliance with NFPA 805, Sections 2.7.1 and 2.7.3 is provided in SE Section 3.8.

According to the LAR, the licensee intends to use an FPRA to evaluate the risk of proposed future plant changes. SE Section 3.4.2, "Quality of the Fire Probabilistic Risk Assessment," discusses the technical adequacy of the FPRA, including the licensee's process to ensure that the FPRA remains current. The NRC staff determined that the quality of the licensee's FPRA and associated administrative controls and processes for maintaining the quality of the PRA model are sufficient to support self-approval of future RI changes to the FPP under the proposed license conditions. Accordingly, the NRC staff concludes that the licensee's process for self-approving future FPP changes is acceptable.

The NRC staff also concludes that the FRE methods used at Beaver Valley to model the cause and effect relationship of associated changes as a means of assessing the risk of plant changes during transition to NFPA 805 may continue to be used after implementation of the RI/PB FPP based on the licensee's administrative controls to ensure that the models remain current and to assure continued quality. (See SE Section 3.4.2, "Quality of the Fire Probabilistic Risk Assessment.") Accordingly, these cause and effect relationship models may be used after transition to NFPA 805 as a part of the PCEs conducted to determine the change in risk associated with proposed plant changes.

2.7 Modifications and Implementation Items

Regulatory Position C.3.1 of RG 1.205, Revision 1 (Reference 4) states that a license condition included in an NFPA 805 LAR should include (1) a list of modifications being made to bring the plant into compliance with 10 CFR 50.48(c), (2) a schedule detailing when these modifications will be completed, and (3) a statement that the licensee shall maintain appropriate compensatory measures in place until implementation of the modifications are completed.

The list of modifications and implementation items originally submitted in the LAR have been updated by the licensee in the final version of LAR Attachment S, "Plant Modifications and Items to be Completed during Implementation," as supplemented, provided in the licensee's letters dated April 21, 2017 (Reference 18), and August 22, 2017 (Reference 20).

2.7.1 Modifications

The NRC staff reviewed LAR Attachment S, as supplemented, which describes the plant modifications necessary to implement the NFPA 805 licensing basis, as proposed. These modifications are identified in the LAR, as necessary, to bring Beaver Valley into compliance with either the deterministic or PB requirements of NFPA 805. As described below, LAR Attachment S, Table S-2, "Plant Modifications Committed," as supplemented, provides a description of each of the proposed plant modifications, presents the problem statement explaining why the modification is needed, and identifies if a compensatory action is required to be in place pending completion/implementation of the modification.

The NRC staff confirmed that the modifications identified in LAR Tables S-1 and S-2 are the same as those identified in LAR Table B-3, "Fire Area Transition," on a fire area basis, as the modifications being credited in the proposed NFPA 805 licensing basis. The NRC staff also confirmed that LAR Attachment S, Table S-2, as supplemented; modifications; and associated completion schedule are the same as those provided in the proposed NFPA 805 license conditions.

As depicted in LAR Attachment S, Table S-1, "Plant Modifications Completed," as supplemented, the licensee has completed 11 modifications as part of the NFPA 805 transition.

In its letter dated April 21, 2017, the licensee revised LAR Attachment S, as supplemented, Table S-1 and indicated that it completed an additional 22 modifications. LAR Attachment S, as supplemented, Table S-2 provides a detailed listing of the 15 remaining plant modifications that must be completed in order for Beaver Valley to be in full accordance with NFPA 805, implement many of the attributes upon which this SE is based, and thereby meet the requirements of 10 CFR 50.48(c). The modifications will be completed in accordance with the schedule provided in the proposed NFPA 805 license condition, which states that all modifications will be in place by the end of the second refueling outage (for each unit) after issuance of the license amendments. In addition, the licensee agreed to keep the appropriate compensatory measures in place until the modifications are complete.

2.7.2 Implementation Items

Implementation items are items that the licensee has not fully completed or implemented as of the issuance date of the license amendments, but which will be completed during implementation of the license amendments to transition to NFPA 805 (e.g., procedure changes that are still in process or NFPA 805 programs that have not been fully implemented). The licensee identified the implementation items in LAR Attachment S, Table S-3, as supplemented. For each implementation item, the licensee and the NRC staff have reached a satisfactory resolution involving the level of detail and main attributes that each remaining change will incorporate upon completion. Completion of these items in accordance with the schedule discussed in SE Section 2.7.3 does not change or impact the bases for the safety conclusions made by the NRC staff in the SE.

Each implementation item will be completed prior to the deadline for implementation of the RI/PB FPP based on NFPA 805 as specified in the license conditions and the letter transmitting the amended license (i.e., implementation period), which states that the licensee will implement the items listed in LAR Attachment S, Table S-3, as supplemented on August 22, 2017, 12 months after NRC issuance of the license amendments, except for those items listed in Note 1 on page S-19 of LAR Attachment S, Table S-3, which are to be completed by the end of the second Unit 2 refueling outage scheduled for April/May 2020 (2R21).

The NRC staff, through an onsite audit or during a future fire protection inspection, may choose to examine the closure of the implementation items, with the expectation that any variations discovered during this review or concerns regarding adequate completion of the implementation item, would be tracked and dispositioned appropriately under the licensee's corrective action program. Any discrepancies identified during onsite audits or fire protection inspections examining dispositioning of the implementation items could be subject to appropriate NRC enforcement action, as completion of the implementation items would be required by the proposed license conditions.

2.7.3 Schedule

LAR Section 5.5, supplemented by the licensee's letter dated May 12, 2016, provides the overall schedule for completing the NFPA 805 transition at Beaver Valley. The licensee initially stated that implementation of the new NFPA 805 FPP to include procedure changes, process updates, and training to affected plant personnel will occur 180 days after NRC approval. In a letter dated May 12, 2016, the licensee requested an extension to complete the implementation items to 12 months after issuance of the license amendments.

LAR Section 5.5, supplemented by the licensee's letter dated May 12, 2016, also states that modifications will be completed by the startup of the second refueling outage (for each unit) after issuance of the SE, and that appropriate compensatory measures will be maintained until the modifications are complete.

Based on its review of the information provided by the licensee, the NRC staff concludes that the completion schedules proposed by the licensee for the modifications and implementation items are acceptable.

3.0 TECHNICAL EVALUATION

The following sections evaluate the technical aspects of the LAR to transition the FPP at Beaver Valley to one based on NFPA 805 (Reference 3) in accordance with 10 CFR 50.48(c). While performing the technical evaluation of the licensee's submittal, the NRC staff used the guidance provided in NUREG-0800, Section 9.5.1.2, "Risk Informed, Performance-Based Fire Protection" (Reference 48), to determine whether the licensee had provided sufficient information in both scope and level of detail to adequately demonstrate compliance with the requirements of NFPA 805, as well as the other associated regulations and guidance documents discussed in SE Section 2.0. Specifically:

- Section 3.1 provides the results of the NRC staff's review of the licensee's transition of the FPP from the existing deterministic guidance to that of NFPA 805, Chapter 3, "Fundamental FPP and Design Elements."
- Section 3.2 provides the results of the NRC staff's review of the methods used by the licensee to demonstrate the ability to meet the NSPC.
- Section 3.3 provides the results of the NRC staff's review of the FM methods used by the licensee to demonstrate the ability to meet the NSPC using an FM PB approach.
- Section 3.4 provides the results of the NRC staff's review of the fire risk assessments used to demonstrate the ability to meet the NSPC using an FRE PB approach.
- Section 3.5 provides the results of the NRC staff's review of the licensee's NSCA results by fire area.
- Section 3.6 provides the results of the NRC staff's review of the methods used by the licensee to demonstrate an ability to meet the radioactive release performance criteria.
- Section 3.7 provides the results of the NRC staff's review of the NFPA 805 monitoring program developed as a part of the transition to an RI/PB FPP based on NFPA 805.
- Section 3.8 provides the results of the NRC staff's review of the licensee's program documentation, configuration control, and quality assurance (QA).

SE Attachments A and B provide additional detailed information that was evaluated by the NRC staff during the course of the review to support the licensee's request to transition to an RI/PB FPP in accordance with NFPA 805 (i.e., 10 CFR 50.48(c)). These attachments are discussed as appropriate in the associated SE sections.

3.1 NFPA 805 Fundamental FPP and Minimum Design Requirements

NFPA 805, Chapter 3, contains the fundamental elements of the FPP and specifies the minimum design requirements for fire protection systems and features that are necessary to meet the standard. The fundamental FPP elements and minimum design requirements include necessary attributes pertaining to the fire protection plan and procedures, the fire prevention program and design controls, industrial fire brigades, and fire protection SSCs. However, 10 CFR 50.48(c) provides exceptions, modifications, and supplementations to certain aspects of NFPA 805, Chapter 3, as follows:

- 10 CFR 50.48(c)(2)(v) – *Existing cables.* In lieu of installing cables meeting flame propagation tests as required by Section 3.3.5.3 of NFPA 805, a flame-retardant coating may be applied to the electric cables or an automatic fixed fire suppression system may be installed to provide an equivalent level of protection. In addition, the italicized exception to Section 3.3.5.3 of NFPA 805 is not endorsed.

- 10 CFR 50.48(c)(2)(vi) – *Water supply and distribution.* The italicized exception to Section 3.6.4 of NFPA 805 is not endorsed. Licensees who wish to use the exception to Section 3.6.4 of NFPA 805 must submit a request for a license amendment in accordance with 10 CFR 50.48(c)(2)(vii).

- 10 CFR 50.48(c)(2)(vii) – *Performance-based methods.* While Section 3.1 of NFPA 805 prohibits the use of PB methods to demonstrate compliance with the NFPA 805, Chapter 3, requirements, 10 CFR 50.48(c)(2)(vii) specifically permits that the FPP elements and minimum design requirements of NFPA 805, Chapter 3, may be subject to the PB methods permitted elsewhere in the standard.

Furthermore, Section 3.1 of NFPA 805 specifically allows the use of alternatives to the NFPA 805, Chapter 3, fundamental FPP requirements that have been previously approved by the NRC (the AHJ as denoted in NFPA 805 (Reference 3) and RG 1.205, Revision 1 (Reference 4), and are contained in the currently approved FPP for the facility.

3.1.1 Compliance with NFPA 805, Chapter 3, Requirements

The licensee used the systematic approach described in NEI 04-02, Revision 2 (Reference 7), as endorsed by the NRC in RG 1.205, Revision 1, to assess the proposed FPP against the NFPA 805, Chapter 3, requirements.

As part of this assessment, the licensee reviewed each section and subsection of NFPA 805, Chapter 3, against the existing FPP and provided specific compliance statements for each Chapter 3 attribute that contained applicable requirements. As discussed below, some subsections of NFPA 805, Chapter 3, do not contain requirements or are otherwise not applicable, and others are provided with multiple compliance statements to fully document compliance with the element.

The methods used for achieving compliance with the fundamental FPP elements and minimum design requirements are as follows:

1. The existing FPP element directly complies with the requirement: noted in LAR Attachment A, "NEI 04-02 Table B-1, Transition of Fundamental Fire Protection Program and Design Elements" (also called the B-1 Table), as "Complies."

2. The existing FPP element complies through the use of an explanation or clarification: noted in LAR Attachment A, Table B-1 as "Complies with Clarification."

3. The existing FPP element complies through the use of existing engineering equivalency evaluations (EEEEs) whose bases remain valid and are of sufficient quality: noted in LAR Attachment A, Table B-1 as "Complies with Use of EEEE."

4. The existing FPP element complies with the requirement based on prior NRC approval of an alternative to the fundamental FPP attribute and the bases for the NRC approval remain valid: noted in LAR Attachment A, Table B-1 as "Complies by Previous NRC Approval."

5. The existing FPP element does not comply with the requirement, but the licensee is requesting specific approval for a PB method in accordance with 10 CFR 50.48(c)(2)(vii): noted in LAR Attachment A, Table B-1 as "Submit for NRC Approval."

6. The existing FPP element does not comply with the requirement, but will be in direct compliance with the completion of a required action: noted in LAR Attachment A, Table B-1 as "Will Comply with the Use of Commitment." These outstanding actions are identified in Attachment S, as supplemented, of the LAR, as modifications or implementation items, and in Section 2.9 of this SE.

Compliance approach 6, "Will Comply with the Use of Commitment," is a modification from the NEI 04-02 based approach in that it is a new category not included in NEI 04-02. The intent of this method for achieving compliance is to identify FPP elements that will comply after completion of an action by the licensee. The required actions are identified in LAR Attachment S, as supplemented, as implementation items or modifications and would be required by the proposed license condition. The NRC staff finds compliance approach 6 acceptable because the actions for achieving compliance will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

The NRC staff has determined that taken together, these methods compose an acceptable approach for documenting compliance with the NFPA 805, Chapter 3, requirements, because the licensee has followed the compliance strategies identified in the endorsed NEI 04-02 guidance document and proposed one modified approach (compliance approach 6) that the NRC staff finds acceptable as discussed above. The process defined in the endorsed guidance provides an organized structure to document each attribute in NFPA 805, Chapter 3, allowing the licensee to provide significant detail in how the program meets the requirements. In addition to the basic strategy of "Complies," which itself makes the attribute both auditable and inspectable, additional strategies have been provided, allowing for amplification of information, when necessary, regarding how or why the attribute is acceptable.

The licensee stated in LAR Section 4.2.2, "Existing Engineering Equivalency Evaluation Transition," that it evaluated the EEEEs used to demonstrate compliance with the NFPA 805, Chapter 3, requirements in order to ensure continued appropriateness, quality, and applicability to the current Beaver Valley plant configuration. The licensee determined that no EEEE used to support compliance with NFPA 805 required NRC approval.

EEEEs refer to "existing engineering equivalency evaluations" (previously known as GL 86-10 evaluations) performed for fire protection design variances such as fire protection system designs and fire barrier component deviations from the specific fire protection deterministic requirements. Once a licensee transitions to NFPA 805, future equivalency evaluations are to be conducted using a PB approach. The evaluation should demonstrate that the specific plant configuration meets the performance criteria in the standard.

Additionally, the licensee stated in LAR Section 4.2.3, "Licensing Action Transition," that the existing licensing actions used to demonstrate compliance have been evaluated to ensure that their bases remain valid. The results of these licensing action evaluations are provided in LAR Attachment K, as supplemented.

LAR Attachment A (the B-1 Table) provides further details regarding the licensee's compliance strategy for specific NFPA 805, Chapter 3, requirements, including references to where compliance is documented.

3.1.1.1 Compliance Strategy - Complies

For the majority of the NFPA 805, Chapter 3, requirements, as modified by 10 CFR 50.48(c)(2), the licensee determined that the RI/PB FPP complies directly with the fundamental FPP element using the existing FPP element. In these instances, based on the validity of the licensee's statements, the NRC staff concludes that the licensee's statements of compliance are acceptable.

The following NFPA 805 sections identified in LAR Attachment A, Table B-1 as complying by this method required additional review by the NRC staff:

- 3.4.1(c)
- 3.4.3(a)

NFPA 805, Section 3.4.1(c) requires that the fire brigade leader and at least two brigade members have sufficient training and knowledge of nuclear safety systems to understand the effects of fire and fire suppressants on the NSPC. In fire protection engineering (FPE) RAI 09 (Reference 23), the NRC staff requested that the licensee provide additional detail regarding the training that is provided to the fire brigade leader and members that addresses their ability to assess the effects of fire and fire suppressants on the NSPC. In its response to FPE RAI 09 (Reference 12), the licensee stated that its fire brigade administrative procedure designates the fire brigade chief as an operations unit supervisor who, by position, possesses an operating license. The licensee stated that site administrative procedures require licensed operators to complete the operator initial training program and that this program includes plant systems and procedures training which provides a sound level of knowledge in the design, operating characteristics, procedures and system interrelationships. The licensee further stated that licensed operators participate in the licensed operator continuing training program which includes specific training on post-fire SSD procedures, and that training on post-fire SSD procedures is included in the licensed operator continuing training program at a nominal

frequency of at least once every 2 years. The licensee further stated that operations personnel assigned as fire brigade members may possess an operating license or may be nonlicensed operators and that nonlicensed operator fire brigade members are provided initial and continuing training regarding the effects of fire on the ability to achieve and maintain post-fire SSD conditions. The licensee further stated that training on post-fire SSD procedures is included in the nonlicensed operator continuing training program at a nominal frequency of at least once every 3 years. The licensee further stated that the fire brigade initial and retraining programs include instruction on the effects of fire suppressants on plant equipment and components, including those required to achieve post-fire SSD. The licensee further stated that instruction includes the use of pre-fire plan procedures, and these procedures include guidance on use of fire suppressants and the equipment and components required for post-fire SSD located in the fire area. The NRC staff concludes that the licensee's response to FPE RAI 09 is acceptable because the licensee demonstrated that its training for its fire brigade members, including the fire brigade leader and at least two brigade members, provides sufficient knowledge of nuclear safety systems to understand the effects of fire and fire suppressants on the NSPC.

NFPA 805, Section 3.4.3(a) requires that plant industrial fire brigade members receive training consistent with the requirements contained in NFPA 600, "Standard on Industrial Fire Brigades" (Reference 95) or NFPA 1500, "Standard on Fire Department Occupational Safety and Health Program" (Reference 96), as appropriate. The licensee stated that it complies with NFPA 805, Section 3.4.3(a) requirements; however, the compliance basis in the LAR stated that fire brigade training is performed, and the administrative procedure stated that it meets the requirements of Occupational Safety and Health Administration Standards 29 CFR 1910.156(C) and 29 CFR 1910.134(g)(4), 10 CFR 50.48, NFPA 27-1976 (Reference 97), and the guidelines established in BTP CMEB 9.5-1 (Reference 93). In FPE RAI 11 (Reference 23), the NRC staff requested that the licensee describe how complying with these requirements meets the NFPA 600 requirements for brigade training. In its response to FPE RAI 11 (Reference 12), the licensee stated that an EEEE assessed its fire brigade training for compliance with NFPA 600 and concluded that the fire brigade training is acceptable. The licensee further stated that the compliance statement will be revised to "Complies with Use of EEEE." The NRC staff concludes that the licensee's response to FPE RAI 11 is acceptable because the use of an EEEE to evaluate code compliance is an acceptable compliance method in accordance with the guidance contained in RG 1.205 and NEI 04-02.

3.1.1.2 Compliance Strategy – Complies with Clarification

In several NFPA 805, Chapter 3, requirements, the licensee provided additional clarification when describing its means of compliance with the fundamental FPP element. In these instances, the NRC staff reviewed the additional clarifications and concludes that the licensee will meet the underlying requirement for the FPP element as clarified.

The following NFPA 805 sections identified in LAR Attachment A, Table B-1 as complying by this method required additional review by the NRC staff:

- 3.3.3
- 3.3.5.3
- 3.3.7.2
- 3.4.1(a)
- 3.4.2.4
- 3.5.5
- 3.5.10
- 3.5.15
- 3.5.16
- 3.6.1
- 3.6.2
- 3.6.4
- 3.7
- 3.8.1
- 3.8.2
- 3.9.4
- 3.10.3
- 3.10.5
- 3.10.7
- 3.10.8

NFPA 805, Section 3.3.3 requires that interior wall or ceiling finish classification be in accordance with NFPA 101, "Life Safety Code" (Reference 66) requirements for Class A materials and that interior floor finishes be in accordance with NFPA 101 requirements for Class I interior floor finishes. The licensee stated that an administrative procedure states interior finishes shall have a flame spread rating of less than 25 in accordance with American Society for Testing and Materials (ASTM) E-84 (Reference 98), or equivalent, and that the existing original interior wall, ceiling, and floor finish is considered to be compliant with NFPA 805 standards. In FPE RAI 06 (Reference 23), the NRC staff requested additional information as to what specifically the licensee was attempting to clarify. In addition, the NRC staff found that the licensee did not describe in the compliance basis how it meets the smoke developed index portion of the NFPA 101 requirement for Class A materials or the Class I requirement for interior floor finish. The NRC staff requested that the licensee explain how the plant meets the NFPA 805 requirements for interior floor, wall, and ceiling finish. In its response to FPE RAI 06 (Reference 10), the licensee stated that the compliance statement of "Complies by Clarification" is not applicable and that the compliance strategy should indicate "Complies by Previous NRC Approval." In its response, the licensee also provided excerpts from its SER dated June 6, 1979 (Reference 99), and October 1985 (Reference 36), and stated that the technical basis remains valid. The licensee further stated that new and replacement coatings will be required to meet the applicable NFPA 101 sections for interior floor, wall, and ceiling finishes, and the requirements for NFPA 101 will be incorporated and referenced in the appropriate procurement and plant documents in LAR Attachment S, Table S-3. In a letter dated April 21, 2017, the licensee included this action in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2908, and the NRC staff concludes that the action is acceptable because it incorporates the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. The NRC staff concludes that the licensee's response to FPE RAI 06 is acceptable because the licensee changed its compliance strategy for the requirements of NFPA 805, Section 3.3.3 from "Complies by Clarification" to "Complies by Previous NRC Approval" and provided the applicable excerpts from its SER that support the revised compliance basis, and included an action in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2908 to revise its procurement and plant documents to meet NFPA 101 requirements in accordance with NFPA 805

NFPA 805, Section 3.3.5.3 requires that electric cable construction comply with a flame propagation test acceptable to the AHJ. The licensee stated that safety-related cables are considered to be compliant due to being constructed to pass the vertical cable tray flame test with oil/burlap flame source or, later, the Institute of Electrical and Electronics Engineers (IEEE)-383-1974 (Reference 100) flame test, and referenced LAR Attachment T for additional justification. In LAR Attachment T, Prior Approval Clarification Request 1, the licensee stated that the original justifications include all cable types used in the cable trays, and that no explanation is provided in the SER dated June 6, 1979 (Reference 99), as to why only safety-related cables were approved. The licensee requested in the clarification that the NRC's previous approval that cites "all safety-related cables" be extended to all cables installed in the plant. In FPE RAI 04b (Reference 23), the NRC staff requested that the licensee (1) describe the flame propagation tests that were used to support acceptability of the non-safety-related cables with thermoplastic or unknown insulation material, and discuss the results of the tests that demonstrate that extensive propagation does not occur; and (2) state whether the population of these types of cables and configuration is the same as the configuration provided in the original submittal, or confirm that any configuration changes since the original submittal do not invalidate the basis submitted by the licensee for the original NRC approval. In its response to FPE RAI 04b (Reference 12), the licensee stated that LAR Attachment T, Prior Approval Clarification Request 1 is not required and that an engineering evaluation was

performed that analyzed the cables used within the power block fire compartments for qualified and potentially nonqualified cable insulation. The licensee further stated that the cables installed were compared to IEEE-383, which is a recognized flame propagation test accepted in FAQ 06-0022 (Reference 74). The licensee further stated that the engineering analysis determined that the majority of the electric cables used within the power block are equivalent to the requirements of NFPA 805, Section 3.3.5.3, and the low population of electric cables with potentially nonqualified electric cable insulation materials installed in electrical raceways is acceptable. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that it used engineering evaluations to compare its cable installations against the criteria of NFPA 805 and the guidance of FAQ 06-0022 and determined that the insulation materials are acceptable.

NFPA 805, Section 3.3.7.2 requires that outdoor high-pressure flammable gas storage containers be located so that the long axis is not pointed at buildings. The licensee stated that plant drawings show hydrogen storage tanks are positioned so the long axis is pointed at buildings; however, the distance separating the hydrogen tanks and the turbine building is greater than 100 feet. The licensee stated the existing hydrogen storage tanks satisfy the distance requirements of NFPA codes specifically addressing bulk hydrogen storage. In FPE RAI 05(a)(i) (Reference 23), the NRC staff stated that NFPA codes are not cited as the means of compliance for NFPA 805, Section 3.3.7.2; therefore, their use is not a clarification. In its response to FPE RAI 05(a)(i) (Reference 12), the licensee stated that for its outdoor hydrogen storage tank orientation, an EEEE was performed for compliance with NFPA 55, "Compressed Gases and Cryogenic Fluids Code" (Reference 101), and the EEEE concluded that the orientation of the tanks is acceptable. The licensee stated that it will revise its compliance statement from "Complies with Clarification" to "Complies with Use of EEEE." In FPE RAI 05.01(a) (Reference 26), the NRC staff stated that the separation distances in NFPA 55 are associated with the protection from radiant heat based on the storage volume, and that the requirement in NFPA 805, Section 3.3.7.2 is associated with potential missile generation, which goes beyond the requirements of NFPA 55. The NRC staff further stated that in accordance with FAQ 06-0008, this type of EEEE will need to be reviewed and approved by the NRC staff because "Adequate for the Hazard" EEEEs are associated with analysis performed under NFPA 805, Chapter 4, and this Section provided requirements for fundamental FPP and design elements of NFPA 805, Chapter 3. The NRC staff further stated that unless the design and installation of the hydrogen storage tanks is demonstrated by an EEEE to be functionally equivalent to the missile protection intended by the NFPA 805 requirement, the PB engineering analysis will need to be reviewed by the NRC for approval. In its response to FPE RAI 05.01(a) (Reference 14), the licensee stated that the compliance strategy for NFPA 805, Section 3.3.7.2 for the hydrogen storage tank orientation will be revised to "Submit for NRC Approval." The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee submitted the PB engineering evaluation in a letter dated February 24, 2016 (Reference 15), for NRC staff approval as required by 10 CFR 50.48(c)(2)(vii). (See SE Sections 3.1.1.5 and 3.1.4.7 for the NRC staff's evaluation of the approval request.)

NFPA 805, Section 3.4.1(a), requires that the onsite firefighting force conform with the following NFPA standards, as applicable:

(1) NFPA 600, "Standard on Industrial Fire Brigades" (interior structural firefighting)
(2) NFPA 1500, "Standard on Fire Department Occupational Safety and Health Program"
(3) NFPA 1582, "Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians"

The licensee stated that it meets the intent of several sections of NFPA 600, as justified, within the code compliance report. In FPE RAI 05(a)(ii) (Reference 23), the NRC staff stated that the use of a code compliance report to establish intent regarding compliance with NFPA 805 does not appear to be a "clarification." In its response to FPE RAI 05(a)(ii) (Reference 12), the licensee stated that it complies with the provisions of NFPA 805, Section 3.4.1(a) by providing a five-member fire brigade on the site, and an EEEE assessed the fire brigade for compliance with the provisions of NFPA 600 (Reference 95) and concluded that the fire brigade organization is acceptable. The licensee stated that it will revise its compliance statement from "Complies with Clarification" to "Complies with Use of EEEE." In a letter dated October 25, 2017 (Reference 21), the licensee indicated this change was made. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's use of an engineering evaluation is considered an acceptable method of evaluation in accordance with NFPA 805, Section 2.2.7 and the guidance contained in RG 1.205 and NEI 04-02.

NFPA 805, Section 3.4.2.4 requires that pre-fire plans address coordination with other plant groups during fire emergencies. The licensee stated that the pre-fire plans do contain information on what the fire brigade will encounter in a location, but do not specifically address coordination with other plant groups, and that site procedures address coordination with other plant groups during fire emergencies. In FPE RAI 05b (Reference 23), the NRC staff requested the licensee to review all "Compliance with Clarification" compliance statements and ensure that the strategy is suitable for the condition. In its response to FPE RAI 05b (Reference 12), the licensee stated that the compliance statement for NFPA 805, Section 3.4.2.4 will be revised to "Complies" and/or "Complies with Use of EEEE." In FPE RAI 05.02(a) (Reference 26), the NRC staff requested that the licensee identify if the NFPA 805, Chapter 3, compliance statement is either "Complies" or "Complies with Use of EEEE" and provide the compliance bases. In its response to FPE RAI 05.02(a) (Reference 14), the licensee stated that it "Complies" with the NFPA 805, Section 3.4.2.4 requirement and revised the compliance basis to state that the pre-fire plans do not specifically address coordination with other plant groups and that site procedures address coordination with other plant groups during fire emergencies. The NRC staff concludes that the licensee's response to FPE RAI 05b and FPE RAI 05.02(a) are acceptable because the licensee demonstrated that it complies with the NFPA 805 requirement.

NFPA 805, Section 3.5.5 requires that each fire pump and its driver and controls be separated from the remaining fire pumps and from the rest of the plant by rated fire barriers. The licensee stated that an assessment of the fire pump control circuits was completed and the report concluded for a postulated fire rendering both fire pumps unavailable and considering prompt detection and the availability of alternate water supplies for manual firefighting, the existing configuration of the fire pump control circuits is acceptable. In FPE RAI 05(a)(iii) (Reference 23), the NRC staff stated that the use of an assessment of fire impacts on redundant pump control circuits to demonstrate acceptability of the design in meeting the separation requirements of NFPA 805, Section 3.5.5 does not appear to be a "clarification." In its response to FPE RAI 05(a)(iii) (Reference 12), the licensee stated that it evaluated the existing fire pump installations and control circuits for compliance with NFPA 20-1970, "Centrifugal Fire Pumps," in an EEEE and concluded that the configuration of the fire pumps installation and separation of control circuits is acceptable. The licensee stated that it will revise its compliance statement from "Complies with Clarification" to "Complies with Use of EEEE." In the EEEE, the licensee concluded that the configuration of the fire pumps installation and separation of control circuits is "Adequate for the Hazard." In FPE RAI 05.01(b) (Reference 26), the NRC staff stated that the EEEE does not demonstrate "Functional Equivalency" with the requirements of NFPA 805, Section 3.5.5, and that in accordance with the guidance contained in FAQ 06-0008, this type of EEEE should be submitted to the NRC staff for approval. In its response to FPE RAI 05.01(b)

(Reference 14), the licensee stated that it will revise the compliance strategy for NFPA 805, Section 3.5.5 for the fire pumps installation and separation of control circuits to "Submit for NRC Approval." The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee submitted the PB engineering evaluation in a letter dated February 24, 2016 (Reference 15), for NRC staff approval as required by 10 CFR 50.48(c)(2)(vii). (See SE Sections 3.1.1.5 and 3.1.4.8 for the NRC staff's evaluation of the approval request.)

NFPA 805, Section 3.5.10 requires that an underground yard fire main loop, designed and installed in accordance with NFPA 24, "Standard for the Installation of private Fire Service Mains and Their Appurtenances," be installed to furnish anticipated water requirements. The licensee stated that procedures are available that flows water back through the fire hydrants or the fire test manifold to pressurize the fire water system using the portable pump (i.e., fire trucks) when the fire pumps are not available in lieu of using building fire department connections. In FPE RAI 05b (Reference 23), the NRC staff requested the licensee to review all "Compliance with Clarification" compliance statements and ensure that the strategy is suitable for the condition. In its response to FPE RAI 05b (Reference 12), the licensee stated that the compliance statement for NFPA 805, Section 3.5.10 will be revised to "Complies" and/or "Complies with Use of EEEE." In FPE RAI 05.02(a) (Reference 26), the NRC staff requested that the licensee identify if the NFPA 805, Chapter 3, compliance statement is either "Complies" or "Complies with Use of EEEE" and provide the compliance bases. In its response to FPE RAI 05.02(a) (Reference 14), the licensee stated that it "Complies with Use of EEEE" with the NFPA 805, Section 3.5.10 requirement and revised the compliance basis. The NRC staff concludes that the licensee's response to FPE RAI 05b and FPE RAI 05.02(a) are acceptable because the licensee revised the compliance statement and basis to meet the NFPA 805 requirement, which is also in accordance with the guidance contained in RG 1.205 and NEI 04-02 for the use of EEEEs.

NFPA 805, Section 3.5.15 requires that hydrants be installed approximately 250 feet apart on the yard main system. The licensee stated that the distance from yard fire hydrant 10 to the intake structure exceeds the allowable distance and is estimated to be approximately 350 feet away. The licensee stated that the interval between hydrants 15 and 16 on the south side of the Unit No. 2 Turbine Building also exceeds the 250 feet distance with a 370 feet spacing between hydrants 15 and 16. The licensee stated that hose reel cabinets contain three 50-feet sections of hose and this hose length, in addition to the 200 feet of hose available to the fire brigade, will provide approximately 350 feet of hose and that this arrangement meets the intent of the NFPA 24 requirement that there be sufficient hydrants to concentrate the required fire flow on any important building with no hose line exceeding 500 feet in length. Hose houses are equipped with hose and combination nozzles and other auxiliary equipment that is considered to meet the intent of NFPA 24. In FPE RAI 05(a)(iv) (Reference 23), the NRC staff advised that the licensee's compliance strategy described compliance issues as opposed to clarifications and stated that simply describing deviations from the requirement without further justification for the acceptability of the deviations relative to meeting the requirement is not considered to be a clarification. In its response to FPE RAI 05(a)(iv) (Reference 12), the licensee stated it will revise its compliance statement from "Complies with Clarification" to "Complies with Use of EEEE." In a letter dated October 25, 2017 (Reference 21), the licensee indicated this change was made. In the EEEE, the licensee evaluated the acceptability of the distance between yard fire hydrant 9 and the intake structure as being functionally equivalent. In FPE RAI 05.01(c) (Reference 26), the NRC staff requested that the licensee explain how the EEEE, which evaluates the distance between yard fire hydrant 9 and the intake structure, is credited as the basis for changing the compliance statement to "Complies with the Use of EEEE" in LAR Attachment A, which describes the distance between yard fire hydrant 10 and the intake

structure. In its response to FPE RAI 05.01(c) (Reference 14), the licensee stated that it removed the reference to yard fire hydrant 10 and replaced it with information describing the distance between yard fire hydrant 9 and the intake structure. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the yard fire hydrant described in the EEEE is the same hydrant described in LAR Attachment A, and the use of an EEEE is considered an acceptable method to meet the requirements of NFPA 805, Section 3.5.15, in accordance with the guidance contained in RG 1.205 and NEI 04-02.

NFPA 805, Section 3.5.16 requires that the fire protection water supply system be dedicated for fire protection use only. The licensee stated that its fire procedure requires that station personnel not use permanent and installed portable fire protection equipment for purposes other than fire protection without the approval of the plant manager, site fire marshal, and the fire protection system engineer, and require an assessment of the impact on plant safety and the ability to achieve SSD in the event of a fire. The licensee further stated that the diesel fire pump water supply cross-connect is not credited in the FPRA, and there is no need to determine combined flow requirements for the use of the fire protection system water for supply to the auxiliary feedwater (AFW) system during a fire event. In FPE RAI 05(a)(iv) (Reference 23), the NRC staff advised the licensee that its compliance strategy described compliance issues as opposed to clarifications and stated that simply describing deviations from the requirement without further justification for the acceptability of the deviations relative to meeting the requirement is not considered to be a clarification. In its response to FPE RAI 05(a)(iv) (Reference 12), the licensee stated that it will revise its compliance statement from "Complies with Clarification" to "Complies," and the discussion on "water use for other purposes" will be deleted. In a letter dated October 25, 2017 (Reference 21), the licensee indicated this change was made. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee revised its compliance statement, which now demonstrates that the licensee complies with NFPA 805.

NFPA 805, Section 3.6.1 requires that for all power block buildings, Class III standpipe and hose systems be installed in accordance with NFPA 14, "Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems" (Reference 102). The licensee stated that it evaluated the interior standpipe and hose systems for compliance with NFPA 14 and that it conducted the code review for Class II standpipes because the design was approved by the NRC specifying hose size. The licensee indicated that the code review identified several issues that are not in compliance with NFPA 14. The licensee provided justifications for the noncompliances based on analysis of plant conditions, procedures, and licensing documents and the increased controls in a nuclear plant as compared to commercial buildings, including that only trained fire brigade members will be using the hoses. In FPE RAI 05(a)(v) (Reference 23), the NRC staff notified the licensee that compliance strategies associated with engineering evaluations and previous approvals do not appear to be clarifications. In its response to FPE RAI 05(a)(v) (Reference 12), the licensee stated that an EEEE of the interior standpipe and hose station systems determined that they are equivalent to the requirement of NFPA 14, and it will revise its compliance statement from "Complies with Clarification" to "Complies with Use of EEEE." In a letter dated October 25, 2017 (Reference 21), the licensee indicated this change was made. The NRC staff concludes that the licensee's response is acceptable because the licensee revised its compliance basis, which now demonstrates compliance with NFPA 805 and follows the guidance contained in RG 1.205 and NEI 04-02.

NFPA 805, Section 3.6.2 requires that a capability be provided to ensure an adequate water flow rate and nozzle pressure for all hose stations and that this capability includes the provisions of hose station pressure reducers, where necessary, for the safety of plant industrial fire brigade

members and offsite fire department personnel. The licensee stated that pressure reducers are not provided at hose stations, even though the available pressure can exceed 100 pounds per square inch (psi) at some hose stations. The licensee stated that the fire brigade members are trained and drilled using the expected pressures available, and thus, the existing installation is considered adequate. In FPE RAI 05(a)(v) (Reference 23), the NRC advised that compliance strategies associated with engineering evaluations and previous approvals do not appear to be clarifications. In its response to FPE RAI 05(a)(v) (Reference 12), the licensee stated that an EEEE of the interior standpipe and hose station systems determined that they are equivalent to the requirement of NFPA 14, and it will revise its compliance statement from "Complies with Clarification" to "Complies with Use of EEEE." In FPE RAI 05.01(d) (Reference 26), the NRC staff stated an EEEE that demonstrates it is adequate for the hazard for this NFPA 805 requirement will need to be reviewed and approved by the NRC staff. In its response to FPE RAI 05.01(d) (Reference 14), the licensee stated that the compliance strategy for NFPA 805, Section 3.6.2 for the provisions of hose station pressure reducers, where necessary, for the safety of plant industrial fire brigade members and offsite fire department personnel will be revised to "Submit for NRC Approval." The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee submitted the PB engineering evaluation in a letter dated February 24, 2016 (Reference 15), for NRC staff approval as required by 10 CFR 50.48(c)(2)(vii). (See SE Sections 3.1.1.5 and 3.1.4.10 for the NRC staff's evaluation of the approval request.)

NFPA 805, Section 3.6.4 requires that provisions be made to supply water at least to standpipes and hose stations for manual fire suppression in all areas containing systems and components needed to perform the nuclear safety functions in the event of a safe shutdown earthquake. The licensee stated that at the time of construction, the Unit No. 1 header installation specification did not require standpipes to be designed to remain functional after a seismic event, and Unit No. 1 complies with the intent of NFPA 805, Section 3.6.4 by having the ability to isolate piping sections and provide for the ability to pressurize the system by reversing flow through a fire hydrant from a portable pump (i.e., fire truck) using plant procedures. In FPE RAI 03 (Reference 23), the NRC staff requested that the licensee clarify the compliance strategy for NFPA 805, Section 3.6.4 because LAR Attachment A, Table B-1 stated "Complies with Clarification" and LAR Table 5-3, stated complies "by previous approval." In its response to FPE RAI 03 (Reference 10), the licensee stated that the NRC accepted its interior hose configurations in Section 4.3.1.4 of the SER dated June 6, 1979 (Reference 99), and provided the excerpt of the SER. The licensee further stated that the interior hose station configuration has not changed since approval in the SER, and therefore, the approval still applies and remains valid. The licensee stated that it complies by prior approval with the provisions of NFPA 805, Section 3.6.4, and that LAR Table 5-3 correctly indicates the compliance strategy. Based on its review of the licensee's response to FPE RAI 03, the NRC staff concludes that the licensee's statement of compliance of "by previous approval" is acceptable because the licensee demonstrated prior approval through the appropriate SER reference and stated that the interior hose station configuration has not changed and that the prior approval remains valid. In FPE RAI 05b (Reference 23), the NRC staff requested that the licensee review all "Compliance with Clarification" compliance statements and ensure that the strategy is suitable for the condition. In its response to FPE RAI 05b (Reference 12), the licensee stated that the compliance statement for NFPA 805, Section 3.6.4 will be revised to "Complies" and/or "Complies with Use of EEEE." In FPE RAI 05.02(a) (Reference 26), the NRC staff requested that the licensee identify if the NFPA 805, Chapter 3, compliance statement is either "Complies" or "Complies with Use of EEEE" and provide the compliance bases. In its response to FPE RAI 05.02(a) (Reference 14), the licensee stated that subsection 3.6.4 was erroneously included in Table 5b in its response to FPE RAI 05b. The licensee further clarified that it

"Complies by Previous NRC Approval" and that it provided the compliance basis in its response to FPE RAI 03. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee changed its compliance basis, which meets the requirements of NFPA 805 and follows the guidance contained in RG 1.205 and NEI 04-02.

NFPA 805, Section 3.7 requires that where provided, fire extinguishers of the appropriate number, size, and type be provided in accordance with NFPA 10, "Standard for Portable Fire Extinguishers" (Reference 103). The licensee stated that it evaluated the fire extinguishers for compliance with the requirements of NFPA 10-1981 regarding type, spacing, and location. The licensee stated the fire extinguishers either comply or comply with the intent of these requirements by clarification. In FPE RAI 05(a)(vi) (Reference 23), the NRC staff indicated that that just describing deviations from the requirement without further justification for the acceptability of the deviations relative to meeting the requirement is not considered to be a clarification. In its response to FPE RAI 05(a)(vi) (Reference 12), the licensee stated that it analyzed compliance in an EEEE and concluded that the number, size, and type of fire extinguishers throughout the power block are equivalent to the requirements of NFPA 805, Section 3.7, and that it will revise its compliance statement from "Complies with Clarification" to "Complies with Use of EEEE." The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee revised its compliance strategy appropriately and because the use of an EEEE to evaluate the acceptability of NFPA code deviations meets the requirements of NFPA 805 and the guidance contained in RG 1.205 and NEI 04-02. In its response to FPE RAI 05.01(b) (Reference 14), the licensee stated that it identified an issue regarding compliance with NFPA 805, Section 3.7, and that it would change the compliance statement of "Complies with Clarification" to "Submit for NRC Approval." The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee submitted the PB engineering evaluation in a letter dated February 24, 2016 (Reference 15), for NRC staff approval as required by 10 CFR 50.48(c)(2)(vii). (See SE Sections 3.1.1.5 and 3.1.4.9 for the NRC staff's evaluation of the approval request.)

NFPA 805, Section 3.8.1 requires that alarm initiating devices be installed in accordance with NFPA 72, "National Fire Alarm Code" (Reference 69). The licensee stated that for Unit No. 1, the primary supply for the fire detection system and suppression systems is the normal offsite power supply system, and that the secondary supply for the fire detection systems is a diesel generator. The licensee further stated that there is no 4-hour secondary battery supply and that the switchover capability is an automatic function. The licensee stated that the diesel generator supplies the 120 volts (V) alternating current (VAC) uninterruptible power supply system required for the detection system and the 125 volts direct current (VDC) panels for the fire detection and suppression systems and that the primary and secondary power supplies are considered highly reliable and diverse. The licensee further stated that this arrangement is similar to the power supply circuits for Unit No. 2 in which the NRC concluded in the Unit No. 2 SER that the primary and secondary source of power meets Section C.6.a of BTP CMEB 9.5-1 and is acceptable. In FPE RAI 16 (Reference 23), the NRC staff stated that in LAR Attachment T, Prior Approval Clarification Request 14 Unit No. 2, the licensee requested that the configuration for the Unit No. 1 primary and secondary power supply system for the early warning fire detection systems be accepted as "prior approval" because a similar power supply arrangement for the Unit No. 2 early warning fire detection system was approved by the NRC in an NRC SE as discussed in LAR Attachment K, as supplemented, Licensing Action 26. The NRC staff further stated that the power supply arrangement for the fire alarm initiating devices for Unit No. 1 does not appear to comply with NFPA 72, and taking credit for a Unit No. 2 prior approved licensing action to apply to Unit No. 1 is not within the guidance contained NEI 04-02 with respect to "Complies with Clarification." The NRC staff requested that the licensee provide

a compliance basis for the Unit No. 1 fire alarm power supplies that will meet the requirements of NFPA 805, Section 3.8.1, and follow the guidance contained in RG 1.205 and NEI 04-02. In its response to FPE RAI 16 (Reference 12), the licensee stated that an engineering evaluation of the existing Unit No. 1 fire detection/suppression primary and secondary power supply system arrangement concluded that it is equivalent to the requirements in NFPA 72D, 1973, "Proprietary Protective Signaling Systems" (Reference 104). The licensee further stated that it will revise its compliance statement from "Complies with Clarification" to "Complies with Use of EEEE" and that LAR Attachment T, Prior Approval Clarification Request 14 will be withdrawn. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated compliance with NFPA 805 by revising its statement of compliance and prior approval clarification, which also follows the guidance contained in RG 1.205 and NEI 04-02.

NFPA 805, Section 3.8.2 requires that fire detection be installed in accordance with NFPA 72, "National Fire Alarm Code," and its applicable appendices. In LAR Attachment A, the licensee provided justifications in numerous fire compartments for noncompliances through the use of evaluations of individual compartment conditions such as "no fire hazard." In FPE RAI 05(a)(vii) (Reference 23), the NRC staff informed the licensee that using evaluations to justify deviations from code requirements are not considered clarifications. In its response to FPE RAI05(a)(vii) (Reference 10), the licensee stated that the compliance basis for NFPA 805, Section 3.8.2 in LAR Attachment A, Table B-1 for the fire compartments 2-PA-3, 2-PT-1, 2-SG-1N, and 2-SG-1S will be changed to "Complies with EEEE." In a letter dated October 25, 2017 (Reference 21), the licensee indicated this change was made. The NRC staff concludes that the licensee's response to FPE RAI 05(a)(vii) is acceptable because the licensee used an EEEE to evaluate the acceptability of NFPA code deviations, which meets the requirements of NFPA 805 and follows the guidance contained in RG 1.205 and NEI 04-02.

NFPA 805, Section 3.9.4 requires that diesel driven fire pumps be protected by automatic sprinklers. The licensee stated that the NRC SER dated June 6, 1979 (Reference 99), approved the absence of suppression for the intake structure (in which the diesel-driven fire pump cubicle is located) based on control of transient combustibles, addition of smoke detection devices, and sufficient fire barriers. In LAR Attachment K, as supplemented, the licensee described the previous approval for the lack of a suppression system in the intake structure, and in LAR Attachment T, Prior Approval Clarification Request 15, the licensee stated that the intake structure compartment (Cubicle 3-IS-4) contains the diesel fire pump and that the clarification is required because the existing approved exemption for the intake structure did not specifically mention the fire pump area or the sections of the regulations applicable to fire pump sprinkler protection. In FPE RAI 05(a)(viii) (Reference 23), the NRC staff notified the licensee that this appears to be compliance based on previous NRC approval and not a clarification. In its response to FPE RAI 05(a)(viii) (Reference 10), the licensee stated the compliance statement should be "Complies by Prior Approval" and provided excerpts from its SER dated June 6, 1979. The NRC staff concludes that the licensee's response to FPE RAI 05(a)(viii) is acceptable because the licensee changed the compliance basis, which is in accordance with the requirements of NFPA 805, and follows the guidance contained in RG 1.205 and NEI 04-02.

NFPA 805, Section 3.10.1 requires that if an automatic total flooding or local application gaseous fire suppression system is required to meet the performance or deterministic requirements of Chapter 4, then the system must be designed and installed in accordance with the applicable NFPA codes. In LAR Attachment A, the licensee stated that for the CO_2 system installed in fire compartment 2-SB-3, the testing frequency for the CO_2 system is every 18 months, which is based on the performance of the system and the Electric Power Research

Institute (EPRI) Technical Report (TR)-1006756, "Fire Protection Equipment Surveillance Optimization and Maintenance Guide for Fire Protection System and Features" (Reference 105). In FPE RAI 05(b) (Reference 23), the NRC staff requested that the licensee review all other compliance strategies that use the category "Complies with Clarification," and ensure the strategy is suitable in accordance with the guidance of NEI 04-02, and identify any additional changes needed. In its response to FPE RAI 05(b) (Reference 12), the licensee stated that the compliance statement for fire compartment 2-SB-3 will be revised from "Complies with Clarification" to "Complies" or "Complies with EEEE." In FPE RAI 05.02(b) (Reference 26), the NRC staff stated that the use of a PB method (i.e., EPRI TR-1006756) to determine the acceptability of testing frequency does not meet the criteria for "Complies" or "Complies with the Use of EEEE" and will require prior NRC staff approval in accordance with 10 CFR 50.48(c)(2)(vii). In its response to FPE RAI 05.02(b) (Reference 14), the licensee stated that the initial compliance statement of "Complies with Clarification" will be changed to "Submit for NRC Approval." The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee submitted the PB engineering evaluation in a letter dated February 24, 2016 (Reference 15), for NRC staff approval as required by 10 CFR 50.48(c)(2)(vii). (See SE Sections 3.1.1.5 and 3.1.4.11 for the NRC staff's evaluation of the approval request.)

NFPA 805, Section 3.10.3 requires that ventilation system design take into account prevention from over-pressurization during agent injection, adequate sealing to prevent loss of agent, and confinement of radioactive contaminants. The licensee stated that the halon systems in fire compartments 1-CV-3, and the carbon dioxide systems in fire compartments 1-DG-1, 1-DG-2, and 2-SB-3 have been analyzed for over-pressurization conditions for the area and determined that no additional vents are required. In FPE RAI 05b (Reference 23), the NRC staff requested that the licensee review all "Compliance with Clarification" compliance statements and ensure that the strategy is suitable for the condition. In its response to FPE RAI 05b (Reference 12), the licensee stated that the compliance statement for NFPA 805, Section 3.10.3 will be revised to "Complies" and/or "Complies with Use of EEEE." In FPE RAI 05.02(a) (Reference 26), the NRC staff requested that the licensee identify if the NFPA 805, Chapter 3, compliance statement is either "Complies" or "Complies with Use of EEEE" and provide the compliance bases. In its response to FPE RAI 05.02(a) (Reference 14), the licensee stated that it "Complies" with the NFPA 805, Section 3.10.3 requirement and revised the compliance basis. The NRC staff concludes that the licensee's response to FPE RAI 05b and FPE RAI 05.02(a) are acceptable because the licensee demonstrated that its compliance statement and basis meet the requirements of NFPA 805.

NFPA 805, Section 3.10.5 requires that provisions for locally disarming automatic gaseous suppression systems be secured and under strict administrative control. The licensee stated that lockout switches are provided for the CO_2 systems in fire areas 1-CS-1, 1-CV-1, 1-CV-2, 1-DG-1, and 1-DG-2. In FPE RAI 05b (Reference 23), the NRC staff requested that the licensee review all "Compliance with Clarification" compliance statements and ensure that the strategy is suitable for the condition. In its response to FPE RAI 05b (Reference 12), the licensee stated that the compliance statement for NFPA 805, Section 3.10.5 will be revised to "Complies" and/or "Complies with Use of EEEE." In FPE RAI 05.02(a) (Reference 26), the NRC staff requested that the licensee identify if the NFPA 805, Chapter 3, compliance statement is either "Complies" or "Complies with Use of EEEE" and provide the compliance bases. In its response to FPE RAI 05.02(a) (Reference 14), the licensee stated that it "Complies" with the NFPA 805, Section 3.10.5 requirement and revised the compliance basis accordingly. The NRC staff concludes that the licensee's response to FPE RAI 05b and FPE RAI 05.02(a) are

acceptable because the licensee revised its compliance basis, which complies with the requirements of NFPA 805.

NFPA 805, Section 3.10.7 requires that automatic total flooding carbon dioxide systems be equipped with an audible pre-discharge alarm and discharge delay sufficient to permit egress of personnel and the CO_2 system be provided with an odorizer. The licensee stated that due to the subfloor configuration preventing human occupancy per NFPA 12A, the 20-second delay is acceptable. In FPE RAI 05b (Reference 23), the NRC staff requested that the licensee review all "Compliance with Clarification" compliance statements and ensure that the strategy is suitable for the condition. In its response to FPE RAI 05b (Reference 12), the licensee stated that the compliance statement for NFPA 805, Section 3.10.7 will be revised to "Complies" and/or "Complies with Use of EEEE." In FPE RAI 05.02(a) (Reference 26), the NRC staff requested that the licensee identify if the NFPA 805, Chapter 3, compliance statement is either "Complies" or "Complies with Use of EEEE" and provide the compliance bases. In its response to FPE RAI 05.02(a) (Reference 14), the licensee stated that it "Complies" with the NFPA 805, Section 3.10.7 requirement and revised the compliance basis accordingly. The NRC staff concludes that the licensee's response to FPE RAI 05b and FPE RAI 05.02(a) are acceptable because the licensee revised its compliance basis and demonstrated that it complies with the requirements of NFPA 805.

NFPA 805, Section 3.10.8 requires that positive mechanical means be provided to lockout total flooding CO_2 systems during work in the protected space. The licensee stated for fire compartment 1-CR-4 that the fire suppression for the subfloor of CR-4 is a total flooding halon 1301 system consisting of two subsystems, one for the process rack room subfloor north (12B), and one for the process rack room subfloor south (12A). In FPE RAI 05(a)(ix) (Reference 23), the NRC staff notified the licensee that its clarification statement in fire compartment 1-CR-4 involved a halon suppression system and that the NFPA 805 requirement was related to a total flooding CO_2 system. In its response to FPE RAI 05(a)(ix) (Reference 10), the licensee stated that the compliance statement in LAR Attachment A, Table B-1 for fire compartment 1-CR-4 will be revised to indicate "N/A." The NRC staff concludes that the licensee's response to FPE RAI 05(a)(ix) is acceptable, because the licensee revised its compliance basis and demonstrated that it complies with the requirements of NFPA 805.

3.1.1.3 Compliance Strategy - Complies with Use of EEEEs

In several NFPA 805, Chapter 3, requirements, the licensee demonstrated compliance with the fundamental FPP element through the use of EEEEs. The NRC staff reviewed the licensee's statement of continued validity for the EEEEs, identified implementation items and the statement on the quality and appropriateness of the evaluations, and concluded that the licensee's statements of compliance in these instances are acceptable.

As described in SE Section 3.1.1.2 above, the licensee revised its compliance strategy from "Complies with Clarification" to "Complies with use of EEEE" for several NFPA 805 elements in LAR Attachment A, Table B-1 in response to the NRC staff's RAIs. The acceptability of these changes in compliance strategy involving use of EEEEs is evaluated in Section 3.1.1.2.

The following NFPA 805 section identified in LAR Attachment A, Table B-1 as complying by this method required additional review by the NRC staff:

- 3.11.5

NFPA 805, Section 3.11.5 requires that electrical raceway fire barrier systems (ERFBS) required by NFPA 805, Chapter 4, be tested in accordance with and meet the acceptance criteria of 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" (Reference 106). In LAR Table 4-3, the licensee stated that an ERFBS is credited to meet risk criteria (R) and/or required for acceptability of an engineering evaluation (E) in certain fire areas. In LAR Attachment A, the licensee stated for those fire areas that credit ERFBS, it complied with NFPA 805, Section 3.11.5, with the use of an engineering evaluation. In FPE RAI 17 (Reference 23), the NRC staff requested that the licensee provide additional information to support the review of the ERFBS required by NFPA 805, Chapter 4.

In FPE RAI 17a (Reference 23), the NRC staff identified that in LAR Attachment A, Table B-1, the licensee stated that ERFBS credited in fire compartments 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. The NRC staff requested that if the ERFBS is not bounded by a qualified fire test, the licensee 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. In its response to FPE RAI 17a (Reference 11), the licensee stated that an EEEE compared its ERFBS configuration to actual fire endurance tests performed in accordance with GL 86-10, Supplement 1 and determined that its configuration is equivalent to a 1-hour fire rating. The licensee further stated that 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 NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated through an engineering evaluation that the ERFBS is equivalent to a 1-hour fire-rated tested configuration, and the use of an engineering evaluation is considered to be an acceptable method of evaluation in accordance with the requirements of NFPA 805, Section 2.2.7, and the guidance contained in RG 1.205 and NEI 04-02.

In FPE RAI 17b (Reference 23), the NRC staff stated that 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 rating for ductwork and a 2-hour fire resistance for the protection of the 1-½ hour fire dampers. The NRC staff requested that the licensee 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 NSPC, and justify the basis for qualification in the EEEE to the requirements of NFPA 805, Section 3.11.5. In its response to FPE RAI 17b (Reference 11), the licensee stated that fire protection on ductwork is not considered an ERFBS, as ERFBS is referring to fire protection of electrical raceways, and that fire protection on ductwork is considered fire barrier protection and is covered under NFPA 805, Section 3.11.2, "Fire Barrier." The licensee stated that 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 resistance rating for the ductwork and a 2-hour fire resistance rating for the specific fire dampers. The licensee stated that the compliance strategy for NFPA 805, Section 3.11.5 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, and the compliance strategy for NFPA 805, Section 3.11.2 for fire compartment 2-CB-1 will be revised to include the results of the engineering evaluation regarding fire barriers for ductwork. In a letter dated February 24, 2016 (Reference 15), the licensee indicated this change was made. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated it performed an engineering evaluation that concluded that the application of the

3M Interam E-50 series materials will provide equivalent 1-hour and 2-hour ratings to meet the requirements of NFPA 805, Section 3.11.2, which is considered an acceptable method of evaluation in accordance with the requirements of NFPA 805, Section 2.2.7 and the guidance contained in RG 1.205 and NEI 04-02.

In FPE RAI 17c (Reference 23), the NRC staff identified that 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. The NRC staff requested that the licensee describe the method used to evaluate the ERFBS configuration and clarify how it meets the requirements of NFPA 805, Section 3.11.5. In its response to FPE RAI 17c (Reference 11), the licensee stated that the ERFBS installed on conduits at Beaver Valley, Unit No. 2, originally consisted of Thermo-Lag 330-1 pre-shaped conduit sections having 0.5 inch nominal thickness with buttered joint construction and that fire endurance tests for the installed configurations were conducted in accordance with GL 86-10, Supplement 1. The licensee further stated that the Thermo-Lag ERFBS at Beaver Valley, Unit No. 2, were modified, consistent with the industry test program results, in order to achieve a 1-hour fire rating. The licensee stated that the modifications included the addition of 3/8 inch thick preformed conduit sections for conduits 1½ inch to 2 inches in diameter, and the addition of stress skin with Thermo-Lag trowel grade materials for conduits 3 inches to 6 inches in diameter. The licensee further stated that an engineering evaluation performed an analysis of each Section of protected conduit in comparison with the fire endurance test results and determined that the ERFBS meets the acceptance criteria of Section 3.11.5. The NRC staff concludes that the licensee's response is acceptable because the licensee stated that the ERFBS installed at Beaver Valley, Unit No. 2, meets the acceptance criteria of NFPA 805, Section 3.11.5.

In FPE RAI 17d (Reference 23), the NRC staff stated that 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 SSD cables are adequately protected in place by a fire wrap material, and that this deviation was accepted in the Unit No. 2 SER dated October 1985 (Reference 36). The NRC staff requested that the licensee provide an excerpt from the Unit No. 2 SER as it relates to the fire wrap material and configuration credited to meet NSPC to support "Complies by Previous NRC approval." In its response to FPE RAI 17d (Reference 11), the licensee stated that the ERFBS uses several configurations in fire compartment 2-PA-4, and that some configurations "Comply" by meeting an actual fire endurance test and some "Comply with the use of EEEE" for specific configurations that determined that the ERFBS in 2-PA-4 is equivalent to a 1-hour fire rating and stated the LAR would be revised to delete the "Complies by Previous NRC approval" statement. In a letter dated October 25, 2017 (Reference 21), the licensee indicated this change was made. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee clarified the compliance basis for ERFBS installed in fire compartment 2-PA-4 and revised the LAR accordingly to remove the "Complies by Previous NRC Approval," which meets the requirements of NFPA 805. Based on its review of the licensee's response, the NRC staff determined that the excerpt from the Unit No. 2 SER requested in the RAI is not required.

3.1.1.4 Compliance Strategy - Complies by Previous NRC Approval

Certain NFPA 805, Chapter 3, requirements were supplanted by an alternative that was previously approved by the NRC. Beaver Valley, Unit No. 1 (DPR-66), and Beaver Valley, Unit

No. 2 (NPF-73), were licensed to operate on July 2, 1976, and August 14, 1987, respectively. The approval was documented in the following:

Beaver Valley, Unit No. 1:

(1) The original Appendix A to BTP APCSB 9.5-1 SER dated June 6, 1979 (DPR-66) FPP SER (Reference 99)

(2) NRC SER dated January 5, 1983 (Reference 107), approving process instrument room alternate shutdown capability.

(3) NRC SER dated March 14, 1983 (Reference 108), approving lack of 20-foot separation in containment and cable tunnel.

(4) NRC SER dated August 30, 1984 (Reference 109), approving lack of 3-hour barriers in switchgear rooms, process instrumentation room, and cable spread room.

(5) NRC SER dated December 4, 1986 (Reference 110), approving fire doors not 3-hour rated.

Beaver Valley, Unit No. 2:

(1) NUREG 1057, Supplement No. 3, dated November 1986 (Reference 39), approving lack of fire dampers, lack of separation for redundant trains, and a deviation for hydrant spacing.

(2) NUREG 1057, Supplement No. 5, dated May 1987 (Reference 41), approving conduit penetration seal designs, deviation for fire damper assemblies, fire door assemblies, lack of separation for redundant trains, deviation for hydrant spacing, lack of compliance with IEEE-383-1974 flame test, and an unrated containment hatch.

(3) NUREG 1057, Supplement No. 6, dated August 1987 (Reference 42), approving deviations from requirements for seismically designed hydrogen piping, the fire detection power supply, the IEEE-383-1974 flame test, and standpipe and hose station Class III versus Class II design.

In each instance, the licensee evaluated the basis for the original NRC approval and determined that in all cases, the bases remain valid.

In FPE RAI 02 (Reference 23), the NRC staff stated that in LAR Attachment A, Table B-1, the licensee identified several attributes as "Complies by Previous Approval" but did not provide in the compliance basis appropriate excerpts from the licensee's submittal or the NRC SE approval documentation, in accordance with the guidance contained in RG 1.205, Regulatory Position C.1.2.m and discussed in NEI 04-02. The NRC staff requested that the licensee provide evidence of previous NRC approval of the compliance conditions identified for the following attributes and any other attributes in the LAR that cite previous NRC approval for which this information has not been provided:

- 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

In its response to FPE RAI 02 (Reference 11), the licensee stated that it reviewed the LAR Attachment A, Table B-1 attributes that had a compliance strategy of "Complies by Previous Approval" and either provided the appropriate licensing citation (excerpts from NRC documents) or changed its compliance strategy. The licensee provided evidence of previous NRC approval for the following attributes, including those identified above:

- NFPA 805, Section 3.5.15, requires that hydrants be installed approximately every 250 feet apart on the yard main system. In LAR Attachment A, the licensee stated that fire hydrant 16, located at the southwest corner of the Turbine Building was relocated, thus providing a 370-foot spacing. The licensee provided a citation from Section 9.5.1.5 of NUREG-1057, Supplement 5 (Reference 41), which demonstrated previous approval for the 370-foot spacing between hydrants 15 and 16.

- NFPA 805, Section 3.6.1, requires that for all power block buildings, Class III standpipe and hose systems be installed in accordance with NFPA 14 (Reference 102). In LAR Attachment A, Table B-1, the licensee stated that the standpipe and hose systems are equivalent to NFPA 14 Class II systems, which have a 1½-inch hose connections in lieu of the required Class III system, which has both 1½-inch and 2½-inch hose connections. The licensee provided citations from NUREG-1057, Supplement 6 (Reference 42), which demonstrated previous approval for the standpipe and hose system designs.

- NFPA 805, Section 3.8.1, requires alarm initiating devices to be installed in accordance with NFPA 72 (Reference 69). In LAR Attachment A, the licensee stated that the Unit No. 2 fire detection power supply system was previously approved in the Unit No. 2 SER to be compliant with NFPA 72D (Reference 104) for a Class A system with detectors installed in accordance with NFPA 72E (Reference 111). The licensee provided citations from Section 9.5.15 of NUREG-1057, Supplement 6, which demonstrated previous approval for a reliable power supply for the Unit No. 2 fire detection system, which consisted of (1) the primary supply from the normal offsite power supply system, (2) the secondary supply from a non-safety diesel generator with an automatic switchover capability that supplies the 120 VAC uninterruptible power supply system required for the detection system, and the 125 VDC panels for the fire detection and suppression systems, and (3) a battery backup system with a

2-hour rated capability is provided as a backup to the 125 VDC systems. In addition, a battery backup system with a 30-minute capability is provided as a backup to the 120 VAC systems to provide electrical power continuity for the 10 seconds required to start the diesel and achieve rated voltage and frequency.

- NFPA 805, Section 3.8.2, requires that if automatic fire detection is required to meet the performance or deterministic requirements of Chapter 4, then these devices be installed in accordance with NFPA 72 and its applicable appendices (Reference 69). In LAR Attachment A, the licensee stated that the automatic fire detection in fire compartment 1-RC-1 (Unit No. 1 containment) is uniquely located above the protected hazards and that the limited area detection in the cable penetration area and residual heat removal (RHR) pump area were previously approved in the SER dated March 14, 1983 (Reference 108). Similarly, the licensee stated that 2-RC-1 (Unit No. 2 containment) does not have full area detection and that although the detectors are not located on the ceiling of the reactor containment, they are located to detect a fire in these two specific areas (cable penetration area and RHR pump area), the detectors are uniquely located above the protected hazards, and limited area detection for 2-RC-1 was previously approved in NUREG-1057, Supplement 5. The licensee provided citations from NRC SERs dated March 14, 1983, and August 30, 1984 (Reference 109), where the NRC staff accepted the smoke detection coverage for the Unit No. 1 containment area, and citations from NUREG-1057, Supplement 5 for the Unit No. 2 containment area.

- NFPA 805, Section 3.9.1, requires that if an automatic or manual water-based fire suppression system is required to meet the performance or deterministic requirements of Chapter 4, then the system be installed in accordance with the appropriate NFPA standards, including NFPA 13, NFPA 15, NFPA 750, or NFPA 16. In LAR Attachment A, Table B-1, the licensee stated the following:

    - Fire compartment 1-RC-1: The three fixed water spray systems are the only required systems in containment, as previously approved by the NRC and documented in NRC SER dated August 30, 1984.

    - Fire compartment 2-RC-1: The NRC staff concluded in its SER that manually operated deluge spray systems provide for the protection of the cable penetration area, RHR pumps are acceptable, and these four fixed water spray systems are the only required systems in containment, as previously approved by the NRC and documented in NUREG-1057.

- NFPA 805, Section 3.10.1, requires that if an automatic total flooding or local application gaseous fire suppression system is required to meet the performance or deterministic requirements of Chapter 4, then the system be installed in accordance with the appropriate NFPA standards, including NFPA 12, NFPA 12A, or NFPA 2001.

    - In LAR Attachment A, the licensee stated that for fire compartments 1-DG-1 and 1-DG-2, the total flooding CO_2 system was specified to conform to the requirements of NFPA 12-1973. The licensee stated that the initial actuation is by temperature or manual actuation, and that the second actuation can be performed manually. The licensee further stated

that critical attributes of the consensus code were evaluated to ensure functionality and reliability and provided a list of critical attributes. The licensee further stated that the explicit prior approval for the listed attributes is for usage of the fixed CO_2 fire extinguishing system in the Unit No. 1 diesel generator rooms and for the doorway between the Unit No. 1 diesel generator rooms. The licensee provided citations from the SER dated June 6, 1979, which stated that the fixed CO_2 fire extinguishing system is adequate as the primary automatic suppression system.

- In LAR Attachment A, the licensee stated that contrary to the requirements of NFPA 12-1973, in fire compartments 2-CB-1, 2-CV-1, 2-CV-2, 2-CV-3, 2-CV-6, 2-DG-1, and 2-SB-3, there are unsupervised fire doors. The licensee stated that it complies by a previous approval in Licensing Action 06 and provided the citations from NUREG-1057, Supplement 5 for security modifications on fire doors, which consisted of the addition of electric contact switches with a single conduit penetrating the frame.

- NFPA 805, Section 3.11.1, requires that each major building within the power block be separated from the others by barriers having a designated fire resistance rating of 3 hours or by open space of at least 50 feet or space that meets the requirements of NFPA 80A (Reference 112). NFPA 805, Section 3.11.4 requires that through penetration fire stops for penetrations such as pipes, conduits, bus ducts, cables, wires, and pneumatic tubes and ducts, and similar building service equipment that pass through fire barriers be protected as described in the attribute. In LAR Attachment A, the licensee stated that for attribute 3.11.1 for Unit No. 2, the method for sealing penetrations as identified in Amendment 14 of the Final Safety Analysis Report (FSAR) is an acceptable deviation from (NUREG-0800) BTP CMEB 9.5-1 (Reference 93) when installation difficulties do not allow for sealing at the barrier, and was previously approved by the NRC staff in Supplement 5 of the site SER. The licensee further stated that for attribute 3.11.4 for Unit No. 2, eighteen (18) penetration conduit seals could not be sealed to meet the criteria of NUREG-0800 at the plane of the fire barrier and described various configurations that were accepted by the NRC staff in the Unit No. 2 SER. The licensee provided citations from NUREG-1057, Supplement 5 where the NRC staff-approved acceptable methods for sealing penetrations when installation difficulties do not allow sealing at the barrier.

- NFPA 805, Section 3.11.2, requires that fire barriers required by Chapter 4 include a specific fire resistance rating and that fire barriers be designed and installed to meet the specific fire resistance rating using assemblies qualified by fire tests that are in accordance with NFPA 251, "Standard Methods of Tests of Fire Endurance of Building Construction Materials" (Reference 113) or ASTM E-119, "Standard Test Methods for Fire Tests of Building Construction and Materials" (Reference 114). NFPA 805, Section 3.11.3 requires that penetrations in fire barriers be provided with listed fire-rated door assemblies or listed rated fire dampers having a fire resistance rating consistent with the designated fire resistance rating of the barrier as determined by the performance requirements established by Chapter 4 and that passive fire protection devices such as doors and dampers conform with the following NFPA standards, as applicable:

NFPA 80, "Standard for Fire Doors and Fire Windows"; NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating System" (Reference 115); and NFPA 101, "Life Safety Code" (Reference 66).

- In LAR Attachment A, the licensee stated that fire doors that are not 3-hour fire-rated are installed in fire compartments 1-CR-2, 1-CR-4, 1-CS-1, 1-CV-1, 1-CV-2, 1-ES-1, 1-ES-2, 1-FB-1, 1-MG-1, 1-MS-1, 1-NS-1, 1-PA-1A, 1-PA-1C, 1-PA-1E, 1-PA-1G, 1-PA-GA, 1-PA-GB, 1-PA-GC, 1-PT-1, 1-SGPD-1, 1-TB-1, 3-CR-1, 3-IS-1, 3-IS-2, 3-IS-3, 3-IS-4, and 3-IS-6. The licensee stated that the explicit prior approval is from LAR Attachment K, as supplemented, Licensing Action 11.18 and provided a citation from the NRC SER dated December 4, 1986 (Reference 110), which described previous approval of fire doors in 24 fire compartments that are not UL listed for 3 hours.

- In LAR Attachment A, the licensee stated that in fire compartments 2-ASP, 2-CB-1, 2-CB-6, 2-CV-1, 2-CV-2, 2-CV-3, 2-CV-5, 2-CV-6, 2-FB-1, 2-PA-4, 2-PA-5, and 2-SG-1S, there are HVAC duct penetrations in the barrier between the affected fire compartment and adjacent fire compartments that are protected by two 1½-hour fire-rated dampers in series, and a deviation for using two 1½-hour fire dampers in lieu of one 3-hour fire damper is documented and accepted in NRC SERs 3 and 5. In LAR Attachment A, the licensee stated that in fire compartments 2-CV-1, 2-CV-3, and 2-PA-5, ventilation ductwork is wrapped with 1-hour fire wrap material to extend the fire barriers in lieu of fire dampers at the barriers. The licensee stated that the prior NRC staff approval of these configurations is documented in NUREG-1057, Supplement 5.

- In LAR Attachment A, the licensee stated that it complies with NFPA 805, Section 3.11.3, in fire compartments 2-DG-1 and 2-DG-2. The licensee stated that for NFPA 805, attribute 3.11.3 in fire compartments 2-DG-1 and 2-DG-2, it changed its compliance strategy to "Compliance by Previous Approval" and that explicit approval from Licensing Action 06 for modification of fire door assemblies was applicable.

- In LAR Attachment A, the licensee stated that in fire compartments 2-PT-1, 2-SB-1, 2-SB-2, 2-SB-4, 2-SB-5, 2-SB-6, 2-SB-7, 2-SB-8, 2-SB-9, 2-SG-1S, 2-WH-1, and 3-CR-1 there are HVAC duct penetrations in the barrier between the affected fire area and adjacent fire compartments that are protected by two 1½-hour fire-rated dampers in series, and a deviation for using two 1½-hour fire dampers in lieu of one 3-hour fire damper, and in fire compartments 2-PA-3 and 2-SB-3, ventilation ductwork is wrapped with 1-hour fire wrap material to extend the fire barriers in lieu of fire dampers at the barriers. The licensee stated that the prior NRC staff approval of these configurations is documented in NUREG-1057, Supplement 5.

- In LAR Attachment A, the licensee stated that in fire compartments 2-PA-3, 2-PA-3A, 2-PA-3B, and 2-PA-3C, the fire barriers are less than 3-hour fire-rated, there are no fire doors and the HVAC duct penetrations in the barrier between the affected fire area and adjacent fire

compartments are protected by two 1-½ hour fire-rated dampers in series. The licensee stated that prior NRC staff approval of these configurations is documented in NUREG-1057, Supplement No. 3.

- In LAR Attachment A, the licensee stated that in fire compartment 2-RC-1, the containment access hatch does not contain a UL label or certification of fire testing. The licensee stated that the prior NRC staff approval of this configuration is documented in NUREG-1057, Supplement 5.

Also in its response to FPE RAI 02, the licensee revised its compliance strategy from "Compliance by Previous Approval" to "Complies by EEEE" for the following NFPA 805 sections:

- 3.9.1 for fire compartments2-SG-1N and 2-SG-1S

  In LAR Attachment A, the licensee stated for NFPA 805 attribute 3.9.1 in fire compartments 2-SG-1N and 2-SG-1S that the primary power supply for the direct current (DC) panels comes from the normal offsite power supply with the secondary supply being a non-safety diesel generator and that the power supply arrangement was reviewed and found acceptable by the NRC staff in an SER dated October 1985. (See SE Section 3.1.3.3 for additional discussion.)

- 3.10.1 for fire compartment 1-CV-3

  In LAR Attachment A, the licensee stated that for NFPA 805, Section 3.10.1, in fire compartment 1-CV-3, it has prior NRC approval in a letter dated March 14, 1983, to include a total flooding Halon 1301 suppression system in the cable tunnel area of fire compartment 1CV-3, which is installed in accordance with NFPA 12A-1980, and that the critical sections of the consensus code were evaluated to ensure functionality and reliability. The licensee stated that the compliance basis for the fire compartments and NFPA 805 sections mentioned above is revised to "Complies by EEEE." (See SE Sections 3.1.1 and 3.1.3.3 for additional discussion regarding FPE RAI 01.)

- 3.11.2 and 3.11.3 for fire compartments 1-CR-2, 1-CR-3, 1-CR-4, 1-CS-1, and 1-MG-1 and 3.11.2 for fire compartments 1-ES-1 and 1-ES-2

  The licensee stated that the explicit prior approval from LAR Attachment K, 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. The licensee stated that additional PB analysis in support of its response to SSD RAI 06 indicates that Licensing Action 11.17 will not be transitioned. The licensee further stated that the results of the PB analysis determined the barriers are acceptable for the fire severities of the associated adjacent fire compartments, and that the LAR Attachment T Prior Approval Clarification Request 6 will be withdrawn. (See SE Section 3.5.1.3 for additional discussion regarding SSD RAI 06.)

- 3.11.3

  The licensee deleted the compliance strategy "Compliance by Previous Approval' for NFPA 805, Section 3.11.3, in fire compartments 1-CV-1, 1-CV-2, 1-MS-1, 1-NS-1, 1-PA-1E, 1-PA-1G, 1-TB-1, and 2-S-1 because the licensee evaluated acceptability of the fire barrier penetration (fire door) in a PB analysis. The licensee stated that where fire doors are not code compliant, such as a door in a fire barrier that separates a fire compartment from a stairwell or a door that has been modified from the tested configuration, a PB analysis of variance from deterministic requirement (VFDR) BV1-3120 and VFDR BV2-1633 resolves the fire door rating.

- 3.11.2

  The licensee corrected its compliance basis from "Compliance by Previous Approval" to "Request for NRC Approval" for NFPA 805, Section 3.11.2 in fire compartments 2-CB-5, 2-CV-1 2-SB-1, and 2-SB-2 and NFPA 805, Section 3.11.3 in fire compartments 2-ASP, 2-CB-1, 2-CB-4, 2-CB-5, 2-CB-6, 2-CP-1, 2-CV-1, 2-CV-2, 2-CV-3, 2-CV-4, 2-CV-5, 2-CV-6, 2-DG-1, 2-DG-2, 2-FB-1, 2-MS-1, 2-SB-1, 2-SB-2, 2-SB-6, 2-SB-9, 2-SB-10, 2-SG-1N, 2-WH-1, and 3-CR-1 based on its response to SSD RAI 13c. The licensee stated that the response to SSD RAI 13c will include a request for NRC approval of instances where there are fire dampers installed in series and where ducts have fire wraps installed to meet the required barrier rating. The approval request described in the licensee's response to SSD RAI 13c for this barrier configuration is discussed in detail in Section 3.5.1.3 of this SE.

The NRC staff concludes that the licensee's response to FPE RAI 02 is acceptable because it provided the appropriate citations to demonstrate "Compliance by Previous Approval" or it changed its compliance strategy to other compliance strategies that are acceptable in accordance with the guidance provided in RG 1.205 and NEI 04-02.

In each instance, the licensee evaluated the basis for the original NRC approval and determined that in all cases, the bases were still valid. The NRC staff reviewed the information provided by the licensee and concludes that previous NRC approval had been demonstrated using suitable documentation and the licensee's statement that the previous approval are still valid meets the guidance contained in RG 1.205, Revision 1. Based on its review of the licensee's justification for the continued validity of the previously approved alternatives to NFPA 805, Chapter 3, requirements, the NRC staff concludes that the licensee's statements of compliance in these instances are acceptable.

The licensee identified licensing actions that required clarification of NFPA 805, Chapter 3, Section 3.11.3, requirements. In LAR Attachment T, Prior Approval Clarification Requests 8, 9, and 10, the licensee requested that the basis for previously approved configurations described in LAR Attachment K, as supplemented, Licensing Actions 04 and 05, be applied to additional fire compartments and plant conditions that were not described in the original deviation. In SSD RAI 13c (Reference 23), the NRC staff stated that fire compartments that were not part of the scope of the original deviations are not considered "Prior Approval Clarification" and requested that where prior NRC approval is not provided or adequately documented, the licensee may choose to comply with the deterministic requirement of NFPA 805, Chapter 3, by using an engineering evaluation, or including a PB method in accordance with 10 CFR 50.48(c)(2)(vii). In

its response to SSD RAI 13c (Reference 12), the licensee stated that further reviews determined that the correct method for obtaining NRC approval was the development of LAR Attachment L, Approval Request 5, and that LAR Attachment T, Prior Approval Clarification Requests 8, 9, and 10 will be withdrawn. The licensee further stated that Prior Approval Clarification Request 7 was judged to be similar to these requests and will be withdrawn as well. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee submitted the PB engineering evaluation in a letter dated February 24, 2016 (Reference 15), for NRC staff approval as required by 10 CFR 50.48(c)(2)(vii). (See SE Sections 3.1.1.5 and 3.1.4.5 for the NRC staff's evaluation of the approval requests.)

3.1.1.5 Compliance Strategy – Submit for NRC Approval

The licensee requested approval for the use of PB methods to demonstrate compliance with fundamental FPP elements. In accordance with 10 CFR 50.48(c)(2)(vii), the licensee requested specific approvals be included in the license amendment approving the transition to NFPA 805. The NFPA 805 sections identified in LAR Attachment A, Table B-1 as complying by this method are as follows:

- Section 3.3.5.1, which concerns the installation of telephone, voice paging system, lighting, audio, and computer network type cables serving the corresponding areas that are routed above suspended ceilings. The licensee requested NRC approval for the use of a PB method to justify the installation of certain cables above suspended ceilings, thereby meeting the requirements of NFPA 805. (See SE Section 3.1.4.1.)

- Sections 3.3.12(1) and 3.3.12(4), which concern the oil collection system for each reactor coolant pump (RCP) being capable of collecting lubricating oil from all potential pressurized and non-pressurized leakage sites in each RCP oil system. The licensee requested NRC approval for the use of a PB method to justify the RCP lube oil misting that is not captured by the RCP lube oil collection system, thereby meeting the requirements of NFPA 805. (See SE Section 3.1.4.2.)

- Section 3.5.11, which concerns the means provided to isolate portions of the yard fire main loop for maintenance or repair without simultaneously shutting off the supply to both fixed fire suppression systems and fire hose stations provided for manual backup. The licensee requested NRC approval for the use of a PB method for certain locations in the auxiliary building and safeguards area, thereby meeting the requirements of NFPA 805. (See SE Section 3.1.4.3.)

- Section 3.5.14, which concerns the requirement for all fire protection water supply and fire suppression system control valves to be under a periodic inspection program and to be supervised. The licensee requested NRC approval for the use of a PB method for certain fire hydrant curb box valves, thereby meeting the requirements of NFPA 805. (See SE Section 3.1.4.4.)

- Section 3.11.3, which concerns the requirement that the listed fire resistance rating for fire dampers is consistent with the designated fire resistance rating of the barrier as determined by the performance requirements established by Chapter 4. The licensee requested NRC approval for the use of a PB method to

justify the use of two 1.5-hour rated fire dampers in series instead of a 3-hour fire damper, thereby meeting the requirements of NFPA 805. (See SE Section 3.1.4.5.)

- Section 3.3.5.3, which concerns the use of electric cable construction with a flame propagation test acceptable to the NRC staff. The licensee requested NRC approval for the use of a PB method to justify the use of cables that have limited flame propagation test results, thereby meeting the requirements of NFPA 805. (See SE Section 3.1.4.6.)

- Section 3.3.7.2, which concerns the location of outdoor high-pressure flammable gas storage containers located such that the long axis is not pointed at the buildings. The licensee requested NRC approval for the use of a PB method to justify the installation of hydrogen storage tanks in the outdoor yard, thereby meeting the requirements of NFPA 805. (See SE Section 3.1.4.7.)

- Section 3.5.5, which concerns the requirement that each fire pump and its driver and controls be separated from the remaining fire pumps and from the rest of the plant by rated fire barriers. The licensee requested NRC approval of a PB method to justify the installation of the fire pump control cables, thereby meeting the requirements of NFPA 805. (See SE Section 3.1.4.8.)

- Section 3.7, which concerns the requirement to provide fire extinguishers of the appropriate number, size, and type in accordance with NFPA 10, "Standard for Portable Fire Extinguishers." The licensee requested NRC approval of a PB method to justify the use of certain types of portable extinguishers, thereby meeting the requirements of NFPA 805. (See SE Section 3.1.4.9.)

- Section 3.6.2, which concerns the requirement that an adequate water flow rate and nozzle pressure for all hose stations be provided, which includes the provisions of hose station pressure reducers where necessary for the safety of plant industrial fire brigade members and offsite fire department personnel. The licensee requested NRC approval of a PB method to justify not having pressure reducing devices installed on hose station connections, thereby meeting the requirements of NFPA 805. (See SE Section 3.1.4.10.)

- Section 3.2.3(1), which requires establishing procedures for implementation of the fire protection program, including inspection, testing, and maintenance of fire protection systems and features credited by the fire protection program. The licensee requested NRC approval for the use of a PB method to establish inspection, testing, and maintenance frequencies for fire protection systems and features, thereby meeting the requirements of NFPA 805. (See SE Section 3.1.4.11.)

As discussed in SE Section 3.1.4 below, the NRC staff concludes that the use of PB methods to demonstrate compliance with these fundamental FPP elements is acceptable because the licensee demonstrated that the PB methods meet the requirements of 10 CFR 50.48(c)(2)(vii).

3.1.1.6 Compliance Strategy – Will Comply with the Use of Commitment

For several NFPA 805, Chapter 3, requirements, the licensee stated that compliance with the fundamental FPP element will be achieved through the use of commitments. The NRC staff concludes that the licensee's statement of compliance is acceptable because the included actions for achieving compliance will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

In LAR Attachment S, Table S-3, "Implementation Items," as supplemented, the licensee identifies each implementation item as applicable to either Unit Nos. 1 or 2. In FPE RAI 13 (Reference 23), the NRC staff requested that the licensee clarify the relationship between the implementation items and the individual units because it appears that many of these items should apply to both units, such as those that change plant-wide procedures, but applicability to only one unit is identified. In its response to FPE RAI 13 (Reference 11), the licensee clarified the applicability of the LAR Attachment S, Table S-3 implementation items to each unit. The NRC staff concludes that the licensee's response to FPE RAI 13 is acceptable because the licensee clarified whether the implementation items in LAR Attachment S, as supplemented, apply to Unit No. 1, Unit No. 2, or both.

The following NFPA 805, Chapter 3, sections identified in LAR Attachment A, Table B-1, as complying by this method, and the applicable modifications and/or implementation items in LAR Attachment S, Tables S-2, and S-3, as supplemented, required additional review by the NRC staff:

- 3.2.2.4
- 3.2.3(2)
- 3.2.3(3)
- 3.3.1.2(1)
- 3.3.1.2(2)
- 3.3.1.2(3)
- 3.3.1.2(4)
- 3.3.1.2(5)
- 3.3.1.2(6)
- 3.3.1.3.1
- 3.3.1.3.4
- 3.3.3
- 3.3.4
- 3.3.5.1
- 3.3.7.1
- 3.3.8
- 3.3.10
- 3.3.11
- 3.4.1(a)
- 3.4.1(e)
- 3.4.2
- 3.4.2.1
- 3.4.3(a)
- 3.5.3
- 3.5.10
- 3.6.1
- 3.6.2
- 3.6.3
- 3.7
- 3.8.2
- 3.9.1
- 3.10.1
- 3.10.3
- 3.10.8
- 3.11.2
- 3.11.3
- 3.11.4

In LAR Attachment A, the licensee identified an implementation item to revise administrative procedures to address the following NFPA 805 requirements:

- NFPA 805, Section 3.3.1.2(1), which requires that wood used within the power block be listed pressure-impregnated or coated with a listed fire-retardant application.

- NFPA 805, Section 3.3.1.2(3), which requires that waste, debris, scrap, packing materials, or other combustibles be removed from an area immediately following the completion of work or at the end of the shift, whichever comes first.

- NFPA 805, Section 3.3.1.2(4), which requires that combustible storage or staging areas be designated and limits be established on the types and quantities of stored materials.

- NFPA 805, Section 3.3.1.3.4, which requires that plant administrative procedures control the use of portable electric heaters in the plant and that portable fuel fired heaters not be permitted in plant areas containing equipment important to

nuclear safety or where there is a potential for radiological releases resulting from a fire.

- NFPA 805, Section 3.3.3, which requires that interior wall or ceiling finish classification be in accordance with NFPA 101, "Life Safety Code" (Reference 66), requirements for Class A materials, and interior floor finishes be in accordance with the requirements for Class I interior floor finishes.

- NFPA 805, Section 3.3.4, which requires that thermal insulation materials, radiation shielding materials, ventilation duct materials, and soundproofing materials be noncombustible or limited combustible.

- NFPA 805, Section 3.3.10, which requires that combustible liquids, including high flashpoint lubricating oils, be kept from coming in contact with hot pipes and surfaces, including insulated pipes and surfaces, and administrative controls require the prompt cleanup of oil on insulation.

- NFPA 805, Section 3.3.11, which requires that adequate clearance, free of combustible material, be maintained around energized electrical equipment.

In FPE RAI 07 (Reference 23), the NRC notified the licensee that the actions identified in the NFPA 805 sections above to update a plant procedure, procurement specification, or other document "...to be revised to more closely reflect the subject NFPA 805 requirements..." were unclear with regard to meeting the NFPA 805 requirements. The NRC staff requested that for each applicable use of the phrase, "more closely reflect the subject NFPA 805 requirement," that the licensee describe whether the revised procedure(s) and/or specification(s) will meet the applicable NFPA 805 requirement. In its response to FPE RAI 07 (Reference 10), the licensee stated the actions will be revised to state "Administrative procedures to be revised to include the subject NFPA 805 requirement." The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that revisions to administrative procedures will incorporate the provisions of NFPA 805. The licensee included Implementation Items BV1-2360, BV1-2902 through BV1-2909, BV1-2975, BV1-3041, BV1-3060, BV1-3065, BV1-3123, BV2-0362, BV2-1365, and BV2-1576, to updated procedures for NFPA 805 in LAR Attachment S, Table S-3, as supplemented, to incorporate the provisions of NFPA 805 in the FPP, which would be required by the proposed license condition.

In LAR Attachment A, the licensee identifies Open Item BV1-2908 as an action to achieve compliance with the following NFPA 805 requirements:

- Section 3.2.2.4, which requires that a policy document identify the appropriate AHJ.

- Section 3.2.3(2), which requires that the compensatory actions be implemented when fire protection systems and other systems credited by the FPP and NFPA 805 cannot perform their intended function and limits on impairment duration.

- Section 3.3.1.2(5), which requires that controls on use and storage of flammable and combustible liquids be in accordance with NFPA 30, "Flammable and Combustible Liquids Code" (Reference 67), or other applicable NFPA standards.

- Section 3.3.3, which requires that interior wall or ceiling finish classification be in accordance with NFPA 101, "Life Safety Code" (Reference 66), requirements for Class A materials and interior floor finishes be in accordance with the requirements for Class I interior floor finishes.

- Section 3.3.4, which requires that thermal insulation materials, radiation shielding materials, ventilation duct materials, and soundproofing materials be noncombustible or limited combustible.

- Section 3.3.7.1, which requires that storage of flammable gas be located outdoors or in separate detached buildings so that a fire or explosion will not adversely impact systems, equipment, or components important to nuclear safety.

- Section 3.3.8, which requires that bulk storage of flammable and combustible liquids not be permitted inside structures containing systems, equipment, or components important to nuclear safety and, at a minimum, storage and use comply with NFPA 30, "Flammable and Combustible Liquids Code" (Reference 67).

In FPE RAI 08 (Reference 23), the NRC staff identified that in LAR Attachment S, Table S-3, as supplemented, the description of Implementation Item BV1-2908 is a procedure update to enhance controls of flammable gas, which is associated with NFPA 805, Section 3.3.7.1. The NRC staff requested the licensee provide an explanation of the reason for not including the other NFPA 805 sections that cite BV1-2908 in the scope of the implementation item description in LAR Attachment S, Table S-3, as supplemented, or revise the scope of the implementation item. In its response to FPE RAI 08 (Reference 10), the licensee stated that the scope of Implementation Item BV1-2908 in LAR Attachment S, as supplemented, Table S-3 will be revised to include statements that require updating from NFPA 805, Sections 3.2.2.4, 3.2.3(2), 3.3.1.2(5), 3.3.3, 3.3.4, and 3.3.8. In a letter dated April 21, 2017, the licensee submitted its revised Attachment S. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee revised its action, which will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.2.3(3), requires establishing procedures to review the FPP and related performance and trends. In LAR Attachment A, the licensee identified an action to include a process in the monitoring program required by NFPA 805 that reviews the FPP performance and identifies trends in performance based on specific performance goals established to measure the effectiveness of the FPP. This action is included in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2989. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.3.1.2(2), requires that plastic sheeting materials used in the power block be fire-retardant types that have passed NFPA 701, "Standard Methods of Fire Tests for Flame

Propagation of Textiles and Films" (Reference 116), large-scale tests, or equivalent. In LAR Attachment A, the licensee identified an action to revise administrative procedures to meet the NFPA 805 requirements. This action is included in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2907. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.3.1.2(5), requires that controls on use and storage of flammable and combustible liquids be in accordance with NFPA 30, "Flammable and Combustible Liquids Code" (Reference 67), or other applicable NFPA standards. In LAR Attachment A, the licensee identified actions to update administrative procedures based on an NFPA 30 code compliance review. These actions are included in LAR Attachment S, Table S-3, as supplemented, Implementation Items BV1-2907, BV1-2908, BV1-2909, and BV1-3018. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.3.1.2(6), requires that controls on use and storage of flammable gases be in accordance with applicable NFPA standards. In LAR Attachment A, the licensee identified actions to incorporate the provisions of NFPA 55, "Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks" (Reference 101), as necessary to achieve compliance. These actions are included in LAR Attachment S, Table S-2, as supplemented, Modification BV2-1571, and in LAR Attachment S, Table S-3, as supplemented, Implementation Items BV1-2907, BV1-2909, and BV2-1570. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.3.1.3.1, requires that a hot work safety procedure be developed, implemented, and periodically updated as necessary in accordance with NFPA 51B, "Standard for Fire Prevention During Welding, Cutting, and Other Hot Work" (Reference 68), and NFPA 241, "Standard for Safeguarding Construction, Alteration, and Demolition Operations" (Reference 71). In LAR Attachment A, the licensee identified an action to revise procedures to state that the hot work safety procedure is required to be in accordance with NFPA 51B and NFPA 241 as required by NFPA 805, Section 3.3.1.3.1. This action is included in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2905. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP by the proposed license condition.

NFPA 805, Section 3.3.5.1, requires that wiring above suspended ceilings be kept to a minimum. Where installed, electrical wiring is to be listed for plenum use, routed in armored cable, routed in metallic conduit, or routed in cable trays with solid metal top and bottom covers. In LAR Attachment A, the licensee identified an action to revise plant procedures to address the NFPA 805 requirement for future installation and referenced LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2823. In LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2823, states that it is applicable to Unit No. 1. In FPE RAI 13 (Reference 23), the NRC staff requested that the licensee clarify the relationship between the implementation items in LAR Attachment S, Table S-3, as supplemented, and the individual units. In its response to FPE RAI 13 (Reference 11), the licensee stated that Implementation Item BV1-2823 applies to Unit Nos. 1 and 2. The NRC staff concludes that the

licensee's response to the RAI is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.3.7.1, requires that storage of flammable gas be located outdoors or in separate detached buildings, so that a fire or explosion will not adversely impact systems, equipment, or components important to nuclear safety. In LAR Attachment A, the licensee identified actions to revise procedures to meet the NFPA 805 requirements. The licensee included these actions in LAR Attachment S, Table S-3, as supplemented, Implementation Items BV1-2907 and BV1-2908. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.3.8, requires that bulk storage of flammable and combustible liquids not be permitted inside structures containing systems, equipment, or components important to nuclear safety and, at a minimum, storage and use comply with NFPA 30, "Flammable and Combustible Liquids Code" (Reference 67). In LAR Attachment A, the licensee identified actions to revise procedures to address the controls required by NFPA 30. The licensee included these actions in LAR Attachment S, Table S-3, as supplemented, Implementation Items BV1-2907, BV1-2908, and BV1-2909. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.4.1(a), requires that a fully staffed, trained, and equipped firefighting force be available at all times to control and extinguish all fires on site, and that this force have a minimum complement of five persons on duty. In LAR Attachment A, the licensee identified actions to revise procedures and perform a code review for NFPA 1081, "Standard for Industrial Fire Brigade Member Professional Qualifications" (Reference 117). The licensee included these actions in LAR Attachment S, Table S-3, as supplemented, Implementation Items BV1-3019 and BV1-3020. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.4.1(e), requires that each industrial fire brigade member pass an annual physical examination to determine that he or she can perform the strenuous activity required during manual firefighting operations. In LAR Attachment A, the licensee identified an action to revise administrative procedures to include wording from NFPA 805. The licensee included this action in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2903. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.4.2, requires that current and detailed pre-fire plans be available to the industrial fire brigade for all areas in which a fire could jeopardize the ability to meet the performance criteria. In LAR Attachment A, the licensee identified an action to create pre-fire plans for areas determined to have the potential to jeopardize the ability of the plant to meet performance criteria as described in NFPA 805, Section 1.5, and to review and update all pre-fire plans, as necessary, to meet the intent of the NFPA 805 requirement. In FPE RAI 10 (Reference 23), the NRC staff requested that the licensee describe what is meant by the phrase "meet the intent" and how this will meet the requirements of NFPA 805. In its response to FPE RAI 10 (Reference 11), the licensee stated that the updates to the pre-fire plans will comply with the requirements in NFPA 805, Section 3.4.2, and that a reference to LAR Attachment S,

Table S-3, as supplemented, Implementation Item BV1-2371, for changes to pre-fire plans at both units will be added to the compliance basis. The NRC staff concludes that the licensee's response to the RAI is acceptable as the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.4.2.1, requires that pre-fire plans detail the fire compartment configuration and fire hazards to be encountered in the fire compartment along with any nuclear safety components and fire protection systems and features that are present. In LAR Attachment A, the licensee identified an action to either create pre-fire plans for transitioning compartments that do not have established pre-fire plans or to provide justification why a given compartment does not require a pre-fire plan. The licensee included this action in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2371. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.4.3(a), requires that plant industrial fire brigade members receive training consistent with the requirements contained in NFPA 600, "Standard on Industrial Fire Brigades" (Reference 95), or NFPA 1500, "Standard on Fire Department Occupational Safety and Health Program" (Reference 96), as appropriate. In LAR Attachment A, the licensee identified an action to revise procedures based on the NFPA 600 code compliance review, as necessary. The licensee included this action in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-3020. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.5.3, requires that fire pumps designed and installed in accordance with NFPA 20, "Standard for the Installation of Stationary Pumps for Fire Protection" (Reference 118) be provided to ensure that 100 percent of the required flow rate and pressure are available, assuming failure of the largest pump or pump power source. In LAR Attachment A, the licensee identified an action to revise the fire pump test procedure to clarify the pump conditions of water level, condition of the pump, and that the suction pipe is not obstructed. The licensee included this action in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-3026. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.5.10, requires that an underground yard fire main loop, designed and installed in accordance with NFPA 24, "Standard for the Installation of private Fire Service Mains and Their Appurtenances" (Reference 119), be installed to furnish anticipated water requirements. In LAR Attachment A, the licensee identified an action to perform hydraulic calculations, verifying that the appropriate supply requirements of the fire hose stations and water-based sprinkler systems can be delivered by the underground loop. The licensee included this action in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2833. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.6.1, requires that for all power block buildings, Class III standpipe and hose systems be installed in accordance with NFPA 14, "Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems" (Reference 102). In LAR Attachment A, the

licensee identified an action to update the referenced EEEE upon completion of the hydraulic calculations, including the verification of the NFPA 14 requirement for pressure and flow at the top-most outlet of each standpipe. The licensee included this action in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2833. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.6.2, requires that a capability be provided to ensure an adequate water flow rate and nozzle pressure for all hose stations. This capability includes the provisions of hose station pressure reducers, where necessary, for the safety of plant industrial fire brigade members and offsite fire department personnel. In LAR Attachment A, the licensee identified an action to verify an adequate water flow rate and nozzle pressure for all hose stations upon completion the hydraulic calculations. The licensee included this action in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2833. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.6.3, requires that listed electrically safe fixed fog nozzles be provided at locations where high-voltage shock hazards exist. In LAR Attachment A, the licensee stated that locations with high-voltage shock hazards within the service building do not have fixed fog nozzles installed. In the LAR, the licensee identified an action to replace the current nozzles with fixed fog nozzles. The licensee included this action in LAR Attachment S, Table S-2, as supplemented, Modification BV1-3016. In a letter dated April 21, 2017, the licensee stated that this modification was removed because it determined through an EEEE that the existing nozzles are equivalent to NFPA 805, Section 3.6.3. The NRC staff concludes that the licensee's statement of compliance is acceptable because it is in accordance with the guidance provided in RG 1.205 and NEI 04-02.

NFPA 805, Section 3.7, requires that where provided, fire extinguishers of the appropriate number, size, and type be provided in accordance with NFPA 10, "Standard for Portable Fire Extinguishers" (Reference 103). In LAR Attachment A, the licensee identified an action to install compliant extinguishers in the Unit No. 2 waste handling building, the emergency response facility (ERF) substation, and the emergency diesel generator (EDG) building. The licensee included this action in LAR Attachment S, Table S-2, as supplemented, Modification BV1-3017. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. In a letter dated April 21, 2017, the licensee stated that this modification has been completed.

NFPA 805, Section 3.8.2, requires that if automatic fire detection is required to meet the performance or deterministic requirements of Chapter 4, then these devices be installed in accordance with NFPA 72, "National Fire Alarm Code" (Reference 69), and its applicable appendices. In LAR Attachment A, the licensee identified actions to install additional detection to comply with NFPA 72 in fire compartments 1-CR-2, 1-CR-4, and 1-CS-1. Additionally, the licensee identified an action to perform a field verification to confirm hazard protection is acceptable in fire compartment 1-RC-1. The licensee identified actions in LAR Attachment S, Table S-2, as supplemented, Modifications BV1-1875, BV1-2839, BV1-2840, BV1-2841, and LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2826. The NRC staff concludes that the licensee's statement of compliance is acceptable because the

licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. In a letter dated April 21, 2017, the licensee stated that Modification Items BV1-1875, BV1-2839, and BV1-2840 have been completed.

NFPA 805, Section 3.9.1, requires that if an automatic or manual water-based fire suppression system is required to meet the performance or deterministic requirements of Chapter 4, then the system be installed in accordance with the appropriate NFPA standards including (1) NFPA 13, "Standard for the Installation of Sprinkler Systems" (Reference 120); (2) NFPA 15, "Standard for Water Spray Fixed Systems for Fire Protection" (Reference 121); (3) NFPA 750, "Standard on Water Mist Fire Protection Systems" (Reference 122); or (4) NFPA 16, "Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems" (Reference 123). In LAR Attachment A, the licensee identified actions to revise hydraulic calculations to include hose stream coverage required by NFPA 13 and include all piping and elevation losses back to the fire pump supply. The licensee also stated that for fire compartment 1-QP-1, it will revise testing procedures to include verification of system actuation within 20 seconds after heat detector activation. The licensee also identified modifications to fire suppression systems. The licensee included these actions in LAR Attachment S, as supplemented, Table S-2, Modifications BV1-2841, BV1-2986, and BV2-1572, and LAR Attachment S, Table S-3, as supplemented, Implementation Items BV1-2833, BV1-2828, BV2-1314, BV2-1369, and BV2-1372. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. In a letter dated April 21, 2017, the licensee stated that Modifications BV1-2986 and BV2-1572 have been completed.

NFPA 805, Section 3.10.1, requires that if an automatic total flooding and local application gaseous fire suppression system is required to meet the performance or deterministic requirements of Chapter 4, then the system be designed and installed in accordance with NFPA 12, "Standard on Carbon Dioxide Extinguishing Systems" (Reference 124); NFPA 12A, "Standard on Halon 1301 Fire Extinguishing Systems" (Reference 125); or NFPA 2001, "Standard on Clean Agent Fire Extinguishing Systems" (Reference 126). In LAR Attachment A, the licensee stated that because it found some devices to exceed the allowable code spacing requirements, it identified actions to modify the detection system to meet code compliance for fire compartments 1-CS-1, 2-CB-1, and 2-CV-6. The licensee included these actions in LAR Attachment S, Table S-2, as supplemented, Modifications BV1-2839 and BV2-1457, and LAR Attachment S, Table S-3, as supplemented, Implementation Item BV2-0487. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. In a letter dated April 21, 2017, the licensee stated that Modifications BV1-2839 and BV2-1457 have been completed.

NFPA 805, Section 3.10.3, requires that ventilation system design take into account prevention from over-pressurization during agent injection, adequate sealing to prevent loss of agent, and confinement of radioactive contaminants. In LAR Attachment A, the licensee identified an action to update pre-fire plans to confirm exhaust ventilation is off and to actuate a second discharge of CO_2 if necessary. The licensee included an action in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV2-1022. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate

the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.10.8, requires that positive mechanical means be provided to lockout total flooding CO_2 systems during work in the protected space. In LAR Attachment A, the licensee identified actions to provide positive mechanical means to lockout the total flooding carbon dioxide systems during work in protected space. The licensee included these actions in LAR Attachment S, Table S-2, as supplemented, Modifications BV1-0746 and BV2-0406. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. In a letter dated April 21, 2017, the licensee indicated that these modifications have been completed.

NFPA 805, Section 3.11.2, requires that fire barriers required by Chapter 4 include a specific fire resistance rating, and that fire barriers be designed and installed to meet the specific fire resistance rating using assemblies qualified by fire tests. In LAR Attachment A, the licensee identified actions to incorporate the inspection of the fire barriers required for separation into the periodic inspection procedures. The licensee included these actions in LAR Attachment S, Table S-3, as supplemented, Implementation Items BV1-3041 and BV2-1576. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.11.3, requires that penetrations in fire barriers be provided with listed fire-rated door assemblies or listed rated fire dampers having a fire resistance rating consistent with the designated fire resistance rating of the barrier as determined by the performance requirements established by Chapter 4. In LAR Attachment A, the licensee identified actions to incorporate the inspection of the fire dampers and doors required for separation into the periodic inspection procedures. The licensee included these actions in LAR Attachment S, Table S-3, as supplemented, Implementation Items BV1-3041 and BV2-1576. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805, Section 3.11.4, requires that through penetration fire stops for penetrations such as pipes, conduits, bus ducts, cables, wires, pneumatic tubes and ducts, and similar building service equipment that pass through fire barriers be protected. In LAR Attachment A, the licensee identified actions to develop a penetrations seal database and update fire barrier surveillance procedures to support this requirement. The licensee included these actions in LAR Attachment S, Table S-3, as supplemented, Implementation Items BV1-0714, BV1-3041, and BV2-1576. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee's actions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

Based on the licensee's statement of compliance for the individual NFPA 805 sections described above, which include the associated implementation items and modifications identified in LAR Attachment A and listed in LAR Attachment S, as supplemented, the NRC staff concludes that the licensee's statements of compliance are acceptable because completion of the modifications and implementation items will result in compliance with the requirements of NFPA 805 and would be required by the proposed license condition.

3.1.1.7 Compliance Strategy – Multiple Strategies

In certain compliance statements for the NFPA 805, Chapter 3, requirements, the licensee used more than one of the above strategies to demonstrate compliance with aspects of the fundamental element.

In each of these cases, the NRC staff concludes that the individual compliance statements are acceptable, the combination of compliance strategies is acceptable, and holistic compliance with the fundamental FPP element is assured.

The following NFPA 805 section identified in LAR Attachment A, Table B-1, as complying by this method required additional review by the NRC staff:

- 3.3.5.3

NFPA 805, Section 3.3.5.3, requires that electric cable construction comply with a flame propagation test acceptable to the AHJ. In LAR Table 5-3, the licensee stated that electrical cable construction complies with a flame propagation test found to be acceptable to the NRC as documented in NEI 04-02, Table B-1. In the LAR, the licensee provided multiple compliance strategies for this NFPA 805 section. In LAR Attachment A, Table B-1, one of the compliance strategies is "Submit for Approval" for unknown cable identified in the licensee's cable types report and analyzed to address a fire initiating from nonqualified fire resistive cable. However, there was no approval request included in LAR Attachment L for this NFPA 805 section. In FPE RAI 04a and FPE RAI 04c (Reference 23), the NRC staff requested that the licensee provide an approval request in accordance with 10 CFR 50.48(c)(2)(vii) that describes the PB approach to compliance with NFPA 805, Section 3.3.5.3 for which NRC approval is requested or revise the compliance basis. In its response to FPE RAI 04a and FPE RAI 04c (Reference 12), the licensee stated that it will perform an engineering evaluation. In its response to FPE RAI 04.01 (Reference 14), the licensee stated that the compliance strategy for NFPA 805, Section 3.3.5.3, for the low population of cables with potentially nonqualified electrical cable insulation material installed in electrical raceways will be revised to "Submit for NRC Approval." In a letter dated February 24, 2016 (Reference 15), the licensee provided the approval request. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee subsequently submitted the PB engineering evaluation for NRC staff approval as required by 10 CFR 50.48(c)(2)(vii). (See SE Sections 3.1.1.5 and 3.1.4.6 for the NRC staff's evaluation of the approval request.)

In LAR Attachment A, Table B-1 for NFPA 805, Section 3.3.5.3, the licensee stated that it "Complies with Clarification" for safety-related cables, and in LAR Attachment T, "Prior Approval Clarification Request 1," the licensee stated that the original submittal to the NRC included all cable types used in cable trays, but the NRC SER dated June 6, 1979 (Reference 99), only addressed safety-related cables. In FPE RAI 04b (Reference 23), the NRC staff requested that the licensee provide a description of the flame propagation tests that it used to support acceptability of the non-safety-related cables with thermoplastic or unknown insulation material, and discussed the results of the tests that demonstrated extensive propagation does not occur. In its response to FPE RAI 04b (Reference 12), the licensee stated that Prior Approval Clarification Request 1 is no longer required. The NRC concludes that the licensee's response to the RAI is acceptable because the licensee no longer credits previous approval and a clarification to meet the requirements of NFPA 805, Section 3.3.5.3, and will instead be crediting an engineering evaluation as discussed above to meet the requirements of NFPA 805, Section 3.3.5.3.

3.1.1.8 Chapter 3 Sections Not Reviewed

Some NFPA 805, Chapter 3,sections either do not apply to the transition to an RI/PB FPP or have no technical requirements. Accordingly, the NRC staff did not review these sections for acceptability. The sections that were not reviewed fall into one of the following categories:

- Sections that do not contain any technical requirements (e.g., NFPA 805, Sections 3.4.5 and 3.11).
- Sections that are not applicable because of the following:
  - The licensee stated that it does not have systems of this type installed (e.g., 3.9.1(3) and (4), which concern water mist fire protection systems and foam-water sprinkler and foam-water spray systems).
  - The requirements are structured with an applicability statement (e.g., Section 3.3.12, which applies to RCPs in non-inerted containments; or Sections 3.4.1(a)(2) and 3.4.1(a)(3), which apply to the fire brigade standards, which depend on the type of brigade specified in the FPP); or Section 3.5.1(b), which applies to the method to determine the water supply).

3.1.1.9 Compliance with Chapter 3 Requirements Conclusion

As discussed above, the NRC staff evaluated the results of the licensee's assessment of the proposed RI/PB FPP against the NFPA 805, Chapter 3, fundamental FPP elements and minimum design requirements, as modified by the exceptions, modifications, and supplementations in 10 CFR 50.48(c)(2). Based on this review of the licensee's submittal, as supplemented, the NRC staff concludes that the RI/PB FPP is acceptable with respect to the fundamental FPP elements and minimum design requirements of NFPA 805, Chapter 3, as modified by 10 CFR 50.48(c)(2), because the licensee accomplished the following:

- Used an overall process consistent with NRC staff-approved guidance to determine the state of compliance with each of the applicable NFPA 805, Chapter 3, requirements.
- Provided appropriate documentation of its state of compliance with NFPA 805, Chapter 3, requirements, which adequately demonstrated compliance in that the licensee was able to substantiate that it complied:
  - With the requirement directly, or with the requirement directly after the completion of an implementation item or modification; or
  - With the intent of the requirement (or element) given adequate justification; or
  - By previous NRC staff approval of an alternative to the requirement; or
  - Through the use of an engineering equivalency evaluation; or

- Through the use of a combination of the above methods; or

- Through the use of a PB method that the NRC staff has approved in accordance with 10 CFR 50.48(c)(2)(vii).

3.1.2 Identification of the Power Block

The NRC staff reviewed the structures identified in LAR Attachment I, Table I-1, "Beaver Valley, Unit No. 1 Power Block Definition," and LAR Attachment I, Table I-2, "Beaver Valley, Unit No. 2 Power Block Definition," as comprising the "power block." The plant structures listed are established as part of the power block for the purpose of denoting the structures and equipment included in the RI/PB FPP that have additional requirements in accordance with 10 CFR 50.48(c) and NFPA 805. As stated in LAR Section 4.1.3, the power block includes structures that contain equipment required for nuclear plant operations as identified in LAR Attachment I, Table I-1, "Beaver Valley Unit No. 1 Power Block Definition," and LAR Attachment I, Table I-2, "Beaver Valley, Unit No. 2 Power Block Definition." The NRC staff concludes that the licensee appropriately evaluated the structures and equipment and adequately documented a list of those structures that fall under the definition of "power block" in NFPA 805.

3.1.3 Plant-Specific Treatments or Technologies

3.1.3.1 Closure of GL 2006-03, Hemyc and MT Fire Barrier Issues

GL 2006-03 requested that licensees evaluate their facilities to confirm compliance with existing applicable regulatory requirements in light of the results of NRC testing that determined both Hemyc™ and MT™ fire barriers failed to provide the protective function intended for compliance with existing regulations for the configurations tested using the NRC's thermal acceptance criteria. In a letter dated June 8, 2006 (Reference 127), the licensee stated that neither Hemyc nor MT fire barrier material is currently being used at Beaver Valley. Since neither Hemyc nor MT ERFBS are used, the NRC staff concludes that the generic issue, GL 2006-03 (Reference 65), related to the use of these ERFBS is not applicable.

3.1.3.2 Very Early Warning Fire Detection Systems

In LAR Attachment S, Table S-2, as supplemented, Modification Items BV1-1875, BV1-2854, and BV2-0829, the licensee proposed the installation of very early warning fire detection systems (VEWFDS) in select cabinets located in fire compartments 1-CR-4, 2-CB-1, and 2-CB-6 to improve time to detection of fires in these areas and reduce plant risk by improving the likelihood that damage due to a potential fire event will be limited during the incipient stage of a fire. The licensee stated that the installation and operation of these systems will follow the guidance in FAQ 08-0046 (Reference 80).

In FPE RAI 15 (Reference 23), the NRC staff requested that the licensee provide a more detailed description of the proposed modification, which included the following:

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

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

(c) Description of the configuration and design control process that will control and maintain the setpoints for both alert and alarm functions from the VEWFDS;

(d) Instructions that will be given to the first responders until the degrading component is repaired, the cabinet is deenergized, or the alarm is satisfactorily reset in the event of a VEWFDS actuation;

(e) Comparison of the credit taken for its use in assessing the risk of various fire compartments where it is credited to that described in FAQ 08-0046 and provide a technical justification for any differences; and

(f) Description of how the VEWFDS system complies with NFPA 805, Section 3.8, and its subsections.

In its response to FPE RAI 15a (Reference 10), the licensee stated that the VEWFDS will be installed in accordance with NFPA 72-2010 and NFPA 76-2009. The licensee further stated that tubing/piping sample points will be installed inside cabinets and that there will be individual piping zones throughout the room, with each zone containing multiple sample points. The licensee further stated that the VEWFDS will be connected to interface with the control room annunciation systems, and in a letter dated April 21, 2017, included that action in LAR Attachment S, Table S-2, as supplemented, Modification Items BV1-3110 and BV2-1624. The NRC staff considers this acceptable because the licensee included the actions in LAR Attachment S, Table S-2, which indicates that the modifications have been completed.

In its response to FPE RAI 15b (Reference 10), the licensee stated that acceptance testing of the VEWFDS will be performed by the vendor to ensure all equipment is operating as designed and will include verification of communication from each detector to the laptop personal computer, verification of each detector fan speed being set to 99 percent or 100 percent, verification that millimeters of water across the zone manifold is greater than zero using a manifold differential pressure meter, verification that each pipe/tube has an airflow value between 15 percent and 85 percent, verification that each detector zone alarms within 60 seconds when testing the last sample point with the Veri-Fire (heat gun) testing device, and software verification. The licensee further stated that sensitivity settings will include the gain and alarm thresholds, and that each detector will have an associated setpoint document that contains the alarm setpoints, which will be subject to design control program requirements. The licensee stated that alarm response procedures will be developed throughout the modification process, and upon a VEWFDS alarm, the operators will refer to the appropriate alarm response procedure and, at a minimum, pursue the following actions: (i) verification of which detector and associated zone is in alarm, (ii) establishment of a fire watch until alarm is cleared or source has been identified and addressed accordingly, (iii) use of the portable incipient detector to determine source of alarm, and (iv) investigation of the alarm source. The licensee further stated that it provided introductory training to operations personnel for the VEWFDS, which included discussions on the following: (i) description of the VEWFDS and equipment, (ii) equipment arrangement, (iii) function of the VEWFDS equipment, (iv) alarm levels and settings, (v) alarm response procedure, and (vi) annual system testing. The licensee further stated that it will perform additional operations personnel training as part of the modification process and that training will initially be provided to maintenance personnel through vendor

training. The licensee stated that periodic checks and maintenance will be in accordance with vendor requirements that include daily checks, 3-month checks, and annual checks, and that initial site acceptance testing will be performed by the vendor upon installation of completion and that annual testing of the system will be completed by operation surveillance testing procedures developed throughout the modification process in accordance with vendor recommendations. The licensee further stated that the system maintenance procedures will be developed throughout the modification process and performed in accordance with the vendor maintenance requirements.

In its response to FPE RAI 15c (Reference 10), the licensee stated that detector setpoints will be controlled by setpoint document information that is developed and controlled in accordance with its setpoint document program, and that a setpoint document will be completed for reach detector throughout the modification process.

In its response to FPE RAI 15d (Reference 10), the licensee stated that in accordance with the current procedure, the first responders will identify the source of the alarm with the portable VEWFDS detector, and that once the source of the alarm has been identified, operations personnel will determine what appropriate actions are required. The licensee further stated that if the source of the alarm cannot be identified, an attempt will be made to reset the alarm, and if the alarm cannot be reset, a condition report will be initiated to further evaluate the cause of the alarm. The licensee further stated that a change to this procedure is planned through its modification process to establish a fire watch, which will remain in place until the alarm is cleared or the source has been identified and addressed accordingly.

In its response to FPE RAI 15f (Reference 12), the licensee stated that the VEWFDS will be connected to interface with the control room annunciation system, and that LAR Attachment S, Table S-2, as supplemented, was revised to include the modification. The licensee included this action in a letter dated April 21, 2017, in LAR Attachment S, Table S-2, as supplemented, Modifications BV1-3110 and BV-2-1624. The NRC staff considers this acceptable because the licensee included the actions in LAR Attachment S, Table S-2, which indicates that the modifications have been completed. The licensee stated that the code compliance reports will be completed throughout the modification process; however, compliance of the VEWFDS with respect to NFPA 805, Section 3.8, will be performed as part of the plant modification process.

The detailed discussion of the VEWFDS in response to FPE RAI 15e (Reference 11), such as operator and operator response credited in the NSCA, is included in SE Section 3.2.6. The discussion of how the VEWFDS is credited in the FPRA is included in SE Section 3.4.

The NRC concludes that the licensee's response to FPE RAI 15a-d and RAI 15f is acceptable because the licensee demonstrated that the design, installation, maintenance, and operation of the VEWFDS is in accordance with the guidance contained in FAQ 08-0046, and the alarm annunciation system will comply with the requirements of NFPA 805, Section 3.8.

3.1.3.3 NFPA Code Compliance Reviews

NFPA code compliance documents are referenced in LAR Attachment A, Table B-1. In LAR Section 4.1, the licensee stated that it installed the fire protection features and systems based on design documents per NFPA codes and other applicable standards, but do not have specific NFPA code evaluations. The licensee further stated that the LAR Attachment A2 records evaluate the fire protection features for each compartment using the critical attributes of functionality from the applicable NFPA codes. The licensee stated that the LAR Attachment A2

records provide to the docket a compliance statement for each credited fire protection feature by fire compartment instead of compliance by feature throughout the entire power block. In FPE RAI 01 (Reference 23), the NRC staff requested that for each code evaluation relied on for compliance with NFPA 805, Chapter 3, and for which only critical attributes are identified, the licensee provide a description of the basis and methodology for selecting the elements of the code that are considered critical attributes; provide confirmation that all critical attributes as determined by this methodology are identified in LAR Attachment A, Table B-1; and provide additional justification for concluding that compliance with NFPA 805, Chapter 3, is achieved using this methodology. In its response to FPE RAI 01 (Reference 12), the licensee stated that the basis and methodology for the critical attributes review is not described because it performed an engineering evaluation of detection and suppression systems to evaluate compliance with NFPA 805, Sections 3.8, 3.9.1, and 3.10.1. The licensee further stated that it will remove the critical attribute discussion of each credited fire detection and suppression system from the LAR Attachment A, Table B-1 records and replace it with the results of the engineering evaluation that performed the associated NFPA code comparison review; therefore, the methodology and selection of the critical attribute elements of each code will no longer be contained within the LAR. The licensee stated that each credited fire suppression and fire detection system being transitioned was analyzed in the engineering evaluation for compliance with the below applicable NFPA codes:

- NFPA 12, "Carbon Dioxide Extinguishing Systems"
- NFPA 12A, "Halogenated Extinguishing Agent Systems Halon 1301"
- NFPA 13, "Installation of Sprinkler Systems"
- NFPA 15, "Standard for Water Spray Fixed Systems for Fire Protection"
- NFPA 72D, "Standard for the Installation, Maintenance and Use of Proprietary Protective Signaling Systems for Watchman, Fire Alarm and Supervisory Service"
- NFPA 72E, "Automatic Fire Detectors"

The licensee further stated that the engineering evaluation concluded that the credited fire suppression and detection features for transition to NFPA 805 are acceptable using one or more of the approved compliance statements (that is, Complies, Complies by Previous Approval, Complies with use of Existing Engineering Equivalency Evaluation (EEEE), or Will Comply with Use of Commitment). The licensee stated that it inserted the results of the engineering evaluation into the compliance section of each applicable LAR Attachment A, Table B-1, in accordance with Table FPE 01 of its response to FPE RAI 01 (Reference 12). The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee removed the critical attribute discussion of each credited fire detection and suppression system from the LAR Attachment A, Table B-1 and replaced it with the results of its engineering evaluations which demonstrated that its credited fire suppression and detection systems offer equivalent protection to that required by the applicable NFPA codes, and because the licensee completed the engineering evaluations in accordance with the guidance contained in RG 1.205, NEI 04-02, and FAQ 06-0008.

3.1.4 Performance-Based Methods for NFPA 805, Chapter 3,Elements

In accordance with 10 CFR 50.48(c)(2)(vii), a licensee may request NRC approval for use of the PB methods permitted elsewhere in the standard as a means of demonstrating compliance with the prescriptive NFPA 805, Chapter 3, fundamental FPP elements and minimum design

requirements. Paragraph 50.48(c)(2)(vii) of 10 CFR requires that an acceptable PB approach accomplish the following:

(A) Satisfies the performance goals, objectives, and criteria specified in NFPA 805 related to nuclear safety and radiological release;

(B) Maintains safety margins; and

(C) Maintains fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

In LAR Attachment L, "NFPA 805, Chapter 3,Requirements for Approval (10 CFR 50.48(c)(2)(vii)," the licensee requested NRC staff review and approval of PB methods to demonstrate an equivalent level of fire protection for the requirement of the elements identified in SE Section 3.1.1.5. The NRC staff's evaluation of these proposed methods is provided below.

3.1.4.1 NFPA 805, Section 3.3.5.1 – Electrical Wiring Above Suspended Ceiling Limitations

In LAR Attachment L, Approval Request 1, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.3.5.1, requirement that electrical wiring installed above suspended ceilings be listed for plenum use, routed in armored cable, routed in metallic conduit, or routed in cable trays with solid metal top and bottom covers. Specifically, the licensee requested approval of a PB method for use of existing wiring above suspended ceilings. The licensee stated that suspended ceilings are used sparingly throughout the power block areas, as the majority of power block areas use no suspended ceilings. The licensee stated that the areas with suspended ceilings within the power block include:

- Unit No. 1 Primary Auxiliary Building Elevation 768'-7" (1-PA-1A)
- Unit No. 1 Service Building (1-SB-GEN)
- Unit No. 1 Turbine Building Elevation 735'-6" (1-TB-1)
- Unit No. 1 Warehouse Elevation 735'-6" (1-WH-1)
- Unit No. 2 Condensate Polishing Building Elevation 744'-6" (2-CP-1)
- Unit No. 2 Turbine Building Elevation 774'-6" (2-TB-1)
- Unit No. 2 Waste Handling Building Elevation 774'-6" and 786'-6" (2-WH-1)
- Unit No. 2 Primary Auxiliary Building Elevation 773'-6" (2-PA-5)
- Unit No. 1 and Unit No. 2 Control Room (3-CR-1)
- Unit No. 2 Computer Room at Elevation 735'-6" (2-CB-4)

The licensee stated that it has been confirmed from selected plant walkdowns and above-ceiling surveys that there are minimal amounts of cables located above suspended ceilings that may not be in compliance with NFPA 805, Section 3.3.5.1. The licensee further stated that this approval request is based on the assumption that some exposed cables above suspended ceilings are not listed for plenum use or routed in armored cable, routed in metallic conduit, or routed in cable trays with solid metal top and bottom covers. The licensee further stated that these are referred to as "unqualified" cables in this request, and that the types of cables identified above suspended ceilings mainly consist of low voltage cables such as communication, lighting, and network type cables. The licensee stated that in a few

compartments, there were also power, control, and instrumentation cables identified, and that although power cables at Beaver Valley are IEEE-383 (Reference 100) qualified (or equivalent), it is undetermined whether the other cable types meet IEEE-383 or other qualification standards; therefore, these cables are assumed to be "unqualified" in terms of combustibility.

The licensee stated that the term "compartment" is used to refer to the number-letter designations above (e.g., 3-CR-1), consistent with the detailed FM that has been performed, and that the term "location" is used to describe the room or area within the compartment that contains the wiring above the suspended ceilings.

The licensee stated that with the exception of the control room (3-CR-1) Unit No. 1 turbine building (1-TB-1) and Unit No. 2 turbine building (2-TB-1), the compartments in the scope of this request either contain no risk-significant PRA components or they are not risk-significant because the effect of "unqualified" cables is bounded by the assumption of whole room damage in the FPRA, including all SSD/FPRA targets (components and cables). The licensee further stated that detailed FM was, therefore, unnecessary in these compartments.

The licensee stated that there were some non-risk-significant compartments identified that contain other types of cables above suspended ceilings, in addition to the low voltage communication, lighting, and network type cables, and that these compartments include other cable types identified in the following fire compartments:

- Unit No. 1 Warehouse (1-WH-1),
- Unit No. 1 Service Building General Areas (1-SB-GEN),
- Unit No. 2 Condensate Polishing Building (2-CP-1), and
- Unit No. 2 Waste Handling Building (2-WH-1).

The licensee stated that fire compartments 1-WH-1, 1-SB-GEN, 2-CP-1, and 2-WH-1 are not risk-significant compartments and were conservatively modeled by assuming whole room damage. The licensee further stated that the presence of these potentially "unqualified" power type cables, in addition to the communication, lighting, and network type cables, will not preclude the capability to achieve the NSPC of NFPA 805, Section 1.5. The licensee also stated that other cable types identified above may also be present in other non-risk-significant office type areas, and that they would also be bounded by assuming whole room damage, and the presence of the cables would not preclude the capability to achieve the NSPC.
The licensee stated that detailed FM was completed in compartments 3-CR-1, 1-TB-1, and 2-TB-1. The licensee stated that in 1-TB-1 and 2-TB-1, the cables above suspended ceilings are located in office type areas and are not in the vicinity of SSD/FPRA targets (components and cables). The licensee further stated that there is reasonable assurance that a fire involving the unqualified cables above suspended ceilings in these compartments would not damage or otherwise adversely affect SSD/FPRA targets. The licensee further stated that based on this information, the only risk-significant compartment with potentially unqualified cables in the vicinity of SSD/FPRA targets of those listed as part of this request is the control room.

The licensee stated that within the control room, there are also other cable types above the suspended ceiling, in addition to the low voltage communications, lighting, and network type cables, and that from visual inspection of locations above the control room suspended ceiling, many conduits were identified that include both control and instrumentation cables that may not be IEEE-383 (or equivalent) qualified. The licensee further stated that although not confirmed, some conduits above the suspended ceiling may also contain power cables, which would be

IEEE-383 (or equivalent) qualified, and that visual inspections revealed that the majority of lighting cables are armored or located within conduit. The licensee further stated that in general, power, instrumentation, and control cables located above the control room suspended ceiling are routed in conduit, with the exception of short sections of cable that may be exposed at the end of the conduit.

The licensee stated that the presence of potentially unqualified cables above suspended ceilings will not preclude the capability to achieve the NSPC of NFPA 805, Section 1.5, and that DID is also achieved in accordance with NFPA 805, Section 1.2, and thus, meeting the intent of NFPA 805, Section 3.3.5.1. The licenses stated that the technical basis for this request includes the following:

- Based on walkdowns and above-ceiling surveys in the subject plant areas, fixed ignition sources located in the space above the suspended ceilings are limited to small hazards such as communication, lighting, and network cables. These types of cables were determined to be low voltage, which are not prone to heat-generating overload faults and are not required to achieve the NSPC.

- Per FPRA FAQ 13-0005 (Reference 89), experience has shown that in the unlikely event of a self-ignited cable tray fire, the fire is not expected to spread beyond the cable tray of fire origin. Based on this and the guidance provided in Appendix R, "Cable Fires," to NUREG/CR-6850, self-ignited fixed cable fires were screened as non-challenging ignition sources in the FM reports. The Electric Power Research Institute (EPRI) fire events database shows that self-ignitable tray fires have only led to localized failures in a small number of cables within a single raceway. No event has led to sustained open flaming fires or damage to cables beyond the initially impacted raceway. Therefore, the presence of a limited number of potentially unqualified low voltage type cables above suspended ceilings in the identified compartments does not introduce any additional challenging ignition sources.

- LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2823, will revise plant administrative procedures to ensure that all future cable installations above suspended ceilings comply with the requirements of NFPA 805, Section 3.3.5.1.

- 3-CR-1 (control room): This compartment is continuously occupied by operators from which fire brigade response can be immediately initiated. Portable fire extinguishers are provided in this compartment, and hose racks are provided in adjacent stairwells. Automatic detection is provided above and below the suspended ceilings.

- 1-PA-1A: Early warning ionization smoke detectors with partial area coverage and audible alarms sounding locally and in the control room. A deluge system is installed over the main exhaust filter banks, and a partial area wet pipe suppression system is installed over the western portion of the fire compartment. There are portable fire extinguishers and hose racks positioned in the area.

- 1-SB-GEN: No detection. An automatic suppression system is installed at the ceiling of the potentially contaminated area shop. There are portable fire extinguishers and hose racks located in the area.

- 1-TB-1: No detection. An automatic CO_2 suppression system is installed to suppress fires in the turbine bearings and generator area, which is actuated by heat detectors in the same location. There are portable fire extinguishers and fire hose racks located in the area.

- 1-WH-1: No detection. An automatic suppression system is installed in the area. There are portable fire extinguishers and hose racks located in the area.

- 2-PA-5: Early warning ionization smoke detectors with audible alarms locally and in the control room. Heat detectors are located inside the charcoal filter banks. There are portable fire extinguishers and hose racks located in the area. Also, there is a water spray system for the supplementary leak collection and release system charcoal filters.

- 2-CP-1: Automatic sprinkler flow alarms in chemistry lab elevator walkway. Heat detectors are installed for charcoal filter. An automatic suppression system is installed in the chemistry lab and walkway near the elevator. There are portable fire extinguishers and hose racks located in the area.

- 2-TB-1: No detection. An automatic CO_2 suppression system is installed to suppress fires in the turbine bearings and generator area, which is actuated by heat detectors in the same location. There are portable fire extinguishers and fire hose racks located in the area.

- 2-WH-1: No detection. An automatic wet pipe sprinkler system is installed in the area. There are portable fire extinguishers and fire hose racks located in the area.

- 2-CB-4: Early warning ionization smoke detectors with audible alarms are installed in the area. Additionally, smoke detectors are installed that provide alarm and actuation of the Halon system. An automatic Halon system is installed in the area. Additionally, there are portable fire extinguishers located in the area and hose racks are available in the stairwells.

- Propagation of fire through ventilation: It has been determined that fire above or below a suspended ceiling would not likely result in propagation of fire by the ventilation system(s). As described above, with the exception of 3-CR-1, 1-TB-1, and 2-TB-1, these compartments are not risk-significant locations, as they either do not contain risk-significant PRA equipment/cables, or all the SSD/FPRA targets (components and cables) are assumed to be damaged by a fire in these locations and have minimal risk impact. All compartments that are adjacent to and potentially exposed by these locations were also reviewed as part of the FPRA multi-compartment analyses (MCA). It was determined that in all cases, there is acceptably low risk to the NSPC.

The licensee stated that detailed FM was completed in compartments 3-CR-1, 1-TB-1, and 2-TB-1. The licensee stated that in 1-TB-1 and 2-TB-1, cables above suspended ceilings are located in office type areas and are not in the vicinity of SSD/FPRA targets (components and cables). The licensee further stated that there is reasonable assurance that a fire involving the unqualified cables above suspended ceilings in these compartments would not damage or otherwise adversely affect SSD/FPRA targets. The licensee stated that the only risk-significant compartment with potentially unqualified cables in the vicinity of SSD/FPRA targets of those listed as part of this request is the control room. The licensee further stated that the vast majority of SSD/FPRA cables are routed up through the floor into the control room and are not routed above the suspended ceiling. The licensee further stated that fixed ignition sources located in the space above the suspended ceiling are limited to small hazards such as communication, lighting, and network cables, and that these types of cables were determined to be low voltage, which are not prone to heat-generating overload faults and are not required to achieve the NSPC. The licensee also stated that the SSD/FPRA cables and the majority of the power, control, and instrumentation cables located above the suspended ceiling were determined to be routed in metal raceways, with the exception of short sections of cable that may be exposed at the end [sic] of the conduit. The licensee further stated that the control room suspended ceiling is not an entirely enclosed ceiling and the suspended ceiling tiles are of an open grid type (i.e., egg-crate design); therefore, if a fire were to occur above the suspended ceiling, it would be readily detected by operators who are located within the control room at all times. The licensee stated that any NSCA-credited cables that are routed above a suspended ceiling are assumed to be fire-damaged in the NSCA, as appropriate, and evaluated in an FRE that determined that the VFDRs identified are acceptable based upon the measured change in CDF and LERF, adequate DID, and maintaining safety margins.

The licensee stated that the cables above the suspended ceilings also have no adverse impact on the radiological release performance criteria. The licensee further stated that the radiological release performance criteria are satisfied based on the determination of limiting radioactive release (Attachment E), which is not affected by cables above the suspended ceilings that do not comply with the requirements specified in NFPA 805, Section 3.3.5.1.
The licensee stated that the exposed, non-plenum-rated electrical wiring located above suspended ceilings is minimal and is well dispersed such that it will not threaten components that are necessary for nuclear safety capability. The licensee further stated that the safety margin inherent in the analysis in the event of a fire has been preserved.

The licensee stated that the three echelons of DID are (1) to prevent fires from starting; (2) to rapidly detect, control, and extinguish fires that do occur, thereby limiting damage; and (3) to provide an adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee further stated that per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided. The licensee stated that echelon 1 is met by hot work controls, and the lack of significant fixed ignition sources in the locations above the suspended ceilings will limit the possibility of fires in these locations. The licensee further stated that echelon 2 is met by the automatic detection and suppression systems serving the compartments and that manual detection and fire brigade manual suppression capability will limit fire damage in these locations, and that fire-rated barriers between fire areas limit the spread of fire above the suspended ceilings. The licensee further stated that echelon 3 is met because it evaluated VFDRs and found them to be acceptable in accordance with NFPA 805, Section 4.2.4.2, "Performance based approach – FRE with simplifying deterministic assumptions." The licensee stated that a reasonable balance of the elements is provided, and therefore, DID is achieved.

Based on its review of the information submitted by the licensee in the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.3.5.1, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains sufficient safety margin; and maintains adequate fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.2 NFPA 805, Sections 3.3.12(1) and 3.3.12(4) – Reactor Coolant Pumps Oil Collection

In LAR Attachment L Approval Request 2, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for NFPA 805, Sections 3.3.12(1) and 3.3.12(4), requirements for the oil collection system for each RCP to be capable of collecting lubricating oil from all potential pressurized and non-pressurized leakage sites and the leakage points on an RCP motor to be protected, including, but not limited to, the lift pump and piping, overflow lines, oil coolers, oil fill and drain lines and plugs, flanged connections on oil lines, and the oil reservoirs, where such features exist on the RCPs. Specifically, the licensee requested approval to use a PB method to allow RCP lube oil misting that is not captured by the RCP lube oil collection system.

The licensee stated that the RCPs, steam generator (SG), and piping associated with each of the three reactor coolant loops are partitioned from one another at various levels by radial reinforced concrete walls positioned approximately 120 degrees from adjacent radial walls. The licensee stated that oil collection pans with spray shields and enclosures for the RCP lubricating oil system are provided, and that this design is intended to prevent the RCP lubricating oil system from becoming a potential source of fire. The licensee stated that it installed stainless steel shrouds to encompass each of the following potential oil discharge points: upper bearing assembly, oil cooler assembly, lower bearing assembly, oil lift pump motor assembly, motor catch basin assembly, and oil retention ring. The licensee further stated that these shrouds will catch oil leakage that may be sprayed from these points.

The licensee stated that the associated drain lines are large enough to accommodate the largest anticipated oil leakages and that each of the three RCPs has an oil collection tank that can accommodate the entire oil capacity of its associated RCP (320 gallons for Unit No. 1 and 300 gallons for Unit No. 2). The licensee stated that a flame arrestor/vent assembly continuously vents each oil collection tank to containment and that the RCP oil collection system is seismically supported and has been designed to accommodate the differential movement of the reactor coolant loops.

The licensee stated that the RCP motors are large and will consume oil during the course of normal operation, and that large motors tend to lose some oil due to heat through the seals, and the oil potentially will become atomized in the ventilation system. The licensee further stated that its previously approved RCP oil collection systems are designed and sized to collect and contain oil from potential pressurized and non-pressurized leakage areas in a seismic event, resulting in failure of the lubrication system. The licensee stated that the oil collection system design cannot wholly contain the atomized oil mist, as its design is not completely sealed in order to permit adequate air cooling for safe motor operation, and that a design change to a completely sealed motor of this size would be a significant modification that would contribute little to reducing fire risk.

The licensee stated that the oil mist resulting from normal operation can accumulate on surfaces in the vicinity of the RCP and motor and will not adversely impact the ability of the plant to achieve safe and stable conditions, even if ignition occurs. The licensee further stated that the quantity of oil that may be found in areas of the containment building due to the RCP oil vapor mist is very small and does not contribute significantly to fire loading nor create potential fire propagation between fire compartments.

The licensee stated that historically, there have been no fires attributed to oil misting based on normal operation in the industry, and that fires have occurred due to oil leakage from equipment failure such as cracked welds on piping or inadequate collection pan design. The licensee stated that it does not have a history (34 years of operation for Unit No. 1 and 25 years of operation for Unit No. 2) of significant oil loss from the RCPs as a result of oil misting or oil leakage that is not contained by the properly designed and installed oil collection system. The licensee further stated:

- The OCS, as designed, complies with 10 CFR 50, Appendix R, Section III.O, and was approved to collect leakage from pressurized and non-pressurized leakage sites in the RCP oil system.

- Oil misting from normal operation is not leakage; it is normal motor oil consumption.

- Oil misting from normal operation does not significantly reduce the oil inventory.

- Oil misting does not account for an appreciable HRR or accumulation near potential ignition sources or non-insulated reactor coolant piping.

- The RCPs use synthetic oil having a high flash point in excess of 400 degrees Fahrenheit (°F). This temperature is well above the expected design surface temperature (150 °F) of any of the mirror insulation and other small components that the vaporized oil might contact.

- The RCP piping is covered with metal mirror insulation, which will not absorb/accumulate oil mist in quantities that will create a fire ignition source.

The licensee further stated that the NSPC are met because redundant RCPs are available, as necessary, and the RCPs are not required to achieve or maintain post-fire SSD.

The licensee stated that the radiological release performance criteria is met because (1) the entire containment building during power operations is an environmentally sealed radiological area, (2) the potential for oil mist from the RCPs does not change the radiological release evaluation performed for each fire zone where potentially contaminated water and smoke is contained and monitored, (3) the oil mist does not add additional radiological materials to the area or challenge systems boundaries that contain such materials, and (4) fire brigade control of water runoff and smoke is not hindered because of the existence of the misting.

The licensee stated that the oil mist resulting from normal operation will not adversely impact the ability of a plant to achieve and maintain fire SSD, even if ignition occurs, and that there are redundant RCPs to achieve and maintain safe and stable conditions, if required; therefore, the safety margin inherent in the analysis for the fire event has been preserved. The licensee

further stated that the potential for oil mist from the RCPs does not directly result in compromising automatic fire suppression functions, manual fire suppression functions, or post-fire SSD capability.

In FPE RAI 14b (Reference 23), the NRC staff requested that the licensee 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. In its response to FPE RAI 14b (Reference 11), the licensee stated that the lack of a lube oil collection system in misting areas satisfies the nuclear safety performance goals, performance objectives, and performance criteria, because redundant RCPs exist that are separated from each other by reinforced concrete walls. The licensee further stated that the RCPs are not required for post-fire SSD, and 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. The licensee stated that the three echelons of DID are (1) to prevent fires from starting; (2) to rapidly detect, control, and extinguish fires that do occur, thereby limiting damage; and (3) to provide an adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee further stated that per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided. The licensee stated that echelon 1 is maintained by the oil collection system and by the RCP design, and is not affected by this configuration, and that the introduction of small amounts of oil misting does not affect echelons 2 and 3. The licensee further stated that the oil misting does not result in compromising fire detection, automatic or manual fire suppression functions, or post-fire SSD capability. The licensee stated that since a balance of the elements is provided, DID is achieved. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that oil misting associated with the RCPs does not impact the plant's ability to meet the nuclear safety and radioactive material release performance criteria and maintains DID and safety margin.

Based on its review of the information submitted by the licensee in the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Sections 3.3.12(1) and 3.3.12(4), requirements, because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains sufficient safety margin; and maintains adequate fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.3 NFPA 805, Section 3.5.11 – Yard Main Isolation

In LAR Attachment L, Approval Request 3, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.5.11, requirement to provide a means to isolate portions of the yard fire main loop for maintenance and repair without simultaneously shutting off the supply for both fixed fire suppression systems and fire hose stations provided for manual backup. Specifically, the licensee requested approval to use PB methods to address the Unit No. 1 issue regarding certain locations in the auxiliary building and safeguards area.

The licensee stated that the underlying purpose of NFPA 805, Section 3.5.11, is to ensure that there is available water supply for suppression (automatically or manually) after isolation for maintenance or during a repair of the fire protection supply piping.

The licensee stated that portions of the system can be isolated with the available sectionalizing valves, in combination with other compensatory measures, to restore suppression capabilities to the area or zone with the use of staged temporary fire hoses or through bypassing the isolated portion of piping with fire hoses.

The licensee stated that where maintenance and/or repair actions for Unit No. 1 may be required, the closing of some sectional valves to isolate the piping section may also isolate both suppression systems and backup manual hose stations serving the area and that in these situations, compensatory measures would be enacted as required by plant procedures, which require providing an equivalent capacity backup fire hose protection to the unprotected area, unless the area does not contain safety-related equipment and the establishment of fire surveillance within the related area or zone. The licensee further stated that these compensatory measures would ensure effective and adequate temporary fire protection for the subject areas during the time when the primary fire suppression features are nonfunctional.

The licensee stated that additional fire hose and fittings are available, per plant procedures, to provide temporary fire protection water supply by bypassing the isolated section of piping with water from the non-isolated section of piping to serve the affected area, or alternatively, to develop a sufficient hose length supplying the area from an available source of fire water. The licensee further stated that additional hoses are located at various and diverse locations around the site, such as in hydrant hose houses, on emergency vehicles, at hose stations outside the fire area, and on responding mutual aid fire department trucks.

The licensee stated the radiological release performance criteria is met because (1) the potential for the fire brigade to suppress a fire is not diminished in radiological areas, should a failure in the supply piping occur [sic] because of the available additional fire hose to either bypass the isolated sections of piping or reach the isolated areas directly, and (2) the fire brigade control of water runoff and smoke is not hindered because of a potential isolation to a section of the fire protection water supply piping.

The licensee stated that the isolation of a section of the fire protection supply piping will not adversely impact the ability of the plant to achieve and maintain fire SSD in the event of a fire. The licensee further stated that plant personnel are familiar with periodic isolation of sections of piping to perform routine maintenance and that prior to this activity, the site evaluates the areas that are unprotected and creates appropriate compensatory measures, such as the readiness of additional fire hoses to reach the affected areas, additional fire prevention controls, and fire surveillances. The licensee further stated that there are many ready sources for additional fire hoses that are available to retrieve the needed temporary fire hoses. The licensee further stated that fire protection piping inside the power block buildings, except for the intake structure, is not required to achieve and maintain safe and stable conditions. The licensee concluded that the safety margin inherent in the post-fire SSA for the fire event has been preserved, and the safe and stable capability has not been reduced.

In FPE RAI 14c (Reference 23), the NRC staff requested that the licensee 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. In its response to FPE RAI 14c (Reference 11), the licensee stated that 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. The licensee further stated that 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, and that the 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 NSPC. The licensee stated that the three echelons of DID are (1) to prevent fires from starting; (2) to rapidly detect, control, and extinguish fires that do occur, thereby limiting damage; and (3) to provide an adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee stated that per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided. The licensee stated that echelon 1 is met through plant fire prevention procedures and is not affected by this configuration, and that echelons 2 and 3 are met in performance evaluations through appropriate compensatory measures, such as the readiness of an additional fire hose to reach the affected areas and fire surveillances. The licensee further stated that 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 licensee further stated that the lack of sectional isolation valves does not result in compromising fire suppression functions or post-fire SSD capability and that since a balance of the elements is provided, DID is achieved. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the lack of sectionalizing valves between fixed suppression systems and hose stations in certain plant areas does not impact the ability to meet the NSPC and DID is maintained.

Based on its review of the information submitted by the licensee in the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.5.11, requirements because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains sufficient safety margin; and maintains adequate fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.4 NFPA 805, Section 3.5.14 – Supervision of Water Supply and Fire System Control Valves

In LAR Attachment L, Approval Request 4, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.5.14, requirement that fire water supply and fire suppression system control valves be supervised by electrical supervision with audible and visual signals, by locking valves in their normal position and keys available only to authorized personnel, or by sealing valves in their normal positions. Specifically, the licensee has requested approval of a PB method for fire hydrant curb box valves.

The licensee stated that the control valves in the supply lines to the individual fire hydrants are underground valves and that these valves do not have an extended, permanently attached method of changing the valve's position. The licensee further stated that it selected this type of valve because the location of the underground piping in the yard precludes the installation of a post-indicator valve above the surface level, which would interfere with vehicle traffic, equipment movement, and have the potential for damage. The licensee stated that the valves were referred to as curb box type valve in the Unit No. 1 SER and as key-operated valves in the Unit No. 2 SER, and that plant procedures refer to them only as curb box valves. The licensee

further stated that the term "key" comes from the description of the long T-handle portable valve operating tool.

The licensee stated that the underground control valves supplying each outdoor fire hydrant are provided with a curb box for access and require the use of a long handle T-wrench to reposition the valve. The licensee further stated that these valves are in the plant surveillance procedures and are periodically inspected to confirm that they are in the required open position.

The licensee further stated:

- The underground valves and/or curb boxes are not designed to accept monitoring switches, locks and chains, or sealing devices.
- The valves are not subject to inadvertent closure or tampering because they require the use of special T-wrench for operation. Each valve controls the water supply to only one outdoor fire hydrant.
- The valves are located underground, and without the special long handle valve wrench for operation, the valves cannot be inadvertently operated or misaligned accidently.
- The valves are included in a periodic inspection program.

The licensee stated that even though the valves are not equipped to monitor tampering or repositioning, their inaccessibility and the physical requirement to obtain and use the special T-wrench prevents them from being the subject of tampering.

The licensee stated the non-supervision of curb valves for the underground yard fire main loop does not affect the NSPC. The licensee further stated that the valves are operated only by trained personnel to ensure that water is available to plant fire protection systems as required, and therefore, there is no impact on the NSPC. The licensee stated that similarly, the non-supervision of curb valves has no impact on the radiological release performance criteria.

The licensee stated the non-supervised curb valves for the underground fire main loop require a special wrench for operation and they are operated by authorized personnel only; therefore, the safety margin inherent in the analysis for the fire event has been preserved. The licensee further stated that based on these justifications, this condition does not negatively affect the system pressure or flow, and therefore, does not impact fire protection DID, and the non-supervision of curb valves does not directly result in compromising fire suppression functions, manual fire suppression functions, or post-fire SSD capability.

In FPE RAI 14d (Reference 23), the NRC staff requested that the licensee 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 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. In its response to FPE RAI 14d (Reference 11), the licensee stated that for the nuclear safety and radiological release performance criteria section, it has implemented administrative controls for periodic surveillance of the box curb valves. The licensee stated that the inaccessibility of the curb box valves, the required usage of a special T-wrench, and periodic surveillance by trained and authorized personnel ensure that the nuclear safety and radiological release performance goals, performance objectives, and performance criteria are not affected.

The licensee stated that the non-supervised curb valves for the underground fire main loop require a special wrench for operation, and they are operated by authorized personnel only; therefore, the safety margin inherent in the analysis in the event of a fire has been preserved. The licensee further stated that based on these justifications, this condition does not adversely affect the system pressure or flow, and therefore, does not impact fire protection DID, and the non-supervision of curb valves does not directly result in compromising fire suppression functions, manual fire suppression functions, or post-fire SSD capability.

The licensee stated that the three echelons of DID are (1) to prevent fires from starting; (2) to rapidly detect, control, and extinguish fires that do occur, thereby limiting damage; and (3) to provide an adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee further stated that per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided. The licensee stated that echelon 1 is met through plant fire prevention procedures and is not adversely affected by this configuration. The licensee further stated that 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 SSD capability. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that unsupervised fire hydrant curb box valves do not impact the plant's ability to meet the nuclear safety and radioactive material release performance criteria and maintains DID and safety margin.

Based on its review of the information submitted by the licensee in the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.5.14, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains sufficient safety margin; and maintains adequate fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.5 NFPA 805, Section 3.11.3 – Use of Fire Damper Assemblies

In LAR Attachment L, Approval Request 5, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.11.3, requirement that penetrations in fire barriers be provided with listed rated fire dampers having a fire resistance rating consistent with the designated fire resistance rating of the barrier, as determined by the performance requirements established by Chapter 4. Specifically, the licensee requested approval of a PB method for the use of two 1.5-hour fire dampers in series with 1-hour fire wrap on the associated ductwork to the fire area boundary instead of a 3-hour fire damper.

In SSD RAI 13.01a (Reference 27), the NRC staff requested that the licensee describe how it can be assured that the fire damper/wrap configurations described in the approval request are capable of withstanding the fire hazards associated with the fire areas and, in particular, to describe how the configurations are adequate for areas with fire loadings greater than 1 hour. In its response to SSD RAI 13.01a (Reference 16), the licensee clarified that additional plant walkdowns and review of design drawings identified that the majority of configurations of 1.5-hour fire dampers in series were different from those discussed in the original Approval Request 5. Subsequently, the licensee revised Approval Request 5 to describe the fire damper configurations identified from the plant walkdown and review. The NRC staff concludes that the licensee's response to SSD RAI 13.01a is acceptable because the licensee provided a revised

Approval Request 5, which evaluated the fire damper configurations and demonstrated that the fire dampers are capable of withstanding the fire hazards associated with the fire areas.

In LAR Attachment L (Reference 16), the licensee revised Approval Request 5 and requested approval for the use of fire damper configurations that contain two 1.5-hour fire dampers in series as follows:

1. Two 1.5-hour fire dampers in series located within the fire barrier and

2. Two 1.5-hour fire dampers in series with one located within the fire barrier and one located close to, but outside, the fire barrier.

The licensee stated that although the fire damper assemblies were purchased as UL-labeled units, the manufacturer removed the UL label from the assemblies due to the untested configuration. The licensee further stated that it completed a PB evaluation for the fire damper configurations and concluded that the configurations are adequate and capable of withstanding the fire hazards associated within the affected fire areas.

The areas with two 1.5-hour rated fire dampers in series within the power block areas of Unit No. 2 are listed in SE Table 3-1 below.

Table 3-1

Fire Compartment	Description
2-ASP	Alternate Shutdown Panel (ASP) Room
2-CB-1	Instrument and Relay Room and Cable Spreading Room
2-CB-5	Control Building Fan Room
2-CB-6	West Communications Room
2-CP-1	Condensate Polishing Building
2-CV-1	West Cable Vault and Rod Control Area
2-CV-2	East Cable Vault and Rod Control Area
2-CV-3	Cable Vault and Rod Control Area
2-CV-4	South Cable Vault and Rod Control Area
2-CV-5	North Cable Vault and Rod Control Area
2-CV-6	Cable Vault and Rod Control Relay Room
2-FB-1	Fuel Handling and Decontamination Building
2-PA-5	Auxiliary Building General Area, Elevation 773'-6"
2-SB-1	Service Building Emergency Switchgear – Train A
2-SB-2	Service Building Emergency Switchgear – Train B
2-SB-6	Service Building Battery Room 2-1
2-SB-7	Service Building Battery Room 2-3
2-SB-8	Service Building Battery Room 2-2
2-SB-9	Service Building Battery Room 2-4
2-SG-1N	North Safeguards Area
2-WH-1	Waste Handling Building

In SSD RAI 13.01c (Reference 27), the NRC staff requested that the licensee explain why the two 1.5-hour fire-rated dampers are not included in LAR Table 4-3 as required fire protection features for these areas and also explain why "wrap on exposed ductwork" is not included as a required fire protection feature for fire area 2-ASP. In its response to SSD RAI 13.01c

(Reference 16), the licensee stated that LAR Table 4-3 did not include the 1.5-hour fire-rated dampers because the dampers were considered to be general fire protection features similar to fire doors and penetration seals, and that LAR Table 4-3 did not include a list of all credited fire doors, fire dampers, or penetration seals, as these types of fire protection features are described in LAR Attachment A2 records for the individual fire compartments. The licensee further stated that as discussed in its response to SSD RAI 13.01a, the "wrap on exposed ductwork" for fire area 2-ASP was not listed as a required fire protection feature in LAR Table 4-3 because there are not any configurations of exposed ductwork containing fire wrap within this fire area. The NRC staff concludes that the licensee's response to the RAI is acceptable because it clarified that the fire dampers, along with other fire passive features required to meet NFPA 805, Chapter 4, are identified in LAR Attachment A2 instead of LAR Table 4-3, and the exposed ductwork in fire area 2-ASP is part of this approval request.

The licensee stated that most fire damper configurations in the subject areas were identified to be within the fire barrier, and that two 1.5-hour fire dampers in series located within the fire barrier are equivalent to a 3-hour fire damper. The licensee based its conclusion on the following:

- In areas where the fire loading is greater than 1.5 hours, once actuated, the first fire damper will provide at least 1.5 hours of fire protection until it fails. The second fire damper will provide at least 1.5-hours of additional fire protection, for a total of 3-hours fire protection for the two fire dampers in series. If the first fire damper fails (i.e., fire breaches through the damper), it will be in the closed position providing some level of shielding for the second fire damper from the full effects of the fire event. Since the second fire damper will experience a lower fire intensity, its fire-rating would likely be extended to a value greater than 1.5-hours, providing additional DID.

- The ventilation duct and fire damper configuration has been previously accepted by the NRC staff in site SER -NUREG-1057, Supplement 3 (Reference 39), as equivalent to a 3-hour fire damper.

The licensee further stated that additional DID exists based on the following:

- Previous industry experience has indicated that not all combustibles within an area are likely to be consumed during fire events, which further shortens the required duration for the fire damper configuration to prevent fire spread to the adjacent fire compartment.

- In general, combustible materials located in each fire compartment are dispersed throughout, as opposed to being all located in one specific area, making it unlikely that the fire dampers will be directly exposed to the full fire severity represented by the total combustible loading of the area.

The licensee described that the guidance states that the ductwork from the fire barrier to and including the damper assembly should be enclosed with a fire-rated barrier material equivalent to the fire barrier, and that the majority of the areas in SE Table 3-1 comply with this requirement due to the equivalency of two 1.5-hour fire dampers to a 3-hour fire damper. The licensee stated that only a few areas were identified that contained one of the two 1.5-hour fire dampers outside of the fire barrier, and these configurations are located in the following areas:

- Fire barrier between 2-ASP (Alternate Shutdown Panel Room) and 2-CV-3 (Cable Vault and Rod Control Area).

- Fire barrier between 2-WH-1 (Waste Handling Building) and 2-PA-5 (Auxiliary Building, Elevation 773'-6").

The licensee stated that the fire dampers outside of the barrier are located in 2-CV-3 and 2-WH-1. The licensee evaluated these fire damper configurations and determined that it provided acceptable fire barriers for these areas. The licensee stated that in fire areas 2-ASP and 2-PA-5, one of the 1.5-hour rated fire dampers is located within the fire barrier and that both areas contain combustible loading less than 0.5 hours, and limited combustibles in the general vicinity of the fire dampers.

The licensee stated that in 2-WH-1, one of the fire dampers is located outside of the barrier; however, the combustible loading is less than 0.5 hours, which is shorter in fire duration than the 1.5-hour rating of the second fire damper installed in the barrier interface. The licensee further stated that the ductwork and fire damper located outside of the fire barrier in 2-WH-1 will provide additional DID.

The licensee stated that in 2-CV-3, one of the fire dampers is located directly outside of the barrier interface from the 2-ASP ceiling and that 2-ASP is located within 2-CV-3 at a partial elevation within the fire compartment. The licensee further described that permanent access to the area where the dampers are located is restricted, unless additional measures are taken (i.e., ladder, scaffold) to obtain access, and that it is unlikely that transient combustible materials will be placed or a fire will be ignited in close proximity to the ventilation duct and fire damper configurations. The licensee stated that 2-CV-3 has a combustible loading of less than 2 hours and that the area is very large, with the majority of combustibles located at the opposite side from where the fire dampers above 2-ASP are located. The licensee further stated that a fire event severe enough to actuate the fire dampers within the 2-CV-3/2-ASP barrier would likely only have a peak intensity at that location for a fraction of the total fire duration, then weaken as the fire event moves to igniting combustibles in other areas of the compartment. The licensee stated that additional DID is also provided by the 1.5-hour fire dampers and ductwork located immediately outside of the barrier, resulting in reasonable assurance that an adequate fire barrier is provided.

The licensee stated that as additional DID for configurations that contain ductwork connected to the dampers on each side of the barrier, the ductwork itself provides some level of fire protection. The licensee further stated that certain configurations of ductwork of steel construction penetrating a fire barrier without a fire damper have been tested and shown to remain intact during exposure to a 1-hour fire duration on the ASTM E-119 (Reference 128), time-temperature curve. The licensee further stated that the UL tested HVAC duct, which was 0.022" thick galvanized sheet steel, with an air-drop opening in the ductwork on the unexposed side of the barrier, was located 10 feet from the barrier. The licensee further stated that the UL test results show that maximum temperatures on the unexposed side adjacent to the barrier were 499 °F on uninsulated steel duct and 176 °F on insulated steel duct. The licensee stated that the maximum temperatures on the unexposed side 9 feet from the barrier were 175 °F on uninsulated steel duct and 178 °F on insulated steel duct, and that the testing demonstrates that the steel ducts without fire dampers are adequate and will not propagate a 1-hour fire through the barrier. The licensee further stated that, in addition, the typical melting point for steel is between 2,500-2,800 °F, which is greater than the ASTM E-119 furnace temperature of 1,700 °F

during a 1-hour test, 1,850 °F during a 2-hour test, and 1,925 °F during a 3-hour test; therefore, the steel duct work will remain intact for longer durations.

The licensee stated that typically, ductwork installed at Beaver Valley is of a minimum thickness of 20 gauge (> 0.0359"), which is thicker than the tested ductwork, and that the robust construction of the steel ductwork provides a barrier to prevent the propagation of fire through the ductwork.

The licensee initially stated that this approval request applies to other areas whose configuration is similar to the fire areas, which received prior approval with 1-hour fire wrap extending from the fire barrier to and including the fire damper outside the plane of the fire barrier to create an equivalent 3-hour fire-rated configuration. In the RAI response, the licensee clarified that the primary difference in the configurations is that the majority of areas in this approval request contain fire damper configurations that are within the fire barrier, with the exception of the few areas in which one of the two fire dampers in series is located outside of the fire barrier and no fire wrap is provided on the ductwork between the dampers. The licensee further stated that these configurations do not pose a significant fire hazard in the areas listed below due to the following reasons:

- 2-ASP, 2-CV-2, 2-SB-1, 2-SB-2, 2-SB-6, 2-SB-7, 2-SB-8, 2-SB-9, and 2-SG-1 N have low combustible loading (less than 1 hour) and are provided with fire detection and manual suppression. Additionally, the fire dampers are located within the fire barrier. The low combustible loading and presence of early warning detection ensure that a fire would be detected in its initial stage; thus, the manual suppression from the fire brigade will minimize the likelihood of fire propagation through the barrier. Additional structural support to provide the ability to use 3-hour rated fire wrap would not significantly increase the level of fire safety.

- Fire compartments 2-CB-5, 2-CV-4, 2-CV-5, 2-FB-1, 2-PA-5, and 2-WH-1 have low combustible loading (less than 1.5 hours) and no credited fire detection or automatic suppression; however, manual suppression is available. Given the low combustible loading in these locations, an unmitigated fire would not challenge the fire rating provided by the fire damper configurations. Therefore, fire detection is not required to maintain the integrity of the fire barrier. Fire dampers are located within the fire barrier (with the exception of 2-WH-1), and the low combustible loading and manual suppression from the fire brigade will minimize the likelihood of fire propagation through the barrier. 2-WH-1 contains fire damper configurations with one fire damper outside of the barrier plane, which the licensee evaluated and determined to be acceptable.

- Fire compartment 2-CP-1 has combustible loading less than 1.5 hours and no credited fire detection or automatic suppression; however, manual suppression is available. Given the combustible loading in this location, an unmitigated fire would not challenge the fire rating provided by the fire damper configurations. The licensee stated that 2-CP-1 is a large fire compartment (i.e., the entire compartment spans from elevation 722'-6" to 774'-6") and combustible loading is calculated for the entire 2-CP-1 compartment. The fire damper configurations exist only on the 774'-6" elevation, and this area of 2-CP-1 is not a safety significant area, nor is the adjacent area (2-WH-1). Therefore, fire detection is not required to maintain the integrity of the fire barrier. Fire dampers located

within the fire barrier with combustible loading of less than 1.5 hours and manual suppression from the fire brigade will minimize the likelihood of fire propagation through the barrier.

- Fire compartments 2-CV-3 and 2-CV-6 have combustible loading less than 1.5 hours and are provided with fire detection, automatic suppression, and manual suppression. It is expected that a fire in these areas would be detected in its initial stage, and the early intervention from the fire brigade with manual suppression would minimize the likelihood of fire propagation through the barrier. Additionally, the fire dampers located within the fire barrier (with the exception of a few configurations in 2-CV-3), along with the fixed automatic suppression provide additional DID and reasonable assurances that the growth of postulated fires will be controlled prior to fire propagating through the barrier. There are a few fire damper configurations in 2-CV-3 that have one fire damper outside of the barrier plane, which the licensee evaluated and determined to be acceptable.

- Fire compartments 2-CB-1 and 2-CV-1 have combustible loading less than 2.25 hours and are provided with fire detection, automatic suppression, and manual suppression. It is expected that a fire in these areas would be detected in its initial stage, and the early intervention from the fire brigade with manual suppression would minimize the likelihood of fire propagation through the barrier. Additionally, the fire dampers are located within the fire barrier, and fixed automatic suppression provides additional DID and reasonable assurance that the growth of postulated fires will be controlled prior to fire propagating through the barrier.

- Fire compartment 2-CB-6 has a combustible loading of less than 2 hours. Early warning fire detection is credited in the compartment, and manual suppression is available. Additionally, the fire dampers are located with the fire barrier. Given the fire detection system and the proximity of 2-CB-6 to the continuously occupied control room, a fire in this area would be detected and responded to quickly by the fire brigade to initiate suppression activities within 30 minutes, which will minimize the likelihood of fire propagation through the barrier.

The licensee stated that the use of two 1.5-hour fire dampers in series in steel ductwork does not adversely affect the NSPC. The licensee clarified that the majority of the fire areas identified in Table 1 (of Approval Request 5) contain fire damper configurations consisting of two 1.5-hour fire dampers within the fire barrier, which was concluded to be equivalent to a 3-hour fire damper. The licensee stated that for a fire to spread from one compartment to another, it would have to propagate through two 1.5-hour rated dampers. The licensee further stated that the UL testing has demonstrated that the steel ducts without fire dampers are adequate and will not propagate a 1-hour fire through the barrier, and that the two 1.5-hour fire-rated dampers in series will provide the equivalent fire resistance of one 3-hour fire-rated damper, and the properties of steel demonstrate that the steel will stay intact.

The licensee stated that the use of the two 1.5-hour fire dampers in series has no adverse impact on the radiological release performance criteria, since there will be no adverse impact on fire suppression activities. The licensee further stated that the radiological release review was performed based on the potential location of radiological concerns and is not dependent on the type of fire dampers and fire wraps used for the ventilation ductwork.

The licensee stated that the use of two 1.5-hour fire dampers in series, in power block areas, does not introduce additional fire hazards and that the safety margin is maintained due to low combustible loading, mitigating fire protection systems and features, availability of the fire brigade, and the ability to maintain safe and stable conditions. The licensee further stated that the safety margin inherent in the analysis in the event of a fire has been preserved.

The licensee stated that the three echelons of DID are (1) to prevent fires from starting; (2) to rapidly detect, control, and extinguish fires that do occur, thereby limiting damage; and (3) to provide an adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee further stated that per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided. The licensee stated that echelon 1 is met through plant fire prevention procedures and is not adversely affected by this configuration. The licensee further stated that echelons 2 and 3 are met through fire prevention procedures, which maintain the functionality of the credited fire detection and automatic and manual fire suppression systems.

In SSD RAI 13.01b (Reference 27), the NRC staff requested that the licensee describe the fire prevention procedures and how the three elements of DID required by Section 1.2 of NFPA 805 are achieved in the fire areas described in the approval request. In its response to SSD RAI 13.01b (Reference 16), the licensee stated that echelon 1 is met through fire prevention procedures and is not adversely affected by the fire damper in series configurations. The licensee further stated that echelon 2 is maintained due to the suppression systems located in the areas described in the approval request, as well as manual detection and fire brigade manual suppression capability, which will limit the fire damage within these areas. The licensee further stated that echelon 3 is met by rated fire barriers between adjacent areas, including the evaluated damper configurations as described in the approval request, which will prevent propagation of fire to other locations. The NRC staff concludes that the licensee's response to the RAI is acceptable because it has provided additional information that describes how the balance of DID is maintained, as required by NFPA 805, Section 1.2.

The licensee stated that, in addition, maintenance procedures are in place for the performance of periodic preventive mechanical maintenance of fire dampers and inspection of the fire wrap, and that also the fire brigade is trained to respond to and extinguish fires, and the deviation does not result in compromising automatic fire suppression functions, manual fire suppression functions, or post-fire SSD capability. The licensee further stated that a balance of the elements is provided and, therefore, DID is achieved.

Based on its review of the information submitted by the licensee in the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.11.3, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains sufficient safety margin; and maintains adequate fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.6 NFPA 805, Section 3.3.5.3 – Acceptable Flame Propagation Tests for Electrical Cables

In LAR Attachment L, Approval Request 6, as supplemented, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.3.5.3, requirement that electrical cable construction comply with a flame propagation

test acceptable to the AHJ. Specifically, the licensee requested approval of a PB method for the use of electrical cables with limited information regarding flame propagation results.

The licensee stated that there is a small percentage and/or number of cables in risk-significant compartments that are either thermoplastic or contain unknown cable material.

The licensee stated that generally, detailed FM and other plant documents use the terms "thermoset" and "thermoplastic" when referring to flame propagation properties of electric cables. The licensee further stated that regulatory guidance documents have characterized "qualified" cables as those that exhibit "thermoset"-type burning qualities (i.e., char and will not melt/drip, self-extinguishing, and capable of passing flame propagation tests). The licensee further stated that "nonqualified" cables have been characterized as those that exhibit "thermoplastic" burning qualities (i.e., melt and drip, not self-extinguishing, and not capable of passing flame propagation tests), and that in general, cables that pass IEEE-383 (Reference 100) testing (i.e., are IEEE-383 qualified) are thermoset cables.

The licensee stated that the majority of the cables would pass the flame propagation testing criteria of IEEE-383-1974 or equivalent. The licensee further stated that the presence of small quantities of electric cables that are either thermoplastic or of unknown flame propagation characteristics will not preclude the capability to achieve the NSPC of NFPA 805, Section 1.5. The licensee further stated that DID is also achieved in accordance with NFPA 805, Section 1.2, thus meeting the intent of the electrical cable construction requirements of NFPA 805, Section 3.3.5.3.

The licensee stated that the quantity and location of thermoplastic and thermoset cables in the fire compartments was used as input to the FPRA cable selection, PB analysis, and detailed FM. The licensee further stated that in some raceways, it was confirmed that certain cable types are thermoplastic; however, not all cables types could be confirmed. The licensee further stated that its thermoset and thermoplastic electric cable report conservatively accounted for the cables of unknown jacket or insulation type by including them in the thermoplastic category. The licensee stated that the anticipated HRRs for cable trays containing a mixture of thermoplastic and thermoset cables are bounded by the HRR assumptions in the detailed FM.

The licensee stated that the fire hazard potential of the nonqualified/unknown (thermoplastic) cable types identified in its thermoset and thermoplastic electric cable report has been incorporated into the detailed fire models for the identified fire compartments and subsequently used as an input during the NFPA 805, Section 4.2.4 (PB approach), NSCA. The licensee further stated that the postulated effects of a fire in areas that contain thermoplastic cables are analyzed in each of the supporting compartment's NSCA for NFPA 805, Section 4.2.4. The licensee stated that for the thermoplastic/unknown cable types, it assumed bounding case thermoplastic flame propagation/spread, HRRs, and thermal damage criteria in the FM analysis. The licensee further stated that the FM analysis is consistent with, or more conservative than, the approved guidance (i.e., NUREG/CR-7010 or NUREG/CR-6850) with regard to flame propagation/spread rate, HRR, and thermal damage criteria for raceways containing a mixture of thermoplastic and thermoset cable types, and that this results in a conservative and bounding FM analysis with regard to cable material types and associated flame propagation rates.

The licensee stated that for those fire compartments that were excluded from the detailed FM analysis because their risk was already acceptably low, all cables were conservatively modeled by assuming whole-room damage. The licensee further stated that the flame

propagation/spread rates, HRRs, and thermal damage criteria characteristics of cable in these areas, are therefore, bounded.

The licensee stated that it has been confirmed by review of its thermoset and thermoplastic electric cable report that power cables in risk-significant areas are thermoset cables, and that based on this and the guidance provided in NUREG/CR-6850, Appendix R, "Cable Fires," and PRA FAQ 13-0005, it screened self-ignited cable fires as non-challenging ignition sources in the FM reports.

The licensee stated that the presence of a small percentage and/or number of thermoplastic/unknown cables has no adverse impact on the radiological release performance criteria. The licensee further stated that the radiological release performance criteria are satisfied based on the determination of limiting radioactive release, which is not affected by the flame spread characteristics of a small percentage/number of cables.

The licensee stated that the deviations from the cable construction requirements of NFPA 805, Section 3.3.5.3, do not significantly diminish any safety margins based on the conservative assumptions regarding the cables in the FPRA, the mitigating fire protection systems and features, the availability of alternate success paths for nuclear safety, and the fact that no additional damaging ignition sources are introduced. The licensee further stated that, therefore, the safety margins inherent in the analyses for the postulated fire events have been preserved.

The licensee stated that the three echelons of DID are (1) to prevent fires from starting; (2) to rapidly detect, control, and extinguish fires that do occur, thereby limiting damage; and (3) to provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee further stated that per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided. The licensee stated that for echelon 1, a review of its thermoset and thermoplastic electric cable report determined that its power cables are thermoset-type cables, and that self-ignited cable fires are, therefore, screened as non-challenging ignition sources in the FM reports. The licensee further stated that industry experience has shown that in the unlikely event of a self-ignited cable tray fire, the fire is not expected to spread beyond the cable tray of fire origin. The licensee stated that the presence of a small percentage of thermoplastic or unknown cables does not introduce any additional challenging ignition sources, thus meeting the intent of echelon 1. The licensee stated that for echelon 2, thermoplastic and unknown cables were included in the detailed FM analyses reflecting the as-built, as-operated plant conditions, and that it conservatively modeled cables of unknown material as thermoplastic. The licensee further stated that suppression and detection systems are credited in the FM analysis where necessary for risk improvement. The licensee further stated that the presence of a small percentage and/or number of thermoplastic or unknown cables does not introduce any significant additional challenge to the fire protection systems, and that the intent of echelon 2 is, therefore, met. The licensee stated that for echelon 3, fire-rated barriers between fire areas will limit fire propagation in the plant. The licensee further stated that flame spread characteristics of the cable jacketing are conservatively treated in the FPRA, and that this data is used as input for the preparation of the NFPA 805, Section 4.2.4 (PB approach), NSCA. The licensee further stated that the FPRA conservatively bounds the thermoplastic and unknown cables in the analysis, and that the small percentage and/or quantity of thermoplastic/unknown cables will not present a significant additional challenge to the fire barriers. The licensee further stated that the results of the FPRA are reflected in the FREs that include appropriate DID and safety margins, and that the intent of echelon 3 is, therefore, met in maintaining a success path free of damage. The licensee stated that based on maintaining a balance of the three echelons, DID is achieved.

Based on its review of the information submitted by the licensee in the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.3.5.3, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains sufficient safety margin; and maintains adequate fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.7 NFPA 805, Section 3.3.7.2 – Outdoor High-Pressure Flammable Gas Storage

In LAR Attachment L, Approval Request 7, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection to the NFPA 805, Section 3.3.7.2, requirement that outdoor high-pressure flammable gas storage containers be located so that the long axis is not pointed at buildings. Specifically, the licensee requested approval of a PB method for the installation of hydrogen storage tanks in the outdoor yard area.

The licensee stated that there is currently an array of eight hydrogen storage tanks located to the east of the Unit No. 2 turbine building, approximately 135 feet away, and that the capacity of the hydrogen system is approximately 56,000 cubic feet for the eight tanks. The licensee further stated that based on the safety relief devices installed, the distance from the Unit No. 2 turbine building, lack of ignition sources and combustibles, and the physical protection afforded to the tanks, a fire exposure that is prolonged and severe enough or physical damage that could result in a rocketing tank damaging the turbine building is very unlikely. The licensee further stated that the Unit No. 2 turbine building is located approximately 135 feet away from the hydrogen storage tanks, and that it is expected that the hydrogen tanks would not cause damage to the turbine building due to the separation distance and the unlikely scenario of a rocketing tank. The licensee stated that the guidance in NUREG/CR-6850, Attachment N, for hydrogen tanks does not require [sic] (recommend) analysis of a fire scenario beyond 10-15 feet, and that for purposes of this approval request, it is assumed that the hydrogen tank could result in damage to the turbine building.

The licensee stated that it analyzed fire compartment 2-TB-1 by an FRE and found it to meet the requirements of NFPA 805 and the guidance of RG 1.205. The licensee further stated that the FRE for 2-TB-1 determined that the risk contribution of VFDRs is very low risk significance, and that the findings of the analysis also confirmed that even in the very unlikely event that fire compartment 2-TB-1 is subject to whole area damage due to a hydrogen fire or rocketing tank, adequate DID and safety margins are maintained.

The licensee stated that the probability of the hydrogen storage tanks penetrating the Unit No. 2 turbine building wall is unlikely, and the FRE results indicate that adequate DID and safety margins would remain available in this scenario. The licensee further stated that there is no adverse impact on the NSPC.

The licensee stated that the configuration of the hydrogen storage tanks has no adverse impact on the radiological release performance criteria. The licensee further stated that the radiological release performance criteria are satisfied based on the determination of limiting radioactive release, which is not affected by the hydrogen storage tank configuration.

The licensee stated that the hydrogen tanks meet the design requirements of NFPA 55-2010 (Reference 129), that an explosive event or rocketing tank has a very low probability of occurrence, and that the deviation does not compromise the NSCA. The licensee stated that, therefore, the safety margin inherent in the analysis in the event has been preserved.

The licensee stated that the three echelons of DID are (1) to prevent fires from starting; (2) to rapidly detect, control, and extinguish fires that do occur, thereby limiting damage; and (3) to provide an adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee further stated that per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided. The licensee stated that echelon 1 is maintained by NFPA 55-2010 compliance, including planned implementation items to correct known minor deficiencies, and that automatic fire protection systems are not required for the protection of these tanks, and there are fire hydrants in the vicinity of these tanks such that DID echelon 2 is also met. The licensee further stated that echelon 3 is maintained due to the low probability of a hydrogen storage tank damaging the Unit No. 2 turbine building, and adequate DID and safety margins are maintained if 2-TB-1 is damaged. The licensee stated that the approval request does not result in compromising automatic fire suppression functions, manual fire suppression functions, or post-fire nuclear safety capability. The licensee further stated that since a balance of the elements is provided, DID is maintained.

Based on its review of the information submitted by the licensee in the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.3.7.2, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains sufficient safety margin; and maintains adequate fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.8 NFPA 805, Section 3.5.5 – Separation of Fire Pumps, Driver, and Control Cables

In LAR Attachment L, Approval Request 8, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.5.5, requirement that each fire pump and its driver and controls be separated from the remaining fire pumps and from the rest of the plant by rated fire barriers. Specifically, the licensee requested approval of a PB method for the fire pump control cables.

The licensee stated that the fire pump remote control circuits are routed through fire compartments 3-CR-1, 1-CS-1, and 1-CV-3, and that the control cables for each fire pump then are routed through separate underground ducts through 3-YARD-1 and terminate in their respective cubicles within the intake structure (1-IS-1 and 1-IS-4). The licensee further stated that the fire protection water systems are supplied by an electric motor driven fire pump, BV-1 FP-P-1, and a diesel engine driven fire pump BV-1 FP-P-2, and that these pumps supply the yard loop, which serves both units. The licensee stated that a fire in one of the above locations could cause a fault in the cables between the control room remote start pushbutton and the fire pump controller in the intake structure, resulting in loss of both fire pumps. The licensee further stated that alternate supplies are available through the use of portable pumps (i.e., fire truck) and the warehouse diesel driven fire pump (1 FPWH-P-1) in accordance with site procedures. The licensee stated that pump 1 FPWH-P-1 has automatic start on low fire protection system

pressure and would provide sufficient capacity for fire hose use, and that the hose stations, therefore, remain available due to alternate water supply capabilities.

The licensee stated that if a fire occurred in 3-CR-1, 1-CS-1, 1-CV-3, or 3-YARD-1, alternate fire protection suppression capability is available as follows.

- In the control room (3-CR-1), the control cables for both primary fire pumps are installed on separate equipment trains in the building service control panel and are separated by a fire barrier behind the control panel. The control room is continuously occupied by operators, which constitutes a continuous fire watch. Manual suppression, such as portable extinguishers, are provided. In addition, hose stations are provided in the area upon utilization of alternate water supplies, and automatic detection is also provided. The continuous occupation and availability of manual suppression within the control room significantly minimize fire risk in the area and increase the ability to rapidly detect, control, and extinguish fires that could occur, thereby limiting damage.

- In the cable spreading room (1-CS-1), the control cables are routed together and are not separated by a rated fire barrier. However, the cable spreading room is equipped with a total flooding CO_2 system, which is normally automatic, but also can be actuated manually. System actuation and trouble alarms are provided in the control room. Manual suppression such as portable extinguishers is provided. In addition, hose stations in the vicinity of the area are available upon utilization of alternate water supplies, and automatic smoke detection is provided as well. The available fire protection features ensure that a fire in the area will be rapidly detected, controlled, and extinguished without relying on the primary fire pumps.

- In the cable tunnel (1-CV-3), the control cables are routed together and are not separated by a rated fire barrier. However, the cable tunnel is equipped with a total flooding Halon system, which is normally automatic but also can be actuated manually. Additional manual suppression is available from portable extinguishers in the yard, as well as fire hydrants upon utilization of alternate water supplies. Automatic smoke detection is also provided. The available fire protection features significantly minimize fire risk in the area and increase the ability to rapidly detect, control, and extinguish fires that could occur, thereby limiting damage.

- In the underground yard (3-YARD-1) duct lines, the control cables are routed separately in different duct lines. The yard is comprised of underground electrical manholes and associated electrical duct lines. Neither detection nor suppression is available in the duct lines. Each electrical manhole is spatially separated from other fire compartments, providing reasonable assurance that postulated fires would be confined to the compartment of origin. Spread of fire between manholes is highly unlikely due to the physical separation; therefore, loss of both control cables due to a single fire event is highly unlikely.

The licensee stated that the areas in which the primary fire pumps control circuits are not separated by fire barriers and do not rely on automatic wet pipe suppression or hose stations. The licensee further stated that the fire protection systems in these areas include detection and

alternate means of suppression such as automatic gaseous suppression systems and portable fire extinguishers, and that sufficient pressure could be provided for hose stations for manual suppression if required, due to the availability of backup alternate water supplies. The licensee further stated, therefore, a fire in 3-CR-1, 1-CS-1, or 1-CV-3, which results in loss of the fire pumps, control circuits does not adversely affect the capability to extinguish fires within these compartments.

The licensee stated that the current configuration of the primary fire pump remote control circuits does not adversely affect nuclear safety as alternate manual, fixed suppression capability or adequate separation remain available for these areas, and that there is no adverse impact on the NSPC.

The licensee stated that the radiological release performance criteria are satisfied based on the determination of limiting radioactive release. The licensee further stated that the potential loss of the fire protection water supply does not change the radiological release evaluation, which concluded that potentially contaminated water is contained and smoke is monitored, and therefore, the results and conclusions in LAR Attachment E remain valid.

The licensee stated that the current configuration of the fire pump remote control circuits will not adversely impact the ability of the station to achieve and maintain post-fire SSD as alternate manual, fixed suppression capability, or adequate separation is provided in these areas. The licensee further stated, therefore, that the safety margin inherent in the analysis in the event of a fire has been preserved.

The licensee stated that the three echelons of DID are (1) to prevent fires from starting; (2) to rapidly detect, control, and extinguish fires that do occur, thereby limiting damage; and (3) to provide an adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee further stated that per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided. The licensee stated that echelon 1 is met through plant fire prevention procedures and is not adversely affected by this configuration. The licensee further stated that echelon 2 is maintained due to the suppression systems located in the areas, as well as hose stations or hydrants that are expected to remain available from the use of alternate water supplies. The licensee stated that with the exception of 3-YARD-1, these areas are provided with either thermal heat or smoke detectors that increase the ability to rapidly detect, control, and extinguish fires that could occur, thereby limiting damage. The licensee further stated that echelon 3 is maintained, as these areas are provided with rated fire barriers, which will prevent the propagation of fire to other locations where essential equipment is located. The licensee further stated that for the subject plant locations, the deviation from NFPA 805, Section 3.5.5, does not result in compromising the credited fire protection systems or features or post-fire SSD capability. The licensee stated that since a balance of the elements is provided, DID is achieved.

Based on its review of the information submitted by the licensee in the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.5.5, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains sufficient safety margin; and maintains adequate fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.9 NFPA 805, Section 3.7 – Appropriate Type of Fire Extinguishers

In LAR Attachment L, Approval Request 9, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection to the NFPA 805, Section 3.7, requirement that where provided, fire extinguishers of the appropriate number, size, and type shall be provided in accordance with NFPA 10, "Standard for Portable Fire Extinguishers" (Reference 103) . Specifically, the licensee requested approval of a PB method for the use of type B:C portable fire extinguishers.

The licensee stated that portable fire extinguishers provided in certain fire compartments of the plant are provided with type B:C extinguishers in lieu of the required type A:B:C extinguishers, and that although these areas contain type A combustibles, they are provided with type B:C extinguishers rather than type A:B:C dry chemical extinguishers. The licensee further stated that some areas contain small amounts of miscellaneous Class A combustibles or potential transients, and other areas contain sensitive plant equipment. The licensee further stated that due to the potential for the chemicals contained in type A:B:C extinguishers to promote corrosion of stainless steel piping and sensitive plant equipment, these areas only contain type B:C extinguishers.

The licensee stated that the use of type B:C portable fire extinguishers in lieu of type A:B:C extinguishers is considered adequate for the hazard for the fire compartments because:

- These areas also contain Class B and/or C hazards, so the type B:C extinguisher is appropriate for these hazards, and utilizing an A:B:C multipurpose dry chemical extinguisher can be extremely corrosive and damaging to plant equipment.

- Carbon dioxide extinguishers, although rated for Class B and C hazards only, are able to extinguish small Class A fires, and re-ignition can be prevented by applying CO_2 to cool the fuel after the fire has been extinguished, resulting in a similar effect to the smothering achieved by the A:B:C multipurpose dry chemical agent.

- Type B:C dry chemical extinguishers provide interim fire suppression prior to utilizing a hose stream. Water suppression can be achieved with the use of hose stations located throughout the plant areas.

- NFPA 10 requires fire extinguishers suitable for Class A fires for the protection of the building structure, in addition to the occupancy hazard. However, most structures within the power block are of concrete construction, minimizing the need for Class A building protection.

The licensee stated that the placement of portable fire extinguishers in fire compartment 2-FB-1 is considered adequate for the hazard because in the Unit No. 2 fuel building (elevation 735' of 2-FB-1), the current placement of Class B:C extinguishers is along the normal travel paths. The licensee further stated that, in general, the only hazards outside of the required 75' travel distance are small 480 VAC pumps and motors and cable insulation, and it is considered unlikely that transient combustibles would accumulate in these areas since they are not readily accessible; therefore, installing additional type A:B:C extinguishers is not necessary.

The licensee stated that the NFPA 10 deviations present no adverse impact to the nuclear safety and radiological release performance criteria or to the safety margin and DID. The licensee stated that areas that do not comply with the intent of NFPA 10 will be modified and tracked by LAR Attachment S, Table S-2, as supplemented, Modification Item BV1-3017, which is an action to replace fire extinguishers with the appropriate size and type in certain areas of the plant. The NRC staff concludes that this action is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. In a letter dated April 21, 2017 (Reference 18), the licensee stated that this modification has been completed.

The licensee stated that the current configuration of portable fire extinguishers does not adversely affect nuclear safety, as adequate manual and fixed suppression capability are provided for these areas, and therefore, there is no adverse impact on the NSPC.

The licensee stated that the radiological release review was performed based on the fire suppression activities in areas containing or potentially containing radioactive materials and is not impacted by the size, type, or placement of portable fire extinguishers. The licensee further stated that the use of type B:C in lieu of type A:B:C extinguishers does not change the radiological release evaluation, which concluded that potentially contaminated water is contained and smoke is monitored. The licensee stated that the portable fire extinguishers do not add additional radiological materials to the area or challenge system boundaries, and therefore, have no adverse impact on the radiological release performance criteria.

The licensee stated that the current configuration of portable fire extinguishers will not adversely impact the ability of the station to achieve and maintain post-fire SSD, as adequate manual and fixed suppression capability is provided, and therefore, the safety margin inherent in the analysis in the event of a fire has been preserved.

The licensee stated that the three echelons of DID are (1) to prevent fires from starting; (2) to rapidly detect, control, and extinguish fires that do occur, thereby limiting damage; and (3) to provide an adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee further stated that per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided. The licensee stated that echelon 1 is met through plant fire prevention procedures and is not adversely affected by the extinguisher configurations. The licensee stated that echelon 2 is maintained, as the fire brigade is trained to respond to and extinguish fires with the tools provided to them, which include portable fire extinguishers. The licensee stated that echelon 3 is maintained because there are installed features that maintain safety functions, and portable fire extinguishers do not affect those features or prevent a success path free of fire damage. The licensee further stated that the size, type, and placement of existing portable fire extinguishers does not adversely impact fire protection DID, and that it does not compromise administrative fire prevention controls, automatic fire detection and suppression functions, manual fire suppression functions, or post-fire SSD capabilities. The licensee stated that a reasonable balance of the elements is provided, and therefore, DID is achieved.

Based on its review of the information submitted by the licensee in the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.7, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains sufficient

safety margin; and maintains adequate fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.10 NFPA 805, Section 3.6.2 – Pressure Reducers for Hose Stations

In LAR Attachment L, Approval Request 10, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.6.2, requirement that a capability be provided to ensure an adequate water flow rate and nozzle pressure for all hose stations, which includes the provisions of hose station pressure reducers, where necessary, for the safety of plant industrial fire brigade members and offsite fire department personnel. Specifically, the licensee requested approval of a PB method for not having pressure reducing devices installed at hose station connections.

The licensee stated that its NFPA 14 (Reference 102) code of record also requires that where the static pressure at any standpipe outlet for small hoses exceeds 100 psi, an approved device shall be installed at the outlets to reduce the pressure so that the nozzle pressure will be approximately 80 psi for Unit No. 1 and 100 psi for Unit No. 2. The licensee stated that the intent of the NFPA code requirement is to protect an untrained occupant from using a fire hose with a relatively high pressure, which could endanger the safety of the individual. The licensee stated that the 1971 Edition of NFPA 14 states that pressure reducers are not required on outlets for 2½-inch diameter fire hoses when the persons likely to use the hoses are trained in handling large streams. The licensee stated that it does not have 2½-inch diameter fire hose stations. The licensee further stated that the hose stations are utilized only by members of the trained and qualified fire brigade, and that the fire brigade members are trained and drilled using the expected pressures available for manual fire suppression activities. The licensee stated that the intent of the NFPA 805, Section 3.6.2, requirement is achieved through the exclusive use of the fire hose by trained fire brigade members.

The licensee stated that the lack of pressure reducing devices does not adversely affect nuclear safety since the fire brigade is trained in the use of all hose stations at the nominal operating supply pressure. The licensee further stated that fire brigade personnel safety are not compromised through use of hoses without pressure reducing devices.

The licensee stated that the lack of pressure reducing devices has no adverse impact on the radiological release performance criteria. The licensee further stated that the radiological release performance criteria are satisfied based on the determination of limiting radioactive release. The licensee stated that since the fire brigade is trained in the use of the hose stations, the results and conclusions in LAR Attachment E remain valid.

The licensee stated that the fire brigade is trained to extinguish fires using the installed hose stations. The licensee further stated that the lack of pressure reducing devices does not result in compromising manual fire suppression functions or the NSCA. The licensee further stated that since manual fire suppression functions are maintained through training and drills, the safety margin inherent in the analysis in the event of a fire has been preserved.

The licensee stated that the three echelons of DID are (1) to prevent fires from starting; (2) to rapidly detect, control, and extinguish fires that do occur, thereby limiting damage; and (3) to provide an adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee further stated that per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided. The licensee stated that echelon 1 is met through plant fire prevention procedures

and is not adversely affected by this configuration. The licensee further stated that echelon 2 is maintained, as the fire brigade is trained to respond to and extinguish fires with the tools provided to them, which include hose stations that do not have pressure reducing devices. The licensee further stated that echelon 3 is maintained because there are installed features that maintain safety functions, and the hose stations do not adversely affect those features or prevent a success path remaining free of fire damage. The licensee stated that the approval request does not result in compromising automatic fire suppression functions, manual fire suppression functions, or post-fire SSD capability. The licensee further stated that since a balance of the elements is provided, DID is achieved.

Based on its review of the information submitted by the licensee in the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.6.2, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains sufficient safety margin; and maintains adequate fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.11 NFPA 805, Section 3.2.3(1) – Procedures for Implementing the Fire Protection Program

In LAR Attachment L, Approval Request 11, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.2.3(1), requirement that procedures be established to accomplish the inspection, testing, and maintenance for the fire protection systems and features credited by the FPP. Specifically, the licensee requested approval of a PB method to establish the appropriate inspection, testing, and maintenance frequency for fire protection systems and features required by NFPA 805, as described in EPRI TR-1006756 (Reference 105).

The licensee stated that the scope and frequency of the inspection, testing, and maintenance activities for fire protection systems and features required in the FPP have been established based on the previously approved TSs, licensee-controlled documents, and appropriate NFPA codes. The licensee further stated that this approval request does not involve the use of EPRI TR-1006756 to establish the scope of those activities determined by the required systems review identified in LAR Table 4.3.

The license stated that this request is specific to the use of EPRI TR-1006756 to establish the appropriate inspection, testing, and maintenance frequencies for fire protection systems and features credited by the FPP. The licensee stated that EPRI TR-1006756 provides an accepted method to establish appropriate inspection, testing, and maintenance frequencies, which ensures the required NFPA 805 availability, reliability, and performance goals are maintained.

The licensee stated that the target tests, inspections, and maintenance will be those activities for the NFPA 805 required fire protection systems and features, and that the failure criterion will be established based on the credited functions of the required fire protection systems and features and will ensure those functions are maintained (or appropriate actions are implemented). The licensee further stated that the data collection and analysis will follow the EPRI TR-1006756 document guidance, and that the failure probability will be determined based on the EPRI TR-1006756 guidance, and a 95 percent confidence level will be utilized. The licensee stated that performance monitoring will be performed in conjunction with the monitoring program required by NFPA 805, Section 2.6, and it will ensure site-specific operating

experience is considered in the monitoring process. The licensee stated that the methodology established in EPRI TR-1006756 will be utilized to determine the inspection, testing, and maintenance frequencies.

The licensee stated that the use of PB test frequencies established per EPRI TR-1006756 methods, combined with the NFPA, 805 Section 2.6, monitoring program, will ensure that the availability and reliability of the fire protection systems and features are maintained to the levels assumed in the NFPA 805 engineering analysis (or the analysis will be updated accordingly). The licensee further stated that there is no adverse impact to the NSPC by the use of the PB methods described in EPRI TR-1006756.

The licensee stated that the radiological release performance criteria are satisfied based on the determination of limiting radioactive release. The licensee stated that fire protection systems and features are credited as part of the radioactive release evaluation, and that the use of PB test frequencies established per EPRI TR-1006756 methods, combined with the NFPA 805, Section 2.6, monitoring program, will ensure that the availability and reliability of the fire protection systems and features are maintained to the levels assumed in the NFPA 805 engineering analysis (or the analysis will be updated accordingly), which includes those assumptions credited to meet the radioactive release performance criteria. The licensee stated that there is no adverse impact to the radioactive release performance criteria.

The licensee stated that the use of PB test frequencies established per EPRI TR-1006756 methods, combined with the NFPA 805, Section 2.6, monitoring program, will ensure that the availability and reliability of the fire protection systems and features are maintained to the levels assumed in the NFPA 805 engineering analysis (or the analysis will be updated accordingly), including those assumptions credited in the safety margin discussions in the risk evaluation. The licensee further stated that, in addition, the use of these methods in no way invalidates the inherent safety margins contained in the codes used for design and maintenance of fire protection systems and features.

The licensee stated that the three echelons of DID are (1) to prevent fires from starting; (2) to rapidly detect, control, and extinguish fires that do occur, thereby limiting damage; and (3) to provide an adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee further stated that per NFPA 805, Section 1.2, DID is achieved when an adequate balance of each of these elements is provided. The licensee stated that echelon 1 is not affected by the use of EPRI TR-1006756 methods. The licensee further stated that the use of PB test frequencies established per EPRI TR-1006756 methods, combined with the NFPA 805, Section 2.6, monitoring program, will ensure that the availability and reliability of the fire protection systems and features are maintained to the levels assumed in the NFPA 805 engineering analysis (or the analysis will be updated accordingly). Accordingly, the licensee stated there is no adverse impact to echelons 2 and 3 for DID.

Based on its review of the information submitted by the licensee in the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.2.3(1), requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains sufficient safety margin; and maintains adequate fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability)

3.2 Nuclear Safety Capability Assessment Methods

NFPA 805 is an RI/PB standard that allows engineering analyses to be used to show that FPP features and systems provide sufficient capability to meet the requirements of 10 CFR 50.48(c).

NFPA 805, Section 2.4, "Engineering Analyses," states that:

> Engineering analysis is an acceptable means of evaluating a fire protection program against performance criteria. Engineering analyses shall be permitted to be qualitative or quantitative.... The effectiveness of the fire protection features shall be evaluated in relation to their ability to detect, control, suppress, and extinguish a fire and provide passive protection to achieve the performance criteria and not exceed the damage threshold defined in Section [2.5] for the plant area being analyzed.

Chapter 1 of the standard defines the goals, objectives, and performance criteria that the FPP must meet in order to be in accordance with NFPA 805.

NFPA 805, Section 1.3.1, "Nuclear Safety Goal," states that:

> The nuclear safety goal is to provide reasonable assurance that a fire during any operational mode and plant configuration will not prevent the plant from achieving and maintaining the fuel in a safe and stable condition.

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

> In the event of a fire during any operational mode and plant configuration, the plant shall be as follows:
>
> (1) *Reactivity Control.* Capable of rapidly achieving and maintaining subcritical conditions.
>
> (2) *Fuel Cooling.* Capable of achieving and maintaining decay heat removal and inventory control functions.
>
> (3) *Fission Product Boundary.* Capable of preventing fuel clad damage so that the primary containment boundary is not challenged.

NFPA 805, Section 1.5.1, "Nuclear Safety Performance Criteria," states that:

> Fire protection features shall be capable of providing reasonable assurance that, in the event of a fire, the plant is not placed in an unrecoverable condition. To demonstrate this, the following performance criteria shall be met.
>
> (a) *Reactivity Control.* Reactivity control shall be capable of inserting negative reactivity to achieve and maintain subcritical conditions. Negative reactivity inserting shall occur rapidly enough such that fuel design limits are not exceeded.
>
> (b) *Inventory and Pressure Control.* With fuel in the reactor vessel, head on and tensioned, inventory and pressure control shall be capable of

controlling coolant level such that subcooling is maintained for a PWR [pressurized-water reactor] and shall be capable of maintaining or rapidly restoring reactor water level above top of active fuel for a BWR [boiling-water reactor] such that fuel clad damage as a result of a fire is prevented.

(c) *Decay Heat Removal.* Decay heat removal shall be capable of removing sufficient heat from the reactor core or spent fuel such that fuel is maintained in a safe and stable condition.

(d) *Vital Auxiliaries.* 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.

(e) *Process Monitoring.* Process monitoring shall be capable of providing the necessary indication to assure the criteria addressed in (a) through (d) have been achieved and are being maintained

3.2.1 Compliance with NFPA 805 Nuclear Safety Capability Assessment Methods

NFPA 805, Section 2.4.2, "Nuclear Safety Capability Assessment," states that:

The purpose of this section is to define the methodology for performing a nuclear safety capability assessment. The following steps shall be performed:

(1) Selection of systems and equipment and their interrelationships necessary to achieve the NSPC in Chapter 1

(2) Selection of cables necessary to achieve the NSPC in Chapter 1

(3) Identification of the location of nuclear safety equipment and cables

(4) Assessment of the ability to achieve the NSPC given a fire in each fire area

This SE section evaluates the first three topics listed above. SE Section 3.5 addresses the assessment of the fourth topic.

RG 1.205, Revision 1 (Reference 4), endorses NEI 04-02, Revision 2 (Reference 7), and Chapter 3 of NEI 00-01, Revision 2, (Reference 43), and promulgates the method outlined in NEI 04-02 for conducting an NSCA. This NRC-endorsed guidance (i.e., NEI 04-02, Table B-2, "NFPA 805, Chapter 2 – Nuclear Safety Transition – Methodology Review Worksheet," and NEI 00-01, Chapter 3) has been determined to address the related requirements of NFPA 805, Section 2.4.2. The NRC staff reviewed LAR Section 4.2.1, "Nuclear Safety Capability Assessment Methodology," and LAR Attachment B, NEI 04-02, Table B-2, "Nuclear Safety Capability Assessment – Methodology Review," against these guidelines.

The endorsed guidance provided in NEI 00-01, Revision 2, provides a framework to evaluate the impact of fires on the ability to maintain post-fire SSD. It provides detailed guidance for:

- Selecting systems and components required to meet the NSPC,
- Selecting the cables necessary to achieve the NSPC,
- Identifying the location of nuclear safety equipment and cables, and
- Using appropriately conservative assumptions in the performance of the NSCA.

The licensee developed the LAR based on the three guidance documents cited above. Although RG 1.205, Revision 1, endorses NEI 00-01, Revision 2, the licensee's review was performed to the guidance in NEI 00-01, Revision 1 (Reference 77), with a review of the substantive changes in NEI 00-01, Revision 2, Chapter 3. Based on the information provided in the licensee's submittal, a systematic process to evaluate the post-fire SSD analysis against the requirements of NFPA 805, Section 2.4.2, subsections (1), (2), and (3) was used, which meets the methodology outlined in the latest NRC-endorsed industry guidance.

FAQ 07-0039 (Reference 78) provides one acceptable method for documenting the comparison of the SSA against the NFPA 805 requirements. This method first maps the existing safe SSA to the NEI 00-01, Chapter 3 methodology, which, in turn, is mapped to the NFPA 805, Section 2.4.2 requirements.

The licensee performed this evaluation by comparing its SSA against the NFPA 805 NSCA requirements using the NRC-endorsed process in Chapter 3 of NEI 00-01, Revision 1, with a gap analysis of NEI 00-01, Revision 2, and documenting the results of the review in LAR Attachment B, Table B-2, in accordance with NEI 04-02, Revision 2.

The categories used to describe alignment with the NEI 00-01, Chapter 3 attributes are as follows:

1. The SSA directly aligns with the attribute: noted in LAR Table B-2 as "Aligns."
2. The SSA aligns with the intent of the attribute: noted in LAR Table B-2 as "Aligns with Intent."
3. The SSA does not align with the attribute: noted in LAR Table B-2 as "Not in Alignment."
4. The SSA does not align with the attribute, but there is a prior NRC approval of an alternative to the attribute, and the bases for the NRC approval remain valid: noted in LAR Table B-2 as "Not in Alignment, but Prior NRC Approval."
5. The SSA does not align with the attribute, but there are no adverse consequences because of the non-alignment: noted in LAR Table B-2 as "Not in Alignment, but No Adverse Consequences."

Finally, some attributes may not be applicable to the SSA (e.g., the attribute may be applicable only to boiling-water reactors or pressurized-water reactors (PWRs). These are described in LAR Attachment B, Table B-2, as "Not Applicable."

As discussed above, the licensee performed the review of the SSA methodology to the guidance of NEI 00 01, Revision 1, instead of Revision 2. As described in Section 4.2.1.1 and Attachment B, Table B-2, of the LAR, the licensee performed a review against the guidance of NEI 00-01, Revision 2, to identify substantive changes from NEI 00-01, Revision 1, that are applicable to the NFPA 805 transition. Based on this review, the licensee identified the following gaps:

- Post-fire manual operation of rising stem valves in the fire area of concern (NEI 00-01, Revision 2, Section 3.2.1.2)
- Analysis of open circuits on a high voltage (e.g., 4.16 kV) ammeter current transformers (CTs) (NEI 00-01, Revision 2, Section 3.5.2.1)
- Analysis of control power for switchgear with respect to breaker coordination (NEI 00-01, Revision 2, Section 3.5.2.4)

The results of the NEI 00-01, Revision 2 evaluation are incorporated in LAR Attachment B.

In LAR Section 4.2.1.1, the licensee stated that the method used to perform the SSA reviews with respect to selection of systems and equipment, selection of cables, and identification of the location of equipment and cables either meets the NRC-endorsed guidance from NEI 00-01, Revision 1, Chapter 3, directly or met the intent of the endorsed guidance with adequate justification as documented in LAR Attachment B, with the exception of open-circuited CTs (LAR Table B-2, attribute 3.5.2.1). The NRC staff's review of the licensee's alignment to NEI 00-01, attribute 3.5.2.1, is discussed in SE Section 3.2.1.5.

In Safe Shutdown (SSD) Analysis RAI 01 (Reference 23), the NRC staff identified that LAR Attachment B, Table B-2, states that Beaver Valley was not in alignment with NEI 00-01 attributes 3.1.1.9, 3.1.2.4, 3.1.2.5, and 3.2.2.1 and requested that the licensee clarify the discrepancy. In its response to SSD RAI 01 (Reference 11), the licensee stated that LAR Section 4.2.1.1 will be revised to identify the NEI 00-01 attributes that are either "Not in Alignment, but Prior NRC Approval" or "Not in Alignment with no adverse consequences" and the basis for not aligning with the methodology. The NRC staff concludes that the licensee's response to SSD RAI 01 is acceptable because it corrects the alignment strategy discrepancy between LAR Section 4.2.1.1 and LAR Attachment B. The acceptability of the NEI 00-01 attributes that are not in alignment with the methodology from the NRC-endorsed guidance is addressed in the SE sections below that are associated with each of the alignment strategies. The NRC staff has determined that taken together, these methods compose an acceptable approach for documenting compliance with NFPA 805, Section 2.4.2, "Nuclear Safety Capability Assessment," requirements, because the licensee has followed the alignment strategies identified in the endorsed NEI 04-02 guidance document. The process defined in the endorsed guidance provides an organized structure to document each attribute in NEI 00-01, Chapter 3, allowing the licensee to provide significant detail on how the program meets the requirements. In addition to the basic strategy of "Aligns," which itself makes the attribute both auditable and inspectable, additional strategies have been provided, allowing for amplification of information, when necessary, regarding how or why the attribute is acceptable.

3.2.1.1 Attribute Alignment – Aligns

RG 1.205 states that Chapter 3 of NEI 00-01, Revision 2, when used in conjunction with NFPA 805 and the RG, provides one acceptable approach to circuit analysis for a plant

implementing an FPP under 10 CFR 50.48(c). For the majority of the NEI 00-01, Chapter 3 attributes, the licensee determined that the SSA aligns directly with the attribute. In these instances, based on the validity of the licensee's statements, the NRC staff concludes that the licensee's statements of alignment are acceptable.

The following attributes identified in LAR Attachment B, Table B-2, as aligning by this method required additional review by the NRC staff:

- 3.2.1.2
- 3.5.2.5

Attribute 3.2.1.2 – Manual Valves and Piping: The guidance states to assume exposure fire damage for manual valves and piping does not adversely impact the ability to perform the pressure boundary or SSD function. In LAR Section 4.2.1.1 and LAR Attachment B, Table B-2, the licensee stated that where feasibility reviews called into question the use of manual valves in the fire compartment after the fire was extinguished, the recovery strategy was modified to ensure recovery actions (RAs) could be successfully and reliably credited. In SSD RAI 03 (Reference 23), the NRC staff requested the licensee to identify the fire areas where manual operation of rising steam valves may be subjected to the effects of fire exposure and to describe the engineering analysis justifying the post-fire operation of the valves and the modified recovery strategy. In its response to SSD RAI 03 (Reference 10), the licensee stated that there are no RAs that require manual valve operation (rising stem, diaphragm, butterfly, etc.) in the fire-affected compartment, and therefore, no engineering evaluation was required. The NRC staff concludes that the licensee's response to SSD RAI 03 is acceptable because its analysis does not credit manual valve operation in fire-affected compartments, and therefore, aligns with the endorsed guidance in NEI 00-01 for operation of manual valves, including rising stem valves that could be exposed to fire.

Attribute 3.5.2.5 – Circuit Failures Due to Common Enclosure Concerns: The guidance states that common enclosure associated circuit concerns deal with the possibility of causing secondary failures due to fire damage to a circuit whose isolation device either fails to isolate the cable fault or protect the faulted cable from reaching its ignition temperature, or the fire somehow propagates along the cable into adjoining fire areas. In LAR Attachment B, the licensee stated that it incorporated the post-fire SSA into a computerized SSA tool, which maintains success path models of performance goals (methods), systems, equipment, and cables sorted by fire compartment and by equipment identification. In SSD RAI 12 (Reference 23), the NRC staff requested that the licensee describe how this process addresses common enclosure concerns with respect to protective device coordination, fault protection, cable sizing, and barriers and penetration designs as described in the guidance of NEI 00-01, attribute 3.5.2.5. In its response to SSD RAI 12 (Reference 10), the licensee stated that a separate associated circuits review was conducted for both units and that it included a protective device interrupting rating review and a cable protection review, which identified potential common enclosure issues. The licensee further stated that the common enclosure issues were evaluated to ensure that they did not adversely impact any credited FPRAs and SSD components. The NRC staff concludes that the licensee's response to SSD RAI 12 is acceptable because its analysis of associated circuits addressed failure of isolation devices and fire propagation to adjacent fire areas, which aligns with the endorsed guidance in NEI 00-01.

3.2.1.2 Attribute Alignment – Aligns with Intent

For certain of the NEI 00-01, Chapter 3 attributes, the licensee determined that the SSA aligns with the intent of the attribute and provided additional clarification when describing its means of

alignment. The attributes identified in LAR Attachment B, Table B-2, as having this condition are as follows:

- 3.1.1.3
- 3.1.1.10
- 3.1.3.3
- 3.1.3.4
- 3.2.2.3
- 3.2.2.4
- 3.5.1.2
- 3.4.1.4
- 3.4.1.7

Attribute 3.1.1.3 – Pressurizer Heaters: The guidance states that hot shutdown can be maintained without the use of pressurizer heaters (i.e., pressure control is provided by controlling the makeup/charging pumps). The licensee stated the ability to provide reactor coolant system (RCS) pressure control has been reviewed and documented for each SSD fire compartment in LAR Attachment C. The licensee further stated that where subcooling is not demonstrated in accordance with the performance criteria of Section 1.5.1(b), VFDRs have been documented and associated to the applicable fire compartment. The NRC staff concludes that the licensee's analysis is acceptable because it describes similar means or methods that were applied to achieve the intended result of the endorsed NEI 00-01 guidance, which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2, and to meet the NSPC of NFPA 805 for pressure control.

Attribute 3.1.1.10 – Manual Initiation of Systems: The guidance states that manual initiation from the main control room (MCR) or emergency control stations of systems required to achieve and maintain SSD is acceptable where permitted by current regulations or approved by NRC and that automatic initiation of systems selected for SSD is not required but may be included as an option. The licensee stated that primary control station (PCS) actions, which meet the criteria of RG 1.205, Regulatory Position 2.4, are not considered "recovery actions." The licensee further stated that VFDRs have been documented in LAR Attachment C and included RAs, which are required because of a lack of separation in accordance with NFPA 805, Section 4.2.3. The NRC staff concludes that the licensee's description of PCS actions and RAs is consistent with RG 1.205; therefore, the licensee's treatment of manual initiation of systems is acceptable because it describes similar means or methods that were applied to achieve the intended result of the endorsed NEI 00-01 guidance, which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2.

Attributes 3.1.3.3 and 3.1.3.4 – Define and Assign Combination of Systems for Each Safe Shutdown Path: The guidance in these attributes directs the selection of the combination of systems that have the capability to perform all the SSD functions and to designate the set of systems as an SSD path. The licensee described the use of cable logic, component logic, system logic, and finally, the performance goal logic in order to evaluate the overall impact upon SSD capability, as opposed to designated SSD paths. The NRC staff concludes that the methods as described by the licensee are acceptable because logic diagrams provide a similar means of defining the combination of systems and components necessary to achieve safe and stable plant conditions to that provided by designated shutdown paths, and therefore, align with the intent of the NRC-endorsed guidance, which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2.

Attributes 3.2.2.3 and 3.2.2.4 – Develop a List of Safe Shutdown Equipment, Identify Equipment Information, and Assign the Corresponding System and Safe Shutdown Path(s) Designation to Each: This attribute provides the criteria and methods to be used in identifying and documenting the SSD equipment, including cables, interlocks, and power supplies necessary for the selected SSD systems to achieve the SSD functions. Guidance is also provided to establish the relationships or dependencies between the identified equipment and systems. As described in the LAR and consistent with NEI 00-01 guidance, the licensee developed an SSD

equipment list that is input to the logic diagrams that demonstrate the capability to meet the NSCA requirements of NFPA 805, Section 2.4.2. The NRC staff concludes that the methods as described by the licensee are acceptable because the logic diagrams provide a means of defining the combination of SSD systems and components necessary to achieve safe and stable plant conditions, and therefore, align with the intent of the NRC-endorsed guidance, which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2.

Attribute 3.5.1.2 – Circuit Contact Position: The guidance directs the licensee to assume that circuit contacts are positioned (i.e., open or closed) consistent with the normal mode/position of the SSD equipment as shown on the schematic drawings. The licensee stated that the circuit analysis methodology documentation does not specifically address the analysis of electrical contact position; however, the analysis did analyze the loss of system integrity or equipment damage in the analysis. The licensee further stated that in order to perform this analysis, electrical contact positions would have been taken into account. The NRC staff concludes that the methods as described by the licensee are acceptable because for the purpose of performing cable selection, SSD components are assumed initially to be in their normal plant operating position, and therefore, align with the intent of the NRC-endorsed guidance, which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2.

Attribute 3.4.1.4 – Manual Actions: The guidance directs the licensee to use manual actions where appropriate to achieve and maintain post-fire SSD conditions in accordance with NRC requirements. The licensee stated that RAs, which are required because of a lack of separation in accordance with NFPA 805, Section 4.2.3, are identified in LAR Attachment C as potential variances from the deterministic requirements and evaluated by the FRE process. The NRC staff concludes that the methods as documented in the NSCA align with the intent of the NRC-endorsed guidance in NEI 00-01 because they provide a mitigation strategy, including manual actions for fire damage to equipment or cables necessary to achieve and maintain safe and stable conditions.

Attribute 3.4.1.7 – Alternate/backup Selection: The guidance involves the consideration of other equipment that can perform the same SSD function as the fire impacted equipment. The licensee stated that the analyses demonstrate that one train of equipment necessary to achieve SSD is free of fire damage. The licensee stated that the analyses do not specify for a given fire compartment which equipment is the expected train and which equipment is the alternate credited equipment. The licensee stated that the SSA describes the systems that are required for post-fire SSD. The licensee further stated that the systems required for SSD and the impact on these systems that a fire-induced cable failure could have on the required SSD path are identified. The NRC staff concludes that the methods as documented in the NSCA align with the intent of the NRC-endorsed guidance in NEI 00-01, which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2, because the credited mitigation strategy for fire damage to equipment or cables necessary to achieve and maintain safe and stable conditions takes into consideration equipment that could perform the same nuclear safety performance function.

3.2.1.3 Attribute Alignment – Not in Alignment, but Prior NRC Approval

In one of the NEI 00-01, Chapter 3 attributes, the licensee determined that the SSA does not align with the attribute, but there is a prior NRC approval of an alternative to the attribute, and the basis for the NRC approval remains valid. In LAR Section 4.2.3, "Licensing Action Transition," the licensee stated that the existing licensing actions that are used to demonstrate

compliance have been evaluated to ensure that their bases remain valid. The NEI 00-01, Chapter 3 attributes identified in LAR Table B-2 as complying by this method is as follows:

- 3.1.2.5

Attribute 3.1.2.5 – Process Monitoring: The guidance states that in general, process monitoring instruments similar to those listed below are needed to successfully use existing operating procedures (including abnormal operating procedures). For a PWR, these include:

- Reactor coolant temperature (hot leg/cold leg)
- Pressurizer pressure and level
- Neutron flux monitoring (source range)
- Level indication for tanks needed for SSD
- Steam generator level and pressure
- Diagnostic instrumentation for SSD systems

The licensee stated that process monitoring instrumentation required to achieve and maintain a safe and stable plant condition post-fire is identified in LAR Attachment C and that this instrumentation is consistent with minimum process monitoring instrumentation expectations identified in Information Notice 84-09 (Reference 130), as previously approved by the NRC in the current licensing bases for Beaver Valley. The licensee stated that the SSD evaluations require the following instrumentation to be utilized for process monitoring:

- Pressurizer pressure and level: In support of the inventory and pressure control NSPC, both units evaluated pressurizer level. Beaver Valley, Unit No. 1, has LAR Attachment K, as supplemented, Licensing Action 11.24 to permit evaluation of RCS pressure as an acceptable substitute for pressurizer pressure. Beaver Valley, Unit No. 2, evaluates the availability of pressurizer pressure in accordance with NEI 00-01 guidance.

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

- Steam generator (SG) level and pressure: In support of the decay heat removal NSPC, Beaver Valley, Unit No. 1, has Attachment K, as supplemented, Licensing Action 11.24, to permit evaluation of narrow range SG level. SG wide range pressure instruments are evaluated for availability after a fire. Beaver Valley, Unit No. 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 nuclear performance safety capabilities, Beaver Valley, Unit No. 1, has LAR Attachment K, as supplemented, Licensing Action 11.24, to have a source range monitor operational within 80 minutes of the event. Beaver Valley, Unit No. 2, evaluates the availability of the source range detectors after a fire.

- Diagnostic instrumentation for SSD systems: Where beneficial to reduce operator burden, instruments that read out in the control room have been included in the model and logically associated with the component being monitored. In addition, instruments

that provide permissive or controlling signals to SSD components are modeled in direct support of the associated SSD component.

- Level indication for various tanks: These instruments are included in the model system logics for which the tank is required. Level indication for the refueling water storage tank (RWST) and the primary plant demineralized water tank are not provided at the backup indicating panel for Beaver Valley, Unit No. 1, or at the alternate shutdown panel (ASP) for Beaver Valley, Unit No. 2. This does not align with Section 3.1.2.5 of NEI 00-01. Each tank is of sufficient capacity that level monitoring is not critical to SSD functions. This configuration was previously approved by the NRC in the licensing bases for Beaver Valley, Unit No. 1, as further evaluated in Attachment K, as supplemented, Beaver Valley, Unit No. 1, Licensing Action 11.24.

LAR Attachment C documents potential variances from the deterministic requirements due to a lack of separation in accordance with NFPA 805, Section 4.2.3, which were evaluated by the FRE process. Process monitoring is further reviewed in SE Section 3.5.1.3. Based on its review of the information provided in the licensee's submittal, the NRC staff concludes that the licensing actions described above as originally approved by the NRC staff are acceptable, because the use of the instruments is consistent with the minimum process monitoring instrumentation guidance identified in NEI 00-01, and the licensee has determined the basis for approval remains applicable and valid in accordance with the guidance in RG 1.205 and NEI 04-02.

In SSD RAI 07 (Reference 23), the NRC staff requested that the licensee clarify the discrepancy between the approved Licensing Action 11.24 timeframe of 1 hour (60 minutes) to have source range indication available and the 80 minutes as described in LAR Attachment B, Table B-2, for attribute 3.1.2.5. In its response to SSD RAI 07 (Reference 10), the licensee stated that source range would not become available until 20 minutes after reactor trip, which then starts the 1-hour timeclock for installation of the external source range monitor. The licensee stated that the total time required to install the external source range monitor is 80 minutes following a reactor trip, as described in LAR Attachment K, as supplemented, Licensing Action 11.24. The licensee provided revised pages to LAR Attachment B, Table B-2, and LAR Attachment K, as supplemented, Licensing Action 11.24, to explicitly specify that source range indication normally becomes available 20 minutes after a reactor trip, and the external source range monitor at the backup indicating panel will be installed within 1 hour after the time source range indication would normally be available. The NRC staff concludes that the licensee's response to SSD RAI 07 is acceptable because the licensee clarified that the method and timeframe for restoring source range flux monitoring capability was previously approved by the NRC staff and meets the NSPC in NFPA 805, Section 1.5.

3.2.1.4 Attribute Alignment – Not in Alignment, but No Adverse Consequences

In three NEI 00-01, Chapter 3 attributes, the licensee determined that the post-fire SSA does not align with the attribute, but that there are no adverse consequences because of the non-alignment. The NEI 00-01, Chapter 3 attributes identified in LAR Attachment B, Table B-2, as complying by this method are as follows:

- 3.1.1.9
- 3.1.2.4
- 3.2.2.1

Attribute 3.1.1.9 – 72-Hour Coping Period: The guidance states that the post-fire SSA assumes a 72-hour coping period starting with a reactor scram/trip, that fire-induced impacts that provide

no adverse consequences to hot shutdown within this 72-hour period need not be included in the post-fire SSA, and that at least one train can be repaired or made operable within 72 hours using onsite capability to achieve cold shutdown. The licensee stated that the assessment of accomplishment of performance goals documents the equipment required to achieve a safe and stable plant condition in accordance with NFPA 805, Section 1.3. The licensee stated that the 72-hour requirement from NEI 00-01 is not applicable, and safe and stable is the basis for the NFPA 805 post-fire evaluation, as described in LAR Section 4.2.1.2. Because the licensee's methods comply with the requirements of NFPA 805 to demonstrate the capability to achieve safe and stable conditions, which do not include a 72-hour coping period or the requirement to achieve cold shutdown, the NRC staff concludes that there are no adverse consequences, and the licensee's statement of alignment is acceptable.

Attribute 3.1.2.4 – Decay Heat Removal: The guidance states that systems selected for the decay heat removal function(s) should be capable of (1) removing sufficient decay heat from the reactor to reach hot shutdown conditions and (2) removing sufficient decay heat from the reactor to reach cold shutdown conditions. The licensee stated that decay heat is removed by use of a natural circulation cooldown and steam release by the main steam safety valves and manual operation of atmospheric dump valves or RHR and that AFW is credited to supply cooling water to the SGs. The licensee identified that FAQ 07-0039 (Reference 78) states that although 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. The licensee stated that safe and stable conditions are discussed in LAR Section 4.2.1.2. Because the licensee's methods comply with the requirements of NFPA 805 to demonstrate the capability to achieve safe and stable conditions, which do not include the requirement to achieve cold shutdown, the NRC concludes that there are no adverse consequences, and the licensee's statement of alignment is acceptable.

Attribute 3.2.2.1 – Identify the System Flow Path for Each Shutdown Path: The guidance directs the licensee to mark-up and annotate a piping and instrumentation diagram (P&ID) to highlight the specific flow paths for each system in support of each shutdown path. The licensee stated that as part of the NFPA 805 transition, Beaver Valley has incorporated the post-fire SSA into a computerized SSA tool, which maintains success path models of performance goals (methods), systems, equipment, and cables. The licensee further stated that the P&IDs were reviewed to verify the components on the SSD equipment list for the subject system(s) are necessary to support the nuclear safety objectives; however, the use of the computerized SSA tool precludes the need to mark-up and annotate P&IDs. The NRC staff concludes that the licensee's statement of alignment is acceptable because the licensee reviewed the plant P&IDs in developing the SSD paths and identifying the necessary systems, equipment, and cables, which are maintained in a computerized analysis tool, and therefore, is consistent with the NRC-endorsed guidance in NEI 00-01 for identifying success paths and associated SSD equipment.

3.2.1.5 Attribute Alignment – Not in Alignment

For NEI 00-01, Chapter 3, attribute 3.5.2.1, the licensee stated in LAR Attachment B, Table B-2, that the post-fire SSA does not align with this attribute.

Attribute 3.5.2.1 – Circuit Failures Due to Open Circuit: The guidance states that an open circuit is a fire-induced break in a conductor resulting in the loss of circuit continuity, and that an open circuit will typically prevent the ability to control or power the affected equipment or will result in

a change of state for normally energized equipment. The licensee stated that its SSA assumes circuit failures due to an open circuit are functionally identical to the NEI guidance and an analysis of high voltage CTs has been performed. The licensee stated that site calculations list the components that have a cable with conductors connected to a CT circuit and leave the switchgear enclosure unprotected. The licensee further stated that any modifications required will be determined when the guidance is finalized for which CTs pose a credible risk of secondary damage upon an open circuit.

In SSD RAI 02 (Reference 23), the NRC staff requested that the licensee describe the high voltage CT analysis, including the secondary fire areas of concern and describe methods to resolve design concerns, including potential modifications. In its response to SSD RAI 02 (Reference 10), the licensee stated that it will complete a plant-specific CT open circuit analysis on CTs with no open circuit protection and a turns-ratio greater than 1200:5. The licensee further stated that the turns-ratio analysis is based upon NUREG/CR-7150, "Joint Assessment of Cable Damage and Quantification of Effects from Fire (JACQUE-FIRE), Volume 2: Expert Elicitation Exercise for Nuclear Power Plant Fire-Induced Electrical Circuit Failure" (Reference 131), which concluded that the secondary fires from CTs with an open circuited secondary and a turns-ratio of 1200:5 or less are not credible. The licensee further stated that any CT identified as continuing to present a secondary fire risk will be modified per LAR Attachment S, Table S-3, as supplemented, Implementation Items BV1-2706 and BV2-1020. The NRC staff concludes that the licensee's response to SSD RAI 02 is acceptable because Implementation Items BV1-2706 and BV2-1020 will result in modifications to any CT that presents a secondary fire risk to eliminate such risk and because the actions described in the implementation items will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

3.2.1.6 NFPA 805 – Nuclear Safety Capability Assessment Methods Conclusion

The NRC staff reviewed the documentation provided by the licensee describing the process used to perform the NSCA required by NFPA 805, Section 2.4.2. The licensee performed this evaluation by comparing the SSA against the NFPA 805 NSCA methodology requirements using NEI 00-01, Revision 1 (Reference 77), and also conducted a gap analysis between Revision 1 and Revision 2 of NEI 00-01 to determine if any discrepancies existed. The licensee documented the results of its review in LAR Attachment B, Table B-2, in accordance with NEI 04-02, Revision 2 (Reference 7).

Based on its review of the information provided in the licensee's submittal, as supplemented, the NRC staff concludes that the method used by the licensee to perform the NSCA with respect to the selection of systems and equipment, selection of cables, and identification of the location of nuclear safety equipment and cables as required by NFPA 805, Section 2.4.2, is acceptable because it either:

- Met the NRC-endorsed guidance directly,
- Met the intent of the endorsed guidance and the licensee provided adequate justification,

- Had a previous NRC staff approval of an alternative to the guidance, or
- Could demonstrate that not meeting the guidance had no adverse effect.

3.2.2 Maintaining Fuel in a Safe and Stable Condition

The nuclear safety goals, objectives, and performance criteria of NFPA 805 allow more flexibility than the previous deterministic FPPs based on Appendix R to 10 CFR 50 and NUREG-0800, Section 9.5.1.1 (Reference 132), since NFPA 805 only requires the licensee to maintain the fuel in a safe and stable condition rather than achieve and maintain cold shutdown in 72 hours. In LAR Section 4.2.1.2, the licensee stated that the NFPA 805 licensing basis for a fire starting with the reactor in at-power operating Mode 1 (power operation), Mode 2 (startup), and Mode 3 (hot standby) is to maintain hot standby up to the point at which the RHR loop is placed into service. The licensee further stated that Beaver Valley, Unit No. 1, and Beaver Valley, Unit No. 2, will maintain hot standby conditions until a decision is made to either place the reactor in a non-power operating mode (i.e., hot shutdown Mode 4 or cold shutdown Mode 5) or to return to power operations. The licensee further stated that the determination of the final state will be based upon the extent of the fire damage, the inventory remaining in the RWST, the ability to provide makeup water to the RWST, and the ability to reestablish inventory in the primary plant demineralized water storage tank or realign AFW to its alternate sources. The licensee stated that LAR Attachment C, Table B-3, identifies the systems and components credited with supporting safe and stable plant conditions by fire area.

The licensee stated that as part of the transition to NFPA 805, it evaluated each fire compartment for maintaining safe and stable hot standby conditions and that the evaluation determined it can achieve and maintain safe and stable conditions with the minimum shift operating staff. The licensee stated that the primary plant demineralized water storage tank can supply the AFW pumps for at least 9 hours after shutdown and that refilling the primary plant demineralized water storage tank can be accomplished by transferring water from the demineralized water storage tanks by pumps for Beaver Valley, Unit No. 1, and gravity feed for Beaver Valley, Unit No. 2. The licensee further stated that as a long-term backup, water from the Ohio River can be manually aligned to the AFW pumps from the river water system for Beaver Valley, Unit No. 1, or the service water system for Beaver Valley, Unit No. 2. The licensee stated that the necessary valve manipulations to align these sources have adequate procedural guidance and are within the skills and training of the minimum shift operating staff.

The licensee stated that with these required actions to maintain the plant in a safe and stable condition performed by the shift operating staff, there is sufficient time for the emergency response organization (ERO) to respond and be available to assess plant conditions and determine the required actions necessary to extend safe and stable hot standby conditions. The licensee stated that in the event it is determined a plant cooldown to a non-operating mode is required, the ERO will determine the necessary actions, including maintenance and repairs that are necessary. The licensee stated that the ERO may determine the following, depending on the initial assessment and continued monitoring of plant conditions:

- Offsite support (e.g., equipment, personnel, and supplies) that are needed to continue in a safe and stable condition or to perform a plant cooldown.
- The purchase and delivery to the site of EDG fuel oil. Each plant is able to operate the EDGs at continuous rating for a 7-day period under existing TSs.

- Expertise of the technical support center, operations support center, and emergency operations facility staff. This will include additional maintenance and operations personnel needed to support additional activities deemed necessary by the ERO.

- The adequacy of existing emergency operating procedures and other emergency procedures to assist the operating staff in placing the plant in the desired mode.

- Additional procedures, maintenance instructions, and work orders can be written, planned, and reviewed prior to implementation. These process controls are very event-specific to the extent that it has been judged to not be useful to develop them in advance due to the limitless spectrum of possibilities.

The licensee stated the following describes methods to maintain safe and stable conditions and related support actions:

- Reactivity Control

The reactor core design ensures that K_{eff} is maintained < 0.99 while the plant is in a safe and stable condition, including compensation for any positive reactivity increases as a result of Xenon-135 decay and reactor coolant temperature decreases. Gravity insertion of the control rods into the reactor core will ensure reactivity control is achieved.

Reactor coolant system makeup will be from the RWST, which is a borated source that will ensure the K_{eff} is maintained < 0.99 in all operating and non-operating modes.

- Inventory and Pressure Control

Inventory makeup to the RCS will be required to account for nominal RCS leakage and RCS shrinkage due to cooldown, as well as RCP seal injection. There are design features and procedures to ensure that an adequate source of borated inventory is provided for RCS inventory control from the RWST utilizing the chemical volume control system and high head safety injection system. If RWST inventory is depleted, it will be refilled using a combination of makeup from the spent fuel pool or boric acid storage tanks and primary grade water through the blender.

With fuel in the reactor vessel, head on and tensioned, there are design features and procedures to ensure inventory and pressure control shall be capable of controlling coolant level such that subcooling is maintained, and it shall be capable of maintaining reactor water level such that fuel cladding damage as a result of a fire is prevented.

There are design features and procedures to ensure that excess RCS inventory is released from the RCS utilizing the reactor pressure vessel head vent valves and also to ensure that excess RCS pressure relief is provided utilizing one of three power-operated relief valves (PORVs).

- Decay Heat Removal

There are design features and procedures to ensure reactor core decay heat will be rejected to the secondary plant through the SGs. The heat will be rejected to the atmosphere through the atmospheric dump valves or residual heat release (RHR) valve.

There are design features and procedures to provide adequate AFW to the credited SGs for decay heat removal.

- Vital Auxiliaries - Power and Support Systems

Each EDG is provided with a storage tank having a fuel oil capacity sufficient to operate it for a period of 7 days while the EDG is supplying continuous rating load demand. The EDG will provide power to the shutdown equipment for reactivity control, inventory and pressure control, decay heat removal, and process monitoring. Each EDG will also provide power to the other vital auxiliary systems, including river water/service water and HVAC.

- Process Monitoring

Adequate indications will be provided to the shift operating staff and ERO to ensure assessment can be made of plant conditions.

On the basis of its review of the licensee's analysis as described in the LAR, the NRC staff concludes that there is reasonable assurance that the fuel can be maintained in a safe and stable condition, post-fire, for an extended period of time.

3.2.3 Applicability of Feed and Bleed

Section 50.48(c)(2)(iii) of 10 CFR limits the use of feed and bleed and states:

> In demonstrating compliance with the performance criteria of Sections 1.5.1(b) and (c), a high-pressure charging/injection pump coupled with the pressurizer power-operated relief valves (PORVs) as the sole fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability (i.e., feed-and-bleed) for pressurized-water reactors (PWRs) is not permitted.

The NRC staff reviewed LAR Table 5-3, "10 CFR 50.48(c) – Applicability/Compliance Reference," and LAR Attachment C, "NEI 04-02 Table B-3 – Fire Area Transition," to evaluate whether the licensee meets the feed and bleed requirements. In LAR Table 5-3, the licensee stated that feed and bleed is not utilized as the sole fire-protected SSD path for any scenario. The NRC staff confirmed this by reviewing the designated safe SSD listed in LAR Attachment C for each fire area. This review confirmed that all fire area analyses include the SSD equipment necessary to provide decay heat removal without relying on feed and bleed. In addition, all fire areas either met the deterministic requirements of NFPA 805, Section 4.2.3, or the PB evaluation performed in accordance with NFPA 805, Section 4.2.4, demonstrated that the integrated assessment of risk, DID, and safety margins for the fire area was acceptable.

Based on its review of the information provided in LAR Table 5-3, as well as the fire area analyses documented in LAR Attachment C, the NRC staff concludes that the licensee meets the requirements of 10 CFR 50.48(c)(2)(iii) because feed and bleed is not utilized as the sole fire-protected SSD path.

3.2.4 Assessment of Multiple Spurious Operations

NFPA 805, Section 2.4.2.2.1, "Circuits Required in Nuclear Safety Functions" states, in part:

> Circuits required for the nuclear safety functions shall be identified. This includes circuits that are required for operation, that could prevent the operation, or that result in the maloperation of the equipment identified in 2.4.2.1 ["Nuclear Safety Capability Systems and Equipment Selection"]. This evaluation shall consider fire-induced failure modes such as hot shorts (external and internal), open circuits, and shorts to ground, to identify circuits that are required to support the proper operation of components required to achieve the nuclear safety performance criteria, including spurious operation and signals.

In addition, NFPA 805, Section 2.4.3.2, states that the PSA evaluation shall address the risk contribution associated with all potentially risk-significant fire scenarios. Because the RI/PB approach taken used FREs in accordance with NFPA 805, Section 4.2.4.2, "Use of Fire Risk Evaluation," adequately identifying and including potential multiple spurious operations (MSO) combinations is required to ensure that all potentially risk-significant fire scenarios have been evaluated.

The NRC staff reviewed LAR Section 4.2.1.4, "Evaluation of Multiple Spurious Operations," and LAR Attachment F, "Fire-Induced Multiple Spurious Operations Resolution," to determine whether the licensee has adequately addressed MSO concerns.

As part of the NFPA 805 transition project, the licensee stated that it reviewed and evaluated the susceptibility to fire-induced MSOs. The licensee stated that the process was conducted in accordance with NEI 04-02 and RG 1.205, as supplemented by Frequently Asked Question (FAQ) 07-0038 (Reference 76).

In LAR Attachment F, the licensee stated that the review method used insights from the FPRA developed in support of transition to NFPA 805 and consisted of the following:

- Step 1 - Identify potential MSOs of concern.
- Step 2 - Conduct an expert panel to assess plant-specific vulnerabilities (e.g., per NEI 00-01, Revision 1, Section F.4.2).
- Step 3 - Update the FPRA model and NSCA to include the MSOs of concern.
- Step 4 - Evaluate for NFPA 805 compliance.
- Step 5 - Document the results.

For Step 1, the licensee stated that the initial MSO identification review was conducted using extensive review of plant systems and drawings to determine potential pathways and that this initial review was then supplemented by review of generic industry lists and data sources used as input to the overall assessment of MSOs. The licensee stated that the plant MSO identification process resulted in a list of potential MSO pathways for consideration by the MSO expert panel, and the following was used as input to the overall assessment of MSOs:

- Beaver Valley, Unit No. 1, Updated Fire Protection Appendix R Review and Beaver Valley, Unit No. 2, Fire Protection Safe Shutdown Report
- Generic list of MSOs from Pressurized Water Reactors Owners Group (PWROG)
- "Fire PRA Component Selection" Unit No. 1
- "Fire PRA Component Selection" Unit No. 2
- Miscellaneous operating experience based on knowledge of review team members
- Beaver Valley, Unit No. 1, and Beaver Valley, Unit No. 2, Fire PRA Models and Insights

The licensee stated that following the initial expert panel in 2008, additional reviews were performed of the generic PWROG generic list of MSOs.

For Step 2, the licensee stated that an initial expert panel was conducted in accordance with the guidance of NEI 00-01, Revision 1, Section F.4.2, "Guidance for Post-Fire Safe Shutdown Circuit Analysis" (Reference 77), and NEI 04-06, Revision L, "Guidance for Self-Assessment of Circuit Failure Issues" (Reference 133). The licensee stated that prior to the meeting, each of the expert panel members reviewed the project instructions to fully understand the intended final product of the expert panel deliberations. The licensee stated that a second MSO expert panel assessment was conducted and that the second MSO expert panel discussed and dispositioned open items from the original MSO expert panel and addressed new generic MSOs that had been identified since the first panel.

The licensee stated that the expert panel core structure consisted of an Appendix R/SSD engineer, electrical engineer, NFPA 805 expert, PRA engineer (fire PRA lead), FPRA consultant, a senior reactor operator, and the FPP manager. The licensee further stated that the expert panel had the ability to request supplemental engineering support (e.g., transient analysis, system engineers, etc.) on an as-needed basis to support the resolution of issues identified. The licensee further stated that work already accomplished in identifying potential spurious actuations by the FPRA team was also included in the MSO expert panel project instruction and reviewed by team members prior to the meeting.

For Step 3, the licensee stated that it identified those component spurious operations to be included in the FPRA model, and that this included MSOs identified in the expert panel review, which considered both generic information and plant-specific insights. The licensee stated that the MSO expert panel reports provide a rationale for exclusion of specific MSOs and associated individual spurious actions from the FPRA on the basis that there is no impact on CDF or LERF due to the specific plant configuration (e.g., impact is negated by a mechanical component such as a manual valve) or very low probability of occurrence (e.g., MSO would require multiple proper polarity three phase hot shorts). The licensee stated that MSO combinations of components of concern were then evaluated for inclusion into the NSCA model and that, as necessary, components were added to the NSCA equipment list and logics and circuit analysis, and cable routing was performed.

For Step 4, the licensee stated that the FPRA quantified the fire-induced risk model containing the MSO pathways, and that the quantification addressed the specific electrical cables and the failure mode in each fire compartment that was quantified. The licensee stated that the MSO contribution is included in the FPRA results and in the associated evaluation of VFDRs as documented in applicable FREs. The licensee further stated that the MSO combination of components of concern was evaluated as part of the NSCA and that for cases where the MSO

combination of components did not meet the requirements for deterministic compliance, the MSO combination of components was identified as VFDRs and added to the scope of the FREs.

For Step 5, the licensee stated that results of the first MSO expert panel were documented in reports and that these reports were updated by the results of the second MSO expert panel assessment. The licensee stated that the reports include:

- Each of the functional MSO scenarios identified in the PWROG generic report summarized and dispositioned with respect to the current FPRA spurious actuation review and is part of the MSO report;

- The results of the MSO expert panel discussions were added to each of these tables; and

- The MSOs that were added to the NSCA and resulted in failures are documented as VFDRs, and resolutions are documented in LAR Attachment C, Table B-3.

The NRC staff reviewed the licensee's expert panel process for identifying circuits susceptible to MSOs as described above and concludes that the licensee adopted a systematic and comprehensive process for identifying MSOs to be analyzed using available industry guidance. Furthermore, the NRC staff concludes that the process used provides reasonable assurance that the FREs appropriately identify and include risk-significant MSO combinations. The NRC staff concludes that the licensee's approach for assessing the potential for MSO combinations is acceptable.

3.2.5 Establishing Recovery Actions

NFPA 805, Section 1.6.52, "Recovery Action," defines a recovery action (RA) as:

> Activities to achieve the nuclear safety performance criteria that take place outside the main control room or outside the primary control station(s) for the equipment being operated, including the replacement or modification of components.

NFPA 805, Section 4.2.3.1, states:

> One success path of required cables and equipment to achieve and maintain the nuclear safety performance criteria without the use of recovery actions shall be protected by the requirements specified in either Sections 4.2.3.2, 4.2.3.3, or 4.2.3.4, as applicable. Use of recovery actions to demonstrate availability of a success path for the nuclear safety performance criteria automatically shall imply use of the performance-based approach as outlined in 4.2.4.

NFPA 805, Section 4.2.4, "Performance-Based Approach," states:

> When the use of recovery actions has resulted in the use of this approach, the additional risk presented by their use shall be evaluated.

The NRC staff reviewed LAR Section 4.2.1.3, "Establishing Recovery Actions," and LAR Attachment G, "Recovery Actions Transition," to evaluate whether the licensee meets the associated requirements for the use of RAs per NFPA 805.

As described in LAR Section 4.2.1.3, the licensee's process is based on the methodology of FAQ 07-0030 (Reference 75), and consisted of the following steps:

- Step 1: Clearly define the PCSs and determine which pre-transition operator manual actions (OMAs) are taken at PCSs (activities that occur in the MCR are not considered pre-transition OMAs). Activities that take place at PCSs or in the MCR are not RAs by definition.

- Step 2: Determine the population of RAs that is required to resolve variances from deterministic requirements (VFDRs) (to meet the risk acceptance criteria or maintain a sufficient level of DID).

- Step 3: Evaluate the additional risk presented by the use of RAs required to demonstrate the availability of a success path.

- Step 4: Evaluate the feasibility of the RAs.

- Step 5: Evaluate the reliability of the RAs.

OMAs meeting the definition of an RA are required to comply with the NFPA 805 requirements outlined above. Some of these OMAs may not be required to demonstrate the "availability of a success path" in accordance with NFPA 805, Section 4.2.3.1, but may still be required to be retained in the RI/PB FPP because of DID considerations described in NFPA 805, Section 1.2.

In LAR Attachment G, Tables G-1 and G-2, the licensee did not differentiate between an RA that is needed to meet the NSCA and one retained to provide DID. However, as discussed in the NRC staff's review of RAs in SE Section 3.5.1.7, the licensee provided in its response to SSD RAI 04a (Reference 12) and PRA RAI 18b (Reference 11) a revised list of RAs that differentiated between those RAs credited for DID and those credited for risk reduction. In each instance, the licensee determined whether a transitioning OMA was an RA or not necessary for the post-transition RI/PB FPP.

The licensee stated that the set of RAs necessary to demonstrate the availability of a success path for the NSPC was evaluated for additional risk using the process described in NEI 04-02, FAQ 07-0030, and RG 1.205, and compared against the guidelines of RG 1.174 and RG 1.205. The licensee further stated that other RAs, whether credited for DID or credited to overcome a combination of fire-induced and random failures but not involving the success path, are not evaluated for the addition risk of their use. In SSD RAI 04b (Reference 23), the NRC staff requested that the licensee provide a detailed description of these "other" RAs, including how the RAs were identified, what nuclear safety performance goals and fire SSD functions are associated with the RAs, which of these RAs are listed in LAR Attachment G, which of these RAs will remain in the shutdown procedures, the feasibility evaluation performed, and examples of these types of RAs and how it was determined which RAs are screened out and which are retained in procedures. In its response to SSD RAI 04b (Reference 12), the licensee stated that the statement related to other RAs was included in LAR Attachment G as a contingency for how to deal with such actions, and that after reviewing FREs, VFDRs, and RAs, it was determined that the statement related to other RAs is not applicable. In its letter dated June 23, 2017 (Reference 19), the licensee submitted a revised LAR Attachment G that deleted its previous statement. The NRC staff concludes that the licensee's response to SSD RAI 04b is acceptable

because the approach to evaluating other RAs as described by the licensee was determined to be not applicable and has been removed from the licensee's methodology for evaluating RAs.

In LAR Attachment G, the licensee stated that RAs in existing procedures have been identified, and credit was taken for previously completed feasibility studies that include these RAs. The licensee further stated that RAs not currently in existing post-fire response procedures have been identified and reviewed for feasibility by an expert panel, which consisted of a current licensed reactor operator or a previously licensed senior reactor operator at the site, an engineer familiar with the FPRA model, and an FPP specialist. The licensee further stated that the feasibility criteria used in the licensee's assessment process were based on the criteria listed in NFPA 805, Appendix B.5.2, along with the use of training and drills as originally discussed in earlier versions of NEI 04-02 and current FAQ 07-0030. The criteria include the following:

- The proposed RAs should be verified in the field to ensure the action can be physically performed under the conditions expected during and after the fire event.

- When RAs are necessary in the fire area under consideration, the analysis should demonstrate that the area is tenable for the actions to be performed and that fire or fire suppressant damage will not prevent the RA from being performed.

- The lighting should be evaluated to ensure sufficient lighting is available to perform the intended action.

- Walkthrough of operations guidance (modified, as necessary, based on the analysis) should be conducted to determine if adequate manpower is available to perform the potential RAs within the time constraints (before an unrecoverable condition is reached).

- The communications system should be evaluated to determine the availability of communication where required for coordination of RAs.

- Evaluations for all actions, which require traversing through the fire area or an action in the area of the fire, should be performed to determine acceptability.

- Sufficient time to travel to each action location and perform the action should exist. The action should be capable of being identified and performed in the time required to support the associated shutdown function(s) such that an unrecoverable condition does not occur. Previous action locations should be considered when sequential actions are required.

- There should be a sufficient number of essential personnel to perform all of the required actions in the times required based on the minimum shift staffing. The use of essential personnel to perform actions should not interfere with any collateral industrial fire brigade or control room duties.

- Any tools, equipment, or keys required for the action should be available and accessible. This includes consideration of self-contained breathing apparatus and personal protective equipment, if required.

- Training - Training should be provided on the post-fire procedures and implementation of the RAs.

- Drills - Periodic drills, which simulate the conditions to the extent practical (e.g., communications between the control room and field actions, the use of self-contained breathing apparatus if credited, appropriate use of operator aids) should be performed.

The licensee stated that the expert panel determined that all RAs listed in LAR Attachment G, Table G-1 and Table G-2, that are not currently in Appendix R response procedures are feasible. The licensee identified an implementation item for procedure updates that will incorporate new RAs and for confirmatory demonstrations of the feasibility of these RAs. The licensee further stated that training and drills will be updated after completion of the procedures. In LAR Attachment S, Table S-3, as supplemented, the licensee included Implementation Item BV1-3027 to revise post-fire SSD procedures and update training and fire brigade drills. The NRC staff considers this action acceptable because it will incorporate the provisions of NFPA 805 in the FPP, and it would be required by the proposed license condition.

Based on its review of the above considerations, the NRC staff concludes that the licensee followed the endorsed guidance of NEI 04-02 and RG 1.205 to identify and evaluate RAs in accordance with NFPA 805, and concludes, therefore, that there is reasonable assurance of meeting the regulatory requirements of 10 CFR 50.48(c). The NRC staff concludes that the feasibility criteria applied to RAs are acceptable based on conformance with the endorsed guidance contained in NEI 04-02, subject to successful completion of Implementation Item BV1-3027.

3.2.6 Plant-Specific Treatments or Technologies

3.2.6.1 Very Early Fire Detection System

The licensee proposed the installation of several VEWFDS to monitor conditions, as well as provide indication and alarms inside key electrical cabinets during the incipient stage of a fire.

In LAR Attachment S, Table S-2, as supplemented, Modification Items BV1-1875, BV1-2854, and BV2-0829, the licensee indicated that a VEWFDS will be added as follows:

- Unit No. 1 - Add incipient fire detection to the process rack fire compartment (1-CR-4) to improve time to detection of fires. This modification will provide improved detection capability in cabinets that are important for the ability to operate essential plant equipment. Very early warning detection capability improves the likelihood that damage due to a potential fire event will be limited and thus reduces plant risk.

- Unit No. 2 - Add incipient fire detection to 2-CB-1 process racks area and 2-CB-6 west communications room to improve time to detection of fires. This modification will provide improved detection capability in cabinets that are

important for the ability to operate essential plant equipment. Very early warning detection capability improves the likelihood that damage due to a potential fire event will be limited and thus reduces plant risk.

- Unit No. 1 – Replace computer inverter with a new inverter containing an internal static switch and connect the incipient detection system to the new inverter.

In a letter dated April 21, 2017 (Reference 18), the licensee indicated that Modification Items BV1-1875 and BV2-0829 have been completed.

In LAR Attachment W, the licensee stated that the installation of VEWFDS incipient detection in low voltage cabinets located in fire compartments 1-CR-4, 2-CB-1, and 2-CB-6 is to reduce the likelihood of fire propagation outside the cabinets.

The NRC staff concludes that the fire protection aspects related to the proposed installation of the VEWFDS as described in SE Section 3.1.3.2 are acceptable because:

- First responders to VEWFDS indications will be trained in the use of fire extinguishers and instructed to suppress or control a fire that breaks out in the alarming cabinet.

- The licensee's procedure will require the first responders to establish a fire watch, which will remain in place until the degrading component is repaired, the cabinet is deenergized, or the alarm is satisfactorily reset.

- The configuration and design control process will control and maintain the setpoints for both alert and alarm functions from the VEWFDS.

- The VEWFDS equipment will be periodically tested and maintained in accordance with the vendor's requirements.

- The licensee's procedure will require the first responders to identify the source of the alarm with the portable VEWFDS detector, and once the source of the alarm has been identified, operations personnel will determine what appropriate actions are required until the degrading component is repaired, the cabinet is deenergized, or the alarm is satisfactorily reset.

In addition, the FPRA modeled the installation of the VEWFDS and took credit for its use in assessing the risk of various fire areas during certain scenarios. SE Section 3.4 addresses the technical review of the treatment of the VEWFDS in the FPRA, as well as the acceptability of the risk credit taken for the associated fire areas.

3.2.7 Conclusion for Section 3.2

The NRC staff reviewed the licensee's LAR for conformity with the requirements contained in NFPA 805, Section 2.4.2, regarding the process used to perform the NSCA. The NRC staff concludes that the declared safe and stable condition proposed is acceptable and that the licensee's process is adequate to appropriately identify and locate the systems, equipment, and cables required to provide reasonable assurance of achieving and maintaining the fuel in a safe and stable condition, as well as to meet the NFPA 805 NSPC.

The NRC staff confirmed, through review of the documentation provided in the LAR, that feed and bleed was not the sole fire-protected SSD path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability, in accordance with 10 CFR 50.48(c)(2)(iii).

The NRC staff also reviewed the licensee's process to identify and analyze MSOs. Based on the LAR, the process used to identify and analyze MSOs is considered comprehensive and thorough. Through the use of an expert panel process, in accordance with the guidance of RG 1.205, NEI 04-02, and FAQ 07-0038, potential MSO combinations were identified and included as necessary in the NSCA, as well as the applicable FREs. The NRC staff also considers the approach the licensee uses for assessing the potential for MSO combinations acceptable because it was performed in accordance with NRC-endorsed guidance.

Subject to completion of Implementation Item BV1-3027 in LAR Attachment S, Table S-3, as supplemented, the NRC staff concludes that the process used by the licensee to review, categorize, and address RAs during the transition is consistent with RG 1.205 and the NRC-endorsed guidance contained in NEI 04-02. Therefore, the information provided by the licensee provides reasonable assurance that the regulatory requirements of 10 CFR 50.48(c) and NFPA 805 for NSCA methods are met.

The NRC staff reviewed the proposed installation of a VEWFDS to monitor conditions in certain key electrical cabinets at Beaver Valley as described in LAR Modification Items BV1-1875, BV1-2854, and BV2-0829, and in its response to FPE RAI 15. Based on the information provided, the NRC staff concludes that the fire protection aspects of the proposed VEWFDS installation are acceptable because the installation will be done in accordance with appropriate NFPA codes and the guidance of FAQ 08-0046 (Reference 80).

3.3 Fire Modeling

NFPA 805 (Reference 3) allows both FM and FREs as PB alternatives to the deterministic approach outlined in the standard. These two PB approaches are described in NFPA 805, Sections 4.2.4.1 and 4.2.4.2, respectively. Although FM and FRE are presented as two different approaches for PB compliance, the FRE approach generally involves some degree of FM to support engineering analyses and fire scenario development. NFPA 805, Section 1.6.18, defines a fire model as a "mathematical prediction of fire growth, environmental conditions, and potential effects on SSCs, based on the conservation equations or empirical data."

The NRC staff reviewed LAR Section 4.5.2, "Performance-Based Approaches," which describes how the licensee used FM as part of the transition to NFPA 805 at Beaver Valley, and LAR Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," which describes how the licensee performed FM calculations in compliance with the NFPA 805 PB evaluation quality requirements for fire protection systems and features to determine whether the FM used to support transition to NFPA 805 is acceptable.

In LAR Section 4.5.2.1 the licensee stated that the FM approach, per NFPA 805, Section 4.2.4.1, was not used for the NFPA 805 transition. The licensee used the FRE PB method (i.e., FPRA) with input from FM analyses. Therefore, the NRC staff reviewed the technical adequacy of the FREs, including the supporting FM analyses, as documented in SE Section 3.4.2, to evaluate compliance with the NSPC.

The licensee did not propose any FM methods to support PB evaluations in accordance with NFPA 805, Section 4.2.4.1 as the sole means for demonstrating compliance with the NSPC. Therefore, the NRC staff concludes that there are no plant-specific FM methods acceptable for use to support compliance with NFPA 805, Section 4.2.4.1 for supporting the transition to NFPA 805.

3.4 Fire Risk Assessments

This section addresses the licensee's FRE PB method, which is based on NFPA 805, Section 4.2.4.2. The licensee chose to use only the FRE PB method in accordance with NFPA 805, Section 4.2.4.2. The FM PB method of NFPA 805, Section 4.2.4.1, was not used for this application.

NFPA 805, Section 4.2.4.2, "Use of Fire Risk Evaluations," states that:

> Use of fire risk evaluation for the performance-based approach shall consist of an integrated assessment of the acceptability of risk, defense in depth [DID], and safety margins.
>
> The evaluation process shall compare the risk associated with implementation of the deterministic requirements with the proposed alternative. The difference in risk between the two approaches shall meet the risk acceptance criteria described in NFPA 805, Section 2.4.4.1, "Risk Acceptance Criteria." The fire risk shall be calculated using the approach described in NFPA 805, 2.4.3, ["Fire Risk Evaluations"].

3.4.1 Maintaining Defense-in-Depth and Safety Margins

NFPA 805, Section 4.2.4.2, requires that the "use of fire risk evaluation for the PB approach shall consist of an integrated assessment of the acceptability of risk, DID, and safety margins."

3.4.1.1 Defense-in-Depth

NFPA 805, Section 1.2, states:

> Protecting the safety of the public, the environment, and plant personnel from a plant fire and its potential effect on safe reactor operations is paramount to this standard. The fire protection standard shall be based on the concept of defense-in-depth. Defense-in-depth shall be achieved when an adequate balance of each of the following elements is provided:
>
> - Preventing fires from starting.
> - Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage; and
> - Providing an adequate level of fire protection for structures, systems, and components (SSCs) important to safety, so that a fire that is not promptly

extinguished will not prevent essential plant safety functions from being performed.

The NRC staff reviewed LAR Section 4.5.2.2, "Fire Risk Approach"; LAR Section 4.8.1, "Results of the Fire Area Review"; and LAR Attachment C, Table B-3, "NEI 04-02 Table B-3 – Fire Area Transition," as well as the associated supplemental information, in order to determine whether the principles of DID were maintained in regard to the planned transition to NFPA 805 at Beaver Valley.

In LAR Section 4.5.2.2, the licensee provided a high level overview of its method for evaluating DID as part of the FREs performed for each PB fire area and provided additional detail in its response to PRA RAI 21 (Reference 11). The licensee followed guidance contained in NEI 04-02 on consideration of DID as part of the change process. The licensee's method for evaluating DID addressed each of three elements in NFPA 805, Section 1.2, referred to as echelons 1, 2, and 3, respectively. In its response to PRA RAI 21, the licensee described its evaluation of each of the three DID echelons, which included identification of fire protection features addressing the DID echelons and issues considered in the evaluation that impact fire risk. The evaluation determined whether there was an overreliance on an echelon of DID and whether changes were needed to assure that an echelon of DID had been satisfactorily achieved. Many of the identified fire protection features are required to be in place in order to demonstrate compliance with the fundamental fire protection and design elements of NFPA 805, Chapter 3, such as the combustible control and hot work programs. However, other considered fire protection features included RAs and fire detection and suppression systems.

LAR Table 4.3 and LAR Attachment C, provide the following: (1) documentation of the fire protection systems/features required to either meet the deterministic criteria of NFPA 805, Section 4.2.3, or to support the fire probabilistic risk assessment (FPRA); (2) notes whether changes or improvements are necessary for each fire protection system/feature to maintain a balance among the DID echelons; and 3) a justification or basis for why the required fire protection systems/features are adequate for DID. As such, the information developed as part of the FRE and provided in the LAR is the licensee's internal record of the systems required to meet the NSPC and DID requirements of NFPA 805.

In its response to PRA RAI 21 (Reference 11), the licensee defined the term "potentially risk-significant fire scenarios" as a means of providing additional criteria for when DID measures should be considered. The licensee defined "potentially risk-significant" fire scenarios for the purposes of evaluating the need for DID as:

- Scenarios in which the estimated CDF is greater than 1E-06/year or the LERF is greater than 1E-07/year LERF.
- Scenarios in which the estimated CDF falls between 1E-06/year and 1E-08/year or the LERF falls between 1E-07/year and 1E-09/year, and for which DID echelons 1 and 2 reduce risk significantly.
- Scenarios with a high consequence (i.e., conditional core damage probability (CCDP) > 1E-01).

Based on the review of the LAR, the FREs, and the licensee's response to PRA RAI 21, the NRC staff concludes that the licensee systematically and comprehensively evaluated fire hazards, area configurations, detection and suppression features, and administrative controls in

each fire area. The NRC staff also concludes that the licensee's methodology adequately evaluates DID against fires as required by NFPA 805, and therefore, the proposed RI/PB FPP adequately maintains DID.

3.4.1.2 Safety Margins

NFPA 805, Section 2.4.4.3, states that:

> The plant change evaluation shall ensure that sufficient safety margins are maintained.

NEI 04-02, Section 5.3.5.3, "Safety Margins," lists two specific criteria that should be addressed when considering the impact of plant changes on safety margins:

- Codes and standards or their alternatives accepted for use by the NRC are met and

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR and supporting analyses) are met or provide sufficient margin to account for analysis and data uncertainty.

LAR Section 4.5.2.2, "Fire Risk Approach," states that safety margins were considered as part of the FRE process and that each compartment with VFDRs was evaluated against the safety margin criteria of NEI 04-02 and RG 1.205. The licensee performed an FRE for each fire area containing VFDRs. The FREs contain the details of the licensee's review of safety margins for each PB fire area.

In LAR Attachment H, "NFPA 805 Frequently Asked Question Summary Table"; LAR Attachment J, "Fire Modeling V&V"; and its response to PRA RAI 21 (Reference 11), the licensee described the methodology it used to evaluate safety margins in the FREs that included the following evaluations and determinations:

- FM for the FPRA was specifically reviewed for adequate safety margin and, in general, was developed utilizing industry, NRC, and National Institute of Standards and Technology (NIST) accepted codes, supported by guidance that includes NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities"; NEI 04-02; and associated FAQs resolutions as described in LAR Section 3.4 and specifically identified throughout the LAR as supplemented.

- Plant system performance was evaluated, given the specific demands associated with postulated fire events. The methods, input parameters, and acceptance criteria utilized in the RI/PB analysis were reviewed against the plant design-basis events. This evaluation determined the safety margin established in the plant design-basis events was preserved.

- The FPRA logic model, including supporting FM, was developed in accordance with NUREG/CR-6850 and ASME/ANS RA-Sa-2009, "Addenda to ASME/ANS

RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications."

The safety margin criteria described in the LAR and NEI 04-02, Section 5.3.5.3, are consistent with the criteria as described in RG 1.174 and in NEI 04-02, Revision 2, and therefore, the NRC staff concludes that the safety margin is acceptable. The licensee used appropriate codes and standards (or NRC guidance) and met the safety analyses acceptance criteria in the licensing basis. Based on its review of the LAR, the FREs, and the licensee's response to PRA RAI 21 (Reference 11), the NRC staff concludes that the licensee's approach adequately addresses the issue of safety margins in the implementation of the FRE process.

3.4.2 Quality of the Fire Probabilistic Risk Assessment

The objective of the PRA quality review is to determine whether the plant-specific PRA used in evaluating the proposed LAR is of sufficient scope, level of detail, and technical adequacy for the application. The NRC staff evaluated the PRA quality information provided by the licensee in its NFPA 805 submittal, as supplemented, including industry peer review results. The NRC staff reviewed LAR Section 4.5.1, "Fire PRA Development and Assessment"; LAR Section 4.7, "Program Documentation, Configuration Control, and Quality Assurance"; LAR Attachment C, "NEI 04-02 Table B-3 – Fire Area Transition"; LAR Attachment U, "Internal Events PRA Quality"; LAR Attachment V, "Fire PRA Quality"; LAR Attachment W, "Fire PRA Insights"; and the LAR supplement dated February 14, 2014 (Reference 9); as well as other associated supplemental information.

In the licensee's letter dated February 14, 2017 (Reference 9), the licensee indicated that it developed separate internal events PRA (IEPRA) models for Beaver Valley, Units Nos. 1 and 2, to support the individual plant examination process and continued to maintain and improve those PRA models as RG 1.200 and supporting industry standards have evolved. The licensee developed its FPRA models for each unit for both Level 1 (core damage) and partial Level 2 (large early release) PRA during at-power conditions. For the development of the FPRA, the licensee modified its IEPRA models to capture the effects of fire.

The licensee identified administrative controls and processes used to maintain the FPRA model current with plant changes and to evaluate any outstanding changes not yet incorporated into the PRA model for potential risk impacts as a part of the routine change evaluation process. In LAR Section 4.8.2, the licensee stated that no known plant changes (beyond those identified and scheduled to be implemented as part of the transition to a FPP based on NFPA 805) are outstanding with respect to their inclusion in the FPRA model. Further, as described in SE Section 3.8.3, the licensee has a program for ensuring that developers and users of these models are appropriately trained and qualified. Therefore, the NRC staff concludes that the PRA should be capable of supporting post-transition FREs to support, for example, the self-approval process, after any changes required during implementation are completed.

3.4.2.1 Internal Events PRA Model

The licensee evaluated the technical adequacy of the portions of its IEPRA model used to support development of the FPRA model, as discussed in LAR Attachment U, using full-scope peer reviews, subsequent gap assessments, and focused-scope peer reviews. In its letter dated February 14, 2014 (Reference 9), the licensee stated that a full-scope peer review by the Westinghouse Owner's Group was performed in July 2002 using the NEI 00-02 (Reference 134) industry PRA peer review process. The licensee explained that subsequent self-assessments

(also referred to by the licensee as '"gap assessments") were performed for both units in 2007 on the IEPRAs against the Capability Category II (CC-II) requirements of the 2005 ASME PRA standard (Reference 135) and RG 1.200, Revision 1 (Reference 136). In addition, focused-scope peer reviews were performed for both units in 2007 of the human reliability analysis (HRA) methodology against the CC-II requirements of the 2005 ASME PRA standard and RG 1.200, Revision 1. This 2007 self-assessment and focused-scope peer review of the Unit Nos. 1 and 2 IEPRAs cited by the licensee were not performed against the ASME/ANS RA-Sa-2009 PRA standard (Reference 46) and clarifications/qualifications defined in RG 1.200 Revision 2 (Reference 45). However, the NRC staff notes that a complete self-assessment of the IEPRA models was performed for another application (i.e., the LAR to extend containment leak rate test frequencies). In its letter dated November 4, 2014 (Reference 137), the licensee explained that a self-assessment of the IEPRAs was performed using the ASME/ANS RA-Sa-2009 PRA standard, the RG 1.200 clarifications/qualifications, and guidance in NEI 05-04 (Reference 138) with respect to an LAR to extend containment leak rate test frequencies. The licensee explained that the differences between the 2005 and 2009 IEPRA standard supporting requirements (SRs) were evaluated for both the Unit Nos. 1 and 2 IEPRAs, and the IEPRAs were determined to be compliant with ASME/ANS RA-Sa-2009 PRA standard and clarifications/qualifications defined in RG 1.200, Revision 2. In addition, the licensee indicated that in 2011, a focused-scope peer review was performed on the internal flooding PRA model against the 2009 ASME/ANS PRA standard and RG 1.200, Revision 2. Based on this information, the NRC staff concludes that the IEPRA models used to develop the FPRA models were evaluated consistent with the ASME/ANS RA-Sa-2009 PRA standard and clarifications/qualifications defined in RG 1.200, Revision 2.

For each SR in the PRA standard, there are three possible degrees of "satisfaction" referred to as capability categories (i.e., CC-I, CC-II, and CC-III), with CC-I being the minimum, CC-II considered widely acceptable, and CC-III indicating the maximum achievable level of detail, plant specificity, and realism. For many SRs, the CCs are combined (e.g., the requirement for meeting CC-I is combined with CC-II or the requirement is the same across all CCs so that the requirement is simply met or not met).

In its letter dated February 14, 2014 (Reference 9), the licensee provided resolutions to all facts and observations (F&Os) from the 2002 full-scope peer reviews, 2007 gap assessments, and 2007 and 2011 focused-scope peer reviews. For the 2002 peer reviews, this includes all F&Os having significant Level A (extremely important and necessary to address to assure the technical adequacy of the PRA or the quality of the PRA or the quality of the PRA update process); Level B (important and necessary to address, but disposition may be deferred until the next PRA update); Level C (recommended, but not likely to significantly affect results or conclusions); and Level D (editorial or minor technical item). For the 2007 gap assessments, this includes all F&Os that have the potential to affect the risk results or insights or impact the documentation or traceability of analyses (i.e., Levels A, B, C, and D). For the focused-scope peer reviews, the resolutions to all F&Os findings and suggestions, as defined in peer review the guidance, are provided. In general, a finding level F&O is written for any SR that is judged not to be met or does not fully satisfy CC-II of the ASME standard, consistent with RG 1.200, Revision 2.

In its letter dated February 14, 2014 (Reference 9), the licensee resolved each F&O by either providing a description of how the F&O was resolved or providing an assessment of the impact of resolution of the F&O on the FPRA. The NRC staff evaluated each F&O and the licensee's resolution to determine whether the F&O had any significant impact for the NFPA 805

application. The NRC staff's review and conclusion for the licensee's resolution of each F&O is summarized in the NRC's record of review dated September 5, 2017 (Reference 139).

In PRA RAI 02.b (Reference 23) associated with F&O SY-01 for both Unit Nos. 1 and 2, the NRC staff requested that the licensee provide further justification for not modelling a potential common mode failure of the charging pumps when seal heat exchanger cooling fails causing increased water temperatures in the volume control tank (VCT). In its response to PRA RAI 02.b (Reference 10), the licensee explained that the PRA did not include the model for realignment of the water supply to the charging pumps from the VCT, which precludes the impact on the charging pumps due to VCT inventory heat-up. In its response to PRA RAI 03 (Reference 19), the licensee explained that it added the excluded fault tree modelling to the FPRA so that the common cause failure mode could be explicitly modelled (i.e., failure of both automatic and manual realignment of the VCT). The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that it included the explicit consideration of the common cause failure mode into the FPRA to resolve F&O SY-01.

In PRA RAI 02.f (Reference 23) associated with F&O HR-PR-006 for both Unit Nos.1 and 2, the NRC staff requested that the licensee provide further justification for using significantly different time windows for the availability of the same HFE (i.e., ZHEMA2) in the Unit Nos. 1 and 2 HRAs. In its response to PRA RAI 02.f (Reference 10) and PRA RAI 03 (Reference 19), the licensee explained that the time difference was a result of different assumptions made about when the cue is received and when SG failure occurs. The licensee explained that it incorporated more realistic and consistent HFEs for these operator errors into its the integrated analysis provided in its response to PRA RAI 03. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its revised treatment resolves the F&O.

In PRA RAI 24 (Reference 23), the NRC staff requested that the licensee identify any changes made to the Unit Nos. 1 and 2 IEPRAs, since the last full-scope peer review of PRA models that are consistent with the definition of a "PRA upgrade," as defined by the ASME/ANS PRA standard (Reference 46), necessitating the need for further peer review. In its response to PRA RAI 24 (Reference 10), the licensee explained that it identified such changes to the IEPRA, and focused-scope peer reviews were performed for those changes. In its response to PRA RAI 24 and its letter dated February 14, 2014 (Reference 9), the licensee explained that a focused-scope peer review was performed in 2007 on the HRA after the HRA was migrated to another HRA tool (i.e., the EPRI HRA calculator) and that a focused-scope peer review was performed in 2011 on the internal flooding PRA because it was updated to meet CC-II requirements in the 2009 PRA standard as clarified by RG 1.200, Revision 2. The licensee stated that no other changes consistent with the definition of "PRA upgrade" were made. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's determination of the need for followup peer review of PRA upgrades is based on the ASME/ANS PRA standard and RG 1.200 guidance.

As a result of its review of the LAR and RAI responses, the NRC staff concludes that the Unit Nos. 1 and 2 IEPRAs are adequate and can be used to support the FPRAs. To reach this conclusion, the NRC staff reviewed all the F&Os provided by the peer reviewers, as well as the results of the gap assessments, and determined that the resolution of every F&O supports the determination that the quantitative results are adequate or had no significant impact on the FPRA. The NRC staff also concludes that the licensee demonstrated that the IEPRAs meet the guidance in RG 1.200, Revision 2. They were reviewed against the applicable SRs in

ASME/ANS-RA-Sa-2009, and they are technically adequate to support the FREs and other risk calculations required for the NFPA 805 application.

3.4.2.2 Fire PRA Model

The licensee evaluated the technical adequacy of the Unit Nos. 1 and 2 FPRA for this application by conducting full-scope peer reviews and a focused-scope peer review. A full-scope peer review was performed in January 2009 for the Unit No. 1 FPRA against the ASME/ANS RA-S-2008 fire PRA standard (Reference 140). A subsequent focused-scope peer review was performed in January 2011 for the Unit No. 1 FPRA against the ASME/ANS RA-Sa-2009 PRA standard (Reference 46). The scope of this 2011 peer review included reviewing the resolutions to F&Os from the 2009 peer review for those elements of the FPRA that were complete at the time of the 2009 peer review and reviewing all SRs for those elements of the FPRA that were not complete at the time of the 2009 peer review. For the Unit No. 2 FPRA, the full-scope peer review was performed in February 2012 against the ASME/ANS RA-Sa-2009 FPRA standard.

In PRA RAI 23 (Reference 23), in regard to the Unit No. 1 FPRA, the NRC staff requested that the licensee explain how it addressed the differences in the SRs between the 2008 and 2009 versions of the PRA standard and to also describe whether the peer reviews addressed the clarifications/qualifications in RG 1.200, Revision 2, and whether they were performed in accordance with NEI 07-12 (Reference 141). In its response to PRA RAI 23 (Reference 11), the licensee explained that the 2008 version of the PRA standard used in the peer review was evaluated and determined to be the same as the 2009 version of the PRA standard. The licensee also explained that the full-scope and focused-scope peer reviews evaluated the Unit Nos. 1 and 2 FPRA against all the requirements of the ASME/ANS RA-Sa-2009 PRA standard, as clarified by RG 1.200, Revision 2, using the process defined in NEI 07-12.

LAR Attachment V, Table V-1a, provides the licensee's resolutions to all 17 F&Os from the 2011 focused-scope peer review of the Unit No. 1 FPRA, which includes seven findings, seven suggestions, one unreviewed analysis method, and two best practices, as defined by NEI 07-12. LAR Attachment V, Table V-2a, identifies all SRs that were determined by the Unit No. 1 FPRA focused-scope peer review to be met only at CC-I, each of which was addressed by F&Os provided in LAR Attachment V, Table V-1a. The licensee explained that the resolutions to all of the F&Os from the 2009 full-scope peer review of the Unit No. 1 FPRA were reviewed and closed by the 2011 focused-scope peer review. LAR Attachment V, Table V-1b, provides the licensee's resolutions to all 32 F&Os from the 2012 full-scope peer review of the Unit No. 2 FPRA, which includes 14 findings, 15 suggestions, and 3 best practices. LAR Attachment V, Table V-2b, identifies all SRs that were determined by the Unit No. 2 FPRA full-scope peer review to be met only at CC-I or not met, each of which were addressed by F&Os provided in LAR Attachment V, Table V-1b. The NRC staff concludes that the licensee's response to PRA RAI 23 is acceptable because the licensee demonstrated that there is no difference between the 2008 and 2009 versions of the PRA standard, and that the peer reviews were conducted against the requirements in the 2009 version of the PRA standard, as clarified by NRC guidance using the process defined in NEI 07-12.

In PRA RAI 24 (Reference 23), the NRC staff requested that the licensee identify any changes made to the FPRAs that are consistent with the definition of a "PRA upgrade" since the last full-scope peer review of PRA models, as defined by the ASME/ANS PRA standard (Reference 46). In its response to PRA RAI 24 (Reference 10), the licensee stated that no other changes to the PRA in response to F&Os resulted in an upgrade other than for those described

in SE Section 3.4.2.1. Subsequently, in its response to PRA RAI 03.b (Reference 19), the licensee stated that it used updated guidance from NUREG-2178 (Reference 142) to model certain fire scenarios in order to improve the risk results in important fire compartments. The licensee stated it recognizes that modelling the obstructed plume from NUREG-2178 and modelling direct current hot short duration represent a "PRA upgrade," and per its procedures, a focused-scope peer review will be performed before this modeling is used for self-approval. The licensee included this action in Implementation Items BV1-3108 and BV2-1622, which will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that it is following the ASME/ANS PRA standard and RG 1.200 guidance regarding PRA upgrades.

The NRC staff evaluated each F&O and the licensee's resolutions in LAR Attachment V to determine whether the F&O had any significant impact for the application. The NRC staff's review and conclusion for the licensee's resolution of each F&O and basis of acceptability of SRs that are "not met" or only meet CC-I are summarized in the NRC's record of review dated September 5, 2017 (Reference 139).

In PRA RAI 01.a (Reference 23) associated with F&O CF-A1-01, the NRC staff stated that the licensee's use of Option #2 from NUREG/CR-6850, Section 10.5.3.2, does not provide an adequate method for quantifying the likelihood of hot short-induced failures and that updated guidance in NUREG/CR-7150, Volume 2 (Reference 131), has been issued on assessing the likelihood of hot short-induced failures. The NRC staff requested that the licensee explain how the guidance in NUREG/CR-7150 will be addressed for the Unit Nos. 1 and 2 FPRA models, particularly in cases in which the licensee's analysis is not conservative with respect to the updated guidance. In its response to PRA RAI 01.a (Reference 10) and PRA RAI 03 (Reference 19), the licensee explained that it updated the circuit failure mode likelihood analysis calculations Unit Nos. 1 and 2 to be consistent with NUREG/CR-7150, Volume 2, in its integrated analysis provided in its response to PRA RAI 03. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that it resolved the F&O in accordance with NRC guidance.

In PRA RAI 1.c (Reference 23) concerning F&O QNS-C1-01, the NRC staff requested that the licensee provide justification for the sufficiency of the sampling method it used to determine that the sum of the LERF contributions for all screened scenarios was less than 10 percent of the estimated total LERF for fire events. In its response to PRA RAI 01.c (Reference 10), the licensee explained that scenarios having a CDF higher than 1E-08 were retained and that LERF screening was performed on the next most risk dominant scenarios (i.e., scenarios with a CDF between 1E-08/year and 1E-09/year). The licensee explained that it compared the total LERF of the screened scenarios to the LERF of unscreened scenarios (i.e., scenarios with a CDF higher than 1E-08/year) and used this comparison to conservatively calculate the ratio of screened LERF scenarios to total LERF, which was determined to be about 3 percent. In LAR Attachment S, Table S-3, Implementation Items BV1-3108 and BV2-1622, the licensee included actions to rescreen the fire scenarios in the FPRA model prior to self-approval, and the NRC staff considers this action acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its treatment of quantitative screening using the simplified approach is sufficient to show that the

ratio of quantitatively screened LERF scenarios is a small fraction of the total LERF and because all fire scenarios would be rescreened prior to self-approval.

In PRA RAI 1.d (Reference 23) concerning F&O FSS-D7-01, the NRC staff requested that the licensee explain how the unavailability of fire detection and suppression systems would be addressed in the FPRA for post-transition change evaluations. In its resolution to F&O FSS-D7-01, the licensee explained that it had not incorporated plant-specific unavailability data for fire detection and suppression systems into the FPRA because of its small impact on the risk estimates (i.e., use of the plant-specific data would increase CDF by 5 percent and LERF by 3 percent.) In its response to PRA RAI 01.d (Reference 11) and PRA RAI 03 (Reference 19), the licensee explained that an unavailability probability of 0.01 (from NUREG/CR-6850) was used in the integrated analysis except for cases in which the historical unavailability of the system exceeded 0.01, in which cases the plant-specific system unavailability was used. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its treatment of fire detection and suppression systems unavailability is consistent with NRC guidance on the use of generic and/or plant-specific data as appropriate.

In PRA RAI 1.e (Reference 23) associated with F&O CS-B1-02, the NRC staff requested that the licensee explain how it modelled in the FPRA the potential for fire damage, given fire-induced open circuits on the secondary side of CTs. In its resolution to F&O FSS-D7-01, the licensee indicated that evaluation of fire-induced open circuits on the secondary side of CTs that could lead to secondary fires had not been completed. In its response to PRA RAI 01.e (Reference 10) and SSD RAI 02 (Reference 10), the licensee stated that any CT found to present a secondary fire risk because of fire-induced open circuits based on unit-specific analysis would be modified and included the action to do so in LAR Attachment S, Table S-3, Implementation Items BV1-2706 and BV2-1020, and the NRC staff considers this action acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee indicated that it will conduct a CT secondary open circuit analysis and eliminate the risk of secondary fires from fire-induced open circuits as necessary.

In PRA RAI 01.f (Reference 23), the NRC staff indicated that the licensee's resolution to F&O HRA-E1-01 for Unit No. 2, which questioned the HRA analysis, did not provide a technical response to the F&O. In PRA RAI 01.f.i (Reference 23), the NRS staff requested that the licensee describe and justify its analysis for those weaknesses cited in the F&O. In its response to PRA RAI 01.f (Reference 11), the licensee indicated that it used a systematic and comprehensive search for and evaluation of dependent human actions, and that the dependency analysis was consistent with the state-of-the-art and NUREG-1921, "EPRI/NRC-RES Fire Human Reliability Analysis Guidelines" (Reference 62). The licensee also explained that FPRA dependencies in operator actions are incorporated in the structure of the Beaver Valley RISKMAN model because the HEPs are calculated for specific plant states that result from the success or failure of events that precede the HEP in the accident sequence. With regard to identifying important combinations of HFEs, the licensee indicated that all operator action values were initially assigned a probability of 0.8 to ensure that potentially important combinations of HFEs were identified. The licensee further indicated that it then determined the dependence level between combinations of operator actions using a generic

dependence evaluation tree, which incorporated dependencies in crew, cognition, cues, locations, timing, and resources, and that these results were reviewed by an expert panel.

In PRA RAI 01.f.ii.01 (Reference 25), the NRC staff requested that the licensee provide the range of the joint HEPs used in its analysis. The NRC staff described the long strings of HEP combinations presented in the licensee's response and the unrealistically low HEP values associated with these combinations. In its response to PRA RAI 01.f.ii.01 (Reference 13), the licensee explained that HEP combinations evaluated for dependency in this manner are not minimal HEP combinations but rather sets of HEPs from all split fractions calculated in the event tree branch points of an accident sequence (i.e., because RISKMAN does not generate minimal cutsets to quantify risk). In its response to PRA RAI 01.f.ii.01.01 (Reference 16), the licensee explained that although RISKMAN does not generate minimum cutsets, it "effectively" considered joint HEPs in "accident sequence minimal cutsets" as part of applying the general dependency analysis tree and as part of the detailed expert review.

In PRA RAI 01.f (Reference 23), the NRC staff stated that the licensee's analysis indicated that joint HEPs less than 1E-05 without justification were used in the dependency analysis, which is inconsistent with industry and NRC guidance. In PRA RAIs 01.f.ii (Reference 23), 01.f.ii.01 (Reference 13), and 01.f.ii.01.01 (Reference 16), the NRC staff requested that the licensee provide justification for use of joint HEPs less than 1E-05. In its response to PRA RAI 01.f.ii (Reference 11), the licensee provided general examples of factors that it credited to reduce the dependency between operator actions. In its response to PRA RAI 01.f.ii.01.01 (Reference 16), the licensee explained that consistent with NUREG-1792, "Good Practices for Implementing Human Reliability Analysis" (Reference 143), "[e]ach joint HEP with a value less than 1E-05 has a specific documented justification why it is acceptable." The NRC staff concludes that the licensee's responses to the RAIs are acceptable because the licensee demonstrated that its treatment of the dependency between HEPs is consistent with the guidance in NUREG-1921 and NUREG-1792, and because the licensee performed an expert panel review of the HEP combinations for dependencies.

In PRA RAI 04 (Reference 23), the NRC staff requested that the licensee identify and justify any deviations from NRC accepted guidance (e.g., NUREG/CR-6850, interim guidance, or guidance in FAQs) that it used in the FPRA. In its response to PRA RAI 04 (Reference 12), the licensee identified four treatments not already the subject of other RAIs and characterized them as deviations from NRC accepted guidance. In its response to PRA RAI 04 and PRA RAI 03 (Reference 19), the licensee explained that it updated these four treatments using approved methods or provided appropriate justification for its use. The licensee explained that it revised the approach used in the Unit No. 1 FPRA to credit the limited access to a cable tunnel in fire areas 1-CV-3 and 1-TB-1 to be consistent with the guidance contained in FAQ 12-0064 (Reference 87). The licensee further explained that it originally screened junction boxes out of the FPRA because they are well-sealed and robustly secure but added them into its integrated analysis as ignition sources consistent with guidance in FAQ 13-0006 (Reference 90). The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its treatment of transient fires in hard-to-access areas and treatment of junction box fires is consistent with NRC guidance.

Also in its response to PRA RAI 04 (Reference 12), the licensee acknowledged that its treatment of transient fires in the yard deviated from NRC guidance but considered its treatment to be conservative. The licensee explained that for general transient fires, it assumed that a large diesel fuel spill occurred at locations in the yard where cables exist in manholes and that bounding transient fires resulted. The licensee further explained that it evaluated cable fires in

the yard caused by welding and cutting for all manhole and transformer yard locations by apportioning the fire ignition frequency across a scenario for each location. The NRC staff found that the licensee did not evaluate some cables in the yard as part of a general transient fire, and in PRA RAI 04.01 (Reference 26), the staff requested that the licensee provide further justification for its use of this approach. In its response to PRA RAI 4.01 (Reference 13), the licensee explained that it excluded manholes located outside the vicinity of a possible fuel spill and manholes with "much lower" conditional core damage probabilities (CCDPs) and conditional large early release probabilities than average manhole CCDPs and conditional large early release probabilities from the results. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its treatment of transient fires in the yard uses a realistic bounding fire scenario to assess plant yard transient fires, which is considered conservative.

In PRA RAI 05 (Reference 23), the NRC staff stated that a number of RAs were listed in LAR Attachment G that involve implementing repair procedures on valves that have been impacted by fire. The NRC staff requested that the licensee explain whether these actions were modelled in the FPRA and to provide justification of this credit. In its response to PRA RAI 05 (Reference 11), the licensee explained that it credited RAs associated with repairs for DID but did not credit them in the FPRA. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the repair actions were not modelled in the FPRA, which does not necessitate a review by the NRC staff.

In PRA RAI 06 (Reference 23), the NRC staff found that the licensee credited reduced transient HRRs for certain fire areas and requested that the licensee provide justification for these reduced rates in light of the NRC letter dated June 21, 2012 (Reference 144). In its response to PRA RAI 06 (Reference 10), (Reference 11), and (Reference 12), the licensee explained that an HRR of 142 kilowatts (kW) was used in four areas and an HRR of 69 kW was used in three fire areas instead of the NUREG/CR-6850 HRR of 317 kW for 98th percentile transient fires. The licensee explained that walkdowns and review of the combustible materials, flammable liquids, and activities in these areas provide a basis for assuming that the reduced HRRs used in the FPRA for these areas is consistent with the specific attributes and considerations applicable to the locations (e.g., the types and quantities of combustibles that permanently or temporarily exist, access restrictions, the existence of normal travel paths, and the signage and controls for the area). The licensee further explained that it had performed reviews of past transient fire experience and that as a result, corrective actions have been implemented, training has been added, and management attention has been heightened. The licensee further explained that enhanced administrative controls in fire areas where reduced HRRs are credited involve designation of these fire areas as "transient exclusion areas" that require the use of transient combustible permits, which allow combustible materials for required maintenance activities to be used in the areas but only with appropriate compensatory measures such as a fire watch for unattended combustible materials. The licensee further explained that plant procedures do not allow accumulation of combustible material except in metal containers with approved fire suppressive lids or in designated storage areas and require that transient combustibles be protected from ignition sources. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its use of a reduced transient HRR is consistent with NRC guidance.

In PRA RAI 07 (Reference 23), the NRC staff requested that the licensee provide a description of how it treated sensitive electronics in the FPRA and whether this treatment is consistent with the guidance contained in FAQ 13-0004 (Reference 88). In its response to PRA RAI 07 (Reference 12), the licensee explained that it reviewed FPRA components located in

compartments where FM was performed to determine if its treatment was consistent with FAQ 13-0004. The licensee explained that field inspections based on FAQ 13-0004 identified configurations for which cabinet walls did not protect sensitive electronics. For these components, a reduced critical damage temperature of 65 degrees Celsius (°C) and a critical heat flux of 3 kW/m2 as specified in Section H.2 of NUREG/CR-6850 was used. The licensee further explained that configurations determined to be protected by an enclosure not subject to the caveats defined in FAQ 13-0004 were assumed to be damaged at the larger heat flux for thermoset cables as specified in Table H.1 of NUREG/CR-6850 (i.e., 11 kW/m2) in accordance with the guidance in FAQ 13-0004. In its response to PRA RAI 07 and PRA RAI 03 (Reference 19), the licensee explained that it updated its integrated analysis to fail sensitive electronics damaged by fire as described above. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its treatment is consistent with NRC guidance contained in FAQ 13-0004 and NUREG/CR-6850.

In PRA RAI 08 (Reference 23), the NRC staff requested that the licensee explain how "pinch points" (i.e., locations within a physical analysis unit (PAU) where CCDPs are the highest) were identified and modelled, how hotwork and transient fires were distributed within PAUs, and how the ignition frequency was allocated for transient fires. In its response to PRA RAI 08 (Reference 12), the licensee explained that it postulated transient and hotwork fires for accessible floor area by subdividing that area into transient zones and apportioning the fire ignition frequencies according to the ratio of the transient zone floor area to the total floor area. The licensee further explained that it did not limit target damage sets to targets in a single transient zone because transient fires in one transient zone could damage targets in other transient zones. In PRA RAI 08.01 (Reference 25) and PRA RAI 08.01.01 (Reference 28), the NRC staff explained that the licensee's basis for excluding transients from certain floor areas did not appear to be consistent with NUREG/CR-6850 criteria for excluding floor areas "precluded by design or operations" and requested that the licensee provide further justification for areas excluded from transient fire analysis. In its response to PRA RAI 08.01 (Reference 13), the licensee explained that excluded areas included inaccessible areas occupied by permanent fixtures such as plant equipment, structural features, piping, and cable trays. In its response to PRA RAI 08.01.01 (Reference 16) and PRA RAI 03 (Reference 19), the licensee explained that it incorporated transient fire scenarios previously excluded because they occurred in spaces behind cable tray stacks difficult to enter into its integrated analysis. The NRC staff concludes that the licensee's responses to the RAIs are acceptable because the licensee demonstrated that its treatment of pinch points includes the highest CCDPs since all accessible floor area is assigned an apportioned part of the fire ignition frequency.

In PRA RAI 09 (Reference 23), the NRC staff requested that the licensee explain how it treated fire propagation from electrical cabinets greater that 440 volts (V) in the FPRA. In its response to PRA RAI 09 (Reference 12) and PRA RAI 03 (Reference 19), the licensee explained that for cabinets greater than 440 volts (V) other than "well sealed" motor control centers (MCCs), modelling of fire propagation beyond the ignition source was reviewed and updated to be consistent with the guidance contained in NUREG/CR-6850. The licensee further explained that it used the guidance in FAQ 14-0009 (Reference 91) to model propagation of fires beyond the ignition source for "well sealed" MCC cabinets that contain circuits greater than 440V. The NRC staff concludes that the licensee's response to the RAI is acceptable because it demonstrated that its treatment of fire propagation from electrical cabinets greater 440V is consistent with NRC guidance contained in FAQ 14-0009 and NUREG/CR-6850.

In PRA RAI 10 (Reference 23), the NRC staff explained that the licensee quantitatively screened MCR abandonment scenarios due to loss of habitability from the fire risk contribution

based on an assumed CCDP of 1.0 for the main control board (MCB) fires and an assumed CCDP of 0.1 for other MCR cabinet fires. The NRC staff requested that the licensee provide justification for using a CCDP of 0.1 for the non-MCB cabinet fires, given that the actual CCDP might be higher. The NRC staff also requested that the licensee provide justification for evaluating the MCR habitability scenarios for each unit separately even though the MCR area is common to both units. In its response to PRA RAI 10 (Reference 12), the licensee explained that a CCDP of 0.1 was only used for noncomplex fire scenarios where accident mitigation was not compromised by fire, and that for other fires it used a CCDP of 1.0. The licensee also explained that based on using these conservative assumptions, the resulting core damage frequency (CDF) for each unit is only marginally above 1E-08/year. The licensee further explained that the impact of abandoning the MCR of the affected unit has an insignificant impact on the non-affected unit because: (1) there are no fire scenarios that impact the controls for both units, (2) there are no credited systems shared by both units, and (3) each MCR has sufficient resources to shut down simultaneously from fires that render the MCRs of both units uninhabitable. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its screening of MCR abandonment scenarios due to loss of habitability assesses fire impact on one unit's MCR on the other unit, and given conservative estimates of the CCDP for these scenarios, they have a negligible risk for this application.

In PRA RAI 11 (Reference 23), the NRC staff explained that the licensee's analysis was not clear in how MCR abandonment scenarios due to loss of control were developed, and particularly, how the CCDP for these scenarios was determined and how MCR abandonment operator actions were modeled. The NRC staff requested that the licensee provide specific information about modelling these loss of control scenarios. In its response to PRA RAI 11 (Reference 12), the licensee indicated that it did not credit MCR abandonment due to loss of control for Unit No. 1. The licensee also explained that the analysis of MCR abandonment due to loss of control for Unit No. 2 assumed an HEP of 0.1 for failure of actions to abandon the MCR, activate alternate shutdown, and perform subsequent actions at the ASP. The licensee indicated that it based the assumed value on interim NRC guidance provided in a NRC letter dated July 23, 2014 (Reference 145). The licensee stated that local RAs performed following MCR abandonment are not assumed to be included in the 0.1 HEP and are quantified separately using the guidance contained in NUREG-1921.

The licensee explained how each of the conditions for using the 0.1 failure probability described in the July 23, 2014, letter were met. In PRA RAI 11.01 (Reference 25), the NRC staff explained that although the criteria for using the screening HEP from the NRC guidance appeared to be met, the interim guidance was intended to be used solely for MCR abandonment due to loss of habitability when the cue to abandon is straightforward. The NRC staff requested that the licensee provide information about the basis for applying the model to loss of control scenarios since there may be a delay in abandoning the MCR from determining what MCR functionality is affected by the fire. In its response to PRA RAI 11.01 (Reference 13), the licensee explained that the SSD operator actions in response to fires that could impact MCR functionality are not substantially impacted by the decision to abandon the MCR and the RAs are not significantly different. The licensee also explained that a delay in the decision to abandon the MCR (and the associated delay in starting cool down and depressurization) will have a limited impact on the successful timing of individual actions, because SSD actions are procedurally cued by individual fire-induced failures and credited instruments are available at both the MCR and ASP. The licensee indicated that it evaluated fire scenarios in compartments

where abandonment may occur to further understand the type of damage that severely limits the likelihood of successful shutdown from the MCR.

The licensee stated that the CCDPs for MCR loss of control abandonment scenarios for Unit No. 2 range from 2.66E-03 to 9.98E-01 and account for fires that impact only a few functions to fires that make successful shutdown unlikely. The licensee explained that abandonment of the Unit No. 1 MCR due to loss of control was not credited in the FPRA because there is no Unit No. 1 ASP and the functionality of the Unit No. 1 backup indicating panel is limited. The licensee explained that MCR abandonment scenarios for Unit No. 2 due to loss of control were modelled like all other fire scenarios in that the targets were determined by the source fire and potential subsequent fire propagation, and detailed HRA was used to model RAs consistent with NUREG-1921 guidance.

The NRC staff concludes that the licensee's responses to the RAIs are acceptable because the licensee demonstrated that its modelling of MCR abandonment scenarios due to loss of control is consistent with the guidance contained in NUREG/CR-6850. In addition, the CCDPs determined for these scenarios account for fires that impact only a few functions to those fires, which make successful shutdown unlikely, and the use of a screening HEP value of 0.1 for actions associated with MCR abandonment from NRC interim guidance is reasonable, given that the criteria from the NRC guidance were met for loss of control actions, the decision to abandon does not have a significant impact on the success of alternate shutdown, and the required timing for operator actions is similar to loss of habitability scenarios.

In PRA RAI 13 (Reference 23), the NRC staff explained that a fire event in one unit can contribute to the fire risk associated with the opposite unit and that the impact of fire on shared systems and common areas can contribute to the risk of both units. The NRC staff requested that the licensee explain how it addressed a fire event at one unit for the other unit and specifically how it treated shared systems and common areas in the FPRA. In its response to PRA RAI 13 (Reference 10), the licensee explained that Unit Nos. 1 and 2 are physically separate units and that the partitioning of the plants into PAUs for the FPRA was performed to maintain this separation with the exception of locations where cable or equipment from both units was located. The licensee explained that it identified common locations as "Unit 3" compartments and that it added ignition sources from these locations to fire scenarios for each unit. The licensee also explained that although a few systems are shared between units under certain circumstances, these alignments are not credited in the FPRA. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the risk contribution of fires that impact both units is modelled and the availability of shared systems is conservatively not credited in its treatment of the risk associated with fires that can impact the other unit.

In PRA RAI 14 (Reference 23), the NRC staff requested that the licensee provide an explanation of how the impact of the state-of-knowledge correlation (SOKC) was taken into account in the risk estimates presented in the LAR. In its response to PRA RAI 14 (Reference 10) and PRA RAI 03 (Reference 19), the licensee explained that based on a sensitivity study, the impact of SOKC was determined to be very small, and therefore, was not included in the risk estimates in its integrated analysis. In PRA RAI 03.b.01 (Reference 30), the NRC staff requested that the licensee demonstrate that the SOKC is small with respect to the RG 1.205 risk acceptance guidelines for self-approval or incorporate the contribution from SOKC into fire risk estimates for self-approval evaluations. In its response to PRA RAI 03.b.01 (Reference 20), the licensee provided an action in LAR Attachment S, Table S-3, Implementation Item BV1-3345, to evaluate the impact of SOKC in the risk estimates against

the self-approval acceptance criteria for post-transition changes. The NRC staff considers this action acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. The NRC staff concludes that the licensee's response to the RAI is acceptable because the SOKC contribution to the transition risk is very small and the contribution will be accounted for in the risk estimates supporting the self-approval of changes.

In PRA RAI 15 (Reference 23), the NRC staff explained that guidance in a draft version of NUREG-1921, "EPRI/NRC-RES Fire Human Reliability Guidelines" (Reference 62), rather than the final version, was used to develop the FPRA HRA and requested clarification of the impact this had on the risk estimates. In its response to PRA RAI 15 (Reference 10), the licensee explained that the HRA used to support the LAR reflects the guidance in the final July 2012 NUREG-1921 report, and therefore, there is no impact to the risk estimates from using the draft version. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that it used NRC acceptable guidance to perform the FPRA HRA.

In PRA RAI 16 (Reference 23), the NRC staff explained that Modification Items BV1-3062 and BV2-0828 in LAR Attachment S, Table S-2, indicated that low leakage RCP seals would be installed but did not identify which type of seals would be installed or discuss the technical basis for crediting the seals in the FPRA. The NRC staff requested that the licensee provide a description of the RCP seals that will be installed and explanation of the technical basis for credit taken in the FPRA. The NRC staff also requested that the licensee describe its use of NRC accepted failure models as they become available, describe how it will ensure the risk estimates from the updated FPRA meet RG 1.205 risk acceptance guidelines, and describe how it will restrict self-approved changes until acceptable models have been incorporated into the FPRA. In its response to PRA RAI 16 (Reference 10) and PRA RAI 03 (Reference 19), the licensee explained that Westinghouse Generation III RCP SHIELD SDS will be installed and that the technical basis for credit in the FPRA is from the related Westinghouse topical reports. The licensee also explained that an action to update the RCP SDS modelling in the FPRA using NRC accepted failure models to support self-approval of FPP changes is included in LAR Attachment S, Table S-3, Implementation Items BV1-3109 and BV2-1623. The NRC staff considers this action to be acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. In its letter dated April 21, 2017 (Reference 18), the licensee submitted a revised LAR Attachment S, Table S-1 that indicated Modification Items BV1-3062 and BV2-0828 were completed. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the technical basis for crediting the RCP seals in the FPRA is based on the best available guidance, and also because the action to use NRC accepted SDS failure models as they become available would be required by the proposed license condition.

In PRA RAI 19 (Reference 23), the NRC staff requested that the licensee provide additional information about the contributors to the large negative change-in-risk values presented in LAR Attachment W for each unit, given that conservative calculation of the compliant plant CDF and LERF can lead to a non-conservative calculation of the ΔCDF and ΔLERF. In its response to PRA RAI 19 (Reference 19), the licensee provided the total risk increase associated with retained VFDRs without crediting risk reduction plant modifications (i.e., Unit No. 1 - CDF of 5.9E-05/year and LERF of 4.3E-07/year; Unit No. 2 - CDF of 6.9E-05/year and LERF of 1.8E-06/year), described the dominant fire scenarios in the highest risk fire compartments, and identified conservative modeling assumptions that were made in the FPRA. The licensee also stated that although the modeling conservatisms increased the total risk, they are "present in

both the transitioning plant model and the compliant model and so they have no effect on the reported change in risk." In PRA RAI 19.01 (Reference 30), the NRC staff explained that the calculated change in risk associated with a VFDR can be impacted by the conservative modeling because conservative modeling in both the compliant and transition plant models can underestimate the change in risk associated with a VFDR. The NRC staff stated that there appeared to be a number of VFDRs that cannot be fully modelled because of conservative modeling assumptions that were made in the fire PRA and requested that the licensee determine whether VFDRs existed for the plant whose risk contribution could be impacted by the conservative modeling. In its response to PRA RAI 19.01 (Reference 20), the licensee explained that there were seven conservative modeling assumptions present in both the transitioning and compliant plant models, and of those seven, only two assumptions affected the modeling of VFDRs. The licensee further explained that in the case of these two conservative modeling assumptions (assumed failure of instrument air and RCP trip), modelling adjustments were made to the compliant model so that the change in risk associated with the affected VFDRs would not be underestimated. The licensee further explained that these adjustments were made by setting the failure mode of components in the post-transition plant model to "success" (i.e., zero failure probability) for those fires that would lead to their failure. The NRC staff concludes that the licensee's responses to the RAIs are acceptable because the licensee demonstrated that the change in risk calculated by its compliant and post-transition plant models is not underestimated.

In PRA RAI 25 (Reference 23), the NRC staff explained that the licensee explained that two approaches were used to evaluate cables fires caused by welding and cutting and that for some PAUs, the fires were assumed to damage the highest CCDP tray, while for other PAUs, the location of hot work induced cable fires was determined according to a grid applied to the PAU. The NRC staff requested that the licensee provide justification for this grid approach, given that it appeared to be a deviation from the guidance in FAQ 13-0005 (Reference 89), on hot work fires. In its response to PRA RAI 25 (Reference 12) and PRA RAI 03 (Reference 19), the licensee explained that it corrected its analysis for PAUs utilizing the grid approach since those PAUs were not addressed, which is consistent with FAQ 13-0005. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its treatment of hot work cable fires is consistent with NRC-approved guidance.

In PRA RAI 26 (Reference 23), the NRC staff explained that the licensee analyzed the Unit No. 1 MCB vertical boards using the methodology of Appendix L of NUREG/CR-6850 with credit for an additional 15 minutes for target separation until damage occurred. Given the absence of partitions in the MCB, the NRC staff requested that the licensee provide justification to support crediting the additional 15-minute allowance for fire suppression. In its response to PRA RAI 26 (Reference 12) and PRA RAI 03 (Reference 19), the licensee explained that the MCB is fully open, and therefore, it removed the additional credit of 15 minutes from the evaluation as part of its integrated analysis. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its treatment of MCB fires is consistent with NRC guidance contained in NUREG/CR-6850.

In PRA RAI 27 (Reference 29), the NRC staff requested that the licensee provide an explanation of how its approach used to credit the VEWFDS in the FPRA compares with the guidance contained in NUREG-2180, "Determining the Effectiveness, Limitations, and Operator Response for Very Early Warning Fire Detection Systems in Nuclear Facilities (Delores-VEWFIRE), Final Report" (Reference 64). In response to PRA RAI 27 (Reference 17) and PRA RAI 03 (Reference 19), the licensee explained that it updated its VEWFDS models to be consistent with the guidance contained in NUREG-2180 for its integrated analysis. The

licensee also indicated that its VEWFDS was installed in-cabinet in the process rack rooms and a communications room. The licensee stated that its VEWFDS was credited for reducing the probability of fires that may propagate from cabinets in which the systems are installed and not for reducing damage within the source cabinets. The licensee further explained that its VEWFDS alarm response procedure initially requires an operator with fire watch qualification to respond to the alarm and that a continuous fire watch is in effect until the alarm is "cleared." The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the method, parameters, and assumptions used to model its VEWFDS are consistent with guidance contained in NUREG-2180.

In PRA RAI 22 (Reference 23), the NRC staff explained that there was no action for the licensee to update the PRA when all modifications and implementation items are complete and no plan of action if updated risk results exceed RG 1.174, Revision 2, guidelines. In its response to PRA RAI 22 (Reference 10), the licensee revised LAR Attachment S, Table S-3, to include Implementation Items BV1-3108 and BV2-1622 to update the PRA. In its response to PRA RAI 22.01 (Reference 30), the licensee revised the actions to more fully represent those actions to be taken to complete transition. Those actions include (1) comparing the updated fire PRA model once risk-relevant modifications and implementation items are complete with the acceptance guidelines of RG 1.174 and (2) if the risk from this updated model exceeds those guidelines, then implementing new plant modifications or PRA refinements such that those guidelines are met. The NRC staff considers these actions acceptable because they will incorporate NFPA 805 in the FPP and would be required by the proposed license condition. The NRC staff considers the licensee's responses to the RAIs acceptable because the actions will ensure that the licensee's PRA meets the acceptance guidelines of RG 1.174 once the PRA is updated for the completed modifications and implementation items in order to transition to NFPA 805.

In its response to PRA RAI 03.b (Reference 19), the licensee stated that "[t]o improve the risk results after updating the incipient detection credit," modeling of fire compartment 1-CR-4 for Unit No. 1 and fire compartments 2-CB-1 and 2-CB-6 for Unit No. 2 are evaluated using updated parameters from NUREG-2169, "Nuclear Power Plant Fire Ignition Frequency and Non-Suppression Probability Estimation Using the Updated Fire Events Database" (Reference 146), and NUREG-2178 (Reference 142). Regarding use of the parameters provided in NUREG-2169 (i.e., updated fire ignition frequencies and non-suppression probabilities] and NUREG-2178 (i.e., refined HRRs and obstructed plume model), the licensee stated "that to be fully valid they must be applied to the entire plant LAR." In its letter dated April 21, 2017 (Reference 18), the licensee revised LAR Attachment S, Table S-3, to include Implementation Item BV2-1750 to incorporate NUREG-2169 and NUREG-2178 to the Unit Nos. 1 and 2 fire compartments. The NRC staff considers this action acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. The NRC staff found that the fire frequencies in NUREG-2169 sometimes increase and sometimes decrease the fire frequency as compared to FAQ 08-0048 (Reference 81) (which was used predominantly in this application), but on average the fire frequencies from NUREG-2169 increase the frequency over those from FAQ 08-0048, including the frequency for electrical cabinets in which incipient detection is installed. Applying the new HRRs and obstructed plume model from NUREG-2178 will generally decrease risk. The NRC staff concludes that the approach of providing the risk estimates in an updated LAR Attachment W based on limited application of NUREG-2169 and NUREG-2178 is acceptable because: (1) the licensee implemented changes to the PRA that improve the PRA and not those that solely decrease risk, (2) there is a decrease in change in risk reported in LAR Attachment W and that decrease is not expected to be overcome by applying the new frequencies throughout

the plant, (3) the licensee included an action in LAR Attachment S, Table S-3, to fully apply the guidance contained in NUREG-2169 and NUREG-2178 to the Unit Nos. 1 and 2 fire PRA during the implementation period, and (4) the licensee included actions to ensure that the risk estimates based on the updated FPRA after all modifications and other implementation items are complete will meet RG 1.174 guidelines.

As a result of its review of the LAR, as supplemented, the NRC staff concludes that the Beaver Valley, Unit Nos. 1 and 2, FPRAs have sufficient technical adequacy and the quantitative results, considered together with the results of the sensitivity study results, can be used to demonstrate that the change in risk due to transition to NFPA 805 meets the acceptance guidelines in RG 1.174. In addition, after completing the actions described in the implementation items in LAR Attachment S, Table S-3, the FPRA will be acceptable to support post-transition self-approval evaluations.

3.4.2.3 Fire Modeling in Support of the Development of the Fire Risk Evaluations

The NRC staff performed detailed reviews of the FM used to support the FREs in order to gain further assurance that the methods and approaches used for the application to transition to NFPA 805 (Reference 3) were technically adequate. NFPA 805 has the following requirements that pertain to FM used in support of the development of the FREs:

NFPA 805, Section 2.4.3.3, "On Acceptability," states that:

> The PSA approach, methods, and data shall be acceptable to the AHJ.

NFPA 805, Section 2.7.3.2, "Verification and Validation," 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.

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

> Acceptable engineering methods and numerical models shall only be used for applications to the extent these methods have been subject to verification and validation. These engineering methods shall only be applied within the scope, limitations, and assumptions prescribed for that method.

NFPA 805, Section 2.7.3.4, "Qualification of Users," states that:

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

NFPA 805, Section 2.7.3.5, "Uncertainty Analysis," states that:

> An uncertainty analysis shall be performed to provide reasonable assurance that the performance criteria have been met.

The following sections discuss the results of the NRC staff's reviews of the acceptability of the FM (first requirement). The results of the NRC staff's review of compliance with the remaining requirements are discussed in SE Sections 3.8.3.2 through 3.8.3.5.

3.4.2.3.1 Overview of Fire Models Used to Support the Fire Risk Evaluations

FM was used to develop the zone of influence (ZOI) around ignition sources in order to determine the thresholds at which a target would exceed the critical temperature or radiant heat flux. This approach provides a basis for the scoping or screening evaluation as part of the FREs. The following algebraic fire models and correlations were used for this purpose:

- Flame Height, Method of Heskestad
- Plume Centerline Temperature, Method of Heskestad
- Radiant Heat Flux, Point Source Radiation Model

These algebraic models are described in NUREG-1805, "Fire Dynamics Tools (FDT^s): Quantitative Fire Hazard Analysis Methods for the US Nuclear Regulatory Commission Fire Protection Inspection Program" (Reference 57). Alpert's ceiling jet temperature correlation is described in FIVE, "EPRI Fire Induced Vulnerability Evaluation Methodology," Revision 1 (Reference 147), and serves as the basis for FDT^s that are used to estimate sprinkler, smoke detector, and heat detector response times as documented in NUREG-1805, Chapters 10, 11, and 12, respectively. V &V of these algebraic models is documented in NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," Supplement 1 (Reference 59).

In addition, the licensee developed screening approaches for the evaluation of ignition sources to determine the potential for the generation of a hot gas layer (HGL) in the compartment or fire area being analyzed. The FREs used these HGL screening approaches to further screen ignition sources, scenarios, and compartments that would not be expected to generate an HGL and to identify the ignition sources that have the potential to generate an HGL for further analysis. The following correlation was used to determine the potential for the development of an HGL:

- Method of McCaffrey, Quintiere and Harkleroad (MQH), for naturally ventilated compartments

This HGL correlation is described in NUREG-1805, and its V&V is documented in NUREG-1824, Supplement 1.

In LAR Attachment J, the licensee identified the use of the following empirical correlations that are not addressed in NUREG-1824, Volumes 3 and 4.

- Plume Radius, Method of Heskestad (Reference 148)
- Smoke Detection Actuation Correlation, Method of Heskestad and Delichatsios (Reference 149)
- Heat Detection Actuation Correlation (Reference 150)

- Sprinkler Activation Correlation (Reference 150)
- Correlation for Heat Release Rates of Cables, Method of Lee (Reference 151)
- Corner and Wall Heat Release Rate (Reference 152)
- Correlation for Flame Spread over Horizontal Cable Trays, FLASH-CAT, described in NUREG/CR-7010, "Cable Heat Release, Ignition, and Spread in Tray Installations During Fire (CHRISTIFIRE), Volume 1: Horizontal Trays" (Reference 60)

The plume radius was used as the horizontal ZOI where it exceeded the ZOI based on heat flux. All algebraic fire models and empirical correlations were implemented in a workbook referred to as the Fire Modeling Workbook (FMWB).

The licensee's ZOI approach was used as a screening tool to distinguish between fire scenarios that required further evaluation and those that did not require further evaluation. Qualified personnel performed a plant walkdown to identify ignition sources and surrounding targets or SSCs in compartments and applied the empirical correlation screening tool to assess whether the SSCs were within the ZOI of the ignition source. Based on the fire hazard present, these generalized ZOIs were used to screen from further consideration those specific ignition sources that did not adversely affect the operation of credited SSCs, or targets, following a fire. The licensee's screening was based on the 98th percentile fire HRR from the NUREG/CR-6850 methodology (Reference 52) and NUREG-2178 (Reference 142).

The Consolidated model of Fire and Smoke Transport (CFAST), Version 6, was used for

- HGL temperature calculations
- Control room abandonment calculations
- Temperature sensitive equipment HGL study

Fire Dynamics Simulator (FDS), Version 5, was used for

- Temperature sensitive equipment ZOI study
- Plume/HGL interaction study

FDS, Version 6, was used for

- Fire door temperature analysis
- Target damage analysis

V&V of CFAST and FDS is documented in NUREG-1824, Volumes 5 and 7, respectively, as well as NUREG 1824, Supplement 1 (Reference 59).

The V&V of all correlations and fire models that were used to support the FPRA is discussed in detail in SE Section 3.8.3.2.

3.4.2.3.2 Discussion of RAIs Pertaining to Fire Modeling

By letter dated March 4, 2015 (Reference 23), the NRC staff sought additional information concerning the FM conducted to support the FPRA. By letters dated April 27, 2015 (Reference 10); May 27, 2015 (Reference 11); and June 26, 2015 (Reference 12), the licensee responded to these RAIs.

- In FM RAI 01.b (Reference 23), the NRC staff requested that the licensee describe the differences between the FM methodologies applied in Unit Nos. 1 and 2, and explain why different approaches were used in the two units.

  In its response to FM RAI 01.b (Reference 12), the licensee explained that the same general FM methodologies were consistently applied in the two units, but that each unit has very different plant layouts and that the compartments in the two units may, therefore, have significantly different geometries and ventilation conditions.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee applied the same FM methodologies in the two units.

- In FM RAI 01.c (Reference 23), the NRC staff requested that the licensee explain what administrative controls are in place to minimize the likelihood of fires involving a cabinet with temporarily open doors, and describe how such cabinets were treated in the FM analysis.

  In its response to FM RAI 01.c (Reference 12), the licensee stated that administrative controls are in place to minimize the likelihood of fires involving cabinets with doors that may remain open during maintenance or measurement activities in the plant, and that efforts are made to ensure that electrical equipment is deenergized prior to performing these activities. The licensee further stated that administrative procedures require that periodic inspections be performed to ensure electrical component doors and hardware are intact and that enclosure covers are not open, missing, or not secure, and that the FM analysis, therefore, assumed that electrical cabinets with normally closed doors are maintained closed.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the administrative controls and procedures in place reduce the likelihood of fires involving electrical cabinets to a negligible level.

- In FM RAI 01.d (Reference 23), the NRC staff requested that the licensee provide technical justification for the approach that was used in the FLASH-CAT model to determine the time to ignition, the HRR per unit area (HRRPUA), and the flame spread rate for cable trays that contain a mixture of thermoplastic and thermoset cables.

  In its response to FM RAI 01.d (Reference 11) as supplemented , the licensee explained how the time to ignition, the HRRPUA, and the flame spread rate for

cable trays that contain a mixture of thermoplastic and thermoset were determined. The licensee stated that its approach is consistent with the recommendations of NUREG/CR-7010, (Reference 60), that allow for the mass-weighted average for HRRPUA and the flame spread rate of the predominant cable type to be used for trays with a mixture of thermoplastic and thermoset cables.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee followed the guidance in NUREG/CR-7010.

- In FM RAI 01.e (Reference 23), the NRC staff requested that the licensee describe how non-cable secondary combustibles were identified and accounted for in the FM analysis, and explain if and how the combustible loading of the array of batteries in fire compartment 1-CR-4 was accounted for in the FM analysis.

  In its response to FM RAI 01.e (Reference 12), the licensee stated that small quantities of non-cable secondary combustibles were identified during the initial plant walkdowns of the fire compartments where detailed FM was performed, and that these combustibles were typically screened as they were judged to not significantly increase the ZOI. The licensee further explained that confirmatory plant walkdowns were performed of areas containing previously screened, non-cable secondary combustibles to determine if these combustibles are bounded by the existing fixed initiator fire scenarios, that any non-cable secondary combustibles that are not bounded were added to the fire growth analysis and target damage assessment, and that the FPRA was updated accordingly. Finally, the licensee also stated that a peak HRR of 200 kW was assigned to the battery arrays in fire compartment 1-CR-4 based on the guidance of the NRC Inspection Manual Chapter 0609, Appendix F, that this HRR was added to the fire growth analysis for scenarios capable of igniting the battery arrays, and that the results from the additional analysis were used in the updated integrated risk analysis provided in the licensee's response to PRA RAI 03.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that it properly accounted for the contribution of non-cable secondary combustibles, including the array of batteries in fire compartment 1-CR-4 in the FM analysis.

- In FM RAI 01.f (Reference 23), the NRC staff requested that the licensee explain how the model assumptions in terms of location and HRR of transient combustibles in a fire area or zone will not be violated during and post-transition. In addition, the NRC staff also requested that the licensee provide technical justification for the assumption that in specific scenarios, the HRR of transient fires is less than 317 kW.

  In its response to FM RAI 01.f (Reference 11), the licensee explained that the HRR selected for transient fire scenarios in the subject fire compartments is not expected to be violated during and post-transition based on the expected room usage and contents, administrative controls and procedures, transient combustible control program, and training emphasis for all site personnel. The

licensee further discussed specific administrative controls to justify the use of HRRs less than 317 kW in selected fire areas.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided technical justification for its use of the transient HRR in areas where it assumed a value less than 317 kW.

- In FM RAI 01.g (Reference 23), the NRC staff requested that the licensee describe how high-energy arcing fault (HEAF) initiated fires are treated in the HGL development timing.

  In its response to FM RAI 01.g (Reference 10), the licensee explained that it assumed a cabinet fire reaching an HRR of 211 kW immediately following the initial HEAF event and continuing for 20 minutes until a decay phase of an additional 20 minutes. The licensee further justified selecting the 211 kW fire on the basis that the HEAF event is expected to be severe enough to substantially consume interior cable bundles, and therefore, limit the amount of combustibles available for burning after the HEAF event.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because a post-HEAF cabinet HHR of 211 kW is reasonable, and the licensee followed the guidance in NUREG/CR-6850, Volume 2, and NUREG/CR-7010, Volume 1, to determine the HRR of subsequent HEAF-initiated fires involving fire propagation in cable trays.

- In FM RAI 01.h (Reference 23), the NRC staff requested that the licensee provide the reasons for using CFAST in lieu of the MQH method to perform the HGL temperature calculations in selected fire compartments.

  In its response to FM RAI 01.h (Reference 11), the licensee explained that it used CFAST in lieu of the MQH method to provide a better representation of the post-fire conditions in fire compartments with complex or unique geometries or ventilation aspects and to provide additional information not readily available from MQH, such as lower layer gas temperatures and HGL heights.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's use of CFAST in lieu of the MQH for the HGL temperature calculations is appropriate.

- In FM RAI 01.i(i) (Reference 23), the NRC staff requested that the licensee provide technical justification for the transient fire growth rate that it assumed in the smoke detector actuation and sprinkler activation calculations.

  In its response to FM RAI 01.i(i) (Reference 11), the licensee explained that when utilizing the t^2 fire growth profile for detection in transient scenarios, it used the guidance contained in NUREG/CR-6850, Supplement 1, Chapter 17, to determine the time to peak HRR of a transient fire. The licensee further stated that the HRR profile that was selected for each transient ignition source was based on administrative controls and the expected contents within the compartment, and that it assumed detection to occur when the minimum required HRR for detection was reached in the t^2 fire growth profile.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee used a transient fire growth time consistent with the guidance in FAQ 08-0052 (Reference 82).

- In FM RAI 01.i(ii) (Reference 23), the NRC staff requested that the licensee describe how it determined the vent dimensions for each compartment where it used the method of MQH to estimate the HGL temperature and confirm that the assumed dimensions are consistent with plant conditions or lead to conservative HGL temperature estimates.

  In its response to FM RAI 01.i(ii) (Reference 11), the licensee explained that small vent dimensions are conservative for HGL estimates when using the method of MQH. The licensee further stated that it conducted plant walkdowns for each fire compartment to confirm that there was a door opening with dimensions of at least 0.9 by 2.1 m, and that one exception was identified (fire compartment 1-CV-3), and that a non-standard-sized door of 0.9 by 1.5 m was used for this compartment. In addition, the licensee stated that once the fire is detected, the fire brigade will be dispatched to the room and is expected to open a door and perform suppression activities, which will then provide the door opening assumed in the FM analysis. The licensee further stated that prior to this action, a single door opening was considered an appropriate representation of the various natural ventilation openings within the room. The licensee also stated that a 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.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee confirmed that the assumed vent sizes are representative of plant conditions or lead to conservative results.

- In FM RAI 01.i(iii) (Reference 23), the NRC staff requested that the licensee 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.

  In its response to FM RAI 01.i(iii) (Reference 11), the licensee explained that when it implemented the MQH method for HGL calculations, it disregarded all vents in the floor or ceiling or in a wall at or near the ceiling in compartments with a door opening and represented by a single door in other compartments. The licensee further explained that it assumed the single door to be open for the entire duration of the fire. This is considered an appropriate representation of various natural ventilation openings in the room in the early stages of the fire scenarios and reflects the actual ventilation area when the fire brigade opens a door to perform suppression activities in the latter stages of the fire scenarios.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided justification for the natural ventilation conditions that it assumed in the HGL calculations for compartments with vents in the floor or ceiling, or in a wall at or near the ceiling.

- In FM RAI 01.j(i) (Reference 23), the NRC staff requested that the licensee provide technical justification for not excluding the volumes of obstructions from the effective control room volume used in the CFAST MCR abandonment calculations.

  In its response to FM RAI 01.j(i) (Reference 12), the licensee stated that it estimated the volumes of the obstructions in the MCR and the interstitial space above the egg-crate ceiling based on drawings and walkdown information, and that it subtracted these volumes from the gross MCR volume in the revised CFAST abandonment analysis. The licensee further stated that results of the revised MCR abandonment calculations were used in the integrated risk analysis provided with the response to PRA RAI 03.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee properly accounted for the effective compartment volume reductions in the revised CFAST MCR abandonment calculations.

- In FM RAI 01.j(ii) (Reference 23), the NRC staff requested that the licensee confirm that a fire involving certain transient combustibles (copier, boxes with paper, and a plastic trash can in the corner behind the Unit No. 2 vertical MCB) is bounded by the transient fires that it considered in the MCR abandonment calculations. In addition, the NRC staff requested that the licensee provide justification for not considering fires that originate in the kitchen, computer room, or office in the MCR abandonment calculations.

  In its response to FM RAI 01.j(ii) (Reference 11), the licensee explained that the copier, boxes with paper, and plastic trash can have been removed from behind the Unit No. 2 vertical MCB and placed against the wall near the alternate north MCR entrance, and that the HRR of these combustibles is bounded by that of the transient fires considered in the MCR abandonment calculations. The licensee further stated that the MCR abandonment calculations show that a 98^{th} percentile transient fire (317 kW) is not expected to lead to control room abandonment. The licensee provided a detailed explanation why it did not consider fires in the kitchen, computer room, and office in the MCR abandonment calculations.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided adequate justification for not explicitly considering fires involving certain transient combustibles, and not including fires in the kitchen, computer room, or office in the MCR abandonment calculations.

- In FM RAI 01.j(iii) (Reference 23), the NRC staff requested that the licensee explain why it did not consider transient fires against a wall or in a corner in the MCR abandonment calculations.

  In its response to FM RAI 01.j(iii) (Reference 12), the licensee explained that while wall and corner effects influence fire plume and ceiling jet development, CFAST sensitivity runs have shown that the position of the fire in relation to walls and corners has negligible impact on the HGL properties used to define MCR abandonment, and therefore, it did not consider wall and corner fires in the MCR abandonment analysis.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the sensitivity analyses showed that the position of the fire in relation to walls and corners has negligible impact on the HGL properties used to define MCR abandonment.

- In FM RAI 01.j(iv) (Reference 23), the NRC staff requested that the licensee describe the natural leakage vents it assumed in the MCR abandonment analysis.

  In its response to FM RAI 01.j(iv) (Reference 12), the licensee explained that it performed the MCR abandonment calculations assuming two open doors for cases with inoperative mechanical ventilation or with HVAC in purge mode, and that it did not consider any other natural leakage vents. The licensee further stated that it reevaluated the MCR abandonment analysis with the MCR doors initially closed and subsequently opened at a time based on the arrival of the fire brigade, and that it assumed a ½-inch high gap below the width of the doors during the period the doors are closed. The licensee further stated that it used the results of the revised MCR abandonment calculations in the integrated risk analysis provided with its response to PRA RAI 03.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's assumptions concerning natural leakage vents are consistent with NUREG/CR-6850, Volume 2, guidance.

- In FM RAI 01.j(v) (Reference 23), the NRC staff requested that the licensee explain which doors it assumed to be open in the event of loss of mechanical ventilation in both MCR units, and provide the basis for the time at which the doors are assumed to open.

  In its response to FM RAI 01.j(v) (Reference 12), the licensee explained that the MCR has two entrances (north and south), and that it assumed that the double leaf doors of the south entrance to be open at the start of the fire and remain open throughout the fire duration. The licensee further stated that it updated the MCR abandonment analysis and that in the updated analysis, the doors are assumed to open when the fire brigade is estimated to arrive, and that the estimated fire brigade arrival time is based on review of fire drill records. The licensee further stated that it used results of the revised MCR abandonment calculations in the integrated risk analysis provided with its response to PRA RAI 03.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee updated the MCR abandonment calculations to include scenarios in which the doors are initially closed, and then open when the fire brigade arrives.

- In FM RAI 01.j(vii) (Reference 23), the NRC staff requested that the licensee provide technical justification for not considering cabinet fires that spread to adjacent cabinets in the MCR abandonment analysis.

  In its response to FM RAI 01.j(vii) (Reference 12), the licensee stated that it updated the MCR abandonment analysis to include fire spread to adjacent

cabinets, and that it followed the guidance in NUREG/CR-6850, Appendix S, in the evaluation of propagating cabinet fires. The licensee further stated that cabinets in the MCR are separated by a single metal wall with cables in direct contact with the separating wall, and that it assumed a time for fire propagation to adjacent cabinets of 10 minutes. The licensee further stated that it used the results of the revised MCR abandonment calculations in the integrated risk analysis provided in its response to PRA RAI 03.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee updated the MCR abandonment calculations to include cabinet fires that propagate to adjacent cabinets in 10 minutes, consistent with the guidance in NUREG/CR-6850, Volume 2, for the electrical cabinets in the MCR.

- In FM RAI 01.j(viii) (Reference 23), the NRC staff requested that the licensee describe in detail how the time to ignition of the cable tray was calculated in the Unit No. 1 MCR abandonment scenario that involves a cabinet fire that spreads to a vertical cable tray.

  In its response to FM RAI 01.j(viii) (Reference 10), the licensee stated that a vertical section of cable tray rises from the top of a cabinet that is labeled as retired in place, and explained that the closest ignition source to this tray identified during the initial walkdown was a multi-bundle closed cabinet containing unqualified cable located at a horizontal distance of 7 inches from the tray. However, the licensee further stated that during a more recent walkdown, it was determined that only part of the labeled cabinet is retired, and that the scenario involving the cable tray was, therefore, reevaluated. The licensee stated that the time to reach peak HRR used in its evaluation is based on the guidance contained in NUREG/CR-6850, Appendix G. The licensee also stated that it will include any effect on the risk of the revised cable tray scenario in the aggregate analysis included in its response to PRA RAI 03.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee reevaluated the cable tray scenario so the evaluation matched actual plant conditions and used the NRC-endorsed guidance contained in NUREG/CR-6850 in its evaluation.

- In FM RAI 01.j(ix) (Reference 23), the NRC staff requested that the licensee provide technical justification for the assumption in the MCR abandonment analysis that transient fires grow to peak HRR in 8 minutes.

  In its response to FM RAI 01.j(ix) (Reference 12), the licensee explained that it has general administrative procedures in place to prevent accumulation of loose trash and listed a variety of reasons to support the determination that the accumulation of loose trash in the MCR is highly unlikely, despite the lack of a specific transient control procedure for the MCR. The licensee further stated that a contained trash fire with a time to peak HRR in 8 minutes is, therefore, considered representative of transient fires in the MCR.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the accumulation of loose trash in MCR is highly unlikely and the fire

growth time of 8 minutes for trash in containers is consistent with the guidance contained in FAQ 08-0052 (Reference 82).

- In FM RAI 01.j(x) (Reference 23), the NRC staff requested that the licensee describe the cabinet, cable tray, transient fire elevations, and areas that it used in the CFAST MCR abandonment calculations, and provide technical justification for the assumed values.

  In its response to FM RAI 01.j(x) (Reference 10), the licensee stated that a fire elevation for cabinets and transients of 1 meter was used; provided justification for not following the guidance in NUREG/CR-6850, Volume 2; for the elevation of cabinet fires; and explained that it further investigated the sensitivity of the abandonment risk to transient fire elevation in its response to FM RAI 01.j.(ix). The licensee also stated that a fire area of 1 x 1 m was used for all types of fires.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the assumed cabinet fire height is conservative compared to the height recommended in NUREG/CR-6850, Volume 2; the assumed transient fire height is justified through a sensitivity analysis; and the fire area has little or no effect on the CFAST results.

- In FM RAI 01.j(xi) (Reference 23), the NRC staff requested that the licensee provide the results of the calculations that support the licensee's assertion that MCR abandonment will not be required if at least one of the HVAC systems is changed to smoke purge mode within 705 seconds.

  In its response to FM RAI 01.j(xi) (Reference 12), the licensee stated that its assertion is based on a CFAST analysis for the highest credible HRR of 1,462 kW (representing a multi-bundle, qualified cable cabinet fire) with two open MCR doors throughout the fire duration and no forced ventilation at the start of the fire. The licensee further stated that the CFAST analysis showed that the MCR remains habitable unless the purge mode is not activated at 705 seconds (or sooner). The licensee further stated that results of its revised MCR abandonment calculations will be incorporated in the integrated risk analysis provided in its response to PRA RAI 03.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided the requested calculations, and the calculations support the licensee's assertion that MCR abandonment will not be required if at least one of the HVAC systems is changed to smoke purge mode within 705 seconds.

- In FM RAI 01.j(xii) (Reference 23), the NRC staff requested that the licensee explain why there are slight differences in the calculated abandonment times and resulting probabilities for abandonment between the Unit Nos. 1 and 2 MCRs.

  In its response to FM RAI 01.j(xii) (Reference 10), the licensee explained that the discrepancy is due to the difference in ambient temperature between Unit No. 1 (20 °C) and Unit No. 2 (25 °C), and stated that it performed a sensitivity study to determine the impact of this temperature difference on the probability for control room abandonment. The licensee further stated that the ambient temperature

setting was fixed at 25 °C for both units in the revised MCR abandonment calculations that it performed in support of its response to PRA RAI 03.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the discrepancy has a very small effect on the probability for abandonment, and the licensee revised its MCR abandonment calculations utilizing the same temperature for each unit.

- In FM RAI 01.k (Reference 23), the NRC staff requested that the licensee describe how it determined the size of the opening between the exposing and exposed compartments assumed in the MQH and CFAST MCA calculations, and explain to what extent these vent sizes are representative of conditions in the plant.

  In its response to FM RAI 01.k (Reference 11), the licensee stated that it used the MQH HGL calculation to determine the maximum HGL temperature in the exposing compartment, conservatively it did not consider any intercompartment openings between the exposing and exposed compartments at this stage of the MCA, and it performed detailed MCA CFAST FM only for cases where a damaging HGL could form in the exposing compartment. The licensee further stated that it determined the openings in the CFAST HGL calculation between the exposing and exposed compartments following a review of opening details gathered from drawings, walkdown information, and a propagation pathway credibility assessment; and showed that in all cases, the vent sizes modeled bound the existing plant conditions for a given fire compartment.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided justification for the vent sizes assumed in the MCA calculations and indicated that they bound existing plant conditions.

- In FM RAI 02.a (Reference 23), the NRC staff requested that the licensee describe how it characterized the installed cabling in the power block, and specifically, with regard to the critical damage threshold temperatures and heat fluxes for thermoset and thermoplastic cables as described in NUREG/CR-6850 (Reference 51).

  In its response to FM RAI 02.a (Reference 11), the licensee explained that an investigation was performed to classify each of the various cable types as either thermoset or thermoplastic based upon cable jacket or insulation material. The licensee combined this information with that in Appendix H of NUREG/CR-6850, Volume 2, to determine the thermal damage criteria for thermoplastic targets (including raceways containing mixed or unknown cable types).

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee characterized the installed cabling in the power block in accordance with the guidance in NUREG/CR-6850, Volume 2, and the damage thresholds used in the FM analysis are consistent with the type of cabling installed in each area of the plant.

- In FM RAI 02.b (Reference 23), the NRC staff requested that the licensee explain how it credited solid cable tray covers, fire wraps, and fire barrier systems in

terms of delaying or preventing damage, ignition and subsequent fire propagation, and how perforated and corrugated cable tray covers were treated in this respect.

In its response to FM RAI 02.b (Reference 12), the licensee explained that cable tray covers do not impact the cable damage thresholds, but are credited with delaying damage and ignition to thermoplastic and thermoset cables in accordance with the guidance contained in NUREG/CR-0381, "A Preliminary Report on Fire Protection Research Program Fire Barriers and Fire Retardant Coatings Tests" (Reference 153), and NUREG/CR-6850, Volume 2, Appendix Q.2.2, respectively, and that it did not postulate fire growth and propagation for fully enclosed cable trays. The licensee further stated that it visually inspected covered cable trays for holes or gaps and to identify trays with raised or corrugated covers, and that it revised its analysis to ensure that covers with a significant amount of holes or gaps and covers that are raised or corrugated were not credited. The licensee also stated that it credited fire wraps and barrier systems for the duration of the manufacturer's rating, but that it did not credit wraps or cable tray covers within the ZOI of a high hazard event to prevent damage in those scenarios. The licensee stated that the revised analysis will be used in the integrated risk analysis provided with its response to PRA RAI 03.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's treatment of cable tray covers, openings in cable tray covers, fire wraps, and fire barrier systems in terms of their effect on cable damage, ignition, and fire propagation is consistent with NRC guidance.

- In FM RAI 02.c (Reference 23), the NRC staff requested that the licensee explain how exposed temperature sensitive electronic equipment was treated and provide technical justification for the damage criteria that it used.

  In its response to FM RAI 02.c (Reference 12), the licensee stated that it used a critical temperature threshold of 65 °C and a critical heat flux threshold of 3 kW/m^2 for exposed sensitive electronics and that it followed the guidance in FAQ 13-0004 (Reference 88) for sensitive electronics in an enclosure. The licensee further stated it performed walkdowns of the compartment with enclosed sensitive electronics to verify that the limitations in the FAQ were not exceeded and that the FM analysis was updated to include cabinets with exposed temperature sensitive components that were identified during the walkdowns.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's treatment of temperature sensitive electronic equipment is consistent with the guidance contained in NUREG/CR-6850, Volume 2, and FAQ 13-0004.

3.4.2.3.3 Conclusion for Section 3.4.2.3

Based on its review of the licensee's description in the LAR, as supplemented, of the process for performing FM in support of the FREs and clarifications provided in response to the RAIs, the NRC staff concludes that the licensee's approach for meeting the requirements of NFPA 805, Section 2.4.3.3, is acceptable.

3.4.2.4 Conclusions Regarding Fire PRA Quality

Based on NUREG-0800, Section 19.2 (Reference 50), and Section III.2.2.4.1, summarizing the NRC staff's review of PRA quality required for an application, the NRC staff concludes that the licensee's PRA satisfies the guidance in RG 1.174 (Reference 44), Section 2.3, and RG 1.205 (Reference 4), Section 4.3, regarding the technical adequacy of the PRA used to support risk assessment for transition to NFPA 805.

The FPRA methods used to support the LAR were evaluated by the NRC staff in SE Section 3.4.2.2, and the NRC staff did not accept some of the methods proposed by the licensee. FPRA methods that are not accepted by the NRC are not considered alternatives to NRC-accepted codes and standards. In all cases, the licensee removed the method from the PRA or demonstrated that the method did not impact its ability to meet the risk acceptance guidelines of RG 1.174.

The NRC staff concludes that the PRA approach, methods, and data are acceptable, and therefore, NFPA 805, Section 2.4.3.3, of NFPA 805, is satisfied for the request to transition to NFPA 805. The NRC staff based this conclusion on the findings that: (1) the PRA model meets the criteria in that it adequately represents the current, as built, as operated configuration, and is, therefore, capable of being adapted to model both the post-transition and compliant plant as needed; (2) the PRA models conform sufficiently to the applicable industry PRA standards for internal events and fires at an appropriate CC, considering the acceptable resolution of the peer review and NRC staff's review findings; and (3) the FM used to support the development of the FPRA has been confirmed as appropriate and acceptable.

The FPRA used to support RI self-approval of changes to the FPP must use an acceptable PRA approach and acceptable methods and data. The NRC staff concludes that the changes already made to the updated baseline FPRA model to incorporate acceptable methods, as described in the licensee's response to PRA RAI 03 (Reference 19), and discussed above, subject to completion of all implementation items described in LAR Attachment S, Table S-3, demonstrate that NFPA 805 criteria are satisfied and the PRA is acceptable for use to support self-approval changes to the FPP.

Based on the licensee's administrative controls to maintain the PRA models current and assure continued quality using only qualified staff and contractors (as described in SE Section 3.8.3), the NRC staff concludes that the PRA maintenance process can assure that the quality of the PRA is sufficient to support self-approval of future RI changes to the FPP under the NFPA 805 license condition following completion of all implementation items described in LAR Attachment S, Table S-3.

3.4.3 Fire Risk Evaluations

For those fire areas for which the licensee used an RI approach to meet the NSPC, the licensee used FREs in accordance with NFPA 805, Section 4.2.4.2, and RG 1.205, Section C.2.2.4, to justify acceptable alternatives to compliance with the deterministic criteria of NFPA 805. The NRC staff reviewed LAR Section 4.5.2, "Performance Based Approaches"; LAR Attachment C, "NEI 04-02 Table B-3 – Fire Area Transition"; and LAR Attachment W, "Fire PRA Insights."

Plant configurations that did not meet the deterministic requirements of NFPA 805, Section 4.2.3.1, are considered variances from deterministic requirements (VFDRs). VFDRs

that will be brought into deterministic compliance through plant modifications do not need a risk evaluation. The licensee identified the VFDRs in LAR Attachment C, Table B-3, "Fire Area Transition," and that it does not intend to bring them into deterministic compliance under NFPA 805. For these VFDRs, the licensee performed evaluations using the RI approach, in accordance with NFPA 805, Section 4.2.4.2, to address FPP non-compliances and demonstrate that retaining the VFDRs is acceptable.

The licensee characterized the VFDRs as separation issues or degraded fire protection systems. The separation VFDRs can generally be categorized into the following three types of plant configurations: (1) inadequate separation resulting in fire-induced damage of process equipment or associated cables required for the identified success path, (2) inadequate separation resulting in fire-induced spurious operation of equipment that may defeat the identified success path, (3) inadequate separation resulting in fire-induced failure of process monitoring instrumentation or associated cables required for the identified success path, and (4) combinations of the above configurations.

In its response to PRA RAI 17.d (Reference 10), the license identified and discussed the VFDRs not modelled in the FPRA and the impact of this exclusion. The licensee explained that the VFDRs identified were primarily separation issues resulting in fire-induced cable damage; however, VFDRs were also identified for additional failures that were not strictly separation issues. For example, VFDRs arose from SSD values actuated by instrument air because of the potential for fire-induced failure of copper pipes and soldered joints. The licensee provided a qualitative assessment of failures that are outside the precision of the FPRA (e.g., inadvertent boron dilution and loss of pressurizer heaters) or cites deterministic calculations (e.g., room heat-up calculations) to show that the cited failures have negligible impact on fire risk and can be excluded from the FPRA. The NRC staff concludes that the licensee's inclusion and exclusion of modeling different types of VFDRs in the FPRA is acceptable because the licensee demonstrated that inadequate separation resulting from fire-induced damage is modelled, except in cases where inclusion would have negligible impact on fire risk.

In its response to PRA RAIs 17.a and 17.b (Reference 10), the licensee summarized its process for determining the change in risk associated with VFDRs. The licensee explained that it first created a post-transition FPRA model referred to as the R1 model that included all retained VFDRs and planned modifications. The licensee further explained that from this model, a model referred to as the R3 model was created by removing the risk reduction associated with RCP seal upgrades and installation of incipient detection, and that from the R3 model, the compliant plant model referred to as the R4 model, was created by making adjustments in the model to remove all the VFDRs. The licensee calculated the change in risk (i.e., ΔCDF and ΔLERF) by subtracting the risk associated with the compliant plant model from the risk associated with the post-transition plant model for each fire area. In its response to PRA RAI 20 (Reference 11), the licensee explained that although there are other non-VFDR risk reduction modifications identified in LAR Attachment S, Table S-2, only the RCP shutdown seal and incipient detection modifications are credited to offset the risk increase associated with retained VFDRs. The licensee further explained that the other non-VFDR risk reduction modifications are credited in both the compliant and post-transition plant models and that VFDRs were removed from the compliant plant model by: (1) setting specific components associated with a VFDRs to "success," (2) setting OMAs associated with a VFDR to "success," or (3) setting the impact to an

operator action from loss of instrumentation to "no impact," and setting a split fraction used in association with components and trains that could be failed by fire damage to "success."

In response to PRA RAI 17.b (Reference 10), the license explained that identification of VFDRs and determination of change in risk was performed identically for non-abandonment and abandonment areas. The licensee further explained that MCR abandonment scenarios due to loss of habitability were screened from the risk estimates based on their insignificant risk contribution and that MCR abandonment due to loss of control was not credited for Unit No. 1 because of the limited functionality of the unit backup indicating panel.

The NRC staff concludes that the licensee's approach for calculating the change in risk associated with VFDRs is acceptable because it is consistent with RG 1.205, Section 2.2.4.1, and FAQ 08-0054 (Reference 83). The NRC staff further concludes that the results of the licensee's calculations for each fire area, which are summarized in LAR Attachment W, Tables W-2a and W-2b, as supplemented, demonstrate that the difference between the risk associated with implementation of the deterministic requirements of NFPA 805 and that of the VFDRs meets the risk acceptance criteria described in NFPA 805, Section 2.4.4.1.

3.4.4 Additional Risk Presented by Recovery Actions

The NRC staff reviewed LAR Attachment C, "NEI 04-02 Table B-3 – Fire Area Transition"; LAR Attachment G, "Recovery Actions Transition"; and LAR Attachment W, "Fire PRA Insights," during its evaluation of the additional risk presented by the NFPA 805 RAs. SE Section 3.2.5 describes the identification and evaluation of RAs.

The licensee used the guidance in RG 1.205, Revision 1, and FAQ 07-0030 (Reference 75), for addressing RAs. Any actions required to transfer control to or operate equipment from the PCS were not considered RAs per the RG 1.205 guidance and in accordance with NFPA 805. Conversely, any OMAs required to be performed outside the control room and not at the PCS were considered RAs.

The licensee identified a large number of RAs in its LAR Attachment G, Tables G-1 and G-2, provided in its response to PRA RAI 03 (Reference 19). In PRA RAI 18 (Reference 23), NRC staff requested that the licensee provide clarification regarding which RAs were identified for only DID. In its response to PRA RAI 18 (Reference 11), the licensee identified which RAs were identified for DID and which RAs were credited for risk reduction. The NRC staff found that the licensee credited several RAs both risk reduction and DID for different scenarios in the same fire compartment.

In PRA RAI 18 (Reference 23), NRC staff requested that the licensee provide the additional risk of RAs as part of the risk estimates presented in LAR Attachment W and also to explain how the additional risk of RAs compare to the risk acceptance guidelines in RG 1.174. In its response to PRA RAI 03 (Reference 19), the licensee provided a revised LAR Attachment W, Tables W-2a and W-2b, showing the total risk of RAs and the additional risk of RAs for each fire compartment. The licensee further explained that the additional risk of RAs was calculated by summing the individual risk increases associated with the VFDRs for which the FPRA credits an RA.

In its revised LAR Attachment W, Tables W-2a and W-2b (Reference 19), the licensee showed the total additional risk of RAs for Unit No. 1 is a CDF of 1.91E-05/year and a LERF of 3.79E-07/year. For Unit No. 2, the total additional risk of RAs is a CDF of 3.26E-05/year and a

LERF of 2.63E-07/year. The NRC staff concludes that the CDF for both units is above the risk acceptance guidelines of 1E-05/year, and LERF is below the risk acceptance guidelines of 1E-06/year contained in RG 1.174, respectively. RG 1.205, Regulatory Position 2.2.4.2, states, "If the additional risk associated with the previously approved RAs is greater than the acceptance guidelines in RG 1.174, then the net change in total plant risk incurred by any proposed alternatives to the deterministic criteria in NFPA 805, Chapter 4 (other than the previously approved RAs), should be risk neutral or represent a risk decrease."

The licensee reviewed all of the RAs for adverse impact and resolved each action as stated in LAR Attachment G. The NRC staff found that none of the RAs listed in LAR Attachment G, Tables G-1 and G-2, have an adverse impact on the FPRA. The licensee evaluated all RAs against the feasibility criteria provided in NEI 04-02, FAQ 07-0030, and RG 1.205. In addition, the licensee included an action in LAR Attachment S, Table S-3, Implementation Item BV1-3027, to demonstrate and document the feasibility of credited NFPA 805 RAs and update training and brigade drills after the fire response procedures are updated. The NRC staff concludes that this action is acceptable because it will incorporate the provisions of NFPA 805 into the FPP and would be required by the proposed license condition.

The NRC staff concludes that the licensee's approach for calculating the additional risk of RAs is acceptable because it is consistent with RG 1.205, Section 2.2.4.1, and FAQ 07-0030. Furthermore, although the additional risk of RAs exceeds the acceptance guidelines in RG 1.174, there is a net decrease in risk resulting from non-VFDR risk reduction modifications. Therefore, the NCR staff concludes that the additional risk associated with RAs meets the requirement of NFPA 805, Sections 2.4.4.1 and 4.2.4, and RG 1.205, Section 2.2.4.2.

3.4.5 Risk-Informed or Performance-Based Alternatives to Compliance with NFPA 805

The licensee did not use any RI or PB alternatives to comply with NFPA 805.

3.4.6 Cumulative Risk and Combined Changes

In its letter dated April 21, 2017 (Reference 18), the licensee provided a revised LAR Attachment S, Table S-2, that identified all its committed modifications. In its response to PRA RAI 20 (Reference 11), the licensee identified the modifications to reduce plant risk rather than to bring the plant into compliance with the deterministic requirements of NFPA 805. The NRC staff found that all other plant modifications identified in LAR Attachment S, Table S-2, are being implemented to bring the plant into compliance with the deterministic requirements of either Chapter 3 or Chapter 4 of NFPA 805. In its response to PRA RAI 17 (Reference 10) and PRA RAI 20 (Reference 11), the licensee explained that its FREs credit risk reduction from certain non-VFDR risk reduction plant modifications in the post-transition plant but not in the compliant plant, and therefore, its application to an RI/PB FPP is a combined change as discussed in Section 1.1 of RG 1.174.

The total plant CDF and LERF are generally estimated by adding the risk assessment results for internal flooding, internal fire, seismic, high winds, and other external hazard events. However, the licensee's transition to NFPA 805 results in a risk decrease; therefore, the licensee did not report the total risk from internal and external events. Instead, the licensee states that its estimation of total risk for each unit is below 1E-04/year for CDF and below 1E-05/year for LERF.

The licensee provided ΔCDF and ΔLERF estimates for each fire area that is not deterministically compliant, in accordance with NFPA 805, Section 4.2.3. The NRC staff found that the risk estimates for these fire areas result from the planned modifications and administrative controls that will be implemented as part of the transition to NFPA 805, as well as RAs, to reduce retained VFDR risk. In the licensee's response to PRA RAI 03 (Reference 19), the licensee provided its final change-in-risk values based on a number of revisions to its PRA methods resulting from NRC staff RAIs. The NRC staff found that these results indicate that the total change in risk for CDF and LERF is a risk decrease, and therefore, less than the risk acceptance guideline in RG 1.174. For Unit No. 1, the total change in risk was reported to be a CDF of -3.85E-05/year and a LERF of -2.14E-07/year. For Unit No. 2, the total change in risk was reported to be a CDF of -3.64E-06/year and a LERF of -8.99E-07. The NRC staff found that the change in risk presented for each individual fire area for both units is negative or less than the risk acceptance guidelines in RG 1.174 of 1E-05/year for CDF and 1E-06/year for LERF.

Section 3.2.5 of RG 1.205 states that risk decreases may be combined with risk increases for the purposes of evaluating combined changes in accordance with regulatory positions presented in Sections 1.1 and 1.2 of RG 1.174, Revision 2. In its response to PRA RAI 03 (Reference 19), the licensee provided the risk decrease associated with credited non-VFDR risk reduction modifications (i.e., "risk offset") and the final net change-in-risk values for each fire area. The NRC staff found that for each fire area, the net change in risk is negative or less than the risk acceptance guidelines in RG 1.174. In PRA RAI 19 (Reference 23), and PRA RAI 19.01 (Reference 30), the NRC staff explained that conservatisms in the compliant plant model could have caused overestimation of the risk offset values and underestimation of the change in risk. The NRC staff requested that the licensee identify conservative modeling or modelling assumptions resulting in underestimation of the change in risk and to show that in such cases the underestimation could still be offset by the decrease associated with non-VFDR modifications. In its responses to PRA RAI 19 (Reference 19), and PRA RAI 19.01 (Reference 20), the licensee provided its explanation of how it made modelling adjustments so that the change in risk was not underestimated. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee made appropriate modeling adjustments so that the change in risk was not underestimated.

Based on the information above, the NRC staff concludes that the risk associated with the proposed alternatives to compliance with the deterministic criteria of NFPA 805 is acceptable because it meets the requirements of NFPA 805, Section 2.4.4.1. Additionally, the NRC staff concludes that the licensee has satisfied RG 1.174, Section 2.4, and NUREG-0800, Section 19.2, regarding acceptable risk.

3.4.7 Uncertainty and Sensitivity Analyses

The licensee evaluated key sources of uncertainty and sensitivity in response to several NRC staff RAIs.

The licensee used updated fire bin frequencies as provided for in NUREG/CR-6850, Supplement 1 (i.e., FAQ 08-0048 (Reference 81)). The guidance in FAQ 08-0048 states to perform a sensitivity study using the mean of the fire frequency bins contained in Section 6 of NUREG/CR-6850 for those bins with an alpha value less than or equal to one. In its response to PRA RAI 03 (Reference 19), the licensee provided the results of its sensitivity study using the integrated analysis FPRA model performed according to the guidance in FAQ 08-0048, excluding fire compartments 1-CR-4, 2-CB-1 and 2-CB-6, which were evaluated using the

updated fire ignition frequencies in NUREG-2169. The licensee indicated that the change in risk remains within the threshold of acceptability per RG 1.174 for both units, and therefore, no additional DID actions need be considered. The NRC staff found that this is consistent with FAQ 08-0048, and therefore, acceptable.

In its response to PRA RAI 03 (Reference 19), the licensee stated that Westinghouse recommended that its RCP SDS models include an additional O-ring failure probability of approximately 8.0E-04. The licensee performed a sensitivity study of the impact of adding this failure mode and determined that CDF and LERF values would be increased by less than 1 percent for both units. The NRC staff concludes that the licensee's current treatment of the RCP SDS seals is acceptable because the impact of the O-ring failure on the risk estimates is very small, and because the licensee included an action in LAR Attachment S, Table S-3, Implementation Items BV1-3109 and BV2-1623, to update its treatment of the RCP SDS seals when an NRC-approved model becomes available, which will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

In PRA RAI 14 (Reference 23), the NRC staff requested that the licensee provide an explanation for how SOKC of fire parameters was taken into account in the risk estimates presented in the LAR. In its response to PRA RAI 14 (Reference 10) and PRA RAI 03 (Reference 19), the licensee explained that from a sensitivity study, it determined the impact of SOKC to be very small, and therefore, was not included in the risk estimates. In its response to PRA RAI 03.b.01 (Reference 20), the licensee provided the risk increase associated with the impact of SOKC and confirmed that the risk was very small compared to the total and delta CDF and LERF values for transition to NFPA 805. In LAR Attachment S, Table S-3, Implementation Item BV1-3345, the licensee provided an action to evaluate the impact of the SOKC contribution on self-approval changes post-transition, and the NRC staff concludes that this action is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and it would be required by the proposed license condition.

No other key sources of uncertainty requiring a sensitivity analysis were identified by the licensee or NRC staff.

3.4.8 Conclusion for Section 3.4

Based on the information provided by the licensee in the LAR, as supplemented, regarding the fire risk assessment methods, tools, and assumptions used to support the transition to NFPA 805 at Beaver Valley, the NRC staff concludes the following:

- The licensee's PRA used to perform the risk assessments in accordance with NFPA 805, Section 2.4.4 (PCEs), and Section 4.2.4.2 (FREs), is of sufficient quality to support the application to transition the Beaver Valley FPP to NFPA 805. Therefore, the PRA approach, methods, tools, and data are acceptable and are in accordance with NFPA 805, Section 2.4.3.3.

- The licensee completed changes to the PRA model, which replaced approaches, data, and methods identified during the LAR review with ones that are acceptable to the NRC staff. Therefore, the PRA models may be used to support post-transition self-approval of FPP changes because, subject to the completion of all implementation items identified in LAR Attachment S, Table S-3, the identified acceptable methods that will be used until they are replaced by other acceptable methods.

- LAR Attachment S, Table S-3, Implementation Items BV1-3108 and BV2-1622 (for Unit Nos. 1 and 2, respectively), state that the licensee will reevaluate the risk and change-in-risk results after completing modifications and implementation items associated with the transition to NFPA 805 to ensure that the as-built change in risk does not exceed the risk acceptance guidelines in RG 1.174 prior to its use in support of self-approval of changes to the FPP.

- The licensee's PRA maintenance process is adequate to support self-approval of future RI changes to the FPP following completion of the PRA-related implementation items as described in LAR Attachment S, Table S-3.

- The transition process included a detailed review of fire protection DID and safety margins as required by NFPA 805. The licensee's process followed the NRC-endorsed guidance in NEI 04-02, Revision 2, and is consistent with the NRC staff guidance in RG 1.205, Revision 1, which provides an acceptable approach for meeting the requirements of 10 CFR 50.48(c).

- The licensee did not utilize any RI/PB alternatives to comply with NFPA 805, which fall under the requirements of 10 CFR 50.48(c)(4).

- The licensee's application to transition to NFPA 805 is a combined change (as defined by RG 1.205, Revision 1), which includes risk increases from retained VFDRs and risk decreases resulting from non-VFDR related modifications. Based on the combination of these risk values, the change in risk associated with the proposed alternatives to compliance with the deterministic criteria of NFPA 805 is acceptable. The licensee satisfied the guidance contained in RG 1.205, Revision 1; RG 1.174 Section 2.4; and NUREG-0800, Section 19.2, regarding acceptable risk. By meeting the guidance contained in these approved documents, the changes in risk are found to be acceptable to NRC staff.

- The total additional risk of RAs for Unit No. 1 is a CDF of 1.91E-05/year and a LERF of 3.79E-07/year. For Unit No. 2, the total additional risk of RAs is a CDF of 3.26E-05/year and a LERF of 2.63E-07/year. Accordingly, the CDF for both units is above the risk acceptance guidelines of 1E-05/year and the LERF is below the risk acceptance guidelines of 1E-06/year in RG 1.174, respectively. However, as clarified in RG 1.205, this CDF for the additional risk of RAs is acceptable because the change in CDF for Unit Nos. 1 and 2 are risk decreases.

3.5 Nuclear Safety Capability Assessment Results

NFPA 805 (Reference 3), Section 2.2.3, "Evaluating Performance Criteria," states:

> To determine whether plant design will satisfy the appropriate performance criteria, an analysis shall be performed on a fire area basis, given the potential fire exposures and damage thresholds, using either a deterministic or performance-based approach.

NFPA 805, Section 2.2.4, "Performance Criteria," states:

> The performance criteria for nuclear safety, radioactive release, life safety, and property damage/business interruption covered by this standard are listed in Section 1.5 and shall be examined on a fire area basis.

NFPA 805, Section 2.2.7, "Existing Engineering Equivalency Evaluations," states:

> When applying a deterministic approach, the user shall be permitted to demonstrate compliance with specific deterministic fire protection design requirements in Chapter 4 for existing configurations with an engineering equivalency evaluation. These existing engineering evaluations shall clearly demonstrate an equivalent level of fire protection compared to the deterministic requirements.

3.5.1 Nuclear Safety Capability Assessment Results by Fire Area

NFPA 805, Section 2.4.2, "Nuclear Safety Capability Assessment," states:

> The purpose of this section is to define the methodology for performing a nuclear safety capability assessment. The following steps shall be performed:
>
> (1) Selection of systems and equipment and their interrelationships necessary to achieve the nuclear safety performance criteria in Chapter 1;
>
> (2) Selection of cables necessary to achieve the nuclear safety performance criteria in Chapter 1;
>
> (3) Identification of the location of nuclear safety equipment and cables; and
>
> (4) Assessment of the ability to achieve the nuclear safety performance criteria given a fire in each fire area.

This SE Section addresses the last topic regarding the ability of each fire area to meet the NSPC of NFPA 805. SE Section 3.2.1 addresses the first three topics.

NFPA 805, Section 2.4.2.4, "Fire Area Assessment," states:

> An engineering analysis shall be performed in accordance with the requirements of Section 2.3 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.

In accordance with the above, the process defined in NFPA 805, Chapter 4, provides a framework to select either a deterministic or a PB approach to meet the NSPC. Within each of these approaches, additional requirements and guidance provide the information necessary for the licensee to perform the engineering analyses necessary to determine which fire protection systems and features are required to meet the NSPC of NFPA 805.

NFPA 805, Section 4.2.2, "Selection of Approach," states:

> For each fire area either a deterministic or performance-based approach shall be selected in accordance with Figure 4.2.2. Either approach shall be deemed to satisfy the nuclear safety performance criteria. The performance-based approach shall be permitted to utilize deterministic methods for simplifying assumptions within the fire area.

This SE section evaluates the approach used to meet the NSPC on a fire area basis, as well as what fire protection features and systems are required to meet the NSPC.

The NRC staff reviewed LAR Section 4.2.4, "Fire Area Transition"; Section 4.8.1, "Results of the Fire Area Review"; LAR Attachment C, "NEI 04-02 Table B-3 – Fire Area Transition"; LAR Attachment G, "Recovery Actions Transition"; LAR Attachment S, "Plant Modifications and Items to be Completed During Implementation," as supplemented; and LAR Attachment W, "Fire PRA Insights," during its evaluation of the ability of each fire area to meet the NSPC of NFPA 805.

Beaver Valley is a dual unit PWR with approximately 119 individual fire compartments, including the common yard area (manholes and ductlines in the yard), and each fire compartment is composed of one or more fire zones. Based on the information provided by the licensee in the LAR, the licensee performed the NSCA on a fire compartment basis. The licensee stated that fire compartments were established to support the development of the FPRA. LAR Attachment C provides the results of these analyses on a fire compartment basis and also identified the fire zones within the fire compartments.

SE Table 3.5-1a (Unit No. 1) and Table 3.5-1b (Unit No. 2) identify those fire compartments that were analyzed using either the deterministic or PB approach in accordance with NFPA 805, Chapter 4, based on the information provided in LAR Attachment C, Table B-3, "Fire Area Transition."

Table 3.5-1a: Unit No. 1 Fire Compartment and Compliance Strategy Summary

Fire Compartment	**Area Description**	**NFPA 805 Compliance Basis**
Unit No. 1	Beaver Valley, Unit No. 1	
1-CO-2	C02 Storage and PG Water Pump Room	Performance-Based
1-CR-2	Control Room HVAC Equipment Room	Performance-Based
1-CR-3	Communications Equipment and Relay Room	Performance-Based
1-CR-4	Process Instrumentation Room	Performance-Based
1-CS-1	Cable Spreading Room	Performance-Based
1-CTP-1	Cooling Tower Pump House and Cooling Tower	Performance-Based
1-CV-1	West Cable Vault	Performance-Based
1-CV-2	East Cable Vault	Performance-Based
1-CV-3	Cable Tunnel	Performance-Based
1-DG-1	Diesel Generator Room Train A	Performance-Based
1-DG-2	Diesel Generator Room Train B	Performance-Based
1-ES-1	Emergency Switchgear Train A	Performance-Based
1-ES-2	Emergency Switchgear Room Train B	Performance-Based
1-FB-1	Fuel Handling/Decon Buildings	Performance-Based

Fire Compartment	Area Description	NFPA 805 Compliance Basis
1-H-1	Bulk Hydrogen Storage Tanks in Beaver Valley, Unit No. 1, Yard Area	Performance-Based
1-MG-1	Motor Generator Room	Performance-Based
1-MS-1	Main Steam Valve Room	Performance-Based
1-NS-1	Normal Switchgear Room	Performance-Based
1-PA-1A	Primary Auxiliary Building (768'-7")	Performance-Based
1-PA-1C	Primary Auxiliary Building (752'-6")	Performance-Based
1-PA-1E	Primary Auxiliary Building 735'-6"	Performance-Based
1-PA-1G	Primary Auxiliary Building 722'-6"	Performance-Based
1-PA-1GA	Charging Pump Cubicle 1A	Performance-Based
1-PA-1GB	Charging Pump Cubicle 1B	Performance-Based
1-PA-1GC	Charging Pump Cubicle 1C	Performance-Based
1-PT-1	Pipe Tunnel	Performance-Based
1-QP-1	Quench Spray/AFW Pump Room	Performance-Based
1-RC-1	Reactor Containment Building	Performance-Based
1-S-1	PAB West Stairwell and PAB Elevator Shaft	Performance-Based
1-S-2	Cable Vault East/West Stairwell	Performance-Based
1-S-3	PAB South Stairwell	Performance-Based
1-S-4	Control Room Stairwell	Performance-Based
1-S-5	Service Building Northwest Stairwell	Performance-Based
1-SB-GEN	Service Building (735'-6", 752'-6", 760') and Pipe Chase (713'-6" to 760")	Performance-Based
1-SGPD-1	Steam Generator Blowdown Area (752'-6")	Performance-Based
1-TB-1	Turbine Building	Performance-Based
1-TO-1	Turbine Oil Storage Room	Performance-Based
1-TR-1	Unit No. 1 - Main Transformer (TR-MT1)	Performance-Based
1-TR-2	Unit No. 1 - Unit Station Service Transformer 1 D	Performance-Based
1-TR-3	Unit No. 1 - Unit Station Service Transformer 1C	Performance-Based
1-TR-4	Unit No. 1 - System Station Service Transformer 1A	Performance-Based
1-TR-5	Unit No. 1 - System Station Service Transformer 1B	Performance-Based
1-VP-1	River Water Valve Pit Train A	Performance-Based
1-VP-2	River Water Valve Pit Train B	Performance-Based
1-WH-1	Unit No. 1 Warehouse and Shop Area	Performance-Based
1-WT-1	Refueling Water Storage Tank Area (1QS-TK-1)	Performance-Based
1-WT-10	Primary Plant Demineralized Water Storage Tank (1WT-TK-10)	Performance-Based
1-WT-11	Turbine Plant Demineralized Water Storage Tank (1WT-TK-11)	Performance-Based
1-WT-26	Auxiliary Demineralized Water Storage Tank (1WT-TK-26)	Performance-Based
3-AIS-1	Alternate Intake Structure	Performance-Based
3-CR-1	Control Room	Performance-Based
3-ER-1	ERF Substation	Performance-Based
3-ER-2	ERF Diesel Generator Building	Performance-Based
3-ER-3	Emergency Response Facility	Performance-Based

Fire Compartment	Area Description	NFPA 805 Compliance Basis
3-IS-1	Intake Structure Cubicle 1	Performance-Based
3-IS-2	Intake Structure Cubicle 2	Performance-Based
3-IS-3	Intake Structure Cubicle 3	Performance-Based
3-IS-4	Intake Structure Cubicle 4	Performance-Based
3-IS-6	Intake Structure (all areas except 3-IS-1, 2, 3, 4)	Performance-Based
3-RH-1	Switchyard Relay House	Performance-Based
3-SY-1	Main Switch Yard	Performance-Based
3-TR-6	ERF Offsite Power Transformer (TRF-ERFS-3B)	Performance-Based
3-TR-7	ERF Offsite Power Transformer (TRF-ERFS-3A)	Performance-Based
3-YARD-1	Manholes and Ductlines in the Yard	Performance-Based

Table 3.5-1b: Unit No. 2 Fire Compartment and Compliance Strategy Summary

Fire Area	Area Description	NFPA 805 Compliance Basis
Unit No. 2	Beaver Valley, Unit No. 2	
2-ASP	Alternate Shutdown Panel Room	Performance-Based
2-CB-1	Control Building (Instrument and Relay Room, Cable Spreading Room, Cable Tunnel)	Performance-Based
2-CB-4	Control Building Computer Room (735'-6")	Performance-Based
2-CB-5	Control Building Fan Room (735'-6")	Performance-Based
2-CB-6	West Communications Room	Performance-Based
2-CP-1	Condensate Polishing Building	Performance-Based
2-CTP-1	Cooling Tower Pump House and Cooling Tower	Performance-Based
2-CV-1	West Cable Vault & Rod Control Room	Performance-Based
2-CV-2	East Cable Vault & Rod Control Area	Performance-Based
2-CV-3	Cable Vault & Rod Control Area	Performance-Based
2-CV-4	South Cable Vault and Rod Control Area (773'-6")	Performance-Based
2-CV-5	North Cable Vault and Rod Control Area (773'-6")	Performance-Based
2-CV-6	Cable Vault & Rod Control Relay Room (755'-6")	Performance-Based
2-DG-1	Diesel Generator Cubicle A	Performance-Based
2-DG-2	Diesel Generator Cubicle Train B	Performance-Based
2-FB-1	Fuel Handling & Decontamination Building	Performance-Based
2-H-1	Bulk Hydrogen Storage Tanks in Beaver Valley, Unit No. 2, Yard Area	Performance-Based
2-MS-1	Main Steam Valve Area	Performance-Based
2-PA-3	Auxiliary Building General Area (710'-6", 718'-6", 735'-6")	Performance-Based
2-PA-3A	Charging Pump Cubicle A (735'-6")	Performance-Based
2-PA-3B	Charging Pump Cubicle B (735'-6")	Performance-Based
2-PA-3C	Charging Pump Cubicle C (735'-6")	Performance-Based
2-PA-4	Auxiliary Building General Area (755'-6")	Performance-Based
2-PA-5	Auxiliary Building General Area	Performance-Based
2-PA-6	Auxiliary Building MCC Room Train A (755'-6")	Performance-Based
2-PA-7	Auxiliary Building MCC Room Train B (755'-6")	Performance-Based
2-PT-1	Pipe Tunnel Area	Performance-Based
2-RC-1	Reactor Containment Building	Performance-Based

Fire Area	Area Description	NFPA 805 Compliance Basis
2-S-1	Cable Vault Northwest Stairwell and Personnel Access Tunnel/Passageway	Performance-Based
2-S-4	Cable Vault West Stairwell	Performance-Based
2-SB-1	Service Building Emergency Switchgear Train A	Performance-Based
2-SB-10	Service Building Non-Safety-Related Battery Room 2-5 (760'-6")	Performance-Based
2-SB-2	Service Building Emergency Switchgear Train B	Performance-Based
2-SB-3	Service Building Cable Spreading Area	Performance-Based
2-SB-4	Service Building Normal Switchgear	Performance-Based
2-SB-5	Service Building MFRV Room	Performance-Based
2-SB-6	Service Building Battery Room 2-1 (730'-6")	Performance-Based
2-SB-7	Service Building Battery Room 2-3	Performance-Based
2-SB-8	Service Building Battery Room 2-2	Performance-Based
2-SB-9	Service Building Battery Room 2-4	Performance-Based
2-SG-1N	North Safeguards Area	Performance-Based
2-SG-1S	South Safeguards Area	Performance-Based
2-TB-1	Turbine Building General Area	Performance-Based
2-TB-2	Turbine Building Battery Room 2-6	Performance-Based
2-TR-1	Unit No. 2 Main Transformer (TR-MT-2)	Performance-Based
2-TR-2	Unit No. 2 - Unit Station Service Transformer 2C	Performance-Based
2-TR-3	Unit No. 2 - Unit Station Service Transformer 2D	Performance-Based
2-TR-4	System Station Service Transformer 2B	Performance-Based
2-TR-5	System Station Service Transformer 2A	Performance-Based
2-VP-1	Service Water Valve Pit East Train A	Performance-Based
2-VP-2	Service Water Valve Pit West Train B	Performance-Based
2-WH-1	Unit No. 2 Waste Handling Building (All Levels)	Performance-Based
2-WT-21	Refueling Water Storage Tank Area (2QSS-TK21)	Performance-Based
2-WT-210	Primary Plant Demineralized Water Storage Tank	Performance-Based
2-WT-211	Turbine Plant Demineralized Water Storage Tank (2WTD-TK211)	Performance-Based
2-WT-23	Demineralized Water Storage Tank (2WTD-TK23)	Performance-Based
3-AIS-1	Alternate Intake Structure	Performance-Based
3-CR-1	Main Control Room	Performance-Based
3-ER-1	ERF Substation	Performance-Based
3-ER-2	ERF Diesel Generator Building	Performance-Based
3-ER-3	Emergency Response Facility	Performance-Based
3-IS-1	Intake Structure Cubicle 1	Performance-Based
3-IS-2	Intake Structure Cubicle 2	Performance-Based
3-IS-3	Intake Structure Cubicle 3	Performance-Based
3-IS-4	Intake Structure Cubicle 4	Performance-Based
3-IS-6	Intake Structure (All areas except 3-IS-1, 2, 3, 4)	Performance-Based
3-RH-1	Switchyard Relay House	Performance-Based
3-SY-1	Main Switch Yard	Performance-Based
3-TR-6	ERF Offsite Power Transformer (TRF-ERFS-3B)	Performance-Based
3-TR-7	ERF Offsite Power Transformer (TRF-ERFS-3A)	Performance-Based
3-YARD-1	Manholes and Ductlines in the Yard	Performance-Based

LAR Attachment C provides the results of these analyses on a fire compartment basis. For each fire compartment, the licensee documented the following:

- The approach used in accordance with NFPA 805 (i.e., the deterministic approach in accordance with NFPA 805, Section 4.2.3, or the PB approach in accordance with NFPA 805, Section 4.2.4).
- The SSCs required in order to meet the NSPC.
- Fire detection and suppression systems required to meet the NSPC.
- An evaluation of the effects of fire suppression activities on the ability to achieve the NSPC.
- The disposition of each VFDR using either modifications (completed or committed) or the performance of an FRE in accordance with NFPA 805, Section 4.2.4.2.

3.5.1.1 Fire Detection and Suppression Systems Required to Meet the NSPC

A primary purpose of NFPA 805, Chapter 4, is to determine, by analysis, what fire protection features and systems need to be credited to meet the NSPC. Four sections of NFPA 805, Chapter 3, have requirements dependent upon the results of the engineering analyses performed in accordance with NFPA 805, Chapter 4: (1) fire detection systems, in accordance with Section 3.8.2, (2) automatic water-based fire suppression systems, in accordance with Section 3.9.1, (3) gaseous fire suppression systems, in accordance with Section 3.10.1, and (4) passive fire protection features, in accordance with Section 3.11. The features/systems addressed in these sections are only required when the analyses performed in accordance with NFPA 805, Chapter 4, indicate the features and systems are required to meet the NSPC.

The licensee performed a detailed analysis of fire protection features and identified the fire suppression and detection systems and passive fire protection features required to meet the NSPC for each fire area. LAR Table 4-3, "Summary of NFPA 805 Compliance Basis and Required Fire Protection Systems and Features," lists the fire compartments and identifies if the fire suppression and detection systems installed in these areas are required to meet criteria for separation, DID, risk, licensing actions, or EEEEs.

The NRC staff reviewed LAR Attachment C for each fire compartment to ensure fire detection and suppression met the principles of DID in regard to the planned transition to NFPA 805. Based on the statements provided in LAR Attachment C, the NRC staff concludes that the licensee's treatment of this issue is acceptable because the licensee adequately identified the fire detection and suppression systems required to meet the NFPA 805 NSPC on a fire area basis.

3.5.1.2 Evaluation of Fire Suppression Effects on Nuclear Safety Performance Criteria

Each fire compartment included in LAR Attachment C includes a discussion of how the licensee met the requirement to evaluate the fire suppression effects on the ability to meet the NSPC.

The licensee stated that damage to plant areas and equipment from the accumulation of water discharged from manual and automatic fire protection systems and the discharge of manual suppression water to adjacent compartments is controlled. As described in the LAR, certain plant-specific features in some fire compartments, provision of a floor drainage system, and management by the fire brigade were credited to control fire suppression effects. Therefore, fire suppression activities are not expected to adversely affect achieving the NSPC.

Based on the information provided by the licensee in the LAR, the licensee evaluated fire suppression effects on meeting the NSPC and determined that fire suppression activities will not adversely affect achievement of the NSPC. The NRC staff has reviewed this information and concludes that the licensee's evaluation of the suppression effects on the NSPC is acceptable.

3.5.1.3 Licensing Actions

Based on the information provided in LAR Section 4.2.3 and LAR Attachment C, the licensee identified exemptions from the deterministic requirements for each fire area that were previously approved by the NRC for Unit No. 1. The licensee also identified deviations from the deterministic requirements for each fire compartment that were previously approved by the NRC for Unit No. 2. Each of these exemptions and deviations is further detailed in LAR Attachment K, "Existing Licensing Action Transition," as supplemented. In LAR Section 4.2.3, the licensee stated that six licensing actions for Unit No. 1 and eleven licensing actions for Unit No. 2 will be transitioned into the NFPA 805 FPP as previously approved.

The licensee has proposed clarifications to the previously approved licensing actions and documented these clarifications in LAR Attachment T, "Clarification of Prior NRC Approvals." The licensee used the process described in NEI 04-02, which requires a determination of the basis of acceptability and a determination that the basis of the acceptability is still valid for the licensing actions that will be transitioned. The licensing actions being transitioned, including the clarifications, are summarized in SE Table 3.5-2.

Table 3.5-2: Previously Approved Licensing Actions Being Transitioned

Licensing Action Description	**Applicable Fire Compartment**	**Clarification**	**NRC Staff's Evaluation**
Unit No. 1 Exemptions			
11.02 - Reactor Containment - Lack of 20-foot separation (III.G.2 criteria).	1-RC-1	Clarification Request 2: The licensee requested approval of a clarification to Licensing Actions 11.02 and 11.16, as it is indicated in the NRC SER dated March 14, 1983 (Reference 108), that all cables inside containment are routed in conduit and are qualified to a test comparable to IEEE-383 (Reference 100). The licensee stated that its licensing basis documents did not state that all cables	The licensee stated that the basis is as follows for the lack of 20-foot separation free of intervening combustibles between redundant trains of safe shutdown circuits associated with Pressurizer PORVs, Pressurizer Relief Blocking Valves, Pressurizer Heaters, Steam Generator Level, Pressurizer Level,

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
		are routed in conduit. Additional discussion on Clarification Request 2 is provided below in the discussion of SSD RAI 13a. In response to SSD RAI 13b (Reference 12), the licensee stated that Clarification Requests 3 and 4 are withdrawn. Further discussion is provided in Section 3.5.2 of this SE.	Reactor Coolant Hot and Cold Leg Temperature, and Reactor Coolant Gas Ventilation Solenoids: Due to the configuration and location within the containment and the restricted access of these sub-areas during plant operations, an exposure fire is unlikely. All cable insulation is qualified to a test comparable to IEEE-383 and routed in conduit as clarified in Clarification Request 2. The reactor coolant pump is fitted with an oil collection system. Smoke detection and water deluge systems are provided in the cable penetration area and the RHR pump area. Portable extinguishers and manual hose stations are provided throughout the area. Pressurizer PORV cables are run in conduit inside the crane wall, are 20 feet above the floor outside the crane wall, and are separated by 25 feet at the penetration area.

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			Pressurizer PORV blocking valve power cables are run in conduit approximately 20 feet above the floor to the penetration area where they are separated by a fire barrier and automatic suppression and detection system. Pressurizer heater power cables are in covered horizontal trays 20 feet above the floor and in vertical trays separated by 18 feet. Steam generator level channels are protected by suppression and detection in the penetration area and routed in conduit elsewhere. Channels I and III are routed in opposite directions than Channel II around the containment. Pressurizer level transmitter cables are enclosed in conduit where they are in close proximity. In the penetration area, they are separated by a fire barrier and protected by a fire detection and suppression system. Reactor coolant hot and cold leg temperature channels I and II are in

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			separate conduit and approach the penetration area from different directions. Neutral temperature indication from the bypass manifold is routed in conduit to the penetration area. Based on the previous staff approval of this exemption in SER dated March 14, 1983 (Reference 108), Clarification Request 2, and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
11.05 - Cable Tunnel (1-CV-3) - Lack of 20-foot separation (III.G.2 criteria).	1-CV-3	Clarification Request 17: The licensee requested approval of a clarification to Licensing Action 11.05 because, although the non-safety-related cables in 1-CV-3 are not fire retardant, the existing condition is still acceptable based on the modification to install steel tray covers and to wrap exposed portions of cables. The licensee stated that the basis for the exemption was that there are low in-situ combustibles in the Cable Tunnel, and that this remains valid since the enclosed cables do not present an intervening combustible and it is unlikely the cable will become ignited in the event of a fire in 1-CV-3.	The licensee stated that the basis for less than 20-feet separation of redundant trains of safe shutdown equipment and lack of an automatic suppression system is as follows: All cables are qualified to a test comparable to IEEE-383, as clarified in Clarification Request 17. Each redundant function has at least one train of cables installed in conduit. Access to the area is restricted. A smoke detection system is provided in

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			the Cable Tunnel (1-CV-3). A total flooding Halon 1301 system has been installed. The restricted access minimizes the possibility of a severe exposure fire due to accumulated transient combustibles. The metal conduit will delay the onset of cable damage for a limited time period for small exposure fires. The Halon system should promptly extinguish a fire. Low in-situ combustibles. Based on the previous staff approval of this exemption in SER dated March 14, 1983 (Reference 108), Clarification Request 17, and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable. Additional discussion of the NRC staff's review of Clarification Request 17 is provided in Section 3.5.2 of this SE.
11.16 - Reactor Containment (1-RC-1) - Lack of	1-RC-1	Clarification Request 2: The licensee requested approval of a clarification to	The licensee stated that the bases for lack of 20-foot separation of

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
20-foot separation of redundant trains of circuits associated with source range monitoring within containment (III.G.2 criteria).		Licensing Actions 11.02 and 11.16, as it is indicated in NRC SER dated March 14, 1983 (Reference 108), that all cables inside containment are routed in conduit and are qualified to a test comparable to IEEE-383 (Reference 100). The licensee stated that its licensing basis documents did not state that all cables are routed in conduit.	redundant trains of circuits associated with source range monitoring within containment are as follows: The combustible loading in this area consists of approximately 48,000 pounds of cable , insulation, 265 gallons of lubricating oil for each reactor coolant pump, and 200 pounds of charcoal in the containment air filter cubicles. All cable insulation is qualified to a test comparable to IEEE-383 as clarified in Clarification Request 2. 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 extinguishers and manual hose stations are provided throughout the fire area. Separation of approximately 5 feet is maintained between source range channels. The NRC had previously approved an

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			exemption for the separation of redundant equipment and cables inside containment and added an additional channel of source range neutron detection at the request of the NRC. Based on the previous staff approval of this exemption in SER dated August 30, 1984 (Reference 109), Clarification Request 2, and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable. In response to SSD RAI 06 (Reference 12), the licensee stated that Licensing Action 11.10 will not be transitioned. Additional discussion of the NRC staff's review of SSD RAI 13a and Clarification Request 2 is provided in Section 3.5.2 of this SE.
11.18 - Fire Doors - Lack of 3-hour barriers (III.G.2 criteria).	1-CR-2 1-CR-4 1-CS-1 1-CV-1 1-CV-2 1-ES-1 1-ES-2 1-FB-1 1-MG-1 1-MS-1 1-NS-1 1-PA-1A	None	The licensee stated that the bases for lack of 3-hour fire-rated barriers are as follows: The equivalent fire severity in each of the affected compartments is less than 120 minutes and generally less than 60 minutes.

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
	1-PA-1E 1-PA-1G 1-PA-1GA 1-PA-1GB 1-PA-1GC 1-PT-1 1-SB-GEN 1-SGPD-1 1-TB-1 3-CR-1 3-IS-1 3-IS-2 3-IS-3 3-IS-4 3-IS-6		Except for the doors located in the intake structure, the corrective modifications provide an adequate margin of fire resistance compared to the combustible loading. For the doors in the intake structure, the 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 equipment. Based on the previous staff approval of this exemption in SER dated December 4, 1986 (Reference 110), and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
11.24 - Process Instrumentation – Alternative shutdown capability – only the source range instrument drawer at the backup indicating panel will be transitioned to NFPA 805.	1-CR-4 1-CS-1 1-MS-1 3-CR-1	None	The licensee stated that the bases for the use of a source range instrument drawer installation are as follows: Source range monitor is not permanently installed. Installed source range instrument drawer at the backup indication panel will have the ability to be hooked up to the source

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			range monitor within 1 hour. SSD RAI 07 regarding the timeframe to obtain source range flux indication is discussed in SE Section 3.2.1.3. Based on the previous staff approval of this exemption in SER dated January 5, 1983 (Reference 107), and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
11.26 – Lack of fire extinguishers in the cable tray mezzanine of the cable spreading room.	1-CS-1	None	The licensee stated that the bases for the lack of fire extinguishers in the cable tray mezzanine of the cable spreading room are as follows: Water coverage could be provided for the cable tray mezzanine from hose racks in the PCA and clean shops by adding additional lengths of fire hose. Based on the previous staff approval of this exemption in NRC letter dated June 6, 1979 (Reference 99), and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
Unit No. 2 Deviations			
03 Conduits/Penetration seals and penetration seal design – BTP C.5.a(3).	Various	None	The licensee stated that the bases for fire barrier penetrations that could not be sealed per Branch Technical Position (BTP) C.5.a(3) are as follows: Approximately 18 penetrations, 4-inch diameter or greater, which cannot be sealed at the barrier, will be sealed with fire-seal material at the first opening and wrap the conduit from the seal to the barrier with 1-hour fire wrap material. 17 of these penetrations have detection and automatic suppression on both sides of the barrier, and the remaining penetration has detection on both sides with automatic suppression on one side. Penetrations, which are less than 4 inches in diameter and extend less than 5 feet on either side of the barrier and cannot be sealed at the barrier, will be sealed at the first opening on both sides of the barrier with a fire-seal material. Based on the previous staff approval of this deviation in SER NUREG-1057,

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			Supplement 5 (Reference 41), and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
04 – Ventilation Penetration Openings (Fire Dampers) – Lack of appropriate fire dampers – BTP C.5.a(4).	Various	In its response to SSD RAI 13c, the licensee deleted Clarification Requests 8, 9, and 10.	The licensee stated that the bases for approval for two 1½-hour fire-rated dampers in series instead of one 3-hour fire-rated damper are as follows: The two 1 ½-hour fire dampers in series is equivalent to a 3-hour rate damper and adequately assures that the fire barriers will be maintained for the specific fire areas. The dampers were all purchased as U.L. rated dampers and placed in series in common sleeves to provide the equivalent 3-hour rated damper. Combustible loading for the areas is less than 1 ½ hour, except for two areas, which is less than 3 hours. All areas have an automatic fire suppression system. Fire loading is mostly from cables all of which are IEEE-383-1974 or similarly rated or located

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			in conduit and will not support combustion. Based on the previous staff approval of this deviation in SER NUREG-1057, Supplement 3 (Reference 39), and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
05 – Fire Dampers and Ventilation Ductwork – Assembly location and deviation in ductwork 1-hour fire wrap – BTP C.5.a(4)	Various	In its response to SSD RAI 13c, the licensee deleted Clarification Requests 8, 9 and 10.	The licensee stated that the bases for approval of certain fire dampers being installed outside of a barrier are as follows: The fire dampers are located as close to the fire barriers as possible and the ductwork from the fire dampers to the barrier is wrapped with a 1-hour fire-rated material. Fire wrap is installed on the ductwork beyond the fire damper to the first support if required to ensure the ductwork's integrity. Fire severity is less than 1 hour on both sides of the barrier or automatic suppression and detection have been provided. Based on the previous staff approval of this

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			deviation in SER NUREG-1057, Supplement 5 (Reference 41), and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
06 - Fire Doors - Modification of fire door assemblies – BTP C.5.a(5).	Various	The licensee withdrew Clarification Request 16. Additional discussion of the NRC staff's review of SSD RAI 13e and Clarification Request 16 is provided in Section 3.5.2 of this SE.	The licensee stated that the bases for approval of fire door assemblies, which have been modified by the installation of security hardware or installed for a "special purpose" not approved by Underwriters Laboratories (UL), are as follows: The modifications were made following the guidelines suggested by UL. The door areas have either automatic detection and suppression or manual firefighting equipment available in the areas. The security alarmed doors also have remote monitoring capability by the security system video monitors and the alarm function in the event the door is left open, which would alarm personnel of an abnormal condition in these areas.

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			The door assembly will either bear a UL label denoting the required fire rating, have a certification from the Vendor identifying the fire rating, or be justified by an engineering analysis. The rolling steel doors in the north and south safeguards areas are not used to separate adjacent fire areas, but are used to separate the stairwell within a fire area from the remainder of the area. Since the safeguards areas are normally unoccupied and the fire severity is less than ½ hour, this arrangement is acceptable. The containment area special purpose-type door assemblies are capable of providing adequate fire protection for the area. The doors provide a pressure boundary and no UL fire-rated doors for these purposes are available. The fire door assemblies will be justified by engineering analysis. Areas protected by automatic flooding gas suppression systems are located in buildings that are provided with

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			restricted access by electrically supervised security access locks that place the areas of concern out of normal travel routes. These doors are maintained closed, self-closing, administratively controlled by procedure, and checked on a daily basis. This ensures the operability of the doors and verifies that they are in the closed position. All fire doors to areas protected by guidelines of the applicable NFPA codes for gaseous suppression systems (NFPA 12 or NFPA 12A). Based on the previous staff approval of this deviation in SER NUREG-1057, Supplement 5 (Reference 41), and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
08 - Safe Shutdown Components - Lack of separation of redundant trains – BTP C.5.b. The following safe shutdown components will be transitioned: (1) charging pumps (11) equipment inside containment.	2-PA-3 2-RC-1	Clarification Request 11: It is requested that the NRC document as a "prior approval" recognition that the charcoal combustible hazard is no longer in the fire compartment, and therefore, presents no fire hazard. The fire detection and fire suppression is removed from the basis for	The licensee stated that the bases for approval of lack of separation of redundant charging pumps in fire area 2-PA-3 and redundant equipment in containment, are as follows: - Fire area 2-PA-3

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
		the licensing action approval. In response to SSD RAI 13b (Reference 12), the licensee withdrew Clarification Requests 12 and 13. Additional discussion of the NRC staff's review SSD RAI 13b and Clarification Requests 12 and 13 is provided in Section 3.5.2 of this SE.	The walls between the charging pump cubicles are reinforced concrete with 3-hour fire-rated penetration seals, and the west wall of each cubicle is concrete block with a small crane rail 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 ½ hour. Existing fire protection consists of portable extinguishers, hose stations, and an area-wide ionization-type smoke detection system. - Containment 2-RC-1 Cables inside containment are either qualified IEEE-383 or are run inside conduit. The only significant combustible loadings other than cable are the oil inside the reactor coolant pumps, RHR pumps, and the charcoal filters, which were removed per Clarification Request 11. The reactor coolant pumps are provided

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			with an oil collection system in compliance with the Standard Review Plan, which reduces the potential for spread of combustible oil. Both the RHR pumps and charcoal filters are provided with detection and suppression systems, which are no longer credited in the technical basis of the licensing action per Clarification Request 11. 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. Because access to the area is tightly controlled, it is not expected that transient combustibles would contribute to the fire loading. Based on the previous staff approval of this deviation in SER NUREG-1057, Supplement 3

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			(Reference 39); Supplement 5 (Reference 41); Clarification Request 11; and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
11 - Hydrogen Piping - Deviation in seismic classification – BTP C.5.d(5).	2-PA-4	None	The licensee stated that the basis for seismic design of hydrogen piping in safety-related areas to Seismic Category II requirements, is as follows: The piping is designed and supported to withstand safe shutdown earthquake inertia loading, and the integrity of the pressure boundary is maintained in accordance with Appendix F of the 1972 ASME Code Winter Edition (Reference 154), which states that the faulted condition design procedures contained in subparagraph F-1300 are provided for limiting the consequences of the specified event. They are intended to assure that violation of the pressure boundary will not occur in components or supports that are in compliance with the procedures.

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			Based on the previous staff approval of this deviation in SER NUREG-1057 (Reference 25) and the statement by the licensee that the basis remains valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
18 - Fire Hydrant - Deviation in spacing – BTP C.6.b(7).	Yard	None	The licensee stated that the bases for the 370-feet spacing between fire hydrant No. 16 and No. 15, are as follows: Sufficient lengths of hose have been provided in the associated hose cart houses to provide coverage in the event of a fire. The specific hazards in the area are the main transformer and the two station service transformers. These transformers have been provided with automatic deluge suppression systems. Based on the previous staff approval of this deviation in SER NUREG-1057, Supplement 5 (Reference 41), and the statement by the licensee that the bases remain valid, the NRC staff concludes that the

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			applicability of this licensing action is acceptable.
26 - Fire Detection System Secondary Power Supplies - Use of plant emergency power supply – BTP C.6.a(6).		In its response to FPE RAI 16, the licensee withdrew Clarification Request 14. The detailed discussion of FPE RAI 16 is included in Section 3.1.1.2 of this SE for NFPA 805, Section 3.8.1, compliance.	The licensee stated that the bases for the reliable power supplies for the fire detection system are as follows: The fire detection system complies with NFPA 72D for a Class A system with the detectors installed in accordance with NFPA 72E. The primary supply for the fire detection system and suppression systems is the normal offsite power supply system. The secondary supply is a non-safety diesel generator and the switchover capability is an automatic function. The diesel generator supplies the 120V alternating current (AC) uninterruptible power supply system required for the detection system and the 125V direct current (DC) panels for the fire detection and suppression systems. A battery backup system with a 2-hour rated capability is provided as a backup to the 125V DC systems. A battery backup system with a 30-minute

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			capability is provided as a backup to the 120V AC system. This is to provide electrical continuity for the 10 seconds required to start the diesel and achieve rated voltage and frequency. The licensee also provided the same bases in its response to FPE RAI 02 (Reference 11), which are evaluated in Section 3.1.1.4 of this SE. Based on the previous staff approval of this deviation in SER NUREG-1057, Supplement 5 (Reference 41), and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
29 Standpipe and Hose Systems - Class II versus class III requirement – BTP C.6.c.	Various	None	The licensee stated that the bases for approval of the installation of a Class II type standpipe and hose system are as follows: The hose stations are designed for flow of at least 100 gallons per minute through a 1.5" hose. Manual hose stations are located throughout the plant in accordance with NFPA 14.

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			Standpipe system piping for hose stations protecting safe shutdown equipment has been analyzed for safe shutdown earthquake loading and is provided with seismic supports. The licensee also provided the same bases in its response to FPE RAI 02 (Reference 11). Based on the previous staff approval of this deviation in SER NUREG-1057, Supplement 5 (Reference 41), and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
30 - Intake Structure - Detection and 3-hour barriers versus sprinklers – BTP C.6.c.	3-IS-1 3-IS-2 3-IS-3 3-IS-4	Clarification Request 15: It is requested that the NRC document as a "prior approval" recognition that the absence of sprinkler protection in the intake structure compartment (3-IS-4) that houses the diesel fire pump is acceptable. Additional discussion of the NRC staff's review SSD RAI 13d and Clarification Request 15 is provided in Section 3.5.2 of this SE. In its response to SSD RAI 13d the licensee withdrew clarification request 15.	The licensee stated that the bases for lack of an automatic sprinkler system in the intake structure and the diesel fire pump room are as follows: The river water pumps are located in separate compartments and cabling is in conduit. A separate alternate water intake structure with redundant river water pumps is provided 1,800 feet away. Curbing at the diesel day tank and the trench

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			to the diesel engine will keep a leak from the tank or supply lines from spreading to other areas. Manual hose stations and portable extinguishers are provided within the building for manual firefighting. Thermal type fire detectors that alarm in the control room are provided in the compartments housing the river water pumps and the compartment housing the diesel fire pump. Separation between pump compartments is provided by 18" thick reinforced concrete walls with 3-hour fire-rated doors. All unnecessary combustibles from the intake structures are removed and only fire-retardant treated lumber will be used within the building. Automatic fire detectors are provided in the safety-related pump compartments IS-1, IS-2, and IS-3, which alarm in the control room. Based on the previous staff approval of this

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			deviation in SER dated June 6, 1979 (Reference 99), and the statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
31 - Access Hatch - Unrated containment hatch – BTP C.5.a(5).	2-RC-1	None	The licensee stated that the bases for the acceptability of the containment access hatch not having a UL label or certification of fire testing are as follows: The containment area special purpose-type door assemblies are capable of providing adequate fire protection for the area. The doors provide a pressure boundary and no UL fire-rated doors for these purposes are available. The combustible loading near the hatch is low. The licensee also provided the same bases in its response to FPE RAI 02 (Reference 11), which are evaluated in Section 3.1.1.4 of this SE. Based on the previous staff approval of this deviation in NUREG-1057, Supplement 5 (Reference 41), and the

Licensing Action Description	Applicable Fire Compartment	Clarification	NRC Staff's Evaluation
			statement by the licensee that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.

The NRC staff reviewed the exemptions (Unit No. 1) and deviations (Unit No. 2) from the pre-NFPA 805 licensing basis identified in SE Table 3.5-2, including the description of the previously approved exemption or deviation from the deterministic requirements, the basis for and continuing validity of the exemption or deviation, and the NRC staff's original evaluation or basis for approval of the exemption or deviation. In LAR Section 4.2.3, the licensee stated that the review of these existing licensing actions included a determination of the basis of acceptability and a determination that the basis of acceptability was still valid, except as identified in LAR Attachment T and further described in SE Section 3.5.2.

In LAR Attachment K, as supplemented, Licensing Action 27, the licensee stated that it is transitioning the prior approval for the use of cables that are not qualified to the IEEE Standard 383-1974 (Reference 100) flame test and associated this licensing action with NFPA 805, Section 3.3.5.3. In FPE RAI 04a and FPE RAI 04c (Reference 23), the NRC staff requested that the licensee provide an approval request in accordance with 10 CFR 50.48(c)(2)(vii) that describes the PB approach to compliance with NFPA 805, Section 3.3.5.3, for which NRC approval is requested or revise the compliance basis. In its response to FPE RAI 04a and FPE RAI 04c (Reference 12), the licensee stated that LAR Attachment K, as supplemented, Licensing Action 27 is not required, and an engineering evaluation was performed that analyzed the low population of cables with potential nonqualified electric cable insulation material installed in electrical raceways and determined the configuration to be acceptable, and removed the compliance statement "Submit for NRC Approval." The NRC staff concludes that the licensee's response to FPE RAI 04a is acceptable because it performed an engineering evaluation and concluded that the cable is acceptable, which is in accordance with RG 1.205, NEI 04-02, and FAQ 06-0022.

Based on the NRC staff's review of the licensing actions identified and described in LAR Attachments C and K, and the clarifications in LAR Attachment T as evaluated in SE Section 3.5.2, the NRC staff concludes that the licensing actions are identified by applicable fire area and remain valid to support the proposed license amendment because the licensee utilized the process described in NEI 04-02 (Reference 7) as endorsed by RG 1.205 (Reference 4), which requires a determination of the basis of acceptability and a determination that the basis is still valid.

Based on the previous NRC staff approval of the exemptions and deviations and the statement by the licensee that the basis remains valid, as presented in each appropriate fire area, the NRC staff concludes that the engineering evaluations being carried forward supporting the NFPA 805 transition, as identified in SE Table 3.5-2, are acceptable. (See SE Section 2.5 for further discussion.)

3.5.1.4 Existing Engineering Equivalency Evaluations

The EEEEs that support compliance with NFPA 805, Chapter 4, were reviewed by the licensee using the methodology contained in NEI 04-02. The methodology for performing the EEEE review included the following determinations:

- The EEEE is not based solely on quantitative risk evaluations,
- The EEEE is an appropriate use of an engineering equivalency evaluation,
- The EEEE is of appropriate quality,
- The standard license condition is met,
- The EEEE is technically adequate,
- The EEEE reflects the plant as-built condition, and
- The basis for acceptability of the EEEE remains valid.

In LAR Section 4.2.2, the licensee stated that the guidance in RG 1.205, Regulatory Position 2.3.2, and FAQ 08-0054 (Reference 83) was followed. EEEEs that demonstrate that a fire protection system or feature is "adequate for the hazard" are addressed in the LAR as follows:

- If not requesting specific approval for an "adequate for the hazard" EEEE, then the EEEE is referenced where required and a brief description of the evaluated condition is provided.

- If requesting specific NRC approval for an "adequate for the hazard" EEEE, then the EEEE is referenced where required to demonstrate compliance and is included in LAR Attachment L for NRC review and approval.

The licensee identified and summarized the EEEEs for each fire area in LAR Attachment C, as applicable. The licensee stated that none of the transitioning EEEEs require NRC approval.

Based on the NRC staff's review of the licensee's methodology for review of EEEEs and identification of the applicable EEEEs in LAR Attachment C, the NRC staff concludes that the licensee's use of EEEEs is acceptable because the process meets the requirements of NFPA 805 and the guidance of RG 1.205 and FAQ 08-0054.

3.5.1.5 Variances from Deterministic Requirements

For those fire compartments where deterministic criteria were not met, VFDRs were identified and evaluated using PB methods. VFDR identification, characterization, and resolutions were identified and summarized in LAR Attachment C for each fire compartment. Documented variances were all represented as separation issues. The following strategies were used by the licensee in resolving the VFDRs:

- An FRE determined that applicable risk, DID, and safety margin criteria were satisfied without further action; or

- An FRE determined that applicable risk, DID, and safety margin criteria were satisfied with a credited RA; or

- An FRE determined that applicable risk, DID, and safety margin criteria were satisfied with a DID-RA as discussed in SE Section 3.5.1.7; or

- An FRE determined that applicable risk, DID, and safety margin criteria were satisfied with a plant modification(s), as identified in the LAR.

In LAR Attachment C, the licensee identified VFDR BV2-0411 as being applicable to fire area 2-WH-1 only. However, the NRC staff's review of the FRE for fire areas 2-CV-1 and 2-MS-1 identified that VFDR BV2-0411 is also applicable to these fire areas. The licensee further stated that VFDR BV2-0411 is associated with replacing 120V AC and 125V DC breakers to eliminate multiple high impedance fault operator action, but this modification is not identified in LAR Attachment S, as supplemented. In SSD RAI 09 (Reference 23), the NRC staff requested that the licensee provide the basis for not identifying VFDR BV2-0411 for other applicable fire areas and the justification for not including this modification in LAR Attachment S, as supplemented. In its response to SSD RAI 09 (Reference 11), the licensee stated that LAR Attachment C was incorrect and that VFDR BV2-0411 was removed. The NRC staff concludes that the licensee's response to SSD RAI 09 is acceptable because the VFDR was identified in error and a modification to address multiple high impedance fault operator actions is not required.

In LAR Attachment C, the licensee identified VFDR BV2-0502 in fire area 2-CV-1, which involves fire damage to power cables associated with high-low pressure interface valves 2RHS-MOV701A-P, 2RHS-MOV701B-P, 2RHS-MOV702A-P, and 2RHS-MOV702B-P. The licensee stated in the disposition that the VDR will be corrected by a plant modification. However, the modification was not identified in LAR Attachment S, as supplemented. In SSD RAI 10 (Reference 23), the NRC staff requested that the licensee provide a description of the modification and include the description in LAR Attachment S, as supplemented, as appropriate. In its response to SSD RAI 10 (Reference 10), the licensee stated that the modification that was required to correct the potential spurious operation of a three-phase AC motor hot short is unnecessary per the guidance provided in NUREG/CR-7150 (Reference 155), which states that the spurious operation of a three-phase AC motor due to proper polarity hot shorts on three-phase cabling is incredible. The NRC staff concludes that the licensee's response to SSD RAI 10 is acceptable because the basis for not considering three-phase proper polarity hot shorts is consistent with the guidance provided in NUREG/CR-7150.

For all fire areas where the licensee used the PB approach to meet the NSPC, each VFDR and the associated disposition have been described in LAR Attachment C. Based on the NRC staff's review of the VFDRs and associated resolutions as described in LAR Attachment C, the NRC staff concludes that the licensee's identification and resolution of the VFDRs is acceptable because the licensee identified, characterized, and resolved all VFDRs as summarized in LAR Attachment C for each fire area.

3.5.1.6 Recovery Actions

LAR Attachment G lists the RAs identified in the resolution of VFDRs in LAR Attachment C for each fire compartment. The RAs identified include both actions considered necessary to meet risk acceptance criteria, as well as actions relied upon as DID (see SE Section 3.5.1.7 below). The NRC staff reviewed LAR Section 4.2.1.3, "Establishing Recovery Actions," and LAR Attachment G, "Recovery Actions Transition," to evaluate whether the licensee meets the associated requirements for the use of RAs per NFPA 805. The details of the NRC staff's review for RAs are described in SE Section 3.2.5, "Establishing Recovery Actions." The NRC

staff's evaluation of the additional risk of RAs credited to meet the risk acceptance guidelines is provided in SE Section 3.4.4.

In LAR Attachment G, the licensee identified RAs involving the use of portable fans to provide temporary ventilation for the emergency switchgear room, diesel generator room, and the control room for both Unit Nos. 1 and 2 fire areas. In SSD RAI 05a-d (Reference 23), the NRC staff requested that the licensee describe the placement of the portable fans with respect to the location of SSCs credited in the NSCA and to provide a justification that refueling of the portable fan does not present a fire exposure hazard to the SSCs. The NRC staff also requested that the licensee provide a description of the type, quantity, and location of fuel sources associated with the use of portable fans and the ventilation flow path configuration for each area where the portable fans are used as the credited RA.

In its response to SSD RAI 05a (Reference 11), the licensee stated that plant procedures direct the use of three electrical fans for Beaver Valley, Unit No. 1, emergency switchgear room temporary ventilation, which are placed within the emergency switchgear rooms, and the fans are powered by a gasoline engine-driven portable generator, which is placed in the yard area with adequate separation and isolation from all identified NSCA SSCs. The licensee further stated that plant procedures direct the use of two gasoline engine-driven fans and two electrical fans for Beaver Valley, Unit No. 1, diesel generator room temporary ventilation, and that the electrical fans are powered by gasoline-driven portable generators. The licensee further stated that the two electrical fans are placed in the entrance of 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. The licensee stated that control room temporary ventilation procedures will be developed to direct the placement of one or more electrical fans in the door from the outside, blowing into the common control room, powered from local receptacles, and LAR Attachment G was revised to specify the electric fans and eliminate the notation of fan capacity. The licensee stated that the required fan capacity will be determined as part of preparing the plant procedures. In LAR Attachment S, Table S-3, as supplemented, Implementation Items BV1-2975 and BV2-1365, the licensee included actions to develop control room temporary ventilation procedures to specify the required flow path, with supporting calculations as necessary. The NRC staff concludes that these actions are acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

In its response to SSD RAI 05b (Reference 11), the licensee stated that 15 gallons of gasoline are kept ready for immediate use for the gasoline engine-driven portable generator, which is used to power the electric fans for either the Beaver Valley, Unit No. 1, emergency switchgear rooms or the Beaver Valley, Unit No. 1, diesel generator rooms, and that 5 additional gallons of gasoline/oil mixture is kept ready for immediate use by the two gasoline engine-driven fans used to ventilate the Beaver Valley, Unit No. 1, diesel generator rooms . The licensee further stated that the gasoline is stored in the flammable storage cabinet at the Beaver Valley, Unit No. 1, turbine deck and is inventoried periodically. The licensee stated that the generator fuel tank has a 4 gallon capacity, which will run the generator for about 4.2 hours, and that the available gasoline is enough to keep the generator running for about 15.75 hours. The licensee further stated that the gasoline engine driven fans used for the Beaver Valley, Unit No. 1, diesel generator rooms have a one-quart fuel capacity, which will run the fan for about 1 hour; therefore, the available gasoline/oil mixture is enough to keep both fans running for about 10 hours. The licensee stated that additional fuel can be readily obtained from offsite before it is needed.

In its response to SSD RAI 05c (Reference 11), the licensee stated that the generator powering the Beaver Valley, Unit No. 1, emergency switchgear room fans is located in the yard near the chemical addition building and is not in close proximity to any NSCA SSCs. The licensee further stated that plant procedures direct a continuous fire watch for the gasoline engine-driven portable generator and fans for the Beaver Valley, Unit No. 1, diesel generator room temporary ventilation, and that this portable generator and the fans are located outside the door to the diesel generator room number 2 and not in proximity to any NSCA SSCs.

In its response to SSA RAI 05d (Reference 11), the licensee stated that the Beaver Valley, Unit No. 1, emergency switchgear room temporary ventilation flow path is provided by blocking open doors and that 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 licensee further stated that 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. The licensee further stated that the service building roof dampers are opened to allow the hot air to escape the building and that the cool air from the outside flows into the emergency switchgear rooms through doors blocked open for the electrical cords. The licensee stated that the Beaver Valley, Unit No. 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 licensee further stated that the four fans are arranged in or just outside the security door for the operating diesel generator room door and that each fan is equipped with an "elephant trunk" led inside the room. The licensee stated that cool air form 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. The licensee stated that LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2975, includes an action to develop a temporary ventilation procedure for diesel generator number 1 when it is operating, similar to the existing procedures for diesel generator number 2, and that Implementation Items BV1-2975 and BV2-1365 include actions to develop control room temporary ventilation procedures to specify the required flow path, with supporting calculations as necessary. The licensee stated that it is anticipated that this procedure will require opening two exterior doors to the yard such that cool air is blown in through one door, flows across the control room for both units, and hot air exhausts out the other door. The NRC staff concludes that the actions described in the implementation items are acceptable because they will incorporate the provisions of NFPA 805 in the FPPs and would be required by the proposed license condition.

The NRC staff concludes that the licensee's response to SSA RAI 05a-d is acceptable because the licensee demonstrated that it evaluated the fire exposure hazards associated with the gasoline used to power the gasoline engine-driven portable generators and fans, and also analyzed the flow path configuration to ensure that the installation of temporary ventilation for the Unit No. 1 emergency switchgear and diesel generator rooms does not affect its ability to meet the NSPC as required by NFPA 805, Section 1.5.

3.5.1.7 Recovery Actions Credited for Defense-in Depth

In the LAR, the licensee stated that RAs are identified in LAR Attachment G, Table G-1 "Beaver Valley, Unit No. 1 Recovery Actions and Activities Occurring at the Primary Control Station," and LAR Table G-2, "Beaver Valley, Unit No. 2 Recovery Actions and Activities Occurring at the Primary Control Station." The licensee did not initially differentiate between RAs for risk reduction and RAs for DID in LAR Attachment G, Tables G-1 and G-2. The licensee stated that the set of RAs necessary to demonstrate the availability of a success path for the NSPC was

evaluated for additional risk using the process described in NEI 04-02, FAQ 07-0030, and RG 1.205, and compared against the guidelines of RG 1.174 and RG 1.205.

In SSD RAI 04a (Reference 23), the NRC staff requested that the licensee differentiate the RAs identified in LAR Attachment G as those necessary to meet risk criteria, and therefore, included in the FPRA results reported in LAR Attachment W and those necessary for DID. In its response to SSD RAI 04a (Reference 12), the licensee stated that the differentiation of RAs in LAR Attachment G, Tables G-1 and G-2, was defined and submitted as part of the licensee's response to PRA RAI 18b (Reference 11). In its response to PRA RAI 18b (Reference 11), the licensee provided a revised list of RAs that differentiated between those RAs credited for DID and those credited for risk reduction. The licensee further stated that the RAs would be updated in response to PRA RAI 03 (Reference 19), which is evaluated in SE Section 3.4. In its letter dated June 23, 2017 (Reference 19), the licensee submitted a revised LAR Attachment G that identified which RAs are necessary to meet risk criteria and which RAs are provided for DID. The NRC staff concludes that the licensee's response to SSD RAI 04a is acceptable because it identified RAs that are evaluated for additional risk as required by NFPA 805, Section 4.2.4, and RAs that are not credited to meet the NSPC but have been retained to provide DID.

The licensee stated that the nuclear safety performance goals, objectives, and criteria of NFPA 805, including the risk acceptance guidelines, are met without these actions. However, RAs required for DID are retained to meet the requirements to maintain a sufficient level of DID and are, therefore, considered part of the RI/PB FPP, which necessitates that these actions would be subject to a PCE if subsequently modified or removed.

In LAR Attachment G, the licensee identified many RAs that require equipment repair to resolve the VFDRs. In SSD RAI 08 (Reference 23), the NRC staff requested that the licensee describe the specific repair activities that would need to be performed for each component and to identify any tools or equipment required for the repair activity, including staging areas, the repair procedures, and the feasibility of the repair. In its response to SSD RAI 08 (Reference 11), the licensee stated that LAR Attachment G describes a number of RAs that involved implementing repair procedures on valves that have been impacted by a combination of fire-induced and random failures, and that the RAs associated with repair are DID-RAs and are not credited in the FPRA. The licensee further stated that these repair activities are not required to be documented in LAR Attachment G and were removed. The NRC staff concludes that the licensee's response to SSD RAI 08 is acceptable because there are no actions that involve repair activities, and therefore, the feasibility of the repair actions does not need to be evaluated for feasibility in accordance with RG 1.205, NEI 04-02, and FAQ 07-0030.

The NRC staff reviewed LAR Section 4.2.1.3, "Establishing Recovery Actions," and Attachment G, "Recovery Actions Transition," to evaluate whether the licensee meets the associated requirements for the use of RAs per NFPA 805. The NRC staff's evaluation of the licensee's process for identifying RAs and assessing their feasibility is provided in SE Section 3.2.5, "Establishing Recovery Actions," and concluded that the licensee followed the endorsed guidance of NEI 04-02 and RG 1.205 to identify and evaluate RAs in accordance with NFPA 805, and that the feasibility criteria applied to RAs are acceptable because the criteria conforms with the endorsed guidance contained in NEI 04-02 and because the licensee will be in compliance with the regulation upon completion of implementation items that are required by the proposed license condition.

3.5.1.8 Plant Fire Barriers and Separations

With the exception of electrical raceway fire barrier systems (ERFBS), passive fire protection features include the fire barriers used to form fire compartment boundaries (and barriers separating SSD trains) that were established in accordance with the plant's pre-NFPA 805 deterministic FPP. For the transition to NFPA 805, the licensee retains previously established fire area boundaries as part of the RI/PB FPP.

Fire compartment boundaries are established for those areas described in LAR Attachment C as modified by applicable EEEEs that determine the barriers are adequate for the hazard or otherwise disposition differences in barrier design and performance from applicable criteria. The acceptability of fire barriers and separations is also evaluated as part of the NRC staff's review of LAR Attachment A, Table B-1 process and, as such, is addressed in SE Section 3.1.

3.5.1.9 Electrical Raceway Fire Barrier Systems

The licensee stated that the ERFBS met the deterministic requirements of NFPA 805, Chapter 3. Each fire compartment using ERFBS is identified in LAR Attachment C. In fire compartments with deterministic compliance, the ERFBS met the requirements of NFPA 805, Section 4.2.3. In fire compartments with PB compliance, the ERFBS were analyzed using the PB approach in accordance with NFPA 805, Section 4.2.4. There were no VFDRs associated with ERFBS.

3.5.1.10 Conclusion for Section 3.5.1

As documented in LAR Attachment C, for those fire areas that used a deterministic approach in accordance with NFPA 805, Section 4.2.3, the NRC staff concludes that each of the fire areas analyzed using the deterministic approach meets the associated criteria of NFPA 805, Section 4.2.3. This conclusion is based on:

- The licensee's documented compliance with NFPA 805, Section 4.2.3,
- The licensee's assertion that the success path will be free of fire damage without reliance on RAs,
- The licensee's assessment that the suppression systems in the fire area will have no impact on the ability to meet the NSPC, and
- The licensee's appropriate determination of the automatic fire suppression and detection systems required to meet the NSPC.

For those fire areas that used the PB approach in accordance with NFPA 805, Section 4.2.4, the NRC staff concludes that each fire area has been properly analyzed, and that compliance with the NFPA 805 requirements demonstrated as follows:

- Deviations from the pre-NFPA 805 fire protection licensing basis that were transitioned to the NFPA 805 licensing basis were reviewed for applicability, as well as continued validity, and found acceptable.

- VFDRs were evaluated and either found to be acceptable based on an integrated assessment of risk, DID, and safety margins, or modifications or RAs were identified and actions planned or implemented to address the issue.

- RAs used to demonstrate the availability of a success path to achieve the NSPC were evaluated and the additional risk of their use determined, reported, and found to be acceptable. The licensee's analysis appropriately identified the fire protection SSCs required to meet the NSPC, including fire suppression and detection systems.

- Fire area boundaries (ceilings, walls, and floors) such as fire barriers, fire barrier penetrations, and through penetration fire stops, are established.

- ERFBS credited were documented on a fire area basis, verified to be installed consistent with tested configurations and rated accordingly, and evaluated using an EEEE.

Accordingly, the NRC staff concludes that each fire area utilizing the deterministic or PB approach meets the applicable requirements of NFPA 805, Section 4.2.

3.5.2 Clarification of Prior NRC Approvals

The elements of the pre-transition FPP licensing basis for which specific NRC previous approval needs clarification are included in LAR Attachment T. The licensee included sufficient detail to demonstrate how those elements of the pre-transition FPP licensing basis meet the requirements in 10 CFR 50.48(c) (RG 1.205, Revision 1, Regulatory Position 2.2.1).

In LAR Attachment T, Prior Approval Clarification Request 2, the licensee stated that the licensing submittals associated with Licensing Action 11.02 and 11.16 did not state that "all cables" are routed in conduit, but stated that redundant trains of SSD cables are routed in conduit or routed in trays that are of a covered design in 1-RC-1. In SSD RAI 13a (Reference 23), the NRC staff requested that the licensee provide specific excerpts from the original exemption request to demonstrate that the NRC was made aware of and accepted this specific attribute. In its response to SSD RAI 13a (Reference 12), the licensee provided specific excerpts from its licensing submittal dated October 22, 1982 (Reference 156), to describe that cables are routed in cable trays with a covered design. The NRC staff concludes that the licensee's response to SSD RA 13a is acceptable because it has provided the appropriate excerpts from the original exemption request that described cables in cable trays with tray covers and demonstrated the information had been submitted to the NRC with the original exemption request and as originally approved.

In LAR Attachment T, Prior Approval Clarification Requests 3, 4, 12, and 13, the licensee requested clarification of Licensing Actions 11.02 (Unit No. 1) and 08 (Unit No. 2), respectively, for approval of the pre-action water suppression system consisting of two deluge systems in the electrical cable penetration areas of the containments. The licensee clarified that the deluge systems protecting the "orange" and "purple" system trains and the RHR pumps/motors are not fully automatic and would require remote manual initiation to open the containment isolation valves that supply water to the containments in order for flow to occur. The licensee further clarified that the deluge systems provide adequate spray pattern distribution and design spray density between the "orange" and "purple" trains. In SSD RAI 13b (Reference 23), the NRC

staff stated that LAR Attachment K, as supplemented, did not include citations from the licensee's submittals regarding the configuration of the deluge systems and requested that the licensee describe the scope of the clarification relative to the previously approved configuration and provide the specific excerpts from the applicable licensing basis documents to indicate that the NRC has been aware of and accepted the specific attributes of the deluge system. In its response to SSD RAI 13b (Reference 12), the licensee stated that it performed an engineering evaluation of the containment water suppression systems and concluded that the containment penetration area water suppression systems are acceptable. The licensee withdrew Clarification Requests 3, 4, 12, and 13. The NRC staff concludes that the licensee's response is acceptable because it withdrew the previous approval clarification requests and performed an engineering evaluation of the suppression systems, which is an acceptable method of evaluating a fire protection system that is credited to meet the NFPA 805, Chapter 4, requirements and is in accordance with the methods described in the NRC-endorsed guidance FAQ 06-0008 (Reference 73).

In LAR Attachment T, Prior Approval Clarification Requests 8, 9, and 10, the licensee requested clarification of Licensing Actions 04 and 05 and stated that the original deviation requests were approved for specific fire areas, and that the licensee is requesting that this approval be applied to additional fire areas that were not part of the original deviation. In SSD RAI 13c (Reference 23), the NRC staff stated that it does not consider the additional fire areas that were not part of the scope of the original deviation as a "prior approval clarification." The NRC staff requested that the licensee provide an acceptable means of complying with the requirements of NFPA 805, Chapter 3, in accordance with 10 CFR 50.48(c)(2)(vii), RG 1.205, and the guidance of NEI 04-02. In its response to SSD RAI 13c (Reference 12), the licensee indicated that it would provide LAR Attachment L, Approval Request 5, and delete LAR Attachment T, Prior Approval Clarification Requests 8, 9, and 10, and submitted those revisions. The licensee submitted its revised LAR Attachment L including Approval Request 5 on February 24, 2016 (Reference 15), and updated Approval Request 5 in its letter dated May 12, 2016 (Reference 16). The NRC staff's review of LAR Attachment L, Approval Request 5, is included in SE Section 3.1.4.5. The NRC staff concludes that the licensee's response to SSD RAI 13c is acceptable because the licensee submitted a PB method that evaluates the plant configurations that were not previously approved in Licensing Actions 04 and 05, which is in accordance with 10 CFR 50.48(c)(2)(vii).

In LAR Attachment T, Clarification Request 15, the licensee requested clarification of Licensing Action 30, which approved a deviation for lack of sprinklers in the intake structure common to both Beaver Valley, Unit No. 1, and Beaver Valley, Unit No. 2, because the diesel fire pumps are located in the intake structure compartment (Cubicle 3-IS-4) and the previously approved exemption did not discuss the diesel fire pumps. The licensee stated that a clarification was needed because the diesel fire pumps are required per BTP CMEB 9.5-1 (Reference 93) and NFPA 805, Section 3.9.4, to have automatic sprinkler protection. In SSD RAI 13d (Reference 23), the NRC staff requested that the licensee provide the specific excerpts from its licensing basis documents to demonstrate that the NRC has been aware of and accepted the diesel fire pump room without sprinkler protection. In its response to SSD RAI 13d (Reference 12), the licensee provided excerpts from NRC SER dated June 6, 1979 (Reference 99), a letter from Duquesne Light and Power to the NRC, and the Beaver Valley, Unit No. 2, NUREG-1057 SER (Reference 39), indicating that the fire pumps are located in the intake structure, and therefore, the licensee indicated that it would withdraw LAR Attachment T, Prior Approval Clarification Request 15. The NRC staff concludes that the licensee's response to SSD RAI 13d is acceptable because it provided excerpts from its licensing basis documents

to demonstrate the information for lack of sprinkler system protection in the intake structure applicable to the diesel fire pump, had been previously approved.

In LAR Attachment T, Prior Approval Clarification Request 16, the licensee requested clarification of "prior approval" in LAR Attachment K, as supplemented, Licensing Action 06, for the modified fire door assemblies separating fire areas 2-WH-1 and 2-CP-1 from other fire areas as still adequate without the automatic sprinklers. The licensee stated that these automatic sprinklers were required to satisfy the deviation from Section C.5.a(5) of BTP CMEB 9.5-1 (Reference 93); however, fire areas 2-WH-1 and 2-CP-1 were evaluated using the PB approach, and these automatic sprinklers are no longer necessary. In SSD RAI 13e (Reference 23), the NRC staff clarified that it does not consider the removal of commitments from licensing basis documents as "Prior Approval Clarification" and requested the licensee to provide an appropriate compliance basis for the removal of the automatic sprinklers in accordance with the requirements of 10 CFR 50.48(c) and the guidance of RG 1.205 and NEI 04-02. In its response to SSD RAI 13e (Reference 12), the licensee stated that the compliance basis for the removal of automatic sprinklers for fire compartments 2-WH-1 and 2-CP-1 will be changed to NFPA 805, Section 4.2.4.2, which requires a PB approach consisting of an integrated assessment of the acceptability of risk, DID, and safety margin. The licensee further stated that fire compartments 2-WH-1 and 2-CP-1 are non-risk-significant and a fire in either of these areas will not damage any risk-significant equipment and that the VFDRs written for the evaluation of these fire doors will be included in a revised LAR Attachment A (Table B-1) and LAR Attachment C. The licensee stated that LAR Attachment T, Prior Approval Clarification Request 16, will be withdrawn. The NRC staff concludes that the licensee's response to SSD RAI 13e is acceptable because it evaluated fire compartments 2-WH-1 and 2-CP-1 using PB methods described in Section 4.2.4 of NFPA 805 and determined that the automatic sprinkler systems were not required to meet the requirements of NFPA 805, Chapter 4.

In LAR Attachment T, Prior Approval Request 17, the licensee requested a clarification as "prior approval" in LAR Attachment K, as supplemented, Licensing Action 11.05, that non-safety-related cables in fire area 1-CV-3 that are not fire retardant are acceptable based on the modification to install steel tray covers and to wrap exposed portions of cables. The licensee further stated that the basis for the exemption was that there are low in-situ combustibles in the cable tunnel and that this condition remains valid since the enclosed cables do not present an intervening combustible and it is unlikely for the cables to become ignited in the event of a fire in 1-CV-3. In SSD RAI 13f (Reference 23), the NRC staff requested that the licensee clarify whether or not all "nonfire-retardant" cables in fire area 1-CV-3 are placed in an enclosed tray or wrapped, and if not, to provide a justification for the acceptability of the exposed "nonfire-retardant" cables with respect to flame spread, intervening combustible, and added combustible loading in fire area 1-CV-3. The NRC staff further requested that the licensee provide a comparison between the amount of in-situ combustibles in the current configuration and in the original licensing basis, and if increased, provide a technical basis for acceptability. In its response to SSD RAI 13f (Reference 12), the licensee stated that the "nonfire-retardant" cables in 1-CV-3 are configured in enclosed trays or wrapped with fire-retardant Siltemp material, and that an engineering evaluation determined that "nonfire-retardant" electric cable with respect to qualification, intervening combustibles, and combustible loading in fire area 1-CV-3 is acceptable. The licensee further stated that the comparison between the original in-situ combustibles licensing basis and the current configuration depicts a decrease in combustible loading and that the current in-situ combustible loading is less than 10,000 BTU/ft2, which results in a lower fire severity (greater safety margin) than the previously approved licensing action. The NRC staff concludes that the licensee's response to SSD RAI 13f is acceptable because the technical basis of the approved exemption

is maintained due to having all "nonfire-retardant" cables in fire compartment 1-CV-3 located in enclosed trays or wrapped with a fire-retardant Siltemp material, and the in-situ combustible loading has decreased from the previously approved configuration.

In LAR Attachment T, Prior Approval Clarification Request 5, the licensee requested that the NRC document as "prior approval" with respect to LAR Attachment K, as supplemented, Licensing Actions 11.10 and 11.18, for the increased combustible loading in fire compartment 1-CR-4 from an equivalent fire severity of 45 minutes to 1.38 hours. The licensee stated that the existing condition is acceptable since the increase in combustible loading is still within the 1.5 hour fire barrier rating, a limit of less than 1.5 hours fire loading was established for the process instrumentation room (fire compartment 1-CR-4), and the room will be provided with an incipient detection system as part of the NFPA 805 modifications in LAR Attachment S, as supplemented. In SSD RAI 06 (Reference 23), the NRC staff stated that the basis for and continuing validity of the exemption, and the NRC staff's original evaluation or basis for approval of the exemption, has not been maintained, and therefore, this condition is not considered a "clarification" to the approved exemption. Furthermore, the NRC staff stated that the citation from the NRC SER dated August 30, 1984 (Reference 109), concludes that the 1.5 hour rated doors and ceiling exceed the combustible loading with a "considerable margin." The NRC staff requested that the response discuss how any administrative limit on combustible loading, the incipient detection system, and/or any other fire protection features are credited for offsetting the decrease in the safety margin and its impact on meeting the NSPC requirements of NFPA 805, Section 1.5, in the event that the 1.5-hour rated doors and ceiling were breached due to the increased combustible loading (e.g., risk, DID, and safety margin). The NRC staff also requested that the licensee provide an implementation item in LAR Attachment S, Table S-3, as supplemented, to include an administrative procedure update if a limit on combustible loading is credited for fire compartment 1-CR-4, as well as other appropriate amended pages to the LAR. In its response to SSD RAI 06 (Reference 12), the licensee stated that an engineering evaluation was performed for the barriers separating fire compartment 1-CR-4 from adjacent fire compartments and applied a PB approach that credited the following DID enhancements:

- The floor tiles that provide a barrier that encloses the underfloor cable combustible loading will minimize the likelihood of a fire propagating to the rest of fire compartment 1-CR-4.
- The underfloor Halon gaseous suppression systems will minimize the likelihood of a fire propagating to the rest of 1-CR-4.
- The smoke detection system that is installed in 1-CR-4 will provide an early warning of a fire in 1-CR-4.
- The VEWFDS (the incipient fire detection) that is installed in electrical cabinets located in 1-CR-4 will provide an early warning of a fire in 1-CR-4.
- The incorporation of transient combustible control requirements for 1-CR-4 will limit fire severity to within the evaluated conditions.

The licensee stated that the results of the engineering evaluation determined that the 1.5 hour fire rating of the ceiling and the fire doors associated with fire compartment 1-CR-4 are sufficient to meet the fire barrier performance criteria of NFPA 805, Section 4.2.4, for the adjacent fire compartments. The licensee further stated that this analysis determined that based on the PB approach, there is an acceptable safety margin between the fire hazards in the fire compartments and the associated fire barrier ratings, and that since the barrier is adequate, there is no impact to the NSCA. The licensee stated that LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2907, involves revising the site combustible control

procedures to include additional transient combustible limits for fire compartment 1-CR-4 to maintain the fire loading below the fire barrier rating of less than 1.5 hours. The licensee further stated that because the PB approach was used for the barriers separating fire compartment 1-CR-4 from adjacent compartments and for the fire doors associated with the compartment, it complies with NFPA 805, Sections 3.11.1, 3.11.2, and 3.11.3, and therefore, LAR Attachment K, as supplemented, Licensing Actions 11.09, 11.10, and 11.17, will not be transitioned, and LAR Attachment T, Prior Approval Clarification Requests 5 and 6, will be withdrawn. The licensee indicated that the compliance statement in LAR Attachment A, Table B-1, for fire compartments 1-CS-1, 1-CR-2, 1-CR-3, 1-CR-4, 1-ES-1, 1-ES-2, and 1-MG-1 for Chapter 3, Sections 3.11.2 and 3.11.3 will be revised from "Complies by Previous NRC Approval" to "Complies." The NRC staff concludes that the licensee's response to SSD RAI 06 is acceptable because it credited the PB analysis approach of NFPA 805, Section 4.2.4, to meet the NSPC of NFPA 805, Section 1.5, and that the barriers and ceiling of fire compartment 1-CR-4 comply with NFPA 805, Sections 3.11.2 and 3.11.3.

3.5.3 Fire Protection During Non-Power Operational Modes

NFPA 805, Section 1.1, "Scope," states:

> This standard specifies the minimum fire protection requirements for existing light water nuclear power plants during all phases of plant operation, including shutdown, degraded conditions, and decommissioning.

NFPA 805, Section 1.3.1, "Nuclear Safety Goal," states:

> 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.

The NRC staff reviewed LAR Section 4.3, "Non-Power Operational Modes," and LAR Attachment D, "NEI 04-02 Non-Power Operational Modes Transition," to evaluate the licensee's treatment of potential fire impacts during NPOs. The NRC staff's evaluation determined that the licensee used the process described in NEI 04-02, as modified by FAQ 07-0040 (Reference 79), for demonstrating that the NSPC are met for higher risk evolutions (HREs) during NPO modes.

3.5.3.1 NPO Strategy and Plant Operating States

In LAR Section 4.3 and LAR Attachment D, the licensee stated that the process used to demonstrate that the NSPC are met during NPO modes is consistent with the guidance contained in FAQ 07-0040. As described in LAR Attachment D, the licensee's procedures utilize the DID concept to minimize shutdown risk. The licensee stated that HREs used during plant outages are outage activities or plant conditions during shutdown, which would make the plant more susceptible to an event causing the loss of a key shutdown DID function. The licensee further stated that orange and red risk level activities and conditions are HREs. The license further stated that an example of a shutdown plant condition that is an HRE would be lowering RCS level to mid-loop when time-to-boil is less than 30 minutes, and that shutdown DID contingency plans are developed for HREs.

The licensee stated that identification of HREs is achieved by the use of administrative and operational procedures that have requirements and restrictions that ensure acceptable levels of

risk and DID are maintained based on RCS and fuel pool inventory, decay heat removal capability, and time to core boil.

The licensee stated that Plant Operating States (POS) POS 1, "SG Heat Removal Unavailable," and POS 2 were selected for review to identify the NPO system and components required for shutdown HREs. The licensee stated that POS 3 defined as refueling canal = 23 feet was selected for review to identify any electrical operated component that could potentially spuriously operate and result in an RCS inventory loss.

3.5.3.2 NPO Analysis Process

In LAR Section 4.3.1, the licensee stated that its goal is to ensure that contingency plans are established when the plant is in an NPO mode where the risk is intrinsically high. LAR Section 4.3 discusses these additional controls and measures, and that during low-risk periods, normal risk management controls, as well as fire prevention/protection processes and procedures, will be used.

In LAR Section 4.3.2, the licensee stated that based on FAQ 07-0040 (Revision 4), "Clarification on Non-Power Operations," the POSs were considered for identifying equipment and cable selection to support the key safety functions (KSFs) of inventory control, decay heat removal capability, reactivity control, containment closure, and associated support functions (process cooling and electrical power). The licensee stated that an NFPA 805 analysis model was developed and equipment was logically tied to the supported key safety function (KSF). The licensee further stated that power supplies, interlocks, and supporting equipment were logically tied to their parent component and that for those components that had not been previously analyzed in support of the at-power analysis or whose functional requirements may have been different for the non-power analysis, cable selection was performed in accordance with approved procedures and that cables necessary to support the selected function of a component were selected and analyzed for fire impact.

The licensee stated that in accordance with FAQ 07-0040 (Reference 79), any compartment experiencing fire damage, which eliminates all success paths for a KSF (without RAs outside the MCR) is considered a pinch point. The licensee further stated that FM was not used to eliminate any fire compartment from being a pinch point.

3.5.3.3 NPO KSFs and SSCs Used to Achieve Performance

LAR Attachment D defines the KSFs, and the licensee stated that the following KSFs were evaluated against the POSs for inclusion in the NPO transition review:

- Decay Heat Removal
- Reactor Coolant Inventory Control
- Electrical Power Availability
- Reactivity Control
- Containment Closure
- Spent Fuel Pool Cooling

The licensee stated that the evaluation resulted in the exclusion of the containment closure and spent fuel pool cooling KSFs from further consideration, and that containment access and closure is administratively controlled with requirements for when and how to establish closure

within the necessary timeframes. The licensee further stated that spent fuel pool cooling time-to-boil calculations identify sufficient time to arrange alternate mitigation strategies to protect the spent fuel, and that alternate strategies include inventory makeup from RWST, blender, primary grade water, and river water, and that manual addition of boron to maintain required concentration is also possible.

The licensee stated that all other KSFs identified above were explicitly modeled in the NPO analysis database and equipment was selected based on the systems identified for meeting each applicable KSF. The licensee stated that various modes of operation for each system used to satisfy each KSF were reviewed, and that a comprehensive list of equipment was developed.

The licensee stated that where applicable, the NPO-selected equipment's functional requirement was reviewed against the functions previously analyzed for the at-power analysis and cable selection performed as necessary per applicable project procedures.

The licensee stated that equipment and cables were logically tied and related to the applicable KSF success paths, and that power supplies and other supporting components such as interlocks were also identified, listed, and tied with their component and KSF success paths in the analysis database. The licensee further stated that selected components were flagged as "NPO" within the database to allow 'pinch point' analysis by fire area.

Pinch points refer to plant locations where a single fire may damage all success paths of a KSF.

Based on its review of the information provided in the LAR, as supplemented, the NRC staff concludes that the licensee used methods consistent with the guidance provided in FAQ 07-0040 and RG 1.205 to identify the equipment required to achieve and maintain the fuel in a safe and stable condition during NPO modes. Furthermore, the NRC staff concludes that the licensee has a process in place to ensure that fire protection DID measures will be implemented to achieve the KSFs during plant outages and that any required actions will be completed through implementation items identified in LAR Attachment S, Table S-3, as supplemented, which are required by the proposed license condition.

3.5.3.4 NPO Pinch Point Resolutions and Program Implementation

The licensee stated that it performed a deterministic fire separation analysis to identify pinch points (i.e., areas where redundant equipment and cables credited for a given KSF fail due to fire damage). The licensee further stated that a total of 80 fire compartments at Beaver Valley, Unit No. 1, and 135 fire compartments at Beaver Valley, Unit No. 2, were analyzed, and that a total of 61 fire compartments at Beaver Valley, Unit No. 1, and 97 fire compartments at Beaver Valley, Unit No. 2, were found to have an adequate number of KSF success paths to survive the entire contents loss of the fire compartment. The licensee further stated that overall, 19 compartments at Beaver Valley, Unit No. 1, and 28 compartments at Beaver Valley, Unit No. 2, were found to have pinch points resulting in the potential loss of one or more KSF success paths.

In LAR Attachment D, the licensee stated that to minimize fire risk, fire compartments with identified pinch points were evaluated and plant controls were considered that are consistent with FAQ 07-0040. The licensee stated that in order to preclude or mitigate the KSF failures in certain fire compartments, enhancements will be developed and include planned revisions to the procedures, as necessary. The licensee stated that these revisions will incorporate the

insights and strategies documented in its analyses for the plant to reduce fire risk during HREs. LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2825, addresses the NPO implementation plan, and the NRC staff considers this action acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. The licensee stated that the strategies will include but not be limited to the following based on the actions from FAQ 07-0040:

- Prohibition or limitation of hot work in fire areas during periods of increased vulnerability,
- Verification of operable detection and/or suppression in the vulnerable areas,
- Prohibition or limitation of combustible materials in fire areas during periods of increased vulnerability,
- Use of plant configuration changes (e.g., removing power from equipment once it is placed in its desired position),
- Provision of additional fire patrols at periodic intervals or other appropriate compensatory measures (e.g., surveillance cameras) during increased vulnerability,
- Use of RAs to mitigate potential losses of KSFs,
- Identification and monitoring in-situ ignition sources for "fire precursors" (e.g., equipment temperatures), and
- Reschedule the work to a period with lower risk or higher DID.

In SSD RAI 11 (Reference 23), the NRC staff requested that the licensee describe any actions being credited to minimize the impact of fire-induced spurious actuations of power-operated valves (e.g., air-operated valves and motor-operated valves) during NPO (e.g., pre-fire rack-out, actuation of pinning valves, and isolation of air supplies) and to describe the RAs and instrumentation that are credited to achieve KSFs, including how the RAs are evaluated for feasibility and factored into operating procedures. In its response to SSD RAI 11 (Reference 12), the licensee stated that the NPO modes transition analysis does not credit any specific actions to prevent spurious actuations during NPO; however, pre-positioning has not been excluded as a method of mitigating fire impacts to KSFs. The licensee further stated that it has identified plant configuration changes (such as removing power from valves) as an option to reduce fire risk, and the NPO analysis will be used as reference documents in support of site procedure updates as discussed in LAR Attachment S, Table S-3, as supplemented. The licensee stated that there are no RAs or related instrumentation credited to achieve KSFs during NPO. The NRC staff concludes that the licensee's response to SSD RAI 11 is acceptable because its analysis considered the impact of spurious operations on achieving the KSFs during NPO, and is in accordance with RG 1.205 and FAQ 07-0040.

NFPA 805 requires that the NSPC be met during any operational mode or condition, including NPO. As described above, the licensee has performed the following engineering analyses to demonstrate that it meets this requirement:

- Identified the KSFs required to support the NSPC during NPOs.

- Identified the plant operating states where further analysis is necessary during NPOs.

- Identified the SSCs required to meet the KSFs during the plant operating states analyzed.

- Identified the location of these SSCs and their associated cables.

- Performed analyses on a fire area basis to identify pinch points where one or more KSF could be lost as a direct result of fire-induced damage.

- Planned/implemented modifications to appropriate procedures in order to employ a fire protection strategy for reducing risk at these pinch points during HREs.

Accordingly, based on its review of the information provided in the LAR, as supplemented, the NRC staff concludes that the licensee will provide reasonable assurance that the NSPC are met during NPO modes and HREs because evaluations of power-operated components needed to support NPO KSF have been performed and revisions to procedures in order to employ a fire protection strategy for reducing risk at these pinch points during HREs are included in LAR Attachment S, Table S-3, as supplemented, and are required by the proposed license condition.

3.5.4 Conclusion for Section 3.5

The NRC staff reviewed the licensee's RI/PB FPP as described in the LAR, and its supplements, to evaluate the NSCA results. The licensee used the PB approach in accordance with NFPA 805, 4.2.4.

For those fire areas that utilized a PB approach, the NRC staff verified the following:

- The engineering evaluations form exemptions for Beaver Valley, Unit No. 1, and deviations for Beaver Valley, Unit No. 2, from the existing FPP were evaluated and found to be valid and acceptable for meeting the requirements of NFPA 805, as allowed by NFPA 805, Section 2.2.7.

- Fire suppression effects were evaluated and found to have no adverse impact on the ability to achieve and maintain the NSPC for each fire area.

- All VFDRs were evaluated using the FRE PB approach (in accordance with NFPA 805, Section 4.2.4.2), to address risk impact, DID, and safety margin, and found to be acceptable.

- All RAs necessary to demonstrate the availability of a success path were evaluated with respect to the additional risk presented by their use and found to be acceptable in accordance with NFPA 805, Section 4.2.4.

- All DID-RAs were properly documented for each fire area.

- The required automatic fire suppression and automatic fire detection systems were appropriately documented for each fire area.

Accordingly, the NRC staff concludes that there is reasonable assurance that each fire area utilizing the PB approach does so in accordance with NFPA 805, Section 4.2.4.

The NRC staff's review of the licensee's analysis and outage management process during NPO modes concluded that the licensee provided reasonable assurance that the NSPC will be met

during NPO modes and HREs, and that the licensee used methods consistent with the guidance provided in RG 1.205 and FAQ 07-0040. The NRC staff's review also concluded that no RAs are required during NPO modes and that normal FPP DID actions are credited for addressing the risk impact of those fires that potentially affect one or more trains of equipment that provide a KSF required during NPO modes, but would not be expected to cause the total loss of that KSF. The NRC staff concludes that this overall approach for fire protection during NPO modes is acceptable.

3.6 Radioactive Release Performance Criteria

NFPA 805, Chapter 1, defines the radioactive release goals, objectives, and performance criteria that must be met by the FPP in the event of a fire at an NPP in any plant operational mode.

NFPA 805, Section 1.3.2, "Radioactive Release Goal," 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.

NFPA 805, Section 1.4.2, "Radioactive Release Objective," states that:

> Either of the following objectives shall be met during all operational modes and plant configurations.
>
> (1) Containment integrity is capable of being maintained.
>
> (2) The source term is capable of being limited.

NFPA 805, Section 1.5.2, "Radioactive Release Performance Criteria," states that:

> Radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable 10 CFR, Part 20, limits.

The NRC staff has endorsed (with certain exceptions) the methodology given NEI 04-02 as providing methods acceptable to the staff for establishing an RI/PB FPP consistent with NFPA 805 and 10 CFR 50.48(c) in RG 1.205. Using these methods, the licensee assessed the capability of the current FPP to meet the NFPA 805 performance criteria as contained in NEI 04-02 and FAQ 09-0056, "Radioactive Release Transition."

In order to assess whether the FPP to be implemented under NFPA 805 meets the above requirements, the licensee reviewed pre-fire plans, fire brigade training materials, and engineering controls being credited during all plant operating modes, including full power and non-power conditions. The licensee's review identified the pre-fire plans for those areas where there is no possibility of radioactive materials (contamination) being present (outside of the radiologically controlled area(s) (RCAs) and screened them out from further review. Areas where there was a potential for generation of radioactive effluents created by firefighting activities were identified and included (screened in) for further evaluation. The NRC staff concludes that the scope of the licensee's assessment is adequate because the review included all modes of plant operation and all plant areas.

For each screened-in area where radioactive materials were present such as in the containment building, auxiliary building, radwaste building, and fuel handling building, the licensee's review determined that these areas had adequate engineered controls for containment of liquid and gaseous effluent. Engineering controls credited for containment of gaseous effluents (e.g., forced air ventilation and filtered ventilation exhaust) and liquid effluents (e.g., floor drains and sumps routed to the radioactive waste system) are documented in LAR, Attachment E, "NEI 04-02, Radioactive Review Transition." Operator actions were not credited for mitigating a potential radioactive release. The NRC staff determined that the existing engineering controls in these areas are adequate because prior to discharge, the gaseous effluent is contained, monitored, and filtered to remove radioactive materials, and the liquid effluent is collected, processed, and monitored prior to release.

There are radioactive materials stored in other plant areas such as the yard within the RCA for which there were limited or no engineered controls to contain radioactive gaseous and liquid effluents. The licensee performed a bounding quantitative analysis of the potential public dose from the release of contaminated gaseous effluents resulting from a fire in a sea land storage container fully loaded with radioactive waste. The calculation results bound the dose consequences from a gaseous release for all types of low specific activity containers stored in the RCA yard area and other areas where minor quantities of radioactive materials are stored.

The licensee based its quantitative dose assessment on the type and maximum quantity of radionuclides that are stored in a sea land storage container whose contents were then assumed to be released during a fire. The NRC staff determined that the bounding assessment is based on conservative assumptions and acceptable calculation methods as described in the licensee's Offsite Dose Calculation Manual. The NRC staff concludes that the licensee's analysis uses acceptable methodologies, and the results demonstrate that the maximum offsite dose from the gaseous effluents at the exclusion area boundary are less than the 10 CFR Part 20 dose limits for members of the public and is, therefore, acceptable.

To control liquid effluent releases from firefighting activities in the yard area, the licensee plans to use carbon dioxide, dry chemicals, or similar non-water extinguishing agents to minimize the creation of contaminated water and use temporary dikes to contain potentially contaminated fire suppression water runoff if water is needed for fire suppression. The NRC staff concludes that minimizing water use reduces the potential for contaminated water runoff, thereby providing reasonable assurance that radiation releases from liquid effluents are not expected to exceed the public dose limits in 10 CFR Part 20.

The licensee reviewed the pre-fire plans and determined that the plans need revising to provide guidance for containment and monitoring of smoke and fire suppression agent runoff when the effectiveness of the installed engineered controls may be challenged or impacted by fire suppression activities or are not available. This includes guidance on the need to monitor airborne contamination levels before and during venting operations, and ensuring that liquid runoff from any firefighting activity is monitored and sampled for radioactive contamination. The specific yard area pre-fire plan that was developed to provide guidance for contamination control for fires that may occur in outside yard areas will be revised to include the use of non-water extinguishing agents to minimize the creation of contaminated water and temporary use of dikes for contaminated water if needed. The licensee included these actions in Implementation Items BV1-2371 and BV2-0362, and the NRC staff concludes that these actions are acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

The licensee reviewed the fire brigade training materials to ensure they were consistent with the pre-fire plans in terms of containment and monitoring of potentially contaminated smoke and fire suppression water. The licensee determined that the existing fire brigade training materials did not identify that water used for fire suppression may become contaminated. The fire brigade training materials will be revised to ensure that firefighting personnel are aware of the potential for water contamination and have adequate guidance on containing contaminated liquid effluents. The licensee included these actions in Implementation Items BV1-2371 and BV2-0362, and the NRC staff concludes that these actions are acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

Based on its review of (1) the information provided in the LAR, as supplemented, (2) use of installed and manual engineered controls to contain and monitor potential releases, (3) the development and implementation of newly revised pre-fire plans and fire brigade training procedures, and (4) results of the quantitative analysis, the NRC staff concludes that upon completion of the implementation items, the licensee's RI/PB FPP will provide reasonable assurance that radiation releases to any unrestricted area resulting from the direct effects of fire suppression activities at Beaver Valley are as low as reasonably achievable and are not expected to exceed the public dose limits in 10 CFR Part 20. The NRC staff also finds that upon completion of the implementation items, the licensee's RI/PB FPP will comply with the requirements of NFPA 805, Sections 1.3.2, 1.4.2, and 1.5.2, and that this approach is acceptable.

3.7 NFPA 805 Monitoring Program

3.7.1 Monitoring Program

For this SE section, the following requirements from NFPA 805 (Reference 3), Section 2.6, are applicable to the NRC staff's review of the licensee's LAR:

NFPA 805, Section 2.6, "Monitoring," states that:

> A monitoring program shall be established to ensure that the availability and reliability of the fire protection systems and features are maintained and to assess the performance of the fire protection program in meeting the performance criteria. Monitoring shall ensure that the assumptions in the engineering analysis remain valid.

NFPA 805, Section 2.6.1, "Availability, Reliability, and Performance Levels," states that:

> Acceptable levels of availability, reliability, and performance shall be established.

NFPA 805, Section 2.6.2, "Monitoring Availability, Reliability, and Performance," states that:

> Methods to monitor availability, reliability, and performance shall be established. The methods shall consider the plant operating experience and industry operating experience.

NFPA 805, Section 2.6.3, "Corrective Action," states that:

> If the established levels of availability, reliability, or performance are not met, appropriate corrective actions to return to the established levels shall be implemented. Monitoring shall be continued to ensure that the corrective actions are effective.

The NRC staff reviewed LAR Section 4.6, "Monitoring Program," that the licensee developed to monitor availability, reliability, and performance of FPP systems and features after the transition to NFPA 805. The NRC staff focused on the critical elements related to the monitoring program, including the selection of FPP systems and features to be included in the program, the attributes of those systems and features that will be monitored, and the methods for monitoring those attributes. Implementation of the monitoring program will occur on the same schedule as the NFPA 805 RI/PB FPP implementation, which the NRC staff finds acceptable (see SE Section 2.7).

The licensee stated that it will develop an NFPA 805 monitoring program consistent with the NRC-approved version of FAQ 10-0059 (Reference 85). The licensee further stated that the monitoring program will incorporate phases for scoping, screening using risk criteria, risk target value determination, and monitoring implementation, and that the scope of the program will include fire protection systems and features, NSCA equipment, SSCs relied upon to meet radioactive release criteria, and FPP elements.

Based on its review of the information provided in the LAR, the NRC staff concludes that the licensee's NFPA 805 monitoring program and development and implementation process is acceptable and assures that the licensee will implement an effective program for monitoring risk-significant fires because it:

- Establishes the appropriate SSCs to be monitored;
- Uses an acceptable screening process for determining the SSCs to be included in the monitoring program;
- Establishes availability, reliability, and performance criteria for the SSCs being monitored; and
- Requires corrective actions when SSC availability, reliability, and performance criteria targets are exceeded in order to bring performance back within the required range.

However, since the final values for availability and reliability, as well as the performance criteria for the SSCs being monitored, have not been established for the monitoring program as of the date of this SE, completion of the licensee's NFPA 805 monitoring program is an implementation item addressed in LAR Attachment S, Table S-3, as supplemented, Implementation Item BV1-2989.

The NRC staff concludes that completion of the monitoring program on the same schedule as the implementation of NFPA 805 is acceptable because the monitoring program will be completed with the other implementation items as described in LAR Attachment S, Table S-3, as supplemented, 12 months after NRC approval, which is prior to completion of the

modifications to achieve full compliance with 10 CFR 50.48(c) (which is by the startup of the second refueling outage (for each unit) after issuance of the SER).

3.7.2 Conclusion for Section 3.7

The NRC staff reviewed the licensee's RI/PB FPP and concludes that there is reasonable assurance that the licensee's monitoring program will meet the requirements specified in Sections 2.6, 2.6.1, 2.6.2, and 2.6.3 of NFPA 805 because the licensee identified an action to implement the fire protection monitoring program in accordance with the NRC-approved version of FAQ 10-0059 and included that action as an implementation item that would be required by the proposed license condition.

3.8 Program Documentation, Configuration Control, and Quality Assurance

For this SE, the requirements from NFPA 805 (Reference 3), Section 2.7, "Program Documentation, Configuration Control and Quality," are applicable to the NRC staff's review of the LAR in regard to the appropriate content, configuration control, and quality of the documentation used to support the Beaver Valley FPP transition to NFPA 805.

NFPA 805, Section 2.7.1.1, "General," states that:

> The analyses performed to demonstrate compliance with this standard shall be documented for each nuclear power plant (NPP). The intent of the documentation is that the assumptions be clearly defined and that the results be easily understood, that results be clearly and consistently described, and that sufficient detail be provided to allow future review of the entire analyses. Documentation shall be maintained for the life of the plant and be organized carefully so that it can be checked for adequacy and accuracy either by an independent reviewer or by the AHJ.

NFPA 805, Section 2.7.1.2, "Fire Protection Program Design Basis Document," states that:

> A fire protection program design basis document shall be established based on those documents, analyses, engineering evaluations, calculations, and so forth that define the fire protection design basis for the plant. As a minimum, this document shall include fire hazards identification and nuclear safety capability assessment, on a fire area basis, for all fire areas that could affect the nuclear safety or radioactive release performance criteria defined in Chapter 1.

NFPA 805, Section 2.7.1.3, "Supporting Documentation," states that:

> Detailed information used to develop and support the principal document shall be referenced as separate documents if not included in the principal document.

NFPA 805, Section 2.7.2.1, "Design Basis Document," states that:

> The design basis document shall be maintained up-to-date as a controlled document. Changes affecting the design, operation, or maintenance of the plant shall be reviewed to determine if these changes impact the fire protection program documentation.

NFPA 805, Section 2.7.2.2, "Supporting Documentation," states that:

> Detailed supporting information shall be retrievable records. Records shall be revised as needed to maintain the principal documentation up-to-date.

NFPA 805, Section 2.7.3.1, "Review," states that:

> Each analysis, calculation, or evaluation performed shall be independently reviewed.

NFPA 805, Section 2.7.3.2, "Verification and Validations," 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.

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

> Acceptable engineering methods and numerical models shall only be used for applications to the extent these methods have been subject to verification and validation. These engineering methods shall only be applied within the scope, limitations, and assumptions prescribed for that method.

NFPA 805, Section 2.7.3.4, "Qualification of Users," states that:

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

NFPA 805, Section 2.7.3.5, "Uncertainty Analysis," states that:

> An uncertainty analysis shall be performed to provide reasonable assurance that the performance criteria have been met.

3.8.1 Documentation

The NRC staff reviewed LAR Section 4.7.1, "Compliance with Documentation Requirements in Section 2.7.1 of NFPA 805," to evaluate the Beaver Valley FPP design-basis document and supporting documentation.

The Beaver Valley FPP design basis is a compilation of multiple documents (i.e., fire safety analyses, calculations, engineering evaluations, NSCAs, etc.), databases, and drawings that are identified in LAR Figure 4-9, "NFPA 805 Planned Post-Transition Documentation and Relationships." The licensee stated that the analyses are being performed in accordance with FENOC's processes for ensuring assumptions are clearly defined, results are easily understood, results are clearly and consistently described, and sufficient detail is provided to allow future review of the entire analyses.

The licensee stated that analyses, as defined by NFPA 805, Section 2.4, performed to demonstrate compliance with 10 CFR 50.48(c) will be maintained for the life of the plant and organized to facilitate review for accuracy and adequacy. The licensee further stated that the fire protection design-basis document described in Section 2.7.1.2 of NFPA 805 and necessary supporting documentation described in Section 2.7.1.3 of NFPA 805 have been created as part of the transition to 10 CFR 50.48(c) that will ensure program implementation following receipt of the SER, and that the design-basis documentation is captured in fire protection calculations.

Based on its review of the description provided in the LAR, as supplemented, of the content of the FPP design basis and supporting documentation, and taking into account the licensee's plans to maintain this documentation throughout the life of the plant, the NRC staff concludes that the licensee's approach for meeting the requirements of NFPA 805, Sections 2.7.1.1, 2.7.1.2, and 2.7.1.3 regarding adequate development and maintenance of the FPP design-basis documentation is acceptable.

3.8.2 Configuration Control

The NRC staff reviewed LAR Section 4.7.2, "Compliance with Configuration Control Requirements in Section 2.7.2 and 2.2.9 of NFPA 805," in order to evaluate the licensee's configuration control process.

To support the many other technical, engineering, and licensing programs, the licensee has existing configuration control processes and procedures for establishing, revising, or utilizing program documentation. Accordingly, the licensee is integrating the new FPP design basis and supporting documentation into these existing configuration control processes and procedures. These processes and procedures require that all plant changes be reviewed for potential impact on the various Beaver Valley licensing programs, including the FPP.

The LAR stated that the configuration control process includes provisions for appropriate design, engineering reviews and approvals, and that approved analyses are considered controlled documents available through the document control system. The LAR also stated that analyses based on the PRA program, which includes the FREs, requires the use of qualified individuals, procedures that require calculations be subject to independent review and verification, record retention, peer review, and a corrective action program that ensures appropriate actions are taken when errors are discovered.

Configuration control of the existing FPP during the transition period is maintained by the change evaluation process, as defined in the existing configuration management and configuration control procedures. LAR Attachment S, Table S-3, as supplemented, includes implementation Item BV1-3065 to develop new NFPA 805 control procedures and processes. The NRC staff concludes that this action is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

The NRC staff's review of the licensee's process for updating and maintaining the FPRA in order to reflect plant changes made after completion of the transition to NFPA 805 is discussed in SE Section 3.4.

Based on the description of the configuration control process, which indicates that the new FPP design basis and supporting documentation will be controlled documents and that plant changes will be reviewed for impact on the FPP, the NRC staff concludes that subject to completion of

the implementation items, the licensee's configuration control process provides reasonable assurance that the requirements of NFPA 805, Sections 2.7.2.1 and 2.7.2.2, are met.

3.8.3 Quality

The NRC staff reviewed LAR Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," to evaluate the quality of the engineering analyses used to support transition of the FPP to NFPA 805 based on the requirements outlined above. The individual sections of this SE provide the NRC staff's evaluation of the application of the NFPA 805 quality requirements to the licensee's FPP, as appropriate.

3.8.3.1 Review

NFPA 805, Section 2.7.3.1, requires that each analysis, calculation, or evaluation performed be independently reviewed. The licensee stated that it requires that the calculations and evaluations in support of the NFPA 805 LAR, exclusive of the Fire PRA, be performed within the scope of the QA program, which requires independent review as defined by its procedures. .

The NRC staff concludes that the licensee's approach for meeting the quality requirements of NFPA 805, Section 2.7.3.1, is acceptable because the licensee demonstrated that procedures, analyses, calculations, and evaluations are independently reviewed.

3.8.3.2 Verification and Validation

NFPA 805, Section 2.7.3.2, requires that each calculational model or numerical method used be verified and validated through comparison to test results or other acceptable models. The licensee stated that the calculational models and numerical methods used in support of the transition to NFPA 805 were verified and validated, and that the calculational models and numerical methods used post-transition will be similarly verified and validated. As an example, the licensee provided extensive information related to the V&V of fire models used to support the development of the FREs. The NRC staff's evaluation of this information is discussed below.

3.8.3.2.1 General

NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," Volumes 1-7 (Reference 58), and Supplement 1 (Reference 59), documents the V&V of five selected fire models commonly used to support applications of RI/PB fire protection at NPPs. The seven volumes of this NUREG-series report provide technical documentation concerning the predictive capabilities of a specific set of fire dynamics calculation tools and fire phenomenological models that may be used for the analysis of fire hazards in postulated NPP scenarios. When used within the limitations of the fire models and considering the identified uncertainties, these models may be employed to demonstrate compliance with the requirements of 10 CFR 50.48(c).

Accordingly, for those FM elements performed by the licensee using the V&V applications contained in NUREG-1824, Supplement 1, to support the transition to NFPA 805, the NRC staff concludes that the use of these models is acceptable, provided that the intended application is within the appropriate limitations of the model, as identified in NUREG-1824, Supplement 1.

In LAR Attachment J, as supplemented, the licensee identified the use of several empirical correlations that are not addressed in NUREG-1824, Supplement 1 (see SE Section 3.4.2.3.1). The NRC staff reviewed these correlations, as well as the related material provided in the LAR, in order to determine whether the licensee adequately demonstrated alignment with specific portions of the applicable NUREG-1824, Supplement 1, guidance.

The NRC staff concludes that the theoretical bases of the models and empirical correlations used in the FM calculations that were not addressed in NUREG-1824, Supplement 1, were identified by the NRC staff and described in authoritative publications, peer reviewed journal articles or conference papers, or national research laboratory reports (Reference 148), (Reference 157), (Reference 149), (Reference 150), (Reference 151), (Reference 152), (Reference 158), (Reference 159), (Reference 160), (Reference 161), (Reference 162), (Reference 163), and (Reference 164).

Table 3.8-1, "V&V Basis for Fire Modeling Correlations Used at Beaver Valley," in SE Attachment A and Table 3.8-2, "V&V Basis for Other Fire Models and Related Calculations Used at Beaver Valley," in SE Attachment B, identify these empirical correlations and algebraic models.

The FM employed by the licensee in the development of the FREs used empirical correlations that provide bounding solutions for the ZOI and conservative input parameters, which produced conservative results for the FM analysis.

Based on its review as described above, the NRC staff concludes that this approach provides reasonable assurance that the FM used in the development of the fire scenarios for the Beaver Valley FREs is appropriate, and thus, acceptable for use in transition to NFPA 805 because the V&V of the empirical correlations used by the licensee were consistent with either NUREG-1824, Supplement 1, authoritative publications, peer reviewed journal articles, or national research laboratory reports.

3.8.3.2.2 Discussion of RAIs

By letter dated March 4, 2015 (Reference 23), the NRC staff sought additional information concerning the FM conducted to support the FPRA. By letters dated April 27, 2015 (Reference 10); May 27, 2015 (Reference 11); and June 26, 2015 (Reference 12), the licensee responded to these RAIs.

- In FM RAI 03.a (Reference 23), the NRC staff requested that the licensee provide technical details to demonstrate that it applied the temperature to smoke density correlation within the validated range, or justify the application of the correlation outside the validated range reported in the V&V basis documents.

  In its response to FM RAI 03.a (Reference 11), the licensee explained that 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, and that it applied this correlation within the NUREG-1824 validated range or it provided technical justification in cases in which it used the correlation outside the range. The licensee further explained that the fuels and corresponding smoke properties in the areas where it applied the smoke detection actuation correlation are within the range of the materials that were tested to develop the temperature to smoke

density correlation. In its letter dated April 21, 2017 (Reference 18), the licensee indicated that it applied Alpert's ceiling jet correlation based on the guidance provided in NUREG-1824, Supplement 1 (Reference 59), within the validated range or with appropriate technical justification in cases that were outside the validated range.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee applied the smoke density correlation developed by Heskestad and Delichatsios within the validated range documented in the applicable V&V basis documents.

3.8.3.2.3 Post-Transition

In LAR Section 4.7.3, the licensee stated that post-transition, it will perform work in accordance with NFPA 805, Section 2.7.3, requirements.

3.8.3.2.4 Conclusion for Section 3.8.3.2

Based on its review of the licensee's description of the Beaver Valley process for V&V of calculational models and numerical methods, and their continued use post-transition, the NRC staff concludes that the licensee's approach to meeting the requirements of NFPA 805, Section 2.7.3.2, is acceptable because the models are consistent with approved uses in NRC guidance or authoritative publications, peer reviewed journal articles, or national research laboratory reports, and the licensee identified an action that will result in compliance with NFPA 805, and that action would be required by the proposed license condition.

3.8.3.3 Limitations of Use

NFPA 805, Section 2.7.3.3, requires that acceptable engineering methods and numerical models be used for applications only to the extent that these methods have been subject to V&V and that they are applied within the scope, limitations, and assumptions prescribed for that method. The LAR stated that the engineering methods and numerical models used in support of the transition to NFPA 805 were subject to the limitations of use outlined in NFPA 805, Section 2.7.3.3, and that the engineering methods and numerical models used post-transition will be subject to these same limitations of use.

3.8.3.3.1 General

The NRC staff assessed the acceptability of each empirical correlation and fire model in terms of the limits of its use. SE Table 3.8-1 in SE Attachment A and SE Table 3.8-2 in SE Attachment B, summarize the fire models used, how each was applied in the Beaver Valley FREs, the V&V basis for each, and the NRC staff's evaluation for each.

3.8.3.3.2 Discussion of RAIs

By letter dated March 4, 2015 (Reference 23), the NRC staff sought additional information concerning the FM conducted to support the FPRA. By letters dated April 27, 2015 (Reference 10); May 27, 2015 (Reference 11); and June 26, 2015 (Reference 12), the licensee responded to these RAIs.

- In FM RAI 04.a (Reference 23), the NRC staff requested that the licensee identify applications of algebraic models outside the limits of their applicability, and for these applications explain how their use was justified.

  In its response to FM RAI 04.a (Reference 12), the licensee stated that the limitations and assumptions associated with the algebraic models are documented in NUREG-1805 and NUREG-1824, and that in most cases, it applied the subject correlations within normalized parameter ranges summarized in NUREG-1934. The licensee further explained that in cases where it applied an algebraic model outside the validated range described in NUREG-1934, it justified its use, either by a qualitative assessment or by a quantitative sensitivity analysis. In its letter dated April 21, 2017 (Reference 18), the licensee indicated that it applied the algebraic models based on the guidance provided in NUREG-1824, Supplement 1 (Reference 59), within the validated range or with appropriate technical justification in cases that were outside the validated range.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee used the process described in NUREG-1934 to determine whether an algebraic model was applied within its limits of applicability, and justified the use of the model in cases where it was applied outside these limits.

- In FM RAI 04.b (Reference 23), the NRC staff requested that the licensee identify uses, if any, of CFAST outside the limits of applicability of the model and for those cases explain how it justified the use of CFAST.

  In its response to FM RAI 04.b (Reference 12), the licensee explained that it calculated the normalized parameters summarized in NUREG-1934 for each of the CFAST analyses. The licensee further explained that in cases where it applied the model outside the validated range, it justified its use either by a qualitative assessment or by a quantitative sensitivity analysis.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee identified the applications of CFAST outside its limits of applicability and followed the guidance in NUREG-1934 to justify the use of CFAST in those cases.

- In FM RAI 04.c (Reference 23), the NRC staff requested that the licensee identify uses, if any, of FDS outside the limits of applicability of the model and for those cases explain how it justified the use of FDS.

  In its response to FM RAI 04.c (Reference 12), the licensee explained that the normalized parameters summarized in NUREG-1934 were calculated for each of the FDS analyses. The licensee further explained that in cases where the model was applied outside the validated range, it justified the use of the model either by a qualitative assessment or by a quantitative sensitivity analysis. In its letter dated April 21, 2017 (Reference 18), the licensee indicated that it applied its FDS analysis based on the guidance provided in NUREG-1824, Supplement 1 (Reference 59), within the validated range or with appropriate technical justification in cases that were outside the validated range.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee identified the applications of FDS outside its limits of applicability and followed the guidance in NUREG-1934 to justify the use of FDS in those cases.

3.8.3.3.3 Post-Transition

In LAR Section 4.7.3, the licensee stated that post-transition, it will perform work in accordance with NFPA 805, Section 2.7.3, requirements.

3.8.3.3.4 Conclusion for Section 3.8.3.3

Based on its review of the licensee's statements that the fire models used to support development of the FREs were used within their limitations, and the description of the Beaver Valley process for placing limitations on the use of engineering methods and numerical models, the NRC staff concludes that the licensee's approach to meeting the requirements of NFPA 805, Section 2.7.3.3, is acceptable because the models are consistent with approved uses in NRC guidance or other authoritative publications and the licensee identified actions that will incorporate the provisions of NFPA 805 in the FPP and those actions would be required by the proposed license condition.

3.8.3.4 Qualification of Users

NFPA 805 requires that personnel performing engineering analyses and applying numerical methods (e.g., FM) be competent in that field and experienced in the application of these methods as they relate to NPPs, NPP fire protection, and power plant operations. The licensee's procedures require that cognizant personnel who use and apply engineering analyses and numerical models be competent in the field of application and experienced in the application of the methods, including those personnel performing analyses in support of compliance with 10 CFR 50.48(c).

3.8.3.4.1 General

The requirements related to qualifications of users are being addressed through the implementation of an engineering qualification process at Beaver Valley. The licensee developed procedures that require that cognizant personnel who use and apply engineering analyses and numerical models be competent in the field of application and experienced in the application of the methods, including those personnel performing analyses in support of compliance with 10 CFR 50.48(c).

3.8.3.4.2 Discussion of RAIs

By letter dated March 4, 2015 (Reference 23), the NRC staff sought additional information concerning the FM conducted to support the FPRA. By letters dated April 27, 2015 (Reference 10); May 27, 2015 (Reference 11); and June 26, 2015 (Reference 12), the licensee responded to these RAIs.

- In FM RAI 05.a (Reference 23), the NRC staff requested that the licensee describe the requirements to qualify personnel for performing FM calculations in the NFPA 805 transition.

In its response to FM RAI 05.a (Reference 11), the licensee stated that FM calculations have been, and will be, performed by engineers who meet the qualification requirements of Section 2.7.3.4 of NFPA 805. The licensee further stated that qualification requirements for the contractor personnel that uses, applies, and approves FM include required reading of FM project instructions, relevant industry methodology and guidance documents, and applicable FM software user's guide documents; training or mentoring in fire growth analysis, ZOI calculations, and FM tools; and demonstration of comprehension and proficiency in FM.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the personnel performing FM are appropriately qualified.

- In FM RAI 05.b (Reference 23), the NRC staff requested that the licensee describe the process for ensuring that FM personnel have the appropriate qualifications, not only before the transition but also during and following the transition.

  In its response to FM RAI 05.b (Reference 11), the licensee stated that contract personnel performed FM to support the LAR and FPRA development using their companies' procedures and QA programs, which require that project personnel assigned to each task have the proper experience and training to perform the work. The licensee further stated that during and post-transition, it will continue to use qualified personnel to perform the FM, and that qualification requirements and training will be created to provide a means of qualifying its engineers to perform FM. The licensee also stated that the new guidance, in conjunction with existing training procedures, will ensure personnel performing FM are qualified and that their qualifications are adequately maintained.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its process and procedures ensure that the personnel performing the FM are appropriately qualified.

- In FM RAI 05.c (Reference 23), the NRC staff requested that the licensee describe how proper communication between the FM and FPRA personnel is ensured when FM is performed in support of the FPRA.

  In its response to FM RAI 05.c (Reference 11), the licensee explained that throughout the FPRA process, the FM personnel and the FPRA personnel maintained frequent communications and that it held periodic meetings with the entire FPRA and FM teams, as necessary, to ensure proper communication. The licensee further stated that it developed FM analyses into approved vendor documents that it then used as input to the FPRA, and that these analyses are controlled under the vendor technical information review processes that require that appropriate cross-disciplinary reviews are performed and impacted departments are notified of the change.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated appropriate interactions between FM staff and PRA staff to ensure that FM was adequately performed.

- In FM RAI 05.d (Reference 23), the NRC staff requested that the licensee explain how it ensured consistency between the contractors that were involved in the FM analyses performed in support of the LAR.

  In its response to FM RAI 05.d (Reference 11), the licensee explained that for consistency, it assigned each major FM task (for example, scoping FM, detailed FM, MCA, and MCR analysis) to a single supporting consultant, and therefore, a single vendor procedure and a consistent methodology were utilized for all analyses within each major task. The licensee further stated that all applicable contractor engineering procedures and QA manuals have been reviewed for compliance with its QA program to ensure consistency.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated how it ensured consistency between the multiple supporting consultants that were involved in the FM analyses performed in support of the LAR.

3.8.3.4.3 Post-Transition

The licensee stated that post-transition, for personnel performing FM or FPRA development and evaluation, it developed and maintained qualification requirements for individuals assigned various tasks. The licensee further stated that 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.

3.8.3.4.4 Conclusion for Section 3.8.3.4

Based on the NRC staff's review as discussed above, the NRC staff concludes that the qualification program addresses the requirements of NFPA 805, Section 2.7.3.4, which includes personnel performing engineering analyses and applying numerical methods (e.g., FM) are competent in that field and experienced in the application of these methods as they relate to NPP fire protection and power plant operations.

3.8.3.5 Uncertainty Analysis

NFPA 805 requires that an uncertainty analysis be performed to provide reasonable assurance that the performance criteria have been met (10 CFR 50.48(c)(2)(iv) states that an uncertainty analysis performed in accordance with NFPA 805, Section 2.7.3.5, is not required to support calculations used in conjunction with a deterministic approach). The licensee stated that an uncertainty analysis was performed for the analyses used in support of the transition to NFPA 805, and that an uncertainty analysis will be performed for post-transition analyses.

3.8.3.5.1 General

The industry consensus standard for PRA development (i.e., the ASME/ANS PRA standard (Reference 46)) includes requirements to address uncertainty. Accordingly, the licensee addressed uncertainty as a part of the development of the Beaver Valley FREs. The NRC staff's evaluation of the licensee's treatment of these uncertainties is discussed in SE Section 3.4.7.

NUREG-1855, Volume 1, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk Informed Decision Making" (Reference 61), discusses three types of uncertainty associated with FM calculations as follows:

(1) Parameter Uncertainty: Input parameters are often chosen from statistical distributions or estimated from generic reference data. In either case, the uncertainty of these input parameters affects the uncertainty of the results of the FM analysis.

(2) Model Uncertainty: Idealizations of physical phenomena lead to simplifying assumptions in the formulation of the model equations. In addition, the numerical solution of equations that have no analytical solution can lead to inexact results. Model uncertainty is estimated by the processes of V&V. An extensive discussion of quantifying model uncertainty can be found in NUREG-1934, "Nuclear Power Plant Fire Modeling Application Guide (NPP FIRE MAG)" (Reference 63), and NUREG-1824, Supplement 1 (Reference 59).

(3) Completeness Uncertainty: This refers to the fact that a model is not a complete description of the phenomena it is designed to simulate. Some consider this a form of model uncertainty because most fire models neglect certain physical phenomena that are not considered important for a given application. Completeness uncertainty is addressed by the description of the algorithms found in the model documentation. It is addressed indirectly by the same process used to address the model uncertainty.

3.8.3.5.2 Discussion of RAIs

By letter dated March 4, 2015 (Reference 23), the NRC staff sought additional information concerning the FM conducted to support the FPRA. By letters dated April 27, 2015 (Reference 10); May 27, 2015 (Reference 11); and June 26, 2015 (Reference 12), the licensee responded to these RAIs. The following paragraphs describe the RAI responses related to the associated with the fire models used.

- In FM RAI 06.a (Reference 23), the NRC staff requested that the licensee describe how it addressed and accounted for the uncertainty associated with the FM input parameters in the FM analyses.

  In its response to FM RAI 06.a (Reference 11), the licensee stated that it generally performed FM using conservative methods and input parameters based on NUREG/CR-6850, and that this approach was based upon the current state of knowledge regarding the uncertainties related to the application of the FM tools and associated input parameters for specific plant configurations. The licensee provided a list of examples to illustrate the approach:

  - The majority of the FPRA scenarios involving electrical equipment utilized the 98th percentile HRR for the ZOI.
  - The HRR value for some cabinets was based upon nonqualified internal cable, although 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.

- The radiant and convective fractions were assumed to be 0.4 and 0.7, respectively.
- For transient fire impacts, a large bounding transient zone assumes all targets within its ZOI are affected by a fire, and time to damage is usually calculated based on the closest target.
- In some fire compartments, transient fires assume damage to all targets from the floor to 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.
- For HGL calculations using the MQH correlation, no equipment or structural steel is credited as a heat sink.
- For the non-FDS analyses, as the fire propagates to secondary combustibles, the fire was conservatively modeled as one single fire using the FM closed-form correlations.
- For most scenarios, target damage was assumed to occur when the exposure environment meets or exceeds the damage threshold, and no additional time delay due to thermal response was assumed.
- Oil fires were analyzed as both unconfined and confined spills with 20-minute durations.
- For many scenarios, automatic or manual detection and suppression were not credited.
- Scenarios that identify the time to automatic detection and suppression did not utilize the approach of adding the HGL temperature to the ceiling jet temperature.
- All fires modeled using FDS assumed that the fire does not experience the effects of oxygen deprivation.
- The FDTs generally over-predict HGL temperatures.
- In many cases, cable trays that are partially full were assumed to be filled to capacity.
- For some scenarios, fire propagation to the first cable tray was estimated to be 1 minute.
- Metal top or bottom covers with small and infrequent gaps and cable trays with perforated and corrugated tray covers were not credited to delay damage of target cables.
- 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.
-
- HEAF scenarios were assumed to be at peak fire intensity for 20 minutes from time zero (ignition).
- 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.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that it adequately accounted for the uncertainty associated with the model input parameters by the safety margin created through the use of conservative model input parameter values.

- In FM RAI 06.b (Reference 23), the NRC staff requested that the licensee describe how it accounted for the "model" and "completeness" uncertainties in the FM analyses.

  In its response to FM RAI 06.b (Reference 11), the licensee explained that it did not explicitly account for model and completeness uncertainty in all FM evaluations, and that they were addressed through the use of conservative and bounding analyses and by the selection of FM tools that have been through the V&V process contained in NUREG-1824 and further documented in NUREG-1934. The licensee provided a detailed discussion of the conservatisms in the FDT^s, FDS, and CFAST calculations. The licensee also stated that it addressed completeness uncertainty by the same process used to address the model uncertainty.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that it properly accounted for model uncertainty and completeness uncertainty through the use of conservative and bounding analyses and by the selection of FM tools that have been through the V&V process.

3.8.3.5.3 Post-Transition

In LAR Section 4.7.3, the licensee stated that post-transition, it will perform work in accordance with NFPA 805, Section 2.7.3 requirements.

3.8.3.5.4 Conclusion for Section 3.8.3.5

Based on its review of the licensee's description of the process for performing an uncertainty analysis, the NRC staff concludes that the licensee's approach for meeting the requirements of NFPA 805, Section 2.7.3.5, is acceptable.

3.8.3.6 Conclusion for Section 3.8.3

Based on its review as discussed above, the NRC staff concludes that the RI/PB fire protection QA program adequately addresses each of the requirements of NFPA 805, Section 2.7.3, which include conducting independent reviews, performing V&V, limiting the application of acceptable methods and models to within prescribed boundaries, ensuring that personnel applying acceptable methods and models are qualified, and performing uncertainty analyses.

3.8.4 Fire Protection Quality Assurance Program

GDC 1 of Appendix A to 10 CFR Part 50 states:

> Structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

The guidance in Appendix C to NEI 04-02 (Reference 7) suggests that the LAR include a description of how the existing fire protection QA program will be transitioned to the new NFPA 805 RI/PB FPP.

In LAR Section 4.7.3, the licensee stated that it will maintain the existing fire protection QA program and that during the transition to 10 CFR 50.48(c), it performed work in accordance with the quality requirements of Section 2.7.3 of NFPA 805. The LAR described how the fire protection QA program meets the applicable requirements of NFPA 805, Sections 2.7.3.1 through 2.7.3.5, and also stated that post-transition, the licensee will perform work in accordance with NFPA 805, Section 2.7.3, requirements.

Based on its review and the above explanation, the NRC staff concludes that the licensee's fire protection QA program is acceptable because it provides reasonable assurance that the requirements of NFPA 805, Section 2.7.3.1 through 2.7.3.5, are met.

3.8.5 Conclusion for Section 3.8

The NRC staff reviewed the licensee's RI/PB FPP as described in the LAR, as supplemented, to evaluate the NFPA 805 program documentation content, the associated configuration control process, and the appropriate QA requirements. The NRC staff concludes that the licensee's approach for meeting the requirements specified in NFPA 805, Section 2.7, is acceptable.

4.0 FIRE PROTECTION LICENSE CONDITION

The licensee proposed an FPP license condition regarding transition to an RI/PB FPP under NFPA 805, in accordance with 10 CFR 50.48(c)(3)(i). The new license condition adopts the guidelines of the standard fire protection license condition promulgated in RG 1.205, Revision 1, Regulatory Position C.3.1, as issued on December 18, 2009 (74 FR 67253). Plant-specific changes were made to the sample license condition. However, the proposed plant-specific FPP license condition is consistent with the standard fire protection license condition, incorporates all of the relevant features of the transition to NFPA 805 at Beaver Valley, Unit Nos. 1 and 2, and the NRC staff concludes that it is acceptable.

The following license condition is included in the revised renewed facility operating licenses and will replace Renewed Facility Operating License Nos. DPR-66, Condition 2.C(5), for Unit No. 1, and Renewed Facility Operating License Nos. NPF-73, Condition 2.F, for Unit No. 2:

> Fire Protection Program
>
> FENOC shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the license amendment request dated December 23, 2013 (as supplemented by letters dated February 14, 2014; April 27, May 27, June 26, November 6, and December 21, 2015; February 24 and May 12, 2016; and January 30, April 21, June 23, August 22, October 25, and November 29, 2017), and as approved in the safety evaluation dated January 22, 2018. Except where NRC approval for changes or deviations is required by 10 CFR 50.48(c), and provided no other regulation, technical specification, license condition, or requirement would require prior NRC approval, the licensee may make changes to the fire protection program without prior approval of the Commission if those changes satisfy the provisions set forth in 10 CFR 50.48(a) and 10 CFR 50.48(c), the change does not require a change to a technical specification or a license condition, and the criteria listed below are satisfied.

(a) Risk-Informed Changes that May Be Made Without Prior NRC Approval

A risk assessment of the change must demonstrate that the acceptance criteria below are met. The risk assessment approach, methods, and data shall be acceptable to the NRC and shall be appropriate for the nature and scope of the change being evaluated; be based on the as-built, as-operated, and maintained plant; and reflect the operating experience at the plant. Acceptable methods to assess the risk of the change may include methods that have been used in the peer-reviewed fire PRA model, methods that have been approved by NRC through a plant-specific license amendment or NRC approval of generic methods specifically for use in NFPA 805 risk assessments, or methods that have been demonstrated to bound the risk impact.

1. Prior NRC review and approval is not required for a change that results in a net decrease in risk. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

2. Prior NRC review and approval is not required if the change results in a risk increase less than 1E-7/yr for core damage frequency and less than 1E-8/yr for large early release frequency. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

(b) Other Changes that May be Made Without Prior NRC Approval

1. Changes to NFPA 805, Chapter 3, Fundamental Fire Protection Program

   Prior NRC review and approval are not required for changes to the NFPA 805, Chapter 3, fundamental fire protection program elements and design requirements for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is functionally equivalent or adequate for the hazard. The licensee may use an engineering evaluation to demonstrate that a change to an NFPA 805, Chapter 3, element is functionally equivalent to the corresponding technical requirement. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

   The licensee may use an engineering evaluation to demonstrate that changes to certain NFPA 805, Chapter 3, elements are acceptable because the alternative is "adequate for the hazard." Prior NRC review and approval would not be required for alternatives to four specific sections of NFPA 805, Chapter 3, for which an engineering evaluation demonstrates that the alternative to the Chapter 3 element is adequate

for the hazard. A qualified fire protection engineer shall perform the engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

The four specific sections of NFPA 805, Chapter 3, are as follows:

- Fire Alarm and Detection Systems (Section 3.8)
- Automatic and Manual Water-Based Fire Suppression Systems (Section 3.9)
- Gaseous Fire Suppression Systems (Section 3.10)
- Passive Fire Protection Features (Section 3.11)

This license condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

2. Fire Protection Program Changes that Have No More than Minimal Risk Impact

   Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC SE dated January 22, 2018, to determine that certain fire protection program changes meet the minimal criterion. The licensee shall ensure that fire protection defense-in-depth and safety margins are maintained when changes are made to the fire protection program.

(c) Transition License Conditions

1. Before achieving full compliance with 10 CFR 50.48(c), as specified by (2) below, risk-informed changes to the licensee's fire protection program may not be made without prior NRC review and approval unless the change has been demonstrated to have no more than a minimal risk impact, as described in (2) above.

2. The licensee shall implement the Unit 1 (2) modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," in FENOC letter L-17-122, dated April 21, 2017, to complete the transition to full compliance with 10 CFR 50.48(c), by the completion of the second Unit 1 (2) refueling outage after issuance of the safety evaluation. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

3. The licensee shall implement the items listed in Attachment S, Table S-3, "Implementation Items," of FENOC letter L-17-268, dated August 22, 2017, by 12 months after issuance of the safety evaluation (with the exception of Items BV1-1633, BV1-2974, BV1-3060, BV1-3108, BV1- 3109, BV2-1580, BV2-1622, BV2-1623, and

BV2-1750, which are to be completed by the end of the second Unit 1 (2) refueling outage after issuance of the safety evaluation).

5.0 SUMMARY

The NRC staff reviewed the licensee's application, as supplemented by various letters, to transition to an RI/PB FPP in accordance with the requirements established by NFPA 805. The NRC staff concludes that subject to completion of the modifications and implementation items in LAR Attachment S, the applicant's approach, methods, and data are acceptable to establish, implement, and maintain an RI/PB FPP in accordance with 10 CFR 50.48(c).

Accordingly, implementation of the RI/PB FPP in accordance with 10 CFR 50.48(c) is reflected by a new fire protection license condition, which identifies the list of implementation items that must be completed in order to support the conclusions made in this SE, and establishes a date by which full compliance with 10 CFR 50.48(c) will be achieved. Before the licensee is able to fully implement the transition to an FPP based on NFPA 805 and apply the new fire protection license condition to its full extent, the implementation items must be completed within the timeframe specified.

6.0 STATE CONSULTATION

In accordance with the Commission's regulations, the NRC staff notified the State of Pennsylvania official on November 2, 2017, of the proposed issuance of the amendments. The State official had no comments.

7.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding published in the *Federal Register* on September 9, 2014 (79 FR 53458). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

8.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner; (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations; and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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Attachments:

A. Table 3.8-1 - V&V Basis for Fire Modeling Correlations Used at Beaver Valley
B. Table 3.8-2 - V&V Basis for Fire Modeling Calculations of Other Models Used at Beaver Valley
C. Abbreviations and Acronyms

Attachment A: Table 3.8-1, V&V Basis for FM Correlations Used at Beaver Valley

Correlation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
Flame Height (Method of Heskestad)	The Flame Height correlation was implemented in the Fire Modeling Workbook (FMWB). The correlation was used to determine the vertical extension of the flame region as part of the zone of influence (ZOI) calculations.	NUREG-1805, Chapter 3, (Reference 57) NUREG-1824, Supplement 1 (Reference 59) Society of Fire Protection Engineers (SFPE) Handbook, Chapter 2-1 (Reference 148)	• The licensee provided verification of the FMWB on the basis of comparison with NUREG-1805. • The correlation is validated in NUREG-1824, Supplement 1, and the SFPE Handbook of Fire Protection Engineering. • The licensee stated that in most cases, it applied the correlation within the validated range reported in NUREG-1824, Supplement 1. The licensee provided justification for cases where it used the correlation outside the validated range reported in NUREG-1824, Supplement 1. (see response to FM RAI 04.a (Reference 12)) Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.

Attachment A: Table 3.8-1, V&V Basis for FM Correlations Used at Beaver Valley

Correlation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
Plume Centerline Temperature (Method of Heskestad)	The Plume Centerline Temperature correlation was implemented in the FMWB. The correlation was used to determine vertical separation distance, based on temperature, to a target in order to determine the vertical extent of the ZOI.	NUREG-1805, Chapter 9 (Reference 57) NUREG-1824, Supplement 1 (Reference 59) SFPE Handbook, Chapter 2-1 (Reference 148)	• The licensee provided verification of the FMWB on the basis of comparison with NUREG-1805. • The correlation is validated in NUREG-1824, Supplement 1, and the SFPE Handbook of Fire Protection Engineering. • The licensee stated that in most cases, it applied the correlation within the validated range reported in NUREG-1824, Supplement 1. The licensee provided justification for cases where it used the correlation outside the validated range reported in NUREG-1824, Supplement 1. (see response to FM RAI 04.a (Reference 12)) Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.
Radiant Heat Flux (Point Source Method)	The Radiant Heat Flux (Point Source Method) correlation was implemented in the FMWB. The correlation was used to determine the horizontal separation distance, based on heat flux, to a target in order to determine the horizontal extent of the ZOI.	NUREG-1805, Chapter 5 (Reference 57) NUREG-1824, Supplement 1 (Reference 59) SFPE Handbook, Chapter 3-10 (Reference 158)	• The licensee provided verification of the FMWB on the basis of comparison with NUREG-1805. • The correlation is validated in NUREG-1824, Supplement 1, and the SFPE Handbook of Fire Protection Engineering. • The licensee stated that in most cases, it applied the correlation within the validated range reported in NUREG-1824, Supplement 1. The licensee provided justification for cases where it used the correlation outside the validated range reported in NUREG-1824, Supplement 1. (see response to FM RAI 04.a (Reference 12)) Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.

Attachment A: Table 3.8-1, V&V Basis for FM Correlations Used at Beaver Valley

Correlation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
Plume Radius (Method of Heskestad)	The Plume Radius (Method of Heskestad) correlation was implemented in the FMWB. The correlation was used to calculate the horizontal radius, based on temperature of the plume at a given height. The plume radius was used in the horizontal ZOI, determination.	NUREG-1824, Supplement 1, (Reference 59) SFPE Handbook, Chapter 2-1 (Reference 148)	• The licensee stated that the plume radius was not used as the sole basis for any target failures. • The licensee provided verification of the FMWB on the basis of comparison with NUREG-1805 • The correlation is validated in the SFPE Handbook of Fire Protection Engineering. • The plume radius correlation is derived from Heskestad's plume centerline temperature correlation, for which V&V is documented in NUREG-1824. The plume radius correlation is subject to the same validated ranges. Based on its review and explanation, the NRC staff concludes that the use of this correlation is acceptable.
Hot Gas Layer (Method of McCaffrey, Quintiere, and Harkleroad (MQH)	The HGL MQH temperature correlation was implemented in the FMWB. The correlation was used to calculate the HGL temperature for a room with natural ventilation.	NUREG-1805, Chapter 2 (Reference 57) NUREG-1824, Supplement 1 (Reference 59) SFPE Handbook, Chapter 3-6 (Reference 164)	• The licensee provided verification of the FMWB on the basis of comparison with NUREG-1805. • The correlation is validated in NUREG-1824, Supplement 1, and the SFPE Handbook of Fire Protection Engineering. • The licensee stated that in most cases, it applied the correlation within the validated range reported in NUREG-1824, Supplement 1. The licensee provided justification for cases where it used the correlation outside the validated range reported in NUREG-1824, Supplement 1. (see response to FM RAI 04.a (Reference 12)) Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.

Attachment A: Table 3.8-1, V&V Basis for FM Correlations Used at Beaver Valley

Correlation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
Ceiling Jet Temperature (Method of Alpert)	The Ceiling Jet Temperature (Method of Alpert) correlation was implemented in the FMWB. The correlation was used to calculate horizontal separation distance, based on temperature at the ceiling of a room, to a target in the determination of the horizontal extent of the ZOI.	NUREG-1824, Supplement 1 (Reference 59) SFPE Handbook, Chapter 2-2 (Reference 157)	• The licensee provided verification of the FMWB on basis of comparison with NUREG-1805. • The correlation is validated in NUREG-1824, Supplement 1, and the SFPE Handbook of Fire Protection Engineering. • The licensee stated that in most cases, it applied the correlation within the validated range reported in NUREG-1824, Supplement 1. The licensee provided justification for cases where it used the correlation outside the validated range reported in NUREG-1824, Supplement 1. (see response to FM RAI 04.a (Reference 12)) Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.

Attachment A: Table 3.8-1, V&V Basis for FM Correlations Used at Beaver Valley

Correlation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
Smoke Detection Actuation Correlation (Method of Heskestad and Delichatsios)	The Smoke Detector Actuation correlation (Method of Heskestad and Delichatsios) was implemented in the FMWB. The correlation was used to estimate smoke detector actuation time based on ceiling jet temperature, velocity, and thermal response of detector. The method of Heskestad and Delichatsios was used to calculate the activation time.	NUREG-1805, Chapter 11 (Reference 57) NUREG-1824, Supplement 1 (Reference 59) SFPE Handbook, Chapter 4-1 (Reference 149)	• The licensee provided verification of the FMWB on the basis of comparison with NUREG-1805. • The correlation is validated in the SFPE Handbook of Fire Protection Engineering. • The licensee stated that in most cases, it applied the correlation within the validated range reported in NUREG-1824, Supplement 1. The licensee provided justification for cases where it used the correlation outside the validated range reported in NUREG-1824, Supplement 1 (Response to FM RAI 03.a (Reference 11)). Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.

Attachment A: Table 3.8-1, V&V Basis for FM Correlations Used at Beaver Valley

Correlation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
Heat Detection Actuation Correlation	The Heat Detector Actuation correlation was implemented in the FMWB. The correlation was used to estimate heat detector actuation time based on ceiling jet temperature, velocity, and thermal response of detector.	NUREG-1805, Chapter 12 (Reference 57) NUREG-1824, Supplement 1 (Reference 59) NFPA Handbook, Chapter 3-9 (Reference 150)	• The licensee provided verification of the FMWB on the basis of comparison with NUREG-1805. • The correlation is validated in the National Fire Protection Association, Fire Protection Handbook. • The licensee stated that in most cases, it applied the correlation within the validated range reported in NUREG-1824, Supplement 1. The licensee provided justification for cases where it used the correlation outside the validated range reported in NUREG-1824, Supplement 1. Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.
Sprinkler Activation Correlation	Sprinkler Activation Correlation was implemented in the FMWB. The correlation was used to estimate sprinkler actuation time based on ceiling jet temperature, velocity, and thermal response of sprinkler.	NUREG-1805, Chapter 10 (Reference 57) NUREG-1824, Supplement 1 (Reference 59) NFPA Handbook, Chapter 3-9 (Reference 150)	• The licensee provided verification of the FMWB on the basis of comparison with NUREG-1805. • The correlation is validated in the National Fire Protection Association, Fire Protection Handbook. • The licensee stated that in most cases, it applied the correlation within the validated range reported in NUREG-1824, Supplement 1. The licensee provided justification for cases where it used the correlation outside the validated range reported in NUREG-1824, Supplement 1. Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.

Attachment A: Table 3.8-1, V&V Basis for FM Correlations Used at Beaver Valley

Correlation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
Correlation for Heat Release Rates of Cables (Method of Lee)	Method of Lee was used to correlate bench scale data to HRRs from cable tray fires.	NUREG/CR-6850, Appendix R (Reference 52) NBSIR 85-3195 (Reference 151)	• The modeling technique is documented in an authoritative publication of NIST, formerly NBS. • The licensee stated that it applied the correlation within the range of its applicability. Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.
Corner and Wall HRR	The method was used to account for location effects on the vertical ZOI of wall and corner fires. This adjustment was implemented in the FMWB.	SFPE Handbook, Chapter 2-14 (Reference 152)	• The method is validated in the SFPE Handbook of Fire Protection Engineering. Based on its review and the licensee's explanation, the NRC staff concludes that the use of this method is acceptable.
Correlation for Flame Spread over Horizontal Cable Trays (FLASH-CAT)	The FLASH-CAT method was used to calculate the growth and spread of a fire within a vertical stack of horizontal cable trays.	NUREG/CR-7010, Volume 1, Section 9 (Reference 60)	• The modeling technique is validated in an authoritative publication of NIST. • The licensee stated that it applied the correlation within the range of its applicability. Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.

Attachment A: Table 3.8-1, V&V Basis for FM Correlations Used at Beaver Valley

Correlation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
Obstructed Plume Centerline Temperature (Method of Heskestad, modified)	The method was used to calculate the adjusted vertical separation distance in an obstructed fire plume, based on temperature, to a target in order to determine the vertical extent of the ZOI.	NUREG-1805, Chapter 9 (Reference 57) NUREG-1824, Supplement 1, (Reference 59) SFPE Handbook, Chapter 2-1 (Reference 148)	• The correlation is validated in NUREG-1824, Supplement 1, and the SFPE Handbook of Fire Protection Engineering. • The licensee stated that in most cases, it applied the correlation within the validated range reported in NUREG-1824, Supplement 1. The licensee provided justification for cases where it used the correlation outside the validated range reported in NUREG-1824, Supplement 1. Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.
Obstructed Plume Radius	This method was used to calculate the adjusted horizontal radius of the plume, using a plume angle and the height above the fire source.	NUREG-2178, Volume 1 (Reference 142)	• The correlation is validated in NUREG-2178. • The licensee stated that it applied the correlation within the guidelines outlined in NUREG-2178. Based on its review and the licensee's explanation, the NRC staff concludes that the use of this correlation is acceptable.

Attachment B: Table 3.8-2, V&V Basis for Other Fire Models and Related Calculations Used at Beaver Valley, Unit No. 1, and Beaver Valley, Unit No. 2

Calculation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
Consolidated Model of Fire and Smoke Transport (Version 6) Control Room Abandonment Calculation	CFAST (Version 6) was used to calculate abandonment time for the Beaver Valley, Unit No. 1 and Beaver Valley, Unit No. 2, MCRs.	NUREG-1824, Volume 6 (Reference 58) NIST Special Publication 1086 (Reference 163)	• The modeling technique is validated in NUREG-1824 and an authoritative publication of NIST. • The licensee stated that in most cases, it applied the model within the validated range reported in NUREG-1824. The licensee provided justification for cases where it used the model outside the validated range reported in NUREG-1824. (see response to FM RAI 04.b (Reference 12)) Based on its review and the licensee's explanation, the NRC staff concludes that the use of CFAST for the MCR abandonment time calculations is acceptable.
HGL Calculations using Consolidated Model of Fire and Smoke Transport (Version 6)	CFAST (Version 6) was used in selected compartments to calculate the HGL temperature, and in the MCA to calculate the upper and lower gas layer temperatures and the layer height in connected compartments.	NUREG-1824, Volume 5 (Reference 58) NIST Special Publication 1086 (Reference 163)	• The modeling technique is validated in NUREG-1824, Supplement 1, and an authoritative publication of NIST. • The licensee stated that in most cases, it applied the model within the validated range reported in NUREG-1824, Supplement 1. The licensee provided justification for cases where it used the model outside the validated range reported in NUREG-1824, Supplement 1. (see response to FM RAI 04.b (Reference 12)) Based on its review and the licensee's explanation, the NRC staff concludes that the use of CFAST for the HGL calculations is acceptable.

Attachment B: Table 3.8-2, V&V Basis for Other Fire Models and Related Calculations Used at Beaver Valley, Unit No. 1, and Beaver Valley, Unit No. 2

Calculation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
Temperature Sensitive Equipment Hot Gas Layer Study	CFAST (Version 6) was used to calculate the upper and lower gas layer temperatures for various compartments, and the layer height, for use in assessment of damage to temperature sensitive equipment's.	NUREG-1824, Volume 5 (Reference 58) NIST Special Publication 1086 (Reference 163)	• The modeling technique is validated in NUREG-1824 and an authoritative publication of NIST. • The licensee stated that in most cases, it applied the model within the validated range reported in NUREG-1824. The licensee provided justification for cases where it used the model outside the validated range reported in NUREG-1824. (see response to FM RAI 04.b (Reference 12)) Based on its review and the licensee's explanation, the NRC staff concludes that the use of CFAST for the temperature sensitive equipment HGL study is acceptable.
Temperature Sensitive Equipment ZOI Study using FDS	FDS (Version 5) was used to calculate the radiant heat flux ZOI at which temperature sensitive equipment will reach damage thresholds.	NUREG-1824, Volume 7 (Reference 58) NIST Special Publication 1018-5 Volume 2 (Reference 159) NIST Special Publication 1018-5 Volume 3 (Reference 160)	• The modeling technique is validated in NUREG-1824 and authoritative publications of NIST. • The licensee stated that in most cases, it applied the model within the validated range reported in NUREG-1824. The licensee provided justification for cases where it used the model outside the validated range reported in NUREG-1824. (see response to FM RAI 04.c (Reference 12)) Based on its review and the licensee's explanation, the NRC staff concludes that the use of FDS for the temperature sensitive equipment ZOI study is acceptable.

Attachment B: Table 3.8-2, V&V Basis for Other Fire Models and Related Calculations Used at Beaver Valley, Unit No. 1, and Beaver Valley, Unit No. 2

Calculation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
Plume/Hot Gas Layer Interaction Study using FDS	FDS (Version 5) was used to locate the point where hot gas layer and plume interact and establish limits for plume temperature correlation.	NUREG-1824, Volume 7, 2007 (Reference 58) NIST Special Publication 1018-5 Volume 2 (Reference 159) NIST Special Publication 1018-5 Volume 3 (Reference 160)	• The modeling technique is validated in NUREG-1824 and authoritative publications of NIST. • The licensee stated that in most cases, it applied the model within the validated range reported in NUREG-1824. The licensee provided justification for cases where it used the model outside the validated range reported in NUREG-1824. (see response to FM RAI 04.c (Reference 12)) Based on its review and the licensee's explanation, the NRC staff concludes that the use of FDS for the plume/HGL interaction study is acceptable.
1-NS-1 Fire Door Temperature Analysis Using FDS	FDS (Version 6) was used to calculate the temperature of fire door S13-11 and its frame on both exposed and unexposed faces during a fire event.	NUREG-1824, Supplement 1 (Reference 59) NIST Special Publication 1018-2 (Reference 161) NIST Special Publication 1018-3 (Reference 162)	• The modeling technique is validated in NUREG-1824 and authoritative publications of NIST. • The licensee stated that in most cases, it applied the model within the validated range reported in NUREG-1824. The licensee provided justification for cases where it used the model outside the validated range reported in NUREG-1824. Based on its review and the licensee's explanation, the NRC staff concludes that the use of FDS to calculate the temperature of fire door S13-11 and its frame is acceptable.

Attachment B: Table 3.8-2, V&V Basis for Other Fire Models and Related Calculations Used at Beaver Valley, Unit No. 1, and Beaver Valley, Unit No. 2

Calculation	Application at Beaver Valley, Unit No. 1 & Beaver Valley, Unit No. 2	V&V Basis	NRC Staff's Evaluation of Acceptability
2-CB-1 Target Damage Analysis Using FDS	FDS (Version 6) was used to determine target temperature rise and target radiant heat flux time damage of select FPRA raceways and equipment.	NUREG-1824, Supplement 1 (Reference 59) NIST Special Publication 1018-2 (Reference 161) NIST Special Publication 1018-3 (Reference 162)	• The modeling technique is validated in NUREG-1824 and authoritative publications of NIST. • The licensee stated that in most cases, it applied the model within the validated range reported in NUREG-1824. The licensee provided justification for cases where it used the model outside the validated range reported in NUREG-1824. Based on its review and the licensee's explanation, the NRC staff concludes that the use of FDS to determine target temperature rise and target radiant heat flux time damage of select FPRA raceways and equipment is acceptable.

Abbreviations and Acronyms

AC	alternating current
ADAMS	Agencywide Documents Access and Management System
AFW	auxiliary feedwater
AHJ	authority having jurisdiction
ANS	American Nuclear Society
APCSB	Auxiliary and Power Conversion Systems Branch
ASME	American Society of Mechanical Engineers
ASP	alternate shutdown panel
ASTM	American Society for Testing and Material
BTP	Branch Technical Position
BVPS	Beaver Valley Power Station
BWR	boiling-water reactor
°C	degrees Celsius
CC	capability categories
CCDP	conditional core damage probability
CDF	core damage frequency
CFAST	consolidated model of fire and smoke transport
CFR	*Code of Federal Regulations*
CHRISTIFIRE	Cable Heat Release, Ignition, and Spread in Tray Installations During Fire
CT	current transformers
°F	degrees Fahrenheit
DC	direct current
DID	defense-in-depth
EDG	emergency diesel generator
EEEE	existing engineering equivalency evaluation
EPRI	Electric Power Research Institute
ERF	Emergency Response Facility
ERFBS	electrical raceway fire barrier system
ERO	emergency response organization
F&O	fact and observation
FAQ	frequently asked question
FDS	fire dynamics simulator
FENOC	FirstEnergy Nuclear Operating Company
FLASH-CAT	Flame Spread over Horizontal Cable Tray
FM	fire modeling
FMWB	Fire Modeling Workbook
FPE	fire protection engineering
FPP	fire protection program
FPRA	fire probabilistic risk assessment
FR	*Federal Register*
FRE	fire risk evaluation

FSAR	final safety analysis report
GDC	General Design Criterion/Criteria
GL	Generic Letter
HEAF	high-energy arcing fault
HEP	human error probability
HFE	human failure event
HGL	hot gas layer
HRA	human reliability analysis
HRE	high(er) risk evolution
HRR	heat release rate
HRRPUA	heat release rate per unit area
HVAC	heating, ventilation, and air conditioning
IEEE	Institute of Electrical and Electronics Engineers
IEPRA	internal events probabilistic risk assessment
KSF	key safety function
kW	kilowatt
LAR	license amendment request
LERF	large early release frequency
MCA	multi-compartment analysis
MCB	main control board
MCC	motor control center
MCR	main control room
MQH	Method of McCaffrey, Quintiere and Harkleroad
MSO	multiple spurious operations
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NPO	non-power operation
NPP	nuclear power plant
NRC	U.S. Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
NSCA	nuclear safety capability assessment
NSPC	nuclear safety performance criteria
OMA	operator manual action
PAU	physical analysis unit
PB	performance-based
PCE	plant change evaluation
PCS	primary control station
P&ID	piping and instrumentation diagram
PORV	power-operated relief valve
POS	plant operating state
PRA	probabilistic risk assessment
PSA	probabilistic safety assessment

Psi	pounds per square inch
PWR	pressurized-water reactor
PWROG	Pressurized Water Reactors Owners Group
QA	quality assurance
RA	recovery action
RAI	request for additional information
RCA	radiologically controlled area
RCP	reactor coolant pump
RCS	reactor coolant system
RES	Office of Nuclear Regulatory Research
RG	Regulatory Guide
RHR	residual heat removal
RI	risk-informed
RI/PB	risk-informed, performance-based
RWST	refueling water storage tank
SE	safety evaluation
SER	safety evaluation report
SFPE	Society of Fire Protection Engineers
SG	steam generator
SOKC	state-of-knowledge correlation
SR	supporting requirement
SSA	safe shutdown analysis
SSC	structures, systems, and component
SSD	safe shutdown
TR	technical/topical report
TS	technical specification
UFSAR	updated final safety analysis report
UL	Underwriters Laboratories
V	volts
VAC	volts alternating current
V&V	verification and validation
VCT	volume control tank
VDC	volts direct current
VEWFDS	Very Early Warning Fire Detection Systems
VFDR	variance from deterministic requirement
yr	year
ZOI	zone of influence

SUBJECT: BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2 – ISSUANCE OF AMENDMENTS RE: TRANSITION TO NFPA 805, "PERFORMANCE-BASED STANDARD FOR FIRE PROTECTION FOR LIGHT WATER REACTOR ELECTRIC GENERATING PLANTS" (CAC NOS. MF3301 AND MF3302; EPID L-2013-LLF-0001) DATED JANUARY 22, 2018

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