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

August 8, 2017

Mr. Scott D. Northard
Site Vice President
Prairie Island Nuclear Generating Plant
Northern States Power Company - Minnesota
1717 Wakonade Drive East
Welch, MN 55089

SUBJECT: PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 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. ME9734 AND ME9735)

Dear Mr. Northard:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 220 to Renewed Facility Operating License No. DPR-42 and Amendment No. 207 to Renewed Facility Operating License No. DPR-60 for the Prairie Island Nuclear Generating Plant, Units 1 and 2, respectively. The amendments are in response to your application dated September 28, 2012, as supplemented by letters dated November 8, 2012, December 18, 2012, May 3, 2013, October 17, 2013, April 30, 2014, May 28, 2015, June 19, 2015, October 6, 2015, October 22, 2015, January 20, 2016, May 24, 2016, August 17, 2016, December 14, 2016, and March 6, 2017.

The amendments revise the licenses, including the technical specifications, for Prairie Island Nuclear Generating Plant Units 1 and 2 to establish and maintain fire protection program in accordance with the requirements of 10 CFR 50.48(c).

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

Sincerely,

Robert F. Kuntz, Senior Project Manager
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-282 and 50-306

Enclosures:
1. Amendment No. 220 to DPR-42
2. Amendment No. 207 to DPR-60
3. Safety Evaluation

cc w/encls: Distribution via ListServ

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

NORTHERN STATES POWER COMPANY - MINNESOTA

DOCKET NO. 50-282

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 220
License No. DPR-42

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

   A. The application for amendment by Northern States Power Company, a Minnesota Corporation (NSPM, the licensee), dated September 28, 2012, as supplemented by letters dated November 8, 2012, December 18, 2012, May 3, 2013, October 17, 2013, April 30, 2014, May 28, 2015, June 19, 2015, October 6, 2015, October 22, 2015, January 20, 2016, May 24, 2016, August 17, 2016, December 14, 2016, and March 6, 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. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. DPR-42 is hereby amended to read as follows:

Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 220, are hereby incorporated in the renewed operating license. NSPM shall operate the facility in accordance with the Technical Specifications.

In addition, the license is amended as indicated in the attachment to this license amendment. Paragraph 2.C.(4) is amended as follows:

(4) Fire Protection

NSPM 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 licensee amendment request dated September 28, 2012 (and supplements dated November 8, 2012, December 18, 2012, May 3, 2013, October 17, 2013, April 30, 2014, May 28, 2015, June 19, 2015, October 6, 2015, October 22, 2015, January 20, 2016, May 24, 2016, August 17, 2016, December 14, 2016, and March 6, 2017), and as approved in the safety evaluation dated August 8, 2017. 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 changes that clearly result in a 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 for individual changes that result in a risk increase less than 1×10-7/year (yr) for CDF and less than 1×10-8/yr for LERF. 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); and
- "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 safety evaluation

dated August 8, 2017, 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. and 3. 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 condition 2.C.(4)(b)2.

2. The licensee shall implement the modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," in Northern States Power - Minnesota letter L-PI-16-090, dated December 14, 2016, to complete the transition to full compliance with 10 CFR 50.48(c), before the end of the second full operating cycle for each unit after approval of the LAR. 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 Northern States Power – Minnesota letter L-PI-16-090, dated December 14, 2016, within 12 months after NRC approval, with the exception of Implementation Item 20, 66, and 70 which are associated with modifications and will be completed 180 days after modifications are complete.

3. This license amendment is effective as of the date of its issuance and shall be implemented consistent with condition 2.C.(4) of the license.

FOR THE NUCLEAR REGULATORY COMMISSION

David J. Wrona, Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility Operating License and Technical Specifications

Date of Issuance: August 8, 2017

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

NORTHERN STATES POWER COMPANY - MINNESOTA

DOCKET NO. 50-306

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 207
License No. DPR-60

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

   A. The application for amendment by Northern States Power Company, a Minnesota Corporation (NSPM, the licensee), dated September 28, 2012, as supplemented by letters dated November 8, 2012, December 18, 2012, May 3, 2013, October 17, 2013, April 30, 2014, May 28, 2015, June 19, 2015, October 6, 2015, October 22, 2015, January 20, 2016, May 24, 2016, August 17, 2016, December 14, 2016, and March 6, 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. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. DPR-60 is hereby amended to read as follows:

Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 207, are hereby incorporated in the renewed operating license. NSPM shall operate the facility in accordance with the Technical Specifications.

In addition, the license is amended as indicated in the attachment to this license amendment. Paragraph 2.C.(4) is amended as follows:

(4) Fire Protection

NSPM, 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 licensee amendment request dated September 28, 2012 (and supplements dated November 8, 2012, December 18, 2012, May 3, 2013, October 17, 2013, April 30, 2014, May 28, 2015, June 19, 2015, October 6, 2015, October 22, 2015, January 20, 2016, May 24, 2016, August 17, 2016, December 14, 2016 and March 6, 2017), and as approved in the safety evaluation dated August 8, 2017. 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 changes that clearly result in a 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 for individual changes that result in a risk increase less than 1×10-7/year (yr) for CDF and less than 1×10-8/yr for LERF. The proposed change must also be consistent with the defense-in-depth philosophy and

dated August 8, 2017, 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. and 3. 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 condition 2.C.(4)(b)2.

2. The licensee shall implement the modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," in Northern States Power - Minnesota letter L-PI-16-090, dated December 14, 2016, to complete the transition to full compliance with 10 CFR 50.48(c), before the end of the second full operating cycle for each unit after approval of the LAR. 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 Northern States Power – Minnesota letter L-PI-16-090, dated December 14, 2016, within 12 months after NRC approval, with the exception of Implementation Item 20, 66, and 70 which are associated with modifications and will be completed 180 days after modifications are complete.

3. This license amendment is effective as of the date of its issuance and shall be implemented consistent with condition 2.C.(4) of the license.

FOR THE NUCLEAR REGULATORY COMMISSION

David J. Wrona, Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility
Operating License and Technical
Specifications

Date of Issuance: August 8, 2017

ATTACHMENT TO LICENSE AMENDMENT NOS. 220 AND 207

RENEWED FACILITY OPERATING LICENSE NOS. DPR-42 AND DPR-60

DOCKET NOS. 50-282 AND 50-306

Replace the following pages of the Renewed Facility Operating License Nos. DPR-42 and DPR-60 with the attached revised pages. The changed areas are identified by a marginal line.

Renewed Operating License No. DPR-42

REMOVE	INSERT
Page 3	Page 3
Page 4	Page 4
Page 5	Page 5
Page 6	Page 6
---	Page 7
---	Page 8
---	Page 9

Renewed Operating License No. DPR-60

REMOVE	INSERT
Page 3	Page 3
Page 4	Page 4
Page 5	Page 5
Page 6	Page 6
---	Page 7
---	Page 8

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

REMOVE	INSERT
5.0-6	5.0-6

(3) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, NSPM to receive, possess, and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(4) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, NSPM to receive, possess and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument and equipment calibration or associated with radioactive apparatus or components;

(5) Pursuant to the Act and 10 CFR Parts 30 and 70, NSPM to possess but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility;

(6) Pursuant to the Act and 10 CFR Parts 30 and 70, NSPM to transfer byproduct materials from other job sites owned by NSPM for the purpose of volume reduction and decontamination.

C. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

NSPM is authorized to operate the facility at steady state reactor core power levels not in excess of 1677 megawatts thermal.

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 220, are hereby incorporated in the renewed operating license. NSPM shall operate the facility in accordance with the Technical Specifications.

(3) Physical Protection

NSPM shall fully implement and maintain in effect all provisions of the Commission-approved physical security, guard 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 of 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: "Prairie Island Nuclear Generating Plant Security Plan, Training and Qualification Plan, Safeguards Contingency Plan, and Independent Spent Fuel Storage Installation Security Program," submitted by letters dated October 18, 2006, and January 10, 2007, and as supplemented by letters dated March 18 and June 2, 2011, and approved by NRC Safety Evaluation dated August 16, 2011.

NSPM shall fully implement and maintain in effect all provisions of the Commission-approved Northern States Power Company - Minnesota (NSPM) Cyber Security Plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The NSPM CSP was approved by License Amendment No. 202 and supplemented by License Amendment No. 212.

(4) Fire Protection

NSPM 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 licensee amendment request dated September 28, 2012 (and supplements dated November 8, 2012, December 18, 2012, May 3, 2013, October 17, 2013, April 30, 2014, May 28, 2015, June 19, 2015, October 6, 2015, October 22, 2015, January 20, 2016, May 24, 2016, August 17, 2016, December 14, 2016, and March 6, 2017), and as approved in the safety evaluation dated August 8, 2017. 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 changes that clearly result in a 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 for individual changes that result in a risk increase less than 1×10-7/year (yr) for CDF and less than 1×10-8/yr for LERF. 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); and
- "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 safety evaluation dated August 8, 2017, 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. and 3. 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.C.(4)(b)2.

2. The licensee shall implement the modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," in Northern States Power - Minnesota letter L-PI-16-090, dated December 14, 2016, to complete the transition to full compliance with 10 CFR 50.48(c), before the end of the second full operating cycle for each unit after approval of the LAR. 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 Northern States Power – Minnesota letter L-PI-16-090, dated December 14, 2016, within 12 months after NRC approval, with the exception of Implementation Item 20, 66, and 70 which are associated with modifications and will be completed 180 days after modifications are complete.

(5) Additional Conditions

The Additional Conditions contained in Appendix B, as revised through Amendment No. 216, are hereby incorporated into this license. NSPM shall operate the facility in accordance with the Additional Conditions.

(6) Mitigation Strategy License Condition

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

(7) Upon implementation of Amendment No. 195 adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air in-leakage as required by SR 3.7.10.5, in accordance with TS 5.5.16.c (i), the assessment of CRE habitability as required by TS 5.5.16.c (ii), and assessing the CRE boundary as required by Specification 5.5.16.d, shall be considered met. Following implementation:

a. The first performance of SR 3.7.10.5, in accordance with Specification 5.5.16.c (i), shall be within the specified frequency of 6 years, plus the 18 month allowance of SR 3.0.2, as measured from December 3, 2004, the date of the most recent successful tracer gas test, as stated in the December 18, 2006 letter in response to Generic Letter 2003-01, or within the next 18 months if the time period since the most recent successful tracer gas test is greater than 6 years.

b. The first performance of the periodic assessment of CRE habitability, Specification 5.5.16.c (ii), shall be 3 years, plus the 9 month allowance of SR 3.0.2, as measured from December 3, 2004, the date of the most recent successful tracer gas test, as stated in the December 18, 2006 letter in response to Generic Letter 2003-01, or within the next 9 months if the time period since the most recent successful tracer gas test is greater than 3 years.

(8) License Renewal License Conditions

(a) The licensee may make changes to the programs and activities described in the USAR supplement, submitted pursuant to 10 CFR 54.21(d), as revised during the license renewal application review process, provided the licensee evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

(b) Appendix A of "Safety Evaluation Report Related to the License Renewal of Prairie Island Nuclear Generating Plant, Units 1 and 2," dated October 16, 2009, and supplemented on April 15, 2011, and the licensee's USAR supplement submitted pursuant to 10 CFR 54.21(d) describe certain future programs and activities to be completed before the period of extended operation. The licensee shall complete these activities no later than August 9, 2013, and shall notify the NRC in writing when implementation of these activities is complete.

(c) 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. All capsules placed in storage must be maintained for future insertion. Any changes to storage requirements must be approved by the NRC.

D. This renewed operating license is effective as of the date of issuance and shall expire at midnight August 9, 2033.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

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

Date of Issuance: June 27, 2011

(3) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, NSPM to receive, possess, and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(4) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, NSPM to receive, possess and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument and equipment calibration or associated with radioactive apparatus or components;

(5) Pursuant to the Act and 10 CFR Parts 30 and 70, NSPM to possess but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility;

(6) Pursuant to the Act and 10 CFR Parts 30 and 70, NSPM to transfer byproduct materials from other job sites owned by NSPM for the purposes of volume reduction and decontamination.

C. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

NSPM is authorized to operate the facility at steady state reactor core power levels not in excess of 1677 megawatts thermal.

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 207, are hereby incorporated in the renewed operating license. NSPM shall operate the facility in accordance with the Technical Specifications.

(3) Physical Protection

NSPM shall fully implement and maintain in effect all provisions of the Commission-approved physical security, guard 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 of 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: "Prairie Island Nuclear Generating Plant Security Plan, Training and Qualification Plan, Safeguards Contingency Plan, and Independent Spent Fuel Storage Installation Security Program," submitted by letters dated October 18, 2006 and January 10, 2007, and as supplemented by letters dated March 18 and June 2, 2011, and approved by NRC Safety Evaluation dated August 16, 2011.

NSPM shall fully implement and maintain in effect all provisions of the Commission-approved Northern States Power Company - Minnesota (NSPM) Cyber Security Plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The NSPM CSP was approved by License Amendment No. 189 and supplemented by License Amendment No. 200.

(4) Fire Protection

NSPM 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 licensee amendment request dated September 28, 2012 (and supplements dated November 8, 2012, December 18, 2012, May 3, 2013, October 17, 2013, April 30, 2014, May 28, 2015, June 19, 2015, October 6, 2015, October 22, 2015, January 20, 2016, May 24, 2016, August 17, 2016, December 14, 2016, and March 6, 2017), and as approved in the safety evaluation dated August 8, 2017. 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 changes that clearly result in a 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 for individual changes that result in a risk increase less than 1×10-7/year (yr) for CDF and less than 1×10-8/yr for LERF. 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); and
- "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 safety evaluation dated August 8, 2017, 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. and 3. 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.C.(4)(b)2.

2. The licensee shall implement the modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," in Northern States Power - Minnesota letter L-PI-16-090, dated December 14, 2016, to complete the transition to full compliance with 10 CFR 50.48(c), before the end of the second full operating cycle for each unit after approval of the LAR. 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 Northern States Power – Minnesota letter L-PI-16-090, dated December 14, 2016, within 12 months after NRC approval, with the exception of Implementation Item 20, 66, and 70 which are associated with modifications and will be completed 180 days after modifications are complete.

(5) Additional Conditions

The Additional Conditions contained in Appendix B, as revised through Amendment No. 204, are hereby incorporated into this license. NSPM shall operate the facility in accordance with the Additional Conditions.

(6) Mitigation Strategy License Condition

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

(7) Upon implementation of Amendment No. 184 adopting TSTF-448, Revision 3, the determination of control room envelope (CRE) unfiltered air in-leakage as required by SR 3.7.10.5, in accordance with TS 5.5.16.c (i), the assessment of CRE habitability as required by TS 5.5.16.c (ii), and assessing the CRE boundary as required by Specification 5.5.16.d, shall be considered met. Following implementation:

(a) The first performance of SR 3.7.10.5, in accordance with Specification 5.5.16.c (i), shall be within the specified frequency of 6 years, plus the 18 month allowance of SR 3.0.2, as measured from December 3, 2004, the date of the most recent successful tracer gas test, as stated in the December 18, 2006 letter in response to Generic Letter 2003-01, or within the next 18 months if the time period since the most recent successful tracer gas test is greater than 6 years.

(b) The first performance of the periodic assessment of CRE habitability, Specification 5.5.16.c (ii), shall be 3 years, plus the 9 month allowance of SR 3.0.2, as measured from December 3, 2004, the date of the most recent successful tracer gas test, as stated in the December 18, 2006 letter in response to Generic Letter 2003-01, or within the next 9 months if the time period since the most recent successful tracer gas test is greater than 3 years.

(8) License Renewal License Conditions

(a) The licensee may make changes to the programs and activities described in the USAR supplement, submitted pursuant to 10 CFR 54.21(d), as revised during the license renewal application review process, provided the licensee evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

(b) Appendix A of "Safety Evaluation Report Related to the License Renewal of Prairie Island Nuclear Generating Plant, Units 1 and 2," dated October 16, 2009, and supplemented on April 15, 2011, and the licensee's USAR supplement submitted pursuant to 10 CFR 54.21(d) describe certain future programs and activities to be completed before the period of extended operation. The licensee shall complete these activities no later than October 29, 2014, and shall notify the NRC in writing when implementation of these activities is complete.

c) 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. All capsules placed in storage must be maintained for future insertion. Any changes to storage requirements must be approved by the NRC.

D. This renewed operating license is effective as of the date of issuance and shall expire at midnight October 29, 2034.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

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

Date of Issuance: June 27, 2011

5.0 ADMINISTRATIVE CONTROLS

5.4 Procedures

5.4.1 Written procedures shall be established, implemented, and maintained covering the following activities:

a. The applicable procedures recommended in Regulatory Guide 1.33, Revision 2, Appendix A, February 1978;

b. The emergency operating procedures required to implement the requirements of NUREG-0737 and NUREG-0737, Supplement 1, as stated in Generic Letter 82-33;

c. Quality control for effluent and environmental monitoring;

d. Not used; and

e. All programs specified in Specification 5.5.

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

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NORTHERN STATES POWER COMPANY

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2

DOCKET NOS. 50-282 AND 50-306

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* (FR) 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."

Section 50.48(a)(1) of 10 CFR requires each holder of an operating license and holders of a combined operating license issued under 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) 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;

Enclosure 3

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) 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 [LWR] 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 (RG 1.205) (Reference 4), states, in part, that:

> 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, in part, that:

> 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 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 part:

> 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 an 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, Northern States Power Company, a Minnesota Corporation, doing business as Xcel Energy (the licensee), requested a license amendment to allow it to establish and maintain the Prairie Island Nuclear Generating Plant, Units 1 and 2, (PINGP) FPP in accordance with 10 CFR 50.48(c) and change the Renewed Facility Operating Licenses and Technical Specifications (TSs) accordingly.

1.2 Requested Licensing Action

By letter dated September 28, 2012 (Reference 8), as supplemented by letters dated November 8, 2012 (Reference 9), December 18, 2012 (Reference 10), May 3, 2013 (Reference 11), October 17, 2013 (Reference 12), April 30, 2014 (Reference 13), May 28, 2015 (Reference 14), June 19, 2015 (Reference 15), October 6, 2015 (Reference 16), October 22, 2015 (Reference 17), January 20, 2016 (Reference 18), May 24, 2016 (Reference 19), August 17, 2016 (Reference 20), December 14, 2016 (Reference 21), and March 6, 2017 (Reference 22), the licensee submitted an application for license amendments to transition the PINGP 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 October 9, 2013 (Reference 23), March 30, 2015 (Reference 24), August 28, 2015 (Reference 25), August 28, 2015 (Reference 26), January 8, 2016 (Reference 27), July 26, 2016

(Reference 28), November 18, 2016 (Reference 29), and February 7, 2017 (Reference 30). The licensee's supplemental letters dated May 3, and October 17, 2013; April 30, 2014; May 28, June 19, October 6, October 22, 2015; and January 20, May 24, August 17, and December 14, 2016; and March 6, 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 FR on April 2, 2013 (78 FR 19753).

The licensee requested amendments to the PINGP facility operating licenses and TSs 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 approved FPP as described and referenced in the Updated Safety Analysis Report (USAR) for PINGP and as approved in safety evaluation reports (SERs) dated February 14, 1978 (Reference 31), September 6, 1979 (Reference 32), April 21, 1980 (Reference 33), December 29, 1980 (Reference 34), July 28, 1981 (Reference 35), October 27, 1989 (Reference 36), and October 6, 1995 (Reference 37), 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 PINGP 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 conclusion that:

1. The licensee's application has identified any orders and license conditions that must be revised or superseded, and contains any necessary revisions to the plant's TSs and the bases thereof, 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, as well as revisions to the TSs that address this change to the current FPP basis. SE Sections 2.4.2 and 4.0 discuss in detail the license condition, and SE Section 2.4.3 discusses the 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 fire protection program 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 FR 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 a license

amendment request (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 safe shutdown 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.

In addition, in accordance with GDC 3, "Fire protection," of Appendix A, "General Design Criteria for Nuclear Power Plants [NPPs]," to 10 CFR Part 50, fire protection systems must be designed such that their failure or inadvertent operation does not significantly impair the ability of the structures, systems, and components (SSCs) important to safety to perform their intended safety functions.

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 review also relied on the following additional codes, regulatory guides (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 38), 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 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).

- NEI 05-04, "Process for Performing Internal Events PRA [Probabilistic Risk Assessment] Peer Reviews Using the ASME/ANS [American Society of Mechanical Engineers/American Nuclear Society] PRA Standard," Revision 2 (Reference 39), which provides guidance material for conducting and documenting a peer review for PRAs using the ASME/ANS PRA Standard RA-S-2008a (Revision 1, Addendum A). The original intent of NEI 05-04 was to provide a methodology for PRA peer reviews as a follow-on to the NEI 00-02 methodology. With the release of ASME and ANS standards (to form the basis of a peer review), the emphasis of NEI 05-04 changed from follow-on peer reviews to simply peer reviews performed against an industry consensus standard.

- NEI 07-12, "Fire Probabilistic Risk Assessment (FPRA) Peer Review Process Guidelines," Revision 1, (Reference 40), which provides guidance material for use in conducting and documenting an FPRA peer review. NEI 07-12 provides the method for reviewing a FPRA against part 4 of the ASME/ANS [American Society of Mechanical Engineers/American Nuclear Society] RA-Sa-2009 probabilistic risk assessment (PRA) standard.

- 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 41), which provides the NRC staff's recommendations for using risk information in support of licensee-initiated licensing basis changes to a 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 42), 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 decision-making processes.

- 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" (Reference 43), which provides guidance for 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 decision-making related to design, licensing, procurement, construction, operation, and maintenance.

- RG 1.189, "Fire Protection for Nuclear Power Plants," Revision 2, issued October 2009 (Reference 44), 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 45), 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 46), 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 47), 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 48), Volume 2 (Reference 49), and Supplement 1 (Reference 50), 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-the-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 51), notes that, based on new

experimental information documented in NUREG/CR-6931, "Cable Response to Live Fire (CAROLFIRE)," issued April 2008 (Reference 52), and NUREG/CR-7100, "Direct Current Electrical Shorting in Response to Exposure Fire (DESIREE-Fire): Test Results," issued April 2012 (Reference 53), the reduction in hot short probabilities for circuits provided with control power transformers (CPTs) identified in NUREG/CR-6850 cannot be repeated in experiments, and therefore, may be too high and should be reduced.

- NUREG-1792, "Good Practices for Implementing Human Reliability Analysis (HRA)" (Reference 54), which establishes good practices for performing HRAs and reviewing HRAs to assess the quality of those analyses. The HRAs in NUREG-1792 are of a generic nature and support implementation of RG 1.200 for level 1 and limited level 2 internal events PRAs with the reactor at full power.

- NUREG-1805, "Fire Dynamics Tools (FDTs): Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program" (Reference 55), 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 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 56), which provide 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.

- NUREG/CR-7010, "Cable Heat Release, Ignition, and Spread in Tray Installations during Fire (CHRISTIFIRE), Phase 1: Horizontal Trays," Volume 1 (Reference 57), 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/CR-7150, "Joint Assessment of Cable Damage and Quantification of Effects from Fire (JACQUE-FIRE)," Volume 1 and Volume 2 (Reference 58), which documents the results of a Phenomena Identification and Ranking Table (PIRT) exercise that was undertaken on fire-induced electrical circuit failures that may occur in nuclear power plants when cables are damaged by fires (Volume 1), and also documents the PRA expert elicitation results and includes the best estimate conditional probabilities of hot short-induced spurious operations of control circuits, given fire damage to associated cables (Volume 2).

- NUREG-1855, Volume 1, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making" (Reference 59), provides guidance on how to treat uncertainties associated with PRA in RI decision-making. 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 decision-making. 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 decision-making process itself.

- NUREG-1921, "EPRI/NRC-RES Fire Human Reliability Analysis Guidelines - Final Report" (Reference 60), 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 61), 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.

- Generic Letter (GL) 2006-03, "Potentially Nonconforming Hemyc™ and MT™ Fire Barrier Configurations" (Reference 62), 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 63), 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 64), 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 65), 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 66), 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 67), 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 68), 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 69), 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
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 70)	3.2.2 3.2.5 3.4.4 3.5.1 3.5.2
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 71)	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 72). 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 73)	3.2.1

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 74)	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 Main Control Room.	(Reference 75)	3.1.3 3.2.6 3.2.7 3.4.2.2
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 76)	3.4.7
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 77)	3.4.3 3.5.1
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 78)	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 structures, systems, and components; ▪ Action level thresholds; and ▪ The use of existing monitoring programs.	(Reference 79)	3.1.1 3.7.1
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 80)	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 81)	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 82)	3.4.2.2 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 83)	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 access 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 84)	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," with regard to NRC-issued orders pertinent to PINGP 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 PINGP are maintained. The licensee discussed the affected orders and exemptions in LAR Attachment O.

The licensee determined that no orders need to be superseded or revised to implement an FPP at PINGP that complies with 10 CFR 50.48(c). The NRC staff accepts the licensee's determination that no orders need to be superseded or revised to implement NFPA 805 at PINGP.

The licensee 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 to ensure compliance with 10 CFR 50.48(c) do not invalidate existing commitments applicable to PINGP. 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 in regard to Commission Order EA-02-026 (10 CFR 50.54(hh)(2)) is acceptable.

The licensee stated that the Fukushima [Fukushima Dai-ichi nuclear power plant] Orders are being independently evaluated and that any plant changes will continue to be evaluated for impact on the FPP in accordance with its design change process.

2.4.2 License Conditions

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

The NRC staff reviewed the revised license condition, which supersedes the current PINGP fire protection license condition, 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 the revised license condition provides 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 the revised license condition also defines 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 condition would provide structure and detailed criteria to allow self-approval for FPP changes that meet the requirements of NFPA 805 with regard to 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 condition also references the plant-specific modifications and associated implementation schedules that must be accomplished at PINGP to complete transition to NFPA 805 and comply with 10 CFR 50.48(c). The license condition also includes 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 PINGP FPP license condition.

2.4.3 Technical Specifications (TSs)

The NRC staff reviewed LAR Section 5.2.2, "Technical Specifications," and Attachment N, "Technical Specification Changes," with regard to proposed changes to the PINGP TSs that are being revised or superseded during the NFPA 805 transition process. According to the LAR, the licensee conducted a review of the PINGP 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 licensee identified changes to the TSs needed for adoption of the new fire protection licensing basis and provided applicable justification listed in LAR Attachment N. The licensee identified one change to the TSs that involved deleting TS 5.4.1.d, which requires that written procedures be established, implemented, and maintained for FPP implementation.

Specifically, the licensee stated that deleting TS 5.4.1.d is proposed because after completion of the transition to NFPA 805, the requirement for FPP implementation procedures will be contained in 10 CFR 50.48(a) and (c), as specifically outlined in Section 3.2.3, "Procedures," of NFPA 805. The licensee further stated that the requirement to maintain a FPP in accordance with 10 CFR 50.48(a) and (c) is included in the new license condition described in LAR Attachment M.

Based on the information provided by the licensee, the NRC staff concludes that the proposed deletion is acceptable because TS 5.4.1.d is an administrative control (i.e., a procedure the licensee puts in place to establish, implement, and maintain the FPP as required by the licensee's fire protection license condition and 10 CFR 50.48(a), 10 CFR 50.48(c), and NFPA 805, Section 3.2.3), and would be redundant to the NFPA 805 requirement to establish FPP procedures. NFPA 805 requires the licensee to establish FPP procedures, and 10 CFR 50.48(a) and 10 CFR 40.48(c) would become the fire protection licensing basis of PINGP. In addition, failure by the licensee to establish FPP procedures would result in non-compliance with 10 CFR 50.48(c)(1), which is the licensee's fire protection licensing basis. Changes to fire protection administrative controls are controlled by the proposed fire protection license condition. For the NRC staff's evaluation of the proposed licensee condition, see SE Section 4.0.

2.4.4 Updated Safety Analysis Report (USAR)

The NRC staff reviewed LAR Section 5.4, "Revision to USAR," which states that after approval of the LAR, the PINGP USAR will be revised in accordance with 10 CFR 50.71(e) except that the revised USAR will be submitted in accordance with an exemption from 10 CFR 50.71(e)(4) dated May 22, 2006 (Reference 85). The exemption from 10 CFR 50.71(e)(4) allows periodic updates of the PINGP USAR to be submitted within 6 months after the completion of each Unit 2 refueling outage, not to exceed 24 months from the previous submittal. The licensee further stated that the format and content will be consistent with FAQ 12-0062 (Reference 80).

The NRC staff concludes that the licensee's method to update the USAR is acceptable because the licensee will update the USAR after approval of the LAR in accordance with 10 CFR 50.71(e), in accordance with an applicable exemption, and the content will be consistent with the guidance contained in FAQ 12-0062.

2.5 Rescission of Exemptions

Since PINGP, Unit 1, was licensed to operate on August 9, 1973, and PINGP, Unit 2, was licensed to operate on October 29, 1974, the PINGP FPP is based on compliance with 10 CFR 50.48(a), 10 CFR 50.48(b), 10 CFR 50 Appendix R, and the PINGP FPP license conditions.

The NRC staff reviewed LAR Section 5.2.3, "Orders and Exemptions," LAR Attachment O, and LAR Attachment K with regard to previously-approved exemptions to Appendix R to 10 CFR Part 50, which will be superseded by the transition to an FPP licensing basis in conformance with NFPA 805. These exemptions will no longer be required since upon approval of the RI/PB FPP in accordance with NFPA 805, Appendix R will not be part of the licensing basis for PINGP.

The licensee requested and received NRC approval for 13 exemptions from 10 CFR Part 50 Appendix R. These exemptions were discussed in detail in LAR Attachment K. The licensee requested that the exemptions be rescinded and that 2 of the 13 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; and

- 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 and the underlying condition has either been evaluated using RI/PB methods, has been evaluated using an existing engineering equivalency evaluation (EEEE), or has been found to be deterministically compliant, and found to be acceptable with no further actions:

- Exemption from the requirements of Appendix R, Section III.G.3, control room, lack of automatic fixed suppression system, units 1 and 2, fire area 13.

- Exemption from the requirements of Appendix R, Section III.G.2, train "A" hot shutdown panel, instrument air room and auxiliary feedwater pump room, lack of 20' separation free of intervening combustibles or lack of a 1-hour fire barrier, units 1 and 2, fire area 31.

- Exemption from the requirements of Appendix R, Section III.G.2, train "B" hot shutdown panel, instrument air room and auxiliary feedwater pump room, lack of 20' separation free of intervening combustibles or lack of a 1-hour fire barrier, units 1 and 2, fire area 32.

- Exemption from the requirements of Appendix R, Section III.G.2, auxiliary building, operating level, lack of automatic fixed suppression system, unit 1, fire area 60.

- Exemption from the requirements of Appendix R, Section III.G.2, auxiliary building, operating level, lack of automatic fixed suppression system, unit 2, fire area 75.

- Exemption from the requirements of Appendix R, Section III.G.2, normal switchgear room, lack of automatic fixed suppression system, unit 1, fire area 37.

- Exemption from the requirements of Appendix R, Section III.G.2, auxiliary building, ground level, lack of automatic fixed suppression system, unit 1, fire area 58.

- Exemption from the requirements of Appendix R, Section III.G.2, auxiliary building, ground level, lack of automatic fixed fire suppression system, unit 2, fire area 73.

- Exemption from the requirements of Appendix R, Section III.G.2, auxiliary building, mezzanine level, lack of automatic fixed suppression, unit 1, fire area 59.

- Exemption from the requirements of Appendix R, Section III.G.2, auxiliary building, mezzanine level, lack of automatic fixed suppression, unit 2, fire area 74.

- Exemption from the requirements of Appendix R, Section III.G.2, intervening combustibles between redundant shutdown divisions, units 1 and 2 containments, fire areas 1 and 71.

The following exemptions, which are applicable to both PINGP Units 1 and 2, are rescinded but the engineering evaluation of the underlying condition will be used as a qualitative engineering evaluation for transition to NFPA 805 (see Section 3.5.1.3 of this SE):

- Exemption from the requirements of Appendix R, Section III.O, RCP oil collection, RCP oil collection system is not in strict compliance, fire areas 1 and 71.

- Exemption from the requirements of Appendix R, Section III.G.1, control room, use of repair to remove fuses, fire area 13.

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 conditions 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 that:

> 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, that:

> 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 Section 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 the licensing basis. The licensee also stated that the baseline is defined as that plant condition or configuration that is consistent with the design and licensing basis and that the changed or altered condition or configuration that is not consistent with the design and 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 87), 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) 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 used to maintain configuration control of the FPP documents. The licensee further stated the configuration control procedures which govern the various PINGP 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, Implementation Item 28 and 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 licensee stated that several NFPA 805 document types, such as nuclear safety capability assessment (NSCA) supporting information and non-power mode NPO treatment, etc., generally 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 LAR Attachment S, Table S-3, Implementation Item 29 and 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) 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: Use the NFPA 805 change process developed in accordance with NEI 04-02, RG 1.205, and the PINGP NFPA 805 fire protection license condition to assess the acceptability of the proposed change. This process would 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 41). NFPA 805 requires the use of qualified individuals, procedures that require calculations to 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.

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 using the NFPA 805 change process developed in accordance with NEI 04-02, RG 1.205, and the PINGP 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 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, as well as RG 1.205, Revision 1, 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 via 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 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 PINGP, 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 Section 2.7.1 of this SE (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 proposed license conditions require 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 (the "Section" listed is the section in this SE that the topic is discussed):

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 Section 3.8 of this SE.

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, 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 PINGP 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 Section 3.4.2 of this SE.) Accordingly, these cause and effect relationship models may be used after transition to NFPA 805 as a part of the FREs 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 a 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," provided in the licensee's letter dated December 14, 2016 (Reference 21).

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 PINGP into compliance with either the deterministic or PB requirements of NFPA 805. As described below, LAR Attachment S, Table S-2, provides a description of each of the proposed plant modifications, presents the problem statement explaining why the modification is needed, and identifies the compensatory actions required to be in place pending completion/implementation of the modification.

The NRC staff confirmed that the modifications identified in LAR Attachment S, Table 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 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, the licensee has completed 5 modifications as part of the NFPA 805 transition. LAR Attachment S, Table S-2, provides a detailed listing of the plant modifications that must be completed in order for PINGP to be fully in 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 conditions, which state that all modifications will be completed before the end of the second full operating cycle for each unit after approval of the LAR. In addition, LAR Section 5.5 states that appropriate compensatory measures will be maintained 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. 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 this 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, within 12 months after NRC approval, except for Implementation Items 20, 66, and 70, which are associated with modifications and will be completed 180 days after modifications are complete.

The NRC staff, through an onsite audit or during a future fire protection inspection, may choose to examine the closure of the implementation items. The NRC staff would ensure that any variations discovered during this review, or concerns with regard to adequate completion of the implementation item, would be tracked and resolved appropriately under the licensee's corrective action program. Any discrepancies identified during NRC review of 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, as supplemented, provides the overall schedule for completing the NFPA 805 transition at PINGP. The licensee stated that implementation of the new NFPA 805 FPP to include procedure changes, process updates, and training to affected plant personnel will occur within 12 months after NRC approval, with the exception of Implementation Items 20, 66, and 70 which are associated with modifications and will be completed 180 days after modifications are complete. The licensee requested the 12-month completion time for the implementation items because of the extensive changes to be completed and other staffing demands.

LAR Section 5.5, also states that modifications will be completed before the end of the second full operating cycle for each unit after approval of the LAR and that appropriate compensatory measures will be maintained until the modifications are complete.

Based on 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 PINGP 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 45), 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, in this SE:

- Section 3.1 provides the results of the NRC staff 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 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 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 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 review of the licensee's NSCA results by fire area.
- Section 3.6 provides the results of the NRC staff 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 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 review of the licensee's program documentation, configuration control, and quality assurance (QA).

Attachments A and B of this SE provide additional information regarding the FM that was used by the licensee and evaluated by the NRC staff 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 sections of this SE.

3.1 NFPA 805 Fundamental Fire Protection Program Elements and Minimum Design Requirements

NFPA 805 (Reference 3), 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, provided a license amendment is granted and the approach satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release, maintains safety margins, and maintains fire protection DID.

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 (which is the AHJ as denoted in NFPA 805 and RG 1.205), 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 (Reference 4), to assess the proposed PINGP 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 PINGP FPP and provided specific compliance statements for each NFPA 805, 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 to PINGP, and others are provided with multiple compliance statements to fully document compliance with the element.

The methods used by PINGP 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," 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 for those sections/subsections where the specific NFPA 805 Chapter 3 requirements are not met but previous NRC approval of the configuration exists: noted in LAR Attachment A, Table B-1 as "Complies via Previous Approval."

4. 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 Existing Engineering Equivalency Evaluations."

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 an implementation item: noted in LAR Attachment A, Table B-1 as "Complies with Item for Implementation." These outstanding actions are identified as implementation items in LAR Attachment S in SE Section 2.7.

Compliance approach 6, "Complies with Item for Implementation," is a change from the NEI 04-02 based approach in that it is a new category not included in NEI 04-02. The intent of this choice 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.

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 followed the compliance strategies identified in the endorsed NEI 04-02 guidance document, and because compliance approach 6 includes implementation items that would be required to be completed in accordance with a proposed license condition. 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.

In LAR Section 4.2.2, "Existing Engineering Equivalency Evaluation Transition," the licensee stated 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 plant configuration. The licensee determined that no EEEE used to support compliance with NFPA 805 required NRC approval.
EEEEs (previously known as Generic Letter 86-10 (Reference 88), evaluations) were 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.

In LAR Section 4.2.3, "Licensing Action Transition," the licensee stated 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.

LAR Attachment A, Table B-1, 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 via this method required additional review by the NRC staff:

- 3.4.1(c)

NFPA 805, Section 3.4.1(c), requires that the 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 FPE RAI 02 (Reference 24), the NRC staff requested that the licensee provide the details of the training provided to fire brigade members that address the ability to assess the effects of fire and fire suppressants on the NSPC. In its response to FPE RAI 02 (Reference 14), the licensee stated that all fire brigade members are trained non-licensed operators (NLOs), and that only Auxiliary Plant Equipment Operators (APEOs) perform the duty of the fire brigade leader. The licensee further stated all NLOs and reactor operators (ROs) receive training on all plant systems including system integration with respect to other associated systems, precautions and limitations pertinent to the systems and equipment required for abnormal and emergency operations, and that its training program for NLOs is consistent with the guidance in FAQ 13-0069 (Reference 89). Based on the licensee's statements that the fire brigade and fire brigade leader have the necessary training consistent with the guidance of FAQ 13-0069, the NRC staff concludes that the licensee response to the RAI is acceptable because the licensee demonstrated that it meets the requirements of NFPA 805, Section 3.4.1(c) and that fire brigade members have the ability to assess the effects of fire and fire suppressants on the NSPC.

In its letter dated October 22, 2015 (Reference 17), the licensee provided revised pages to LAR Attachment A and revised its compliance statement from "Complies" to "Submit for NRC Approval," for the following FPP elements:

- 3.2.3(1)
- 3.3.1.2(1)
- 3.3.5.1

The NRC staff's review and approval of these requests is documented in Sections 3.1.1.5 and 3.1.4 of this SE.

In its letter dated October 22, 2015 (Reference 17), the licensee also revised its compliance statement from "Complies" to "Complies by Previous Approval" for the following FPP element:

- 3.4.3(c)(1)

NFPA 805, Section 3.4.3(c)(1) requires that industrial fire brigade members and other plant personnel who would respond to a fire in conjunction with the brigade be provided with training commensurate with their emergency responsibilities and that drills be conducted quarterly for each shift to test the response capability of the industrial fire brigade. The licensee cited previous approval of the fire brigade training program that includes scheduling drills so that each fire brigade will participate in at least two drills per year. In LAR Attachment A, the licensee stated that fire drills are performed once per calendar quarter and that each fire brigade member participates in at least four drills per year (yr). Based on the information provided by the licensee, the NRC concludes that the licensee meets the requirements of NFPA 805 because it demonstrated previous NRC approval of its fire brigade training program and conducts appropriate drills.

In its letter dated October 22, 2015 (Reference 17), the licensee revised its compliance statement from "Complies" to "Complies with use of Existing Engineering Equivalency Evaluation" for the following FPP elements:

- 3.3.1.2(5)
- 3.3.1.2(6)
- 3.3.8
- 3.4.3(a)(1)
- 3.7

For these FPP elements, the licensee performed an engineering evaluation and determined that it meets the appropriate NFPA code and evaluated the acceptability of deviations to the NFPA code, if any. The NRC staff concludes that the revised statements of compliance are acceptable because the licensee demonstrated compliance with the NFPA code, in an engineering equivalency evaluation, which is allowed by NFPA 805, Section 2.2.7.

3.1.1.2 Compliance Strategy -- Complies with Clarification

In two NFPA 805 Chapter 3 requirements, 3.3.6 and 3.3.7.1, 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 based on the information provided in the LAR, the licensee will meet the underlying requirement for the FPP element as clarified.

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. Subsequent to the LAR submittal, in its letter dated October 22, 2015 (Reference 17), the licensee provided revised pages to LAR Attachment A and identified that compliance with the following FPP elements also involves the use of an engineering evaluation:

- 3.3.1.3.1
- 3.3.7.1
- 3.4.1.(a)
- 3.5.15
- 3.8.2
- 3.10.1

The NRC staff reviewed the licensee's statement of continued validity for the EEEEs, and the statement on the quality and appropriateness of the evaluations, and concludes that the licensee's statements of compliance in these instances are acceptable.

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

- 3.6.1
- 3.5.15

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 90). In LAR Attachment A, the licensee described the EEEEs performed for NFPA 14 code compliance and stated that one deviation will require performance of hydraulic calculations to verify the design bases of the standpipe and hose station system and two deviations have action requests to address resolutions to the identified issues. In FPE RAI 06 (Reference 24), the NRC requested that the licensee provide additional detail with regard to the deviation and two outstanding items, including the identification of implementation items or a justification for not considering these issues as implementation items. In its response to FPE RAI 06 (Reference 14), the licensee stated that the deviation involved pipe sizes in the D5/D6 standpipe and hose station system that do not meet the minimum size requirements based on total pipe length. The licensee stated that the two outstanding items involved installing an additional hanger to prevent excessive movement of a standpipe and installing pressure gauges at the top of the hose station risers. The licensee stated that the completion of the hydraulic calculation and the installation of pressure gauges will be addressed in LAR Attachment S, Table S-3, implementation item 64 and the installation of the hanger will be addressed in LAR Attachment S, Table S-2, Modification 40. In a letter dated December 14, 2016 (Reference 21). the licensee updated the status of Modification 40 to complete. The NRC staff concludes that the licensee's response to the RAI and statement of compliance are acceptable because the licensee included actions to incorporate the provisions of NFPA 805 in the FPP which would be required by the proposed license condition.

NFPA 805, Section 3.5.15 requires that a hose house equipped with hose and combination nozzle and other auxiliary equipment specified in NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances" (Reference 91), be provided at intervals of not more than 1000 ft (305 m) along the yard main system. The licensee stated that compliance has been demonstrated through the use of an EEEE for acceptability of removing the fire hoses from fire hydrant hose houses 11 through 26 in the area of the cooling tower and storing the hoses in a readily available mobile trailer for firefighting use. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee demonstrated that storage of the hoses in a mobile trailer and dedicated for firefighting use is an acceptable approach that is functionally equivalent to NFPA 24 and because the licensee demonstrated compliance with NFPA 805 through an EEEE which is allowed by NFPA 805, Section 2.2.7.

3.1.1.4 Compliance Strategy -- Complies via Previous NRC Approval

Certain NFPA 805, Chapter 3 requirements were supplanted by an alternative that was previously approved by the NRC. The approval was documented in the following:

(1) The original September 6, 1979 fire protection SER (Reference 32);
(2) NRC letter dated April 21, 1980 (Reference 33);
(3) NRC letter dated December 29,1980 (Reference 34); and
(4) NRC letter dated July 31, 1984 approving exemption to Appendix R, III.O (Reference 92).

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 has been demonstrated using suitable documentation that meets the approved guidance contained in RG 1.205, Revision 1. Based on the licensee's justification for the continued validity of the previously approved alternatives to the NFPA 805, Chapter 3, requirements, the NRC staff concludes that the licensee's statements of compliance in these instances are acceptable.

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

- 3.4.1(a)

NFPA 805 Section 3.4.1(a) requires that a fully staffed and qualified fire brigade comply with NFPA standards. In LAR Attachment A, Section 3.4.1, the licensee stated it "Complies via Previous Approval," however, the compliance basis does not specify the submitted or approved descriptions from the appropriate licensing documentation that substantiate the previous review and approval of this element. The licensee cited previous technical specification amendments that established minimum staffing requirements for the fire brigade, but did not address the scope of compliance relative to the NFPA standards. Additionally, the licensee stated that the fire brigade has been reviewed against NFPA 600 (Reference 93), however, there is no statement of compliance to the requirements of NFPA 600. In FPE RAI 01 (Reference 24), the NRC staff requested that the licensee provide citations from its licensing bases to substantiate the compliance strategy of previous NRC approval for NFPA 805 Section 3.4.1(a), and also requested that the licensee provide a description of its compliance with NFPA 600. In its response to FPE RAI 01 (Reference 14), the licensee provided citations from its letters to the NRC dated January 9 (Reference 94), March 9 (Reference 95), and May 2, 1979 (Reference 96), and NRC SE dated September 6, 1979 (Reference 32), regarding fire brigade training and drills. The licensee stated that it performed an engineering evaluation of NFPA 600 that did not identify any deviations from the code and based on this review the PINGP fire brigade complies with NFPA 600 and NFPA 805, Section 3.4.1(a). Based on the information provided by the licensee, the NRC concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated previous NRC approval of its fire brigade training program that complies with the requirements of NFPA 805 and NFPA 600.

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 section identified in LAR Attachment A, Table B-1, as complying via this method is as follows:

- 3.5.16, which concerns the dedication of fire protection water supply for fire protection use only. The licensee requested approval for the use of fire protection system water for plant evolutions other than fire protection. The NRC staff's review of this request is included in Section 3.1.4.1 of this SE.

The licensee also requested NRC staff approval for the use of PB methods to demonstrate compliance with fundamental FPP elements of NFPA 805, Sections 3.2.3(1) and 3.3.1.2(1) in new approval requests 2 and 3, which the licensee submitted in its letter dated October 6, 2015 (Reference 16), and NFPA 805, Section 3.3.5.1, in new approval request 4, which the licensee submitted in its letter dated October 22, 2015 (Reference 17). The PB methods described in the approval requests involve the following:

- 3.2.3(1), which concerns establishing procedures for the inspection, testing, maintenance for fire protection systems and features credited by the FPP. The licensee requested approval for the use of a PB method to establish the appropriate inspection, testing, and maintenance frequencies for fire protection systems and features required by NFPA 805, thereby meeting the requirements of NFPA 805, Section 3.2.3(1). The NRC staff's review of this request is included in Section 3.1.4.2 of this SE.

- 3.3.1.2(1), which concerns that wood used within the power block be listed press-impregnated or coated with a listed fire-retardant application. The licensee requested approval for the use of a PB method to justify limited quantities of untreated wood in finished products, such as tool handles, janitorial supplies, special fixtures, M&TE and office-type furniture, and for the temporary use of untreated wood for material/equipment transport (e.g., pallets or crates), thereby meeting the requirements of NFPA 805, Section 3.3.1.2(1). The NRC staff's review of this request is included in Section 3.1.4.3 of this SE.

- 3.3.5.1, which concerns the installation of wiring above suspended ceilings being kept to a minimum and where installed, the electrical wiring be listed for plenum use, routed in armored cable, routed in metallic conduit or routed in cable trays with solid metal top and bottom covers. The licensee requested NRC approval for the use of a PB method to justify the use of wiring above suspended ceilings, thereby meeting the requirements of NFPA 805, Section 3.3.5.1. The NRC staff's review of this request is included in SE Section 3.1.4.4.

As discussed in Section 3.1.4 of this SE, the NRC staff concludes that the use of PB methods to demonstrate compliance with these fundamental FPP elements is acceptable.

3.1.1.6 Compliance Strategy -- Complies with Item for Implementation

For several NFPA 805, Chapter 3 requirements the licensee stated that compliance with the fundamental FPP element will be achieved through the use of implementation items.

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

- 3.2.3(3)
- 3.3.1.3.1
- 3.3.1.3.3
- 3.4.3(c)(3)
- 3.5.1

- 3.8.2
- 3.9.4
- 3.10.1
- 3.10.7

NFPA 805, Section 3.2.3(3), requires that procedures be established to accomplish reviews of FPP related performance and trends. The licensee stated that the monitoring program required by NFPA 805, Section 2.6, will be implemented in accordance with FAQ 10-0059 (Reference 79), and will include a process that reviews the FPP performance and trends in performance. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-3, will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by a proposed license condition.

NFPA 805, Sections 3.3.1.3.1 and 3.3.1.3.3, require that a hot work safety procedure be developed and that open flames or combustion-generated smoke not be permitted for leak or air flow testing. The licensee stated that the hot work procedure will be revised to address the provisions in NFPA 51B (Reference 65), for hot tapping; the provisions in NFPA 241 (Reference 68), for a fire watch where torch-applied roofing hot work operations are in effect; and the requirement of NFPA 805 Section 3.3.1.3.3 that open flames or combustion-generated smoke shall not be permitted for leak or air flow testing. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-3, Implementation Item 2 that will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by a proposed license condition.

NFPA 805, Section 3.4.3(c)(3), requires that fire drills be conducted in various plant areas especially in those areas identified to be essential to plant operation and to contain significant fire hazards. The licensee stated that the fire drill procedure will be revised to include that fire drills will be conducted in various plant areas. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-3, Implementation Item 3, that will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by a proposed license condition.

NFPA 805, Section 3.5.1, requires that a fire protection water supply of adequate reliability, quantity, and duration shall be provided. The licensee stated that a calculation to demonstrate that the fire water supply is capable of delivering the largest design demand with the hydraulically least demanding portion of fire main loop out of service will be performed. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-3, Implementation Item 4, that will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by a proposed license condition.

NFPA 805, Section 3.5.3, requires that fire pumps be designed and installed in accordance with NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, which requires that motor driven pumps be provided with a remote alarm indicating a loss of power supply to the motor. During an internal review, NSPM identified that a remote alarm should be provided in the Control Room to indicate loss of power to the motor-driven firewater pump (MDFP). In its letter dated June 19, 2015 (Reference 15), the licensee submitted a revised LAR Attachment S, Table S-2, includes Modification Item 39 which involves providing a remote alarm in the control room to indicate loss of power to the MDFP. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-2, Modification Item 39, which will incorporate the provisions of NFPA 805, Chapter 3 in the FPP and would be required by a proposed license condition.

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 shall be installed in accordance with NFPA 72, "National Fire Alarm Code" (Reference 66), and its applicable appendixes. The licensee stated that automatic fire detection systems have been reviewed against the requirements of NFPA 72E, "Standard on Automatic Fire Detectors" (Reference 97); that subsequent analysis of identified code deviations was completed and modifications have been captured in LAR Attachment S. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-2, Modification Item 8, will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by a proposed license condition.

NFPA 805, Section 3.9.4, requires that diesel-driven fire pumps be protected by automatic sprinklers. The licensee stated that the diesel-driven fire pump (DDFP) is located in Fire Area 41B, and is protected by a full coverage, pre-action sprinkler system. However, the licensee also stated that it was necessary to move or install a sprinkler head above the diesel-driven fire pump because of a large obstruction. LAR Attachment S, Table S-2, includes Modification Item 9 which involves moving or installing a sprinkler head above the DDFP in FA 41B. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-2, Modification Item 9, which will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by a proposed license condition.

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 shall be designed and installed in accordance with the NFPA codes. The licensee stated that it identified code deviations that require a modification to resolve non-compliances associated with unprotected beam pockets and system supervision. In FPE RAI 03 (Reference 24), the NRC staff requested that the licensee identify the specific plant modification item in LAR Attachment S. In its response to FPE RAI 03 (Reference 14), the licensee stated that the plant modification is the proposed modification for Fire Area 18 described in LAR Attachment S, Table S-2, Modification Item 8. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-2, Modification Item 8, which will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by a proposed license condition.

NFPA 805, Section 3.10.7, requires that the carbon dioxide system be provided with an odorizer. The licensee stated that an odorizer will be added to the carbon dioxide system protecting the relay and cable spreading room. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-2, modification item 9, which will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by a proposed license condition.

In letters dated October 22, 2015 (Reference 17), and May 24, 2016 (Reference 19), the licensee provided a revisions to LAR Attachment A, which added new a compliance statement, "Complies with Item for Implementation," for the following NFPA 805 fundamental FPP elements:

- 3.2.3(1)
- 3.3.1.2
- 3.11.1
- 3.11.2
- 3.11.3
- 3.11.4

NFPA 805, Section 3.2.3(1), requires that procedures be established for the inspection, testing, maintenance for fire protection systems and features credited by the FPP. In its letter dated October 6, 2015 (Reference 16), and its letter dated October 22, 2015 (Reference 17), the licensee stated that its procedures will be revised to allow the use of PB frequencies for inspection, testing and maintenance. In its letter dated May 24, 2016 (Reference 19), the licensee indicated that it will implement the use of PB frequencies for inspection, testing and maintenance separate from the NFPA 805 implementation timeline. The NRC staff's review of the licensee's PB method is included in Section 3.1.4.2 of this SE.

NFPA 805, Section 3.3.1.2, requires that the use of wood within the power block be listed press-impregnated or coated with a listed fire-retardant application. In its letter dated October 6, 2015 (Reference 16), the licensee stated that its procedures will be revised to establish bounding limits in regards to the quantity, duration, and compensatory measures for the use of untreated wood as necessary, in order to maintain the assumptions in the FPRA regarding combustible quantities and heat release rates (HRRs). In its letter dated October 22, 2015 (Reference 17), the licensee provided revised pages to LAR Attachment A and stated that its procedures will be revised to add an exception to allow small quantities of wood in commercial products, and in temporary uses (e.g., pallets) when the quantity, duration, and compensatory measures are administratively controlled. The NRC staff's review of the licensee's PB method is included in Section 3.1.4.3 of this SE. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-3, Implementation Item 61, which will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by a proposed license condition.

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 (ft) or space that meets the requirements of NFPA 80A, "Recommended Practice for Protection of Buildings from Exterior Fire Exposures," (Reference 98). NFPA 805, Section 3.11.2, requires that fire barriers required by Chapter 4 include a specific fire-resistance rating and be designed and installed to meet the specific fire resistance rating using assemblies qualified by fire tests. NFPA 805, Section 3.11.3, requires that penetrations in fire barriers be 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 its letter dated May 24, 2016 (Reference 19), the licensee added LAR Attachment S, Table S-2, Modification Item 43 to upgrade fire protection barriers required by NFPA 805 to meet the requirements of NFPA 805, Section 3.11. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-2, which will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by a proposed license condition.

NFPA 805, Section 3.11.4, requires that the 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 by fire-resistive material. In its letter dated October 22, 2015 (Reference 17), the licensee revised LAR Attachment S, Table S-3, by adding implementation item 69 to enhance the internal penetration seal program. The NRC staff concludes that the licensee's statement of compliance is acceptable because the licensee identified an action in LAR Attachment S, Table S-3, Implementation Item 69, which will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by a proposed license condition.

Based on the licensee's statement of compliance and the associated implementation items or modifications as described in LAR Attachment A and Attachment S, as supplemented, for the individual attributes described above, the NRC staff concludes the licensee's statements of compliance are acceptable because completion of the implementation items and modifications will bring these attributes into compliance with the requirements of NFPA 805 and would be required by a proposed license condition.

3.1.1.7 Compliance Strategy -- Multiple Strategies

In the compliance statements of the NFPA 805, Chapter 3 requirements for 3.5.1 and 3.6.1, the licensee used more than one of the above strategies described in Section 3.1.1 of the SE to demonstrate compliance with aspects of the fundamental element.

In each of these cases, the NRC staff concludes that based on the information provided in the LAR, the individual compliance statements are acceptable, that the combination of compliance strategies is acceptable, and that holistic compliance with the fundamental fire protection program element is assured because the licensee demonstrated that the compliance strategy meets the requirements of NFPA 805.

3.1.1.8 Chapter 3 Sections Not Reviewed

Some NFPA 805, Chapter 3, sections either do not apply to the transition to a 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 to PINGP because of the following:
  - The licensee stated that it does not have systems of this type installed (e.g., Section 3.9.1(3), which applies to water mist fire protection systems; Section 3.9.1(4), which applies to foam water sprinkler and foam-water spray systems; Section 3.10.1(3), which applies to clean agent fire extinguishing systems; and Section 3.10.4, which applies to credited primary and backup gaseous fire suppression systems).
  - The requirements are structured with an applicability statement (e.g., Section 3.3.12, which applies to reactor coolant pumps in non-inerted containments, or Sections 3.4.1(a)(2) and 3.4.1(a)(3), which applies to the fire brigade standards used since they depend on the type of brigade specified in the FPP).

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 one or more of 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, and/or,

- Provided appropriate documentation of its state of compliance with the 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;

  — with the intent of the requirement (or element) given adequate justification;

  — via previous NRC staff approval of an alternative to the requirement;

  — through the use of an engineering equivalency evaluation;

  — through the use of a combination of the above methods; or

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

3.1.2 Identification of Power Block

The NRC staff reviewed the structures identified in LAR Attachment I, Table I-1, "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. In the LAR Section 4.1.3, the licensee stated that the power block includes structures that contain equipment that could affect plant operation for power generation; equipment important to safety; equipment that could affect the ability to maintain the NSCA in the event of a fire; or structures containing radioactive materials that could potentially be released in the event of a fire. 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 Generic Letter 2006-03, "Potentially Nonconforming Hemyc™ and MT™ Fire Barrier Configurations," Issues

GL 2006-03 (Reference 62), requested that licensees evaluate their facilities to confirm compliance with existing applicable regulatory requirements in light of the results of NRC testing that determined that 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 its letter dated June 8, 2006 (Reference 99), the licensee responded to GL 2006-03 and stated that neither Hemyc™ nor MT™ fire barrier material is used for compliance with separation and/or safe shutdown requirements for 10 CFR 50, Appendix R, or the FPP licensing basis at PINGP.

Since PINGP does not use either the Hemyc™ or MT™ electrical raceway fire barrier systems (ERFBS), the generic issue (GL 2006-03) related to the use of these ERFBS is not applicable.

3.1.3.2 Very Early Warning Fire Detection Systems

The licensee proposed the installation of very early warning fire detection systems (VEWFDS) to monitor conditions, as well as provide indication and alarms, inside key electrical cabinets at and 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 75). Detailed discussion of the VEWFDS in contained in Section 3.2.6 of this SE.

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

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 1.3.2, "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 1.4.1, "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 1.4.2, "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 1.5.1, "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.

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.

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 evaluation of these proposed methods is provided below.

3.1.4.1 NFPA 805, Section 3.5.16 - Dedicated Use of Fire Protection Water Supply

In LAR Attachment L, approval request 1, the licensee requested NRC staff approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.5.16, requirement for dedicated use of the fire protection water supply. Specifically, the licensee requested approval of a PB method to justify the use of the fire protection water supply for screenwash system use and emergency uses that do not meet the requirements of NFPA 805.

In FPE RAI 05 (Reference 24), the NRC staff requested that the licensee provide a description of the "other emergency uses" for the fire water supply system and to provide a discussion regarding the potential impacts to the nuclear safety and radiological release performance criteria, including a description of how safety margin is maintained and how the three elements of DID are met. In its response to FPE RAI 05 (Reference 14), the licensee stated that the "other emergency uses" is to provide spent fuel makeup and provided a revised approval request. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee clarified the other emergency use for fire water system and revised the approval request to include the impact on the nuclear safety and radiological release performance criteria, the ability to maintain safety margin, and how the three elements of DID are maintained. The NRC staff's evaluation of the revised approval request is discussed below.

The licensee stated that the Mississippi River provides fire protection water. The licensee stated that the system consists of a MDFP and a DDFP, each rated at 2,000 gallons per minute (gpm) at 125 pounds per square inch gauge (psig), that are connected to a 10" fire header that is maintained between 108 and 113 psig by a jockey pump. The licensee stated the MDFP will automatically start at 95 psig and if the header pressure drops to 90 psig, the DDFP will start. The licensee stated that the screenwash pump can be aligned to the fire protection header to supply 2,000 gpm at a discharge pressure of 125 per square inch (psi).

For the screenwash function, the licensee stated that the MDFP can be aligned to provide a backup water supply to the screenhouse screenwash system in the event the screenwash pump is unavailable. The licensee stated that to use the fire pump to supplement the screen wash header flow, the pump must be started manually either locally or remotely, and that once the pump is operating, if no auto start signal exists from the fire protection header (i.e., if pressure in the fire water header has not been reduced by other uses), the discharge valve to the screenwash header (control valve CV-31131) opens automatically via solenoid valve SV-33049 and supplies water to the screenwash header when required. The licensee stated that if a demand is placed on the fire header from a suppression system actuation, the fire protection header low pressure signal will cause SV-33049 to close CV-31131, thereby, realigning all

water flow to the fire protection header. The licensee stated that the DDFP will also be available to supply water to the fire protection piping.

The licensee stated that there is a bypass line around control valve CV-31131, and that if manual valve FP-27-1 in the bypass line around CV-31131 is opened, it will be manually closed in the event of a fire to realign water flow to the fire protection header. The licensee further stated that if the manual bypass valve (FP-27-1) to divert fire water to the screenwash system is opened, it is tracked as an impairment of the MDFP, and therefore, operators are aware and can shut the manual bypass valve to restore fire protection water flow and pressure to the fire protection header if needed.

The licensee evaluated the impacts of the use of the fire protection water system for screen wash purposes for a fire within the screen house Fire Area 41, and a fire in all other fire areas.

The licensee stated that a fire in any fire area other than Fire Area 41 will cause a pressure drop on the fire header and, thereby, close CV-31131 via SV-33049 and re-align the MDFP water supply from the traveling screens to the fire header.

The licensee stated that for a fire in Fire Area 41, a postulated fire may cause cable damage, thereby creating the potential for a hot short of the circuit resulting in CV 31131 failing in the open position. The licensee stated this would divert some fire protection water from the MDFP from entering the fire header. The licensee stated if this scenario occurs, the DDFP will start, providing the fire header with 2,000 gpm at 125 psi. The licensee stated that the suppression system in Fire Area 41 has a demand of 1,094.1 gpm at 89.1 psi, this demand is within the design capacity of the diesel driven fire pump, and check valve FP-28-2 will prevent water in the fire protection header from entering the screen wash diversion piping network. The licensee stated that the use of the MDFP for screen wash cleaning will not impact the ability of the fire protection header to deliver the system demand for fire suppression activities in any plant fire area.

For maintaining spent fuel pool inventory, the licensee stated that fire protection water is available through hose stations to supply water to the spent fuel pool; however, there are six other preferred sources of water that will first be used to maintain inventory in the spent fuel pool (SFP). The licensee further stated that actions to makeup spent fuel pool inventory are described in an existing plant procedure, and that there are four preferred borated sources for make-up water and two non-borated sources that will be depleted before fire protection water is used for spent fuel pool inventory replenishment.

The licensee stated that the use of the other six water sources for SFP inventory makeup provides time to respond to the fire and/or get additional sources of equipment and resources. The licensee further stated that the existing mutual aid agreement with the City of Red Wing Fire Department and their participation in annual fire drills will ensure that they can provide a timely response and can also provide the ability to independently draw water from the river and augment the fire protection water supply and pressure.

The licensee stated that in the event that fire suppression water is needed after firewater flow to the SFP is established, control room operators will assess the relative significance of these two needs and balance water flows as considered appropriate. The licensee stated that the factors in this consideration will include the location, size, and potential significance of the fire to ensuring safe shutdown of the plant, and the amount of water remaining above fuel stored in the SPF and the rate of change in SFP water level.

The licensee evaluated each of the non-fire protection uses to determine if the alignment satisfies the NFPA 805 performance goals, objectives, and criteria related to nuclear safety and radiological release as follows:

- The licensee stated that the ability to use fire protection water for the screenwash function does not impact the requirements of NSPC as defined in NFPA 805 Section 1.5.1. The licensee stated that this use will not directly result in compromising automatic fire suppression functions, manual fire suppression functions, or post-fire safe shutdown capability since water will automatically or manually be re-directed to the fire protection header upon fire protection header demand. The licensee further stated that the DDFP will also auto start if needed as a result of a pressure drop in the fire header to provide for fire protection header demands, and that, therefore there is no impact to performance goals or objectives as described in LAR Attachment B, Table B-2.

  The licensee stated that the ability to use fire protection water for the screenwash function has no impact on the radiological release performance criteria since water will be automatically or manually redirected to the fire protection header upon fire protection header demand, and that the radiological release review addresses the release of firefighting water potentially containing radioactive materials and is not affected by the use of fire protection water to supplement the screenwash function. The licensee further stated that the ability to use fire protection water for the screenwash function does not change the radiological release evaluation and does not add additional radiological materials to the area or challenge system boundaries.

- For the use of fire protection water to maintain spent fuel pool inventory, the licensee stated that in the event fire protection water is required for suppression system use, there are procedures in place and trained operators that will maintain the suppression system demand for firefighting, and that the NSPC will not be impacted.

  The licensee stated that the ability to use fire protection water only after the other six water sources have been exhausted supports the radiological release performance criteria. The licensee indicated that the use of fire protection water for non-firefighting uses is justified to reduce the potential for radiological release by not allowing the SFP water level to decrease and result in spent fuel being uncovered due to reduced spent fuel decay heat removal, which will create an extremely hazardous radiation environment.

The licensee evaluated each of the non-fire protection uses to determine if the alignment maintains safety margins and maintains fire protection defense-in-depth (fire prevention, fire detection, fire suppression, and post-fire safe shutdown capability) as follows:

- For the use of fire protection water to provide a backup screenwash function, the licensee stated that the ability to use fire protection water for the screenwash function does not change the safety margin since it has no impact on safety analysis acceptance criteria or on functional capabilities of equipment relied upon for safe and stable plant conditions. The licensee further stated that due to the automatic and manual actions to re-direct fire protection water flow, and the

ability of the DDFP to supply additional water to the fire header, the use of fire protection water for cleaning intake screens will not impact the ability of the fire protection header to deliver the system demand for fire suppression requirements.

NFPA 805 Section 1.2 states that DID 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. The licensee stated that the ability to use fire protection water for the screenwash function does not compromise the DID elements, as follows:

- Fire prevention functions are maintained because controls such as combustible controls and hot work controls are not affected.

- Fire detection, automatic fire suppression, manual fire suppression, and mitigation functions are maintained because water will automatically or manually be re-directed to the fire protection header, and water from the DDFP will be supplied if needed, upon actuation of a fire suppression system in the event of a fire.

- Post-fire safe shutdown capability is maintained because fire barriers are maintained so that a fire will not spread and prevent operation of the equipment required to establish and to maintain safe and stable plant conditions.

- For the use of fire protection water to maintain spent fuel pool inventory, the licensee stated that there will be no initial impact to the safety margin of the fire protection water supply, since there will be no immediate diversion of water to the spent fuel pool and that there are multiple preferred borated and non-borated water sources that will be procedurally used prior to using fire suppression water for spent fuel pool inventory control. The licensee further stated that if the preferred sources of water are depleted (or unavailable) and fire protection water must be used to maintain spent fuel pool inventory, procedures in place and trained operators will maintain the suppression system demand until fire extinguishment.

  NFPA 805 Section 1.2 states that DID 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. The licensee stated that the ability to use fire protection water for the SFP makeup function does not compromise the DID elements, as follows:

  - Fire prevention functions are maintained because controls such as combustible controls and hot work controls are not affected.

- Fire detection, automatic fire suppression, manual fire suppression, and mitigation functions are maintained because fire protection water will only be used for SFP makeup after all other sources of water are depleted or are otherwise unavailable, at which time fires will likely have been extinguished; also, by this time other sources of fire protection water, e.g., support from the Red Wing Fire Department, should also be available if needed in the event of a fire.

- Post-fire safe shutdown capability is maintained because fire barriers are maintained so that a fire will not spread and prevent operation of the equipment required to establish and to maintain safe and stable plant conditions.

The licensee stated that operators would balance the need to supply firefighting water and maintain SFP level, and that the additional time provided by the six other water supplies would allow additional equipment and resources to arrive and support the fire protection water supply demand. The licensee stated that there will be no impact to fire prevention, fire detection, automatic fire suppression functions, manual fire suppression functions, mitigation or post-fire safe shutdown capability.

Based on its review of the information submitted by the licensee, 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 3.5.16, requirement, because it satisfies the performance goals, objectives, and 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, Section 3.2.3(1) – Inspection, Testing and Maintenance of Fire Protection Systems

In LAR Attachment L, approval request 2, which the licensee submitted in its letter dated October 6, 2015 (Reference 16), the licensee requested NRC staff approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.2.3(1) requirement for establishing the inspection, testing and maintenance procedures for fire protection systems and features credited by the FPP. Specifically, the licensee requested approval of a PB method as described in Electric Power Research Institute (EPRI) Technical Report TR-1006756, "Fire Protection Equipment Surveillance Optimization and Maintenance Guide," Final Report, July 2003 (Reference 100), to establish the appropriate inspection, testing, maintenance frequencies for fire protection systems, and features required to meet the NFPA 805 requirement.

The licensee stated that NFPA 805, Section 2.6, requires that a monitoring program 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 FPP in meeting the performance criteria and that monitoring shall ensure that the assumptions in the engineering analysis remain valid. NFPA 805, Section 2.6.1, requires that acceptable levels of availability, reliability, and performance be established, and NFPA 805, Section 2.6.2, requires that methods to monitor availability, reliability, and performance be established and that the methods consider the plant operating experience and industry operating experience.

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/License Controlled Documents and appropriate NFPA codes. The licensee stated that the approval request does not involve the use of EPRI Topical Report (TR)-1006756 to establish the scope of those activities as that is determined by the required system review identified in LAR Section 4.8.1 and presented in LAR Attachment C. The licensee also stated that the approval 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 Section 10.1 of EPRI TR-1006756 states that "[t]he goal of a PB surveillance program is to adjust test and inspection frequencies commensurate with equipment performance and desired reliability," and that this goal is consistent with the requirements of NFPA 805 Section 2.6. The licensee stated that EPRI TR-1006756 provides an accepted method to establish appropriate inspection, testing, and maintenance frequencies which ensures that the required NFPA 805 availability, reliability, and performance goals are maintained. The licensee further stated that PB surveillance frequencies will be established as described in EPRI TR-1006756 and that these PB surveillance frequencies will be established as part of LAR Attachment S, Table S-3, Implementation Item 67. In its letter dated May 24, 2016 (Reference 19), the licensee deleted Implementation Item 67 and indicated that it will implement the use of PB frequencies for inspection, testing and maintenance separate from the NFPA 805 implementation timeline. The licensee stated that the target tests, inspections, and maintenance will be those activities for the NFPA 805 required fire protection systems and features. The licensee further stated that the reliability and frequency goals will be established to ensure the assumptions in the NFPA 805 engineering analysis remain valid, and that the failure criterion will be established based on the credited functions of the required fire protection systems and features to ensure those functions are maintained. The licensee stated that data collection and analysis will follow EPRI TR-1006756, and that the failure probability will be determined based on the EPRI TR-1006756 guidance and a 95 percent confidence level will be used. The licensee further stated that the performance monitoring will be performed in conjunction with the monitoring program required by NFPA 805, Section 2.6, and that it will ensure that site-specific operating experience is considered in the monitoring process. The licensee stated that the flow chart in Figure 10-1 of EPRI TR-1006756, which describes the program framework, data collection and evaluation, reliability and uncertainty analysis, and program implementation, will be used.

The licensee stated that the use of PB test frequencies established per EPRI TR-1006756 methods combined with 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, and that therefore, there is no adverse impact to the NSPC by the use of the PB methods in EPRI TR-1006756. The licensee further stated that the radiological release performance criteria are satisfied based on the determination of limiting radioactive release. The licensee further stated that use of PB test frequencies established per EPRI TR-1006756 methods combined with the requirements of NFPA 805, Section 2.6, 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, which includes those assumptions credited to meet the radioactive release performance criteria. The licensee also stated that this request does not change the radiological release evaluation and does not add additional radiological materials to the area or challenge system boundaries, and that therefore, there is no adverse impact to radioactive release performance criteria.

The licensee stated that the use of PB test frequencies established per EPRI TR-1006756 methods combined with 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 which includes those assumptions credited in the risk evaluation safety margin discussions. The licensee further stated that 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, and that therefore, the safety margin inherent and credited in the analysis has been preserved.

The licensee stated that the three echelons of DID are: (1) to prevent fires from starting, (2) rapidly detect, control and extinguish fires that do occur thereby limiting damage, and (3) 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 the use of PB testing and maintenance frequencies based on EPRI TR-1006756 maintains these three echelons of DID as follows:

1) Prevent Fires from Starting:

   This echelon is not affected by the use of EPRI TR-1006756 methods.

2) Rapidly Detect, Control and Extinguish Fires that Do Occur Thereby Limiting Damage:

   Use of PB testing and maintenance frequencies based on EPRI TR-1006756 has no impact on the ability of the automatic suppression systems to perform their functions because the availability and reliability of the fire protection systems and features credited for DID will be maintained through the monitoring program established in accordance with NFPA 805 Section 2.6.

3) Provide Adequate Level of Fire Protection for Systems and Structures so that a Fire Will Not Prevent Essential Safety Functions from Being Performed:

   Use of PB testing and maintenance frequencies based on EPRI TR-1006756 has no impact on the ability of the automatic suppression systems to perform their functions because the availability and reliability of the fire protection systems and features credited for DID will be maintained through the monitoring program established in accordance with NFPA 805 Section 2.6.

Based on its review of the information submitted by the licensee, 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, objectives, and 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 3.3.1.2(1) – Control of Combustible Materials

In LAR Attachment L, approval request 3, which the licensee submitted in its letter dated October 6, 2015 (Reference 16), the licensee requested NRC staff approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.3.1.2(1)

requirement for wood used within the power block to be listed pressure-impregnated or coated with a listed fire-retardant application. Specifically, the licensee requested approval of a PB method to justify the use of limited quantities of untreated wood to meet the NFPA 805 requirement.

The licensee stated that its administrative procedure for combustible controls requires that all wood in the power block be treated with fire retardant material, except for cribbing timbers (6 inches by 6 inches or larger) and that other exceptions are allowed if the material is continuously attended or if the application is approved by the FPP engineer or fire protection coordinator. The licensee requested approval to use limited quantities of untreated wood. The licensee further stated that applications include commercial products with small quantities of untreated wood in the finished products, such as tool handles, janitorial supplies, special fixtures, measuring and test equipment, and office-type furniture; and includes temporary use of untreated wood for material/equipment transport (e.g., pallets or crates). The licensee stated that the combustible control program will identify limits and controls for this use of untreated wood, including the quantity, duration, and compensatory measures as necessary.

The licensee stated that minor non-compliances with the NFPA 805 restrictions on untreated wood may be necessary and can be administratively controlled to manage these conditions and minimize risk, and that examples of these minor noncompliant conditions include:

- It is not possible to procure commercially available products that only have treated wood as an integral part of the finished product.

- Commercially available products utilizing small quantities of non-treated wood, as described above are used throughout the site. It would be impractical to ban such products altogether from the power block.

- Material and equipment items are typically transported to the site using wood pallets or crates, and it is not practical to re-package this material or to require the use of treated wood or other non-combustible materials prior to their introduction into the power block.

The licensee stated that the combustible control program includes controls on the use of untreated wood in the power block, and this program will be revised to address FPRA considerations. The licensee stated that the controls will be revised as part of LAR Attachment S, Table S-3, Implementation Item 61, to establish bounding limits in regards to the quantity, duration, and compensatory measures for the use of untreated wood as necessary, in order to maintain the assumptions in the FPRA regarding combustible quantities and HRRs. The licensee further stated that changes to these bounding limits will be processed via the PCE process described in LAR Section 4.7.2, which is being developed in LAR Attachment S, Table S-3, Implementation Item 25. The NRC staff considers these actions acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. The licensee stated that non-compliances with the administrative controls will be addressed under its corrective action program, with condition evaluations and corrective actions to address and restore compliance.

The licensee stated that the presence of limited quantities of untreated wood in selected risk significant areas, either as an integral part of a commercial product such as hand tools with wooden handles or in temporary use for material/equipment transport (e.g., pallets and crates), under the combustible control program, does not impact the requirements of the NSPC as defined in NFPA

805, Section 1.5.1. The licensee further stated that the limited quantities of wood are restricted by administrative combustible controls and do not contribute significantly to the combustible loading of a given area, and that therefore, any fire involving these materials would be anticipated to be small. The licensee stated that the combustible control program ensures control of transient combustibles, and takes into account separation distance, suppression, and fire barriers, and that fire detection and fire suppression systems are installed throughout the facility and provide alarm notification in the control room. The licensee further stated that control room notification and procedures ensure rapid fire brigade response, and that accordingly, the use of untreated wood under the limits and controls of the combustible control program ensures that there is no impact on the NSPC performance goals or objectives.

The licensee stated that the presence of limited quantities of untreated wood under administrative combustible controls has no impact on the radiological release performance criteria. The licensee further stated that the radiological release review was performed based on fire suppression activities in areas containing or potentially containing radioactive materials, and is not impacted by limited quantities of untreated wood. The licensee stated that these small quantities of untreated wood do not change the radiological release evaluation, do not add additional radiological materials to the area, and do not challenge system boundaries.

The licensee stated that the presence of limited quantities of untreated wood, either as an integral part of a commercial product such as hand tools with wooden handles or in temporary use for material/equipment transport (e.g., pallets and crates), under the combustible control program, does not produce a fire hazard and will not adversely impact the ability to achieve and maintain safe and stable conditions. The licensee further stated that this request does not change the safety margin since it has no impact on safety analysis acceptance criteria or functional capabilities of equipment relied upon for safe and stable plant conditions.

NFPA 805, Section 1.2, states that DID 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. The licensee stated that the presence of limited quantities of untreated wood in selected risk significant areas, either as an integral part of a commercial product such as hand tools with wooden handles or in temporary use for material/equipment transport (e.g., pallets and crates), under the combustible control program, does not compromise the DID elements, as follows:

1. Fire prevention functions are maintained because controls such as combustible controls and hot work controls are maintained.

2. Fire detection, automatic fire suppression, manual fire suppression, and mitigation functions are not affected by this change.

3. Post-fire safe shutdown capability is maintained because fire barriers are maintained, so that a fire will not spread and prevent operation of the equipment required to establish and maintain safe and stable plant conditions.

Based on its review of the information submitted by the licensee, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed performance-based method is an acceptable alternative to the corresponding NFPA 805, Section 3.3.1.2(1), requirement because it satisfies the performance goals, objectives, and 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 3.3.5.1 – Electrical Wiring Above Suspended Ceilings

In LAR Attachment L, approval request 4, which the licensee submitted in its letter dated October 22, 2015 (Reference 17), the licensee requested NRC staff approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.3.5.1 requirement that wiring above suspended ceilings be kept to a minimum, and where installed, electrical wiring 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 to justify the use of electrical wiring above suspended ceilings. In its letter dated January 20, 2016 (Reference 18), in response to FPE RAI 07.c, the licensee withdrew part 2 of the approval request that concerned fire area 8 locker room, unit 1, 715', and indicated that LAR Attachment S, Table S-2, would be revised to include a modification so that fire area 8 locker room, unit 1, 715', would meet the requirements of NFPA 805, Section 3.3.5.1. In its letter dated May 24, 2016 (Reference 19), the licensee included LAR Attachment S, Table S-2, Modification Item 42 to bring Fire Area 8 into compliance with NFPA 805, Section 3.3.5.1. The NRC staff concludes that the licensee's response to the RAI and the proposed action are acceptable because the action will result in compliance with NFPA 805 and would be required by the proposed license condition.

The licensee stated that a visual inspection of the spaces above the suspended ceilings revealed the existence of minimal quantities of wiring (cables), including low voltage video/communication/data cables and power cables in the following fire areas:

- Fire Area 8, Lunch Room, Unit 1, 715' in Southeast corner.
- Fire Area 8, Locker Room, Unit 2, 715' in Northwest corner.
- Fire Area 83, Secondary Alarm Station (SAS) and Operations Lounge.
- Fire Area 94, Computer Room.

The licensee stated that:

- The majority of the cables are low voltage video/communication/data cables and are not susceptible to self-ignition and electrical shorts that would result in a fire in the enclosed space.

- There are minimal sections of low voltage power cable (below 480VAC) supplying an emergency lighting unit and a junction box.

- The only potential ignition sources above the suspended ceilings are florescent lighting fixtures and short section[s] of power cables. There are no additional ignition sources in the listed areas above the suspended ceilings.

- The areas above the suspended ceilings are not used as HVAC plenums or as part of a smoke purge system.

- The SAS is continually manned providing early notification and the potential use of a fire extinguisher as early extinguishment prior to brigade arrival.

- Fire Area 8, Locker Room Unit 2, 715' Northeast corner and Fire Area 8, Lunch Room Unit 1, 715' in the southeast corner are frequently occupied, thereby providing early notification and the potential use of the fire extinguisher located in the room as early extinguishment prior to brigade arrival.

- The estimated bounding quantity of non-plenum rated cable does not significantly increase combustible loading enough to challenge fire barrier integrity.

- The walls are constructed of concrete/concrete block and although not credited, will mitigate fire propagation into an adjoining fire area until the arrival of the fire brigade.

The licensee stated that plant procedures will be revised to ensure that future wiring installations above suspended ceilings will conform to NFPA 805 Section 3.3.5.1, and included that action in LAR Attachment S, Table S-3, Implementation Item 68. In FPE RAI 07.b (Reference 27), the NRC staff requested that the licensee clarify whether Implementation Item 68 will include the administrative control for all suspended ceilings, including the suspended ceiling described in part 2 (subsequently withdrawn by the licensee) of the approval request. In response to FPE RAI 07.b (Reference 18), the licensee stated that Implementation Item 68 will include administrative controls for power block areas with suspended ceilings and that an updated LAR Attachment S would be provided in a future submittal. The licensee provided an updated Attachment S, Table S-3, which included Implementation Item 68 by letter dated December 14, 2016. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee indicated that administrative controls for all suspended ceilings will be included in Implementation Item 68. The NRC staff concludes that the action described in Implementation Item 68 is 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 estimated bounding quantity of cables (linear feet) is as follows:

- Fire area 8 lunch room, unit 1, 715' in southeast corner- 200 feet.
- Fire area 8 locker room, unit 2, 715' in northwest corner- 100 feet.
- Fire area 83 SAS and operations lounge – 500 feet (approximately 120 feet is power cable below 480vac).
- Fire area 94 computer room - 1,000 feet.

The licensee stated that the presence of non-rated and non-enclosed wiring above the suspended ceilings in these fire areas does not adversely affect nuclear safety capability, and that the amount of wiring that is not rated for plenum use and is not located in conduit is minimal. The licensee further stated that low voltage video/communication/data cabling is not generally susceptible to shorts that would result in a fire. The licensee further stated that ignition sources above the suspended ceiling are limited to the florescent lighting fixtures and shorts in the power cables (below 480 VAC), and, therefore, there is no adverse impact on the NSPC due to the non-rated plenum cabling in these areas.

The licensee stated that the NSCA evaluation determined that fire areas 8, 83, and 94 meet the deterministic requirements of NFPA 805, Section 4.2.3. The licensee stated that the NSCA impacts for a fire above the suspended ceiling are as follows:

- Fire area 8 lunch room, unit 1, 715' in southeast corner- There are no NSCA cables above the suspended ceiling in this fire area location, therefore, a fire occurring above the suspended ceiling would have no impact on the NSCA.

- Fire area 8 locker room, unit 2, 715' in northwest corner- There are no NSCA cables above the suspended ceiling in this fire area location, therefore, a fire occurring above the suspended ceiling would have no impact on the NSCA.

- Fire area 83: SAS and operations lounge - A fire could affect cables involving source range monitoring, RCS pressure, RCS temperature, and steam generator level which could result in the loss of one channel for each unit. The other channel has been demonstrated to remain available. Therefore, there is no impact on the NSPC.

- Fire area 94: computer room -There are no NSCA cables above the suspended ceiling in this fire area location, therefore, a fire occurring above the suspended ceiling would have no impact on the NSCA.

The licensee stated that the location of non-rated and non-enclosed wiring above these suspended ceilings has no impact on the radiological release performance criteria. The radiological review was performed based on the potential location of radiological concerns and is not dependent on the type of wiring or locations of suspended ceilings. Radiological material is not used or stored in these areas.

The licensee stated that the amount of non-rated and non-enclosed wiring above the ceilings in the power block is minor and does not present a significant fire hazard, and therefore, the safety margin inherent in the analysis for the fire event has been preserved. The licensee further stated that the introduction of the non-rated and non-enclosed wiring routed above these suspended ceilings does not impact fire protection defense-in-depth, and that the wiring located above the ceilings does not compromise administrative fire prevention controls, and does not challenge automatic fire detection and suppression functions, manual fire suppression functions, or post-fire safe shutdown capability.

NFPA 805, Section 1.2, states that DID 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. The licensee stated that the introduction of the non-rated and non-enclosed wiring routed above the suspended ceiling in this fire area location does not impact fire protection DID, and that the wiring located above the ceilings does not compromise administrative fire prevention controls, and does not challenge automatic fire detection and suppression functions, manual fire suppression functions, or post-fire SSD capability.

In FPE RAI 07.a (Reference 27), the NRC staff requested that the licensee provide a technical basis for how each of the three echelons of fire protection DID is or is not impacted by the wiring above the suspended ceiling in each of the areas of the plant. In its response to FPE RAI 07.a (Reference 18), the licensee stated that for Echelon 1, the cables in the fire areas in the approval request 4 are low voltage video/communication/data cables or low voltage power cable (below 480 VAC) which are not susceptible to self-ignition and that self-ignited cable fires are screened from consideration for all locations in the plant based on an engineering evaluation.

The licensee further stated that the guidance in NUREG-1805 section 7.3, states that "It is common practice to consider only self-ignited cable fires to occur in power cable trays since they carry enough electrical energy for ignition. Control, instrumentation, data cables, etc. typically do not carry enough electrical energy for self-ignition." The licensee further stated that with respect to low voltage power cables, their engineering evaluation determined that all plant routed thermoplastic cables, and cables with unknown jacket or insulation type were used exclusively in low energy applications (e.g., data, instrumentation, control, low voltage power, etc.); and therefore, based upon the results of the evaluation, and consistent with the guidance in NUREG/CR-6850 and NUREG-1805, it was concluded that no areas in the plant need to postulate self-ignited cable fires. The licensee further stated that administrative controls such as combustible controls and hot work controls are not affected. The licensee further stated that this preserves DID Echelon 1.

The licensee stated that for Echelon 2, the following fire areas, which were identified in the approval request, have portable fire extinguishers, hose stations, and pre-fire plans that are available for manual firefighting activities by the site fire brigade which provides assurance that if a fire were to occur the damage from the fire would be limited: Fire Area 8 Lunch Room, Unit 1, 715' in Southeast corner; Fire Area 8 Locker Room, Unit 2, 715' in Northwest corner; Fire Area 83 SAS and Operations Lounge; and, Fire Area 94 Computer Room. The licensee further stated that the SAS (Part of Fire Area 83) is continually manned providing early notification and the potential use of a fire extinguisher as early extinguishment prior to brigade arrival. The licensee further stated that this preserves DID Echelon 2.

The licensees stated that for Echelon 3, the use of the non-plenum rated cables routed above the suspended ceilings does not prevent essential safety functions from being performed. The licensee further stated that the quantity of combustibles associated with the non-rated cabling is considered insignificant with regard to combustible loading in the affected areas, and the non-plenum rated cabling does not compromise manual fire suppression functions, or the nuclear safety capability assessment, which does not impact the ability to achieve and maintain safe and stable conditions. The licensee further stated that this preserves DID Echelon 3.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided the technical basis for how each of the three echelons of fire protection DID is or is not impacted by the wiring above the suspended ceiling. The NRC staff reviewed each of these basis and concludes that the fire protection DID is not impacted by the use of electrical wiring above suspended ceilings.

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

3.2 Nuclear Safety Capability Assessment Methods

NFPA 805, (Reference 3), is a 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, in part, 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 1.3.1, "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 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
>
> (4) Assessment of the ability to achieve the nuclear safety performance criteria given a fire in each fire area

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

Regulatory Guide 1.205, Revision 1 (Reference 4), endorses NEI 04-02, Revision 2 (Reference 7), and Chapter 3 of NEI 00-01, Revision 2, (Reference 38), and promulgates the method outlined in NEI 04-02 for conducting a NSCA. This NRC-endorsed guidance (i.e., NEI 04-02 Table B-2, "NFPA 805 Chapter 2 – Nuclear Safety Transition – Methodology Review" 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 safe shutdown. 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
- Identifying appropriately conservative assumptions to be used 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 72). In addition, the licensee stated that a review of NEI 00-01, Revision 2, Chapter 3, was conducted to identify the substantive changes from NEI 00-01 Revision 1 that are applicable to an NFPA 805 FPP. Based on the information provided in the licensee's submittal, the NRC staff concludes that the licensee used a systematic process to evaluate the post-fire safe shutdown analysis against the requirements of NFPA 805, Section 2.4.2, Subsections (1), (2), and (3), which meets the methodology outlined in the latest NRC-endorsed industry guidance.

FAQ 07-0039 (Reference 73), provides one acceptable method for documenting the comparison of the safe shutdown analysis against the NFPA 805 requirements. This method first maps the existing 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 to NEI 00-01, Revision 2, and documenting the results of the review in LAR Attachment B, "NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment Methodology Review," in accordance with NEI 04-02, Revision 2.

The categories used by PINGP 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 Attachment B, Table B-2 as "Aligns."
2. The SSA aligns with the intent of the attribute: noted in LAR Attachment B, Table B-2 as "Aligns with Intent."
3. 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 remains valid: noted in LAR Attachment B, Table B-2 as "Not in Alignment, but Prior NRC Approval."

Finally, some attributes may not be applicable to the SSA (for example, the attribute may be applicable only to BWRs or PWRs). These are noted in LAR Attachment B, Table B-2 as "Not Applicable."

As described in LAR Section 4.2.1.1 and discussed above, the licensee performed the review of the SSA methodology to the guidance of NEI 00-01, Revision 1, and conducted a gap analysis to compare NEI 00-01 Revision 1 against NEI 00-01, Revision 2, to identify substantive changes that are applicable to the NFPA 805 FPP. 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). The licensee stated that there are no recovery actions (RAs) requiring the use of rising stem valves where the credited valve has been exposed to the fire.

- Analysis of open circuits on high voltage (e.g., 4.16 kV) ammeter current transformers (NEI 00-01, Revision 2, Section 3.5.2.1). The licensee stated that the analysis performed demonstrated that although there are current transformers susceptible to fire-induced faults, including the highly unlikely open circuit fault, none of the current transformers are of concern for secondary fires.

- Analysis of control power for switchgear with respect to breaker coordination (NEI 00-01, Revision 2, Section 3.5.2.4). The licensee stated that the analysis included both the common power supply as well as the common enclosure aspects of the loss of control power. The licensee identified actions included in LAR Attachment S, Table S-2 Modification Items 10, 23, 24, and LAR Attachment S, Table S-3, Implementation Item 34, to preclude coordination and circuit protection concerns resulting from this fire-induced failure sequence. The NRC staff considers these actions acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

In its letter dated June 19, 2015 (Reference 15), the licensee identified a new action to be added to LAR Attachment S, Table S-2. Modification Item 38 to provide a fuse to protect the control circuits for the DC lube oil pumps in both units. 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 results of the NEI 00-01, Revision 2, evaluation are incorporated in LAR Attachment B and the applicable findings were incorporated in the NSCA model.

The NRC staff has determined that, taken together, these methods compose an acceptable approach for documenting compliance with the NFPA 805, Section 2.4.2 "Nuclear Safety Capability Assessment," requirements, because the licensee followed the alignment strategies identified in the endorsed NEI 04-02 guidance document which provides an organized structure to document each attribute in NEI 00-01, Chapter 3, allowing the licensee to provide significant detail in 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 a 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 information provided by the LAR, the NRC staff concludes that the licensee's statements of alignment are acceptable.

3.2.1.2 Attribute Alignment -- Aligns with Intent

For certain 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:

- 3.0
- 3.1
- 3.1.1.9
- 3.1.1.10
- 3.1.2.1
- 3.1.2.3
- 3.1.2.4
- 3.1.2.5
- 3.2.1.1
- 3.2.1.5
- 3.2.2.1
- 3.2.2.4
- 3.4.1.4
- 3.5.1.4

Attribute 3.0 – Deterministic Methodology: The guidance states that a generic deterministic methodology and criteria is used to perform a post-fire SSA to address regulatory requirements, and that the requirements of 10 CFR 50, Appendix R, Sections III.G.1, III.G.2, and III.G.3 apply to equipment and cables required for achieving and maintaining SSD in any fire area. The licensee stated that it used a deterministic methodology to assess conformance of the SSA with the NSCA, as described in NFPA 805, Section 1.5.1, and that results of the detailed comparison of the deterministic methodology against the guidance provided in NEI 00-01, Revision 1, and the NEI 00-01, Revision 2 gap analysis concluded that PINGP either (1) aligns or aligns with intent or (2) does not align, but prior NRC approval is provided to meet the NEI 00-01 attribute. The NRC staff concludes that the methods as described by the licensee are acceptable because the SSD methodology follows the guidance of NEI 00-01 and 04-02 as endorsed by the NRC in RG 1.205, and, therefore, meets the intent of NEI 00-01 to apply deterministic methodology in the performance of the SSA.

Attribute 3.1 – SSDs and Path Development: The guidance discusses the identification of systems available and necessary to perform the required SSD functions and provides information on the process for combining these systems into SSD paths. The licensee stated that systems, functions, equipment, cables and logics required to maintain fuel in a safe and stable condition have been identified and are included in the NSCA model, and that demonstration of the NSPC for safe and stable conditions was performed in two analyses: at-power analysis and non-power analysis. The NRC staff concludes that the methods as described by the licensee are acceptable because the identification of systems, functions, equipment and cables are based on meeting the NSPC of NFPA 805, and, therefore, align with the intent of the NRC-endorsed guidance to identify SSD systems and paths.

Attribute 3.1.1.9 – Criteria/Assumptions: The guidance states that the post-fire SSA assumes a 72-hour coping period starting with a reactor scram/trip, and 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. The guidance further states 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 NFPA 805 NSPC demonstrates that the plant can achieve and maintain a "safe and stable" condition, and that equipment required to achieve cold shutdown is included in the NSCA model to demonstrate availability and identify fire damage that may require repair should plant operations decide to proceed to NPO from a safe and stable condition. The licensee further stated that there is no time or power supply requirement associated with the completion of repairs under NFPA 805. The NRC staff concludes that the methods, as described by the licensee, are acceptable because the NSCA demonstrates that the plant can achieve safe and stable conditions as required by NFPA 805, and therefore, aligns with the intent of the NRC-endorsed guidance to achieve SSD conditions.

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 (ECS), of systems required to achieve and maintain SSD is acceptable where permitted by current regulations or approved by the NRC, and that automatic initiation of systems selected for SSD is not required but may be included as an option. The licensee stated that automatic functions (e.g. load sequencers), when credited, have been analyzed within the NSCA model for availability and spurious operation, and that manual functions are credited by the analysis and listed in the fire risk evaluations (FREs) (RAs) and in the NPO (manual actions). In SSA RAI 01e (Reference 24), the NRC staff requested that the licensee provide a description of how the manual actions performed at the new switch panel, which is included in LAR Attachment S, Table S-2, Modification Item 27, align with this NEI 00-01 attribute. In its response to SSA RAI 01e (Reference 14), the licensee stated that the manual action to isolate the power operated relief valve (PORV) control valves at the new isolation panel is not credited in the NSPC and is credited for risk reduction purposes only. The licensee further stated that the action to de-energize the PORV control valves outside the control room (at DC switch panels in the battery rooms) is the credited action to assure that the PORVs are closed and remain closed to meet the NSPC described in NFPA 805, Section 1.5.1(b). The licensee further stated that the design function of the PORV switch is to preclude or isolate (mitigate) hot shorts from causing spurious openings of the PORVs, and that this will be accomplished by breaking the circuit power connection of the solenoid valve that is not affected by a fire in the fire area. The licensee stated that hot shorts at this switch in the control room would not be able to cause spurious operation of the components. The NRC staff concludes that the licensee's response to SSA RAI 01e is acceptable because the licensee demonstrated that manual initiation of the PORV control valves from the MCR is not credited to meet the NSPC, and, therefore, the provisions of NEI 00-01 Attribute 3.1.1.10 do not apply to this modification. The NRC staff concludes that the licensee's methodology for manual initiation of systems is acceptable because manual functions credited in the NSCA have been analyzed, and therefore, align with the intent of the NRC-endorsed guidance to achieve SSD conditions.

Attribute 3.1.2.1 – Reactivity Control: The guidance states that there must be a method for ensuring that adequate shutdown margin is maintained by ensuring borated water is used for reactor coolant system (RCS) makeup/charging. The licensee stated that long-term reactivity control is accomplished by adding borated water from the refueling water storage tank (RWST) to ensure reactivity margin throughout safe and stable conditions. The licensee further stated that the NSCA model has shown that the credible boron dilution event is only possible for fire occurring in fire areas 13 and 18 and that this event will be addressed as part of the RI/PB methods for these areas. The NRC staff concludes that the methods, as described by the licensee are acceptable, because the long-term reactivity control is ensured by adding borated water from the RWST, and therefore, aligns with the intent of the NRC-endorsed guidance.

Attribute 3.1.2.3 – Inventory Control: The guidance states that systems selected for the inventory control function should be capable of maintaining level to achieve and maintain hot shutdown and that typically, the same components providing inventory control are capable of providing pressure control. The licensee stated that to ensure fuel is maintained in a safe and stable condition, RCS makeup is required for maintenance of RCS integrity (isolating flow diversion paths and maintaining the pressurizer level within the indicating range), and to compensate for RCS inventory losses due to seal leakoff and shrinkage during cooldown. The NRC staff concludes that the methods, as described by the licensee, are acceptable because the RCS inventory is maintained to provide safe and stable conditions, and therefore, aligns with the intent of the NRC-endorsed guidance for inventory control.

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 removing sufficient decay heat from the reactor to reach hot shutdown conditions, and that typically entails utilizing natural circulation, in lieu of forced circulation via the reactor coolant pumps (RCPs) and controlling steam release via the atmospheric dump valves (ADVs). The guidance further states that the decay heat removal function(s) should be capable of removing sufficient decay heat from the reactor to reach cold shutdown conditions. The licensee stated that following a reactor trip, decay heat is removed via the steam generators by natural or forced circulation within the reactor coolant loops, and that feedwater is supplied to the steam generators by the auxiliary feedwater system (AFW). The licensee further stated that, at a minimum, one AFW pump and one steam generator (SG) is required for removal of decay heat from the RCS, and that removing sufficient decay heat to reach cold shutdown conditions is not a requirement for PINGP to maintain fuel in a safe and stable condition. The NRC staff concludes that the methods, as described by the licensee, are acceptable because the decay heat removal function is achieved in maintaining the fuel in a safe and stable condition, and therefore, aligns with the intent of the NRC-endorsed guidance to remove decay heat to reach SSD conditions.

Attribute 3.1.2.5 – Process Monitoring: The guidance states that the process monitoring function is provided for all SSD paths and that the instrumentation is that which monitors the process variables necessary to perform and control the functions specified in 10 CFR 50, Appendix R, Section III.L.1, and that such instrumentation must be demonstrated to remain unaffected by the fire. The licensee stated that the performance of the primary system is monitored by RCS pressure, pressurizer level, and RCS hot-leg and cold-leg temperatures; the secondary system is monitored by the SG level indicators; and reactivity is monitored by the neutron source range flux monitors. The licensee further stated that when using the hot shutdown panels (HSD), SG pressure is available via local mechanical (remote from HSD panel) indicators, and that when controlling charging from the HSD panel, local pressure indication is credited. The licensee further stated that additional tank level monitoring is provided by local mechanical and tank level indicators, and that diagnostic instrumentation is generally provided by local devices that do not require power to operate, and if power or control was required for the diagnostic instrument, it was included in the model for analysis purposes. The NRC staff concludes that the methods, as described by the licensee, are acceptable because a process monitoring function is provided to achieve safe and stable conditions, and therefore, aligns with the intent of the NRC-endorsed guidance to provide instrumentation, including process monitoring, for SSD paths.

Attribute 3.2.1.1 – Criteria/Assumptions on Categorizing Safe Shutdown Equipment: The guidance states that SSD equipment can be divided into two categories: (1) primary components or (2) secondary components; and that secondary components are typically items found within the circuitry for a primary component to provide a supporting role to the overall circuit function. The licensee stated that it did not differentiate between primary and secondary components within the NSCA model, and that all analysis performed in support of added equipment for NFPA 805 included the secondary components, or at a minimum, the function of the secondary components within the model. The NRC staff concludes that the methods, as described by the licensee, are acceptable because the NSCA model considers both primary and secondary components, and, therefore, aligns with the intent of the NRC-endorsed guidance for categorizing SSD equipment.

Attribute 3.2.1.5 – Criteria/Assumption on Instruments: The guidance states that instruments (e.g., resistance temperature detectors, thermocouples, pressure transmitters, and flow transmitters) are assumed to fail upscale, midscale, or downscale as a result of fire damage,

whichever is worse, and that an instrument performing a control function is assumed to provide an undesired signal to the control circuit. The licensee stated that it assumes that instrumentation circuits fail in their worst-case positions when damaged by the fire unless analysis was performed to show that the failure mode is incredible. The licensee further stated that credited instrumentation circuits are modeled in the NSCA model. In SSA RAI 03 (Reference 24), the NRC staff requested the licensee to provide additional information related to alignment with this attribute regarding the methodology used for performing the analyses to show that the failure mode is incredible for instruments credited in the NSCA model. In its response to SSA RAI 03 (Reference 14), the licensee stated that in general, it assumed that instrumentation circuits involving shielded twisted pair cables will fail in the worst-case mode (upscale, downscale or midrange); however, in a very few cases additional analysis was performed to determine that the worst-case failure mode is incredible and to identify the true fire-induced failure mode. The licensee described the methodology for performing the analysis, and indicated that it credits that the circuit be capable of being positively isolated from any signals (interlocks, process variables, etc.) that could cause an undesired output or positioning, which is in accordance with the guidance provided in NUREG/CR-7150 (Reference 58). The NRC staff concludes that the licensee's response to SSA RAI 03 is acceptable because the licensee demonstrated that its analysis methodology for evaluating fire-induced damaged to instrumentation circuits involving shielded twisted pair cables is consistent with the guidance provided in NUREG/CR-7150.

Attribute 3.2.2.1 - Identify the System Flow Path for Each Shutdown Path: The guidance states that piping & instrumentation drawings (P&ID) be marked up and annotated to highlight the specific flow paths for each system in support of each shutdown path. The licensee stated that it used marked-up P&IDs to identify both required flow paths, as well as diversion flow paths, and that this information was used as a basis for the safe and stable logic trees and the equipment listings that are contained in the NSCA model. The licensee further stated that the marked up P&IDs are not required to be retained, as the logic trees within the NSCA model are sufficient to show flow paths with credited components. The NRC staff concludes that the methods, as described by the licensee, are acceptable because the NSCA model includes the logic trees, and therefore, aligns with the intent of the NRC-endorsed guidance to identify the SSD system flow paths.

Attribute 3.2.2.4 – Identify Equipment Information Required for the Safe Shutdown Analysis: The guidance states that additional equipment-related information necessary for performing the post-fire SSA for the equipment, such as equipment type, equipment description, SSD system, SSD path, drawing reference, fire area, fire zone, and room location of equipment or other information such as the following may be useful in performing the SSA: normal position, hot shutdown position, cold shutdown position, failed air position, failed electrical position, high/low pressure interface concern, and spurious operation concern. The licensee stated that it identified and recorded similar data to that given in this guidance and maintains the NSCA equipment listing and analysis data within the NSCA model. The NRC staff concludes that the methods as described by the licensee are acceptable because the equipment information is included in the NSCA model for achieving safe and stable conditions; and therefore, aligns with the intent of the NRC-endorsed guidance.

Attribute 3.4.1.4 – Criteria/Assumptions for Manual Actions: The guidance directs the licensee to use manual actions where appropriate to achieve and maintain post-fire safe shutdown conditions in accordance with NRC requirements. The licensee stated that to achieve and maintain safe and stable conditions, and to minimize the use of RAs, the least fire-impacted success path was credited for each fire area, and that all RAs that varied from the deterministic

requirements were addressed via the variance from deterministic requirement (VFDR) process. The licensee further stated that areas with VFDRs that were not solved by a modification used the RI/PB methodology and that feasibility and/or reliability of the RAs is being addressed as part of the NFPA 805 process as described in LAR Attachment G and Attachment S, Table S-3, Implementation Items 57, 58, and 62. The NRC staff considers these actions acceptable because they 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 methods and implementation items described in LAR Attachment S, Table S-3, are acceptable because they will result in compliance with the requirements of NFPA 805 for evaluation of RAs, and therefore, align with the intent of the NRC-endorsed guidance for the use of manual actions.

Attribute 3.5.1.4 – Criteria/Assumptions for Redundant Trains Located in the Same Fire Area Outside Containment: The guidance states that when both trains are in the same fire area outside of primary containment, all cables that do not meet the separation requirements of 10 CFR 50, Appendix R, Section III.G.2, are assumed to fail in their worst case configuration. The licensee stated that all unprotected cables and equipment within the analysis area, that did not meet the separation requirements of NFPA 805, Section 4.2.3, were identified and the appropriate failure modes were considered and addressed using either deterministic or RI/PB methods. The NRC staff concludes that the methods as documented in the NSCA are acceptable because they comply with the requirements of NFPA 805 and align with the intent of the NRC-endorsed guidance for assumptions for redundant trains in the same fire area.

The NRC staff concludes that the NSCA methodology adequately meets the intent of the NEI 00-01, Chapter 3, attributes identified above, which is to ensure that the post-fire SSD analysis addresses the requirements of NFPA 805, Section 2.4.2.

3.2.1.3 Attribute Alignment -- Not in Alignment, but Prior NRC Approval

In two 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 used to demonstrate compliance have been evaluated to ensure that their bases remain valid. The NEI 00-01, Chapter 3, attributes identified in LAR Attachment B, Table B-2, as complying via this method are as follows:

- 3.1.1.4
- 3.4.1.6

Attribute 3.1.1.4 – Criteria/Assumption on Alternative Shutdown: The guidance states that the classification of shutdown capability as alternative shutdown is made independent of the selection of systems used for shutdown, and that alternative shutdown capability is determined based on an inability to assure the availability of a redundant SSD path. The guidance further states that compliance with the separation requirements of 10 CFR 50, Appendix R, Sections III.G.1 and III.G.2 may be supplemented by the use of manual actions to the extent allowed by the regulations and the licensing basis of the plant, repairs (cold shutdown only), exemptions, deviations, Generic Letter (GL) 86-10 (Reference 88), fire hazards analyses (FHA) or fire protection design change evaluations, as appropriate. In LAR Attachment A and Attachment K, as clarified in Attachment T, the licensee stated that fire areas 13 and 18 (control room and relay and cable spread room) were defined as "Alternative / Dedicated Shutdown" areas under 10 CFR 50, Appendix R, and that unlike 10 CFR Part 50, Appendix R, NFPA 805 does not define areas or scenarios as alternative shutdown or dedicated shutdown, and, therefore, fire

areas 13 and 18 are being transitioned as RI/PB areas. The licensee further stated that as an exception to this NEI 00-01 attribute, it is transitioning an existing approved licensing action for a "repair action" to assure isolation of PORVs for a fire occurring in the control room or relay room (fire areas 13 and 18 respectively), that could cause spurious operation of PORV isolation valves. The licensee further stated that the RI/PB analysis for fire areas 13 and 18 credits a control room action on the control board to close the PORV block valves just prior to abandoning, and additional control room actions would then be taken at a switch panel that is being installed within the control room that is included in LAR Attachment S, Table S-2, Modification Item 27, to isolate pressurizer PORV and the pressurizer heaters. 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. Based on the information provided in the licensee's submittal and the modification to allow control room actions taken at a switch panel, the NRC staff concludes that licensing action as originally approved by the NRC staff and clarified in LAR Attachment T, is acceptable because the use of a repair action to isolate pressurizer PORVs will be superseded in the future using disconnect switches, and the licensee determined the basis for approval remains applicable and valid in accordance with the guidance in RG 1.205 and NEI-04-02.

Attribute 3.4.1.6 – Criteria/Assumptions on Demonstrating One Train of Systems Required for Hot Shutdown is Free from Fire Damage: The guidance states that one train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage (i.e., 10 CFR Part 50, Appendix R, III.G.1.a) and when cables or equipment, including associated circuits, are within the same fire area the separation requirements of 10 CFR 50, Appendix R, Section III.G.2, can be provided. The guidance also states that use of exemptions, deviations, and licensing change processes can be used to satisfy the attribute and to demonstrate equivalency depending upon the plant's license requirements. The licensee stated that it is transitioning an existing approved licensing action for the oil collection system in fire areas 1 and 71 (PINGP Unit 1, and PINGP Unit 2 containments) and a "repair action" to assure isolation of pressurizer PORVs for a fire occurring in the MCR or relay room (fire areas 13 and 18, respectively) that could cause spurious operation of PORV isolation valves. The licensee further stated that the basis for approval has been reviewed and that there have been no plant modifications or other changes that would invalidate the basis for approval. The NRC staff reviewed the information provided by the licensee and concludes that previous NRC approval has been demonstrated using suitable documentation that meets the approved guidance in RG 1.205 and NEI-04-02. The NRC staff concludes that the licensee's statements of compliance in these instances are acceptable because the licensee provided adequate justification for the continued validity of the previously approved alternatives to the NFPA 805, Chapter 3, requirements.

3.2.1.4 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 requirements using NEI 00-01, Revision 1, and conducted a gap analysis to the NRC-endorsed process in Chapter 3 of NEI 00-01, Revision 2. The results of the review including the gap analysis are documented in LAR Attachment B, Table B-2, in accordance with NEI 04-02, Revision 2.

Based on the information provided in the licensee's submittal, as supplemented, the NRC staff accepts the method the licensee used 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. The NRC staff accepts the licensee's method because it either:

- Meets the NRC-endorsed guidance directly;
- Meets the intent of the endorsed guidance and adequate justification was provided; or,
- Had a previous NRC staff approval of an alternative to the guidance.

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, 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 is to maintain safe and stable conditions in hot standby (Mode 3) up to the point at which the residual heat removal loop is placed into service. The licensee stated that it 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.

In LAR Section 4.2.1.2, the licensee stated that demonstration of the NSPC for safe and stable conditions was performed in two analyses:

- At-Power analysis, Mode 1 through Mode 3.
- Non-Power analysis, which includes Mode 4 and below.

The licensee further stated that the NFPA 805 licensing basis for a safe and stable condition in the event of a fire starting with the reactor in at-power operating Modes 1, 2, or 3 (power operation, startup, or hot standby, respectively) is to maintain safe and stable conditions in hot standby without use of the RHR system, and that it 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 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 re-establish inventory in the CST or realign AFW to its alternate source (cooling water system).

The licensee stated that a thermal-hydraulic analysis was performed for a mission time of 24 hours to assure that safe and stable conditions can be achieved within that time period, and that this mission time ensures that sufficient time is available for the engineering relief order to respond to the event, assess the extent of fire damage, and assist the plant operating staff with maintaining safe and stable conditions or transitioning the plant to a NPO mode.

In SSA RAI 06a (Reference 24), the NRC staff requested that the licensee provide a qualitative risk assessment for extending the mission time beyond 24 hours and implementing operator actions to establish makeup to the RWST, the CST and/or realignment of AFW to its alternate source. In its response to SSA RAI 06a (Reference 14), the licensee stated that the actions to refill the RWST, CST, and realign AFW to the alternate cooling water source have a low risk

associated with them and that the actions are well described in the existing plant procedures. The licensee described that there are multiple sources available and that the operators are familiar with these actions. The licensee stated that after 24 hours, additional personnel will be available from the emergency plan, as well as additional resources (e.g., power, vehicles, equipment, etc.) to support performing these actions. The licensee stated that beyond time frames of 24 hours, existing plant procedures specific to the situation can be implemented to establish system alignments and to use equipment in ways differing from normal plant practice or training, and that procedures and equipment address a wide spectrum of possibilities. The licensee stated that additional guidance for options beyond those described in the plant procedures is provided in formulating strategies in an event that has placed the plant in a condition that goes beyond the normal and emergency use of operating procedures and equipment. The licensee stated that the risk associated with these actions is low and it can maintain safe and stable conditions indefinitely. The NRC staff concludes that the licensee's response to SSA RAI 06a is acceptable because the licensee demonstrated that a means to maintain decay heat removal and RCS inventory control capability beyond the 24 hours is feasible to maintain safe and stable conditions.

The licensee stated that to sustain safe and stable conditions, the following NSPC are met:

- Reactivity and Inventory Control

  The licensee stated that the reactor design ensures that Keff < 0.99 can be achieved by use of the control rods from any operating mode. Subsequent injection (using charging or safety injection pumps) of soluble poison can be used to assure continuation of mode 3, hot standby, under all circumstances. The licensee further stated that the charging system and the safety injection system (SIS) will remain available beyond the mission time for safe and stable conditions, and that the RWST is the credited source of borated water and is capable of providing water for at least 38 hours. The licensee further stated that operator actions to establish makeup sources of inventory to the RWST are described in existing plant procedures.

- Decay Heat Removal

  The licensee stated that one or both SGs, as well as a motor driven or turbine driven AFW pump will remain available without additional actions to provide symmetrical or asymmetrical decay heat removal beyond the mission time for safe and stable, and that the CST is the initial source for the AFW pumps. The licensee further stated that the CST will provide a continuous water supply for the AFW pumps for 20 hours, and that beyond 20 hours, the CST can be refilled or the AFW pumps can be re-aligned to the cooling water system to provide an unlimited water source.

- Vital Auxiliaries – Power and Support Systems

  The licensee stated that the emergency diesel generators (EDGs) and diesel driven cooling water pumps (DDCLPs) have an on-site fuel oil supply that will last for 14 days, assuming one EDG on each unit and one DDCLP, or 7 days if both EDGs are operating for each unit and both DDCLPs are operating. The licensee further stated that offsite sources of fuel oil are available to replenish fuel oil levels if needed via established contracts.

In SSA RAI 06b (Reference 24), the NRC staff requested that the licensee provide the details of the makeup water sources to the RWST and the CST or AFW pumps and the process for aligning these sources, including a discussion of feasibility. In its response to SSA RAI 06b (Reference 14), the licensee stated that plant procedures credited for accomplishing replenishment of the RWST and CST include the details of the lineups and how the lineups are accomplished. In its response to SSA RAI 06a, the licensee stated that if the CST was to be depleted, the AFW pumps can be re-aligned to take suction from the Mississippi River, providing a virtually unlimited supply of water, and that the AFW re-alignment can be performed from the control room, or locally by opening the cooling water supply valve without having to stop the AFW pump. The licensee stated that there is CST level indication and indication for AFW suction pressure to provide diverse indication, and that because the RCP seals have been replaced with seals that are not initially subject to excessive leakage, there is substantial time available to make up to the RWST. The licensee further stated that the single and multiple spurious combinations that could cause RWST or CST drain down events have been addressed by a thermal-hydraulic analysis, and that the dependency on the RWST to make-up to the RCS is minimized. The licensee further stated that there are redundant RWST level indicators and low level annunciators in the control room. The licensee stated that an action to perform a formal feasibility analysis of the methods to replenish the RWST and CST is included in LAR Attachment S, Table S-3, Implementation Item 53. The NRC staff considers this action acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by a proposed license condition. The NRC staff concludes that the licensee's response to SSA RAI 06b is acceptable because the licensee adequately described the details of the makeup sources and the process for aligning these sources, and feasibility of these actions will be addressed through an action that would be required by a proposed license condition.

The licensee also stated that control room HVAC can be lost in several fire areas due to the loss of instrument air and other fire-induced HVAC component damage. The licensee stated that it demonstrated that control room temperatures will remain below equipment limits for up to 36 hours with actions taken only within the control room itself, and that a portable fan may be installed in the control room prior to 36 hours to allow temperatures to remain below equipment limits indefinitely. The licensee further stated that if the portable fan is required, it will normally be powered by a designated welding receptacle or in cases where the welding receptacle power is lost due to the fire, by a 480 VAC portable generator located outside of the building. The licensee included an action to develop a procedure to connect the portable generator to power the temporary fan for the main control room in LAR Attachment S, Table S-3, Implementation Item 63. The NRC staff considers this action acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by a proposed license condition.

In SSA RAI 04 (Reference 24), the NRC staff requested that the licensee provide additional information related to the steps taken to maintain the control room temperature below equipment limits for 36 hours and to discuss the use of the portable fan or portable generator if credited for achieving the NSPC, including details on the storage and usage locations, type and quantity of fuel, fire exposure hazards when refueling the portable generator and a summary of the procedural guidance for the use of the portable generator or portable fan. In its response to SSA RAI 04 (Reference 14), the licensee stated that the steps to maintain the control room temperature below equipment limits for 36 hours include opening doors and vent paths from the control room. The licensee further stated that the portable fan is used at approximately 36 hours, which is after safe and stable conditions have been achieved (within 24 hours), and therefore, the action to power the portable fan is not considered to be a RA. The licensee

stated that the portable generators will be stored and operated outside the power block, as defined in LAR Attachment I, and that it will not be operational in the vicinity of SSCs credited in the NSCA. The licensee stated that the portable generator will be fueled with diesel fuel. The licensee stated that LAR Attachment S, Table S-3, Implementation Item 63, includes an action to develop procedural guidance to connect a diesel powered portable generator located outside the power block to power a temporary fan for the MCR to maintain safe and stable conditions, and that that procedural guidance will be provided for the operation, maintenance, storage, and refueling of the portable generator, and for training and drills. 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 further stated that the actions taken to maintain safe and stable conditions will be evaluated for feasibility against the criteria of FAQ 07-0030 (Reference 70), and included that action in LAR Attachment S, Table S-3, Implementation Item 53. 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 SSA RAI 04 is acceptable because the licensee demonstrated that its use of portable generators will not affect equipment credited to meet the NSPC and because the licensee included actions to evaluate the feasibility and develop procedures which will result in compliance with NFPA 805.

The licensee stated that if conditions warrant placing the plant in hot shutdown (Mode 4) or cold shutdown (Mode 5), it will initiate operation of the RHR system, and that although the RHR system is not required for maintaining safe and stable conditions, the RHR system is included in the "at power" NSCA model to demonstrate its availability for transition. The licensee further stated that initiation of RHR system operations does not imply that the end state will be cold shutdown (Mode 5).

On the basis of the licensee's analysis as described in the LAR, the NRC staff concludes that the licensee has provided 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

As stated below, 10 CFR 50.48(c)(2)(iii) limits the use of feed and bleed:

> 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 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 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 PINGP meets the feed and bleed requirements. In LAR Table 5-3 the licensee stated that feed and bleed is not used as the sole fire protected SSD path at PINGP for any scenario. The NRC staff confirmed this by reviewing the designated SSD path 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 were acceptable.

Based on 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 used 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, that:

> 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 probabilistic safety assessment (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 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 adequately addressed MSO concerns at PINGP.

In LAR Section 4.2.1.4, and Attachment F, the licensee stated that a review and evaluation of PINGP susceptibility to fire-induced MSOs was performed and the process for identification and evaluation of MSOs was conducted in accordance with the guidance of NEI 04-02 and RG 1.205, as supplemented by FAQ 07-0038 Revision 3, and included the following five steps:

1. Identify potential MSOs of concern;
2. Conduct an expert panel to assess plant specific vulnerabilities;
3. Update the FPRA model and NSCA to include the MSOs of concern;
4. Evaluate for NFPA 805 compliance; and
5. Document results.

For Step 1, the licensee stated that the MSO identification process was performed in two complementary tasks: (1) a systematic review of plant P&IDs was performed to identify potential spurious operation combinations that can lead to initiating events and that can also impact the function of needed mitigating systems, and (2) an expert panel was convened to consider potential MSOs from a number of generic and plant specific sources. The licensee stated that sources of information used as inputs for this process included:

- Pressurized Water Reactor (PWR) Generic MSO List, Rev. 1, May 2009, contained in Appendix G of NEI 00-01, Rev. 2, May 2009;
- PINGP SSA;

- PINGP Internal Events PRA model revision 3.1;
- System P&IDs and electrical drawings; and
- PINGP training material for relevant systems.

For Step 2, the licensee stated that an MSO expert panel was conducted at the plant in December of 2009, which reviewed the applicable industry developed generic owner's group list of MSOs for applicability to PINGP and whether or not applicable MSOs were accounted for in the plant PRA and SSA. The licensee stated that a training session for the panel members was conducted prior to starting the actual assessment, and the results documented in a report, which includes:

- the presentation that was used as the training materials;
- the areas of expertise for each of the MSO expert panel participants; and
- a list of the generic MSOs that were reviewed.

The licensee stated that in addition to the expert panel meeting, a systematic review of system drawings was performed to identify single and MSOs of components that can lead to initiating events and that can also impact the function of needed mitigating systems. The licensee further stated that the purpose of this review was to identify relevant combinations of fire induced single spurious operations (SSOs) and MSOs of equipment which could result in a functional failure leading to an increase in CDF or LERF, and ensure they are evaluated within the context of the FPRA. The licensee further stated that the systematic review scope included all mechanical systems, including water, oil and air, but specifically excluded electrical systems because the spurious operations of electrical systems (i.e., spurious breaker operation) are already evaluated directly in the PRA and are considered, at least in part, in the PWR Owners Group's Generic MSO list. The licensee stated that the output from this review includes the following:

- a summary of the systematic review of systems for spurious operations combinations potentially affecting initiating events and mitigating systems; and,
- a listing of the resulting SSO and MSO combinations identified.

The licensee stated that a second MSO expert panel was conducted at the plant in October of 2013, and that the expert panel was conducted to review PWR Owners Group's Generic electrical MSOs as detailed in NEI 00-01, Revision 2, to validate previous disposition efforts, discuss additional related plant-specific MSOs, and provide disposition in, as required, a report including:

- the presentation that was used as the training materials;
- fire induced MSOs related to PWR Owners Group's Generic electrical MSOs; and,
- the results of the focused-scope expert panel, including required disposition when necessary.

The licensee stated that cable selection and circuit analysis were then performed for those components that did not already have this performed for the current SSA, and that the components susceptible to spurious operation that were not already included in the FPRA model were added to the model at either the system level or the top logic level representing the probability of proceeding down various event tree paths. The licensee further stated that the probabilities for important SSO basic events were generated in the circuit failure mode likelihood

analysis, and that the probabilities for MSO events due to multiple cable hot shorts are also derived from the circuit failure mode likelihood analysis results.

For Step 3, the licensee stated that the results of the FPRA model development including the effects of equipment spurious operations are documented in the PINGP FPRA notebooks, and that the fire induced risk model along with the outputs from the cable selection and circuit failure likelihood analyses were then used to evaluate the impact of fire scenarios in individual fire areas and fire compartments to support the NSCA.

For Step 4, the licensee stated that the PRA quantified the fire-induced risk model containing the MSO failure modes, and that the quantification addressed the specific electrical cables and the failure mode in each fire area and fire zone that was quantified. Thus, the licensee stated that the MSO contribution is included in the FPRA results associated with evaluation of VFDRs as documented in applicable FREs.

The licensee also stated that the MSO combinations of components of concern were also evaluated as part of the NSCA, and that the potential for a spurious operation were reviewed to determine the overall impact on the current fire area SSD strategies. The licensee further stated that during this review process, the systems were reviewed to determine the overall impact. The licensee stated that for cases where the MSO combination of components did not meet the requirements for deterministic compliance, the MSO combination of components were identified as VFDRs and evaluated in FREs.

For Step 5, the licensee identified the plant documentation applicable to the evaluation of MSOs.

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. The NRC staff also concludes that the licensee's approach for assessing the potential for MSO combinations is acceptable because the process used by the licensee provides reasonable assurance that the FREs appropriately identify and include risk significant MSO combinations.

3.2.5 Establishing Recovery Actions

NFPA 805, Section 1.6.52, "Recovery Action," defines a recovery action 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 that:

> 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 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, in part, that:

> 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.

The licensee stated that the following methodology was used in accordance with the guidance provided in NEI 04-02, FAQ 07-0030, Revision 5, and RG 1.205 to determine RAs required for compliance (i.e., determining the population of post-transition RAs), which consisted of the following steps:

- Step 1: define the primary control stations (PCSs) and determine which pre-transition 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 are required to resolve 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; and

- Step 5: evaluate the reliability of the RAs.

The licensee stated that it does not have alternate or dedicated shutdown controls that meet the definition of a PCS as defined by RG 1.205 and that no credit has been taken for PCS actions in the FPRA.

In SSA RAI 01a-d (Reference 24), the NRC staff requested that the licensee provide additional information regarding actions performed at the hot shutdown panel (HSDP), and whether the HSDP location is credited as the PCS when the MCR is abandoned and if that location is where command and control is performed. In its response to SSA RAI 01a-d (Reference 14), the licensee stated that the HSDP was not reviewed and approved by the NRC as an alternate shutdown panel as defined in Generic Letter 81-12, Fire Protection Rule (Reference 101). The licensee further stated that the HSDP contains required indication, but it does not contain the required system and component controls, plant parameter indications, and communications so that an operator can adequately and safely monitor and control the plant using alternative shutdown equipment. The licensee further stated that although the HSDPs in the AFW Pump rooms are the primary command and control center after abandoning the control room, the panels are not credited as the PCS for the purpose of determining RAs. The licensee stated that all actions taken outside the control room after abandoning are considered to be RAs, and the additional risk of those actions is included in the FPRA analysis. The licensee stated that it credits process monitoring indication only at the HSDP, and there are no switch manipulations required to activate or isolate the process monitoring circuits at the HSDP, as the process monitoring indication is always active and isolated from the effects of fire in the control room,

and relay and CSR via always-active instrumentation isolation devices, and therefore, no actions are identified in LAR Attachment G. The licensee further stated that the command and control for the operating crew is described in plant procedures, and that symptoms may necessitate the need to perform RAs. The licensee provided a list of the required indication and the symptom-driven actions. The NRC staff concludes that the licensee's responses to SSA RAI 01a-d are acceptable because the actions performed at the HSDP involve monitoring indication only, and the symptom-driven actions based on cues from monitoring the instruments are evaluated as RAs and the additional risk of those actions were evaluated by the licensee, which meets the methodology for evaluating RAs credited in Chapter 4 of NFPA 805.

In LAR Attachment G, the licensee stated that RAs were identified to either meet the risk acceptance criteria or maintain a sufficient level of DID. Operator manual actions (OMAs) meeting the definition of a 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 Section 1.2 of NFPA 805. The licensee did not differentiate between a RA that is needed to meet the NSCA and one retained to provide DID. In each instance, the licensee determined whether a transitioning OMA was a RA or not necessary for the post-transition RI/PB FPP.

The licensee stated that all credited RAs, as listed in LAR Attachment G, were subjected to a feasibility review. In accordance with the NRC-endorsed guidance in NEI 04-02, the feasibility criteria used in the licensee's assessment process were based on the criteria in FAQ 07-0030 (Reference 70), and each of the 11 individual feasibility attributes were addressed. The FAQ 07-0030 attributes used to assess feasibility are:

- Demonstrations - 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.

- Systems and Indications - Consider availability of systems and indications essential to perform the RA.

- Communications - The communications system should be evaluated to determine the availability of communication, where required for coordination of RAs.

- Emergency Lighting - The lighting (fixed and/or portable) should be evaluated to ensure sufficient lighting is available to perform the intended action.

- Tools-Equipment - Any tools, equipment, or keys required for the action should be available and accessible. This includes consideration of self-contained breathing apparatus (SCBA) and personal protective equipment if required. (This includes staged equipment for repairs.)

- Procedures - Written procedures should be provided.

- Staffing - Walk-through of operations guidance (modified, as necessary, based on the analysis) should be conducted to determine if adequate resources are available to perform the potential RAs within the time constraints (before an un-

recoverable condition is reached), 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.

- Actions in the Fire Area - When RAs are necessary in the fire area under consideration or require traversing through the fire area under consideration, the analysis should demonstrate that the area is tenable and that fire or fire suppressant damage will not prevent the RA from being performed.

- Time - 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.

- 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 SCBAs if credited, appropriate use of operator aids) should be performed.

LAR Attachment G, Table G-1, "Recovery Actions and Activities Occurring at the Primary Control Stations," describes each RA associated with the resolution of a VFDR from the fire area assessments as documented in LAR Attachment C, "Fire Area Transition." The feasibility review was based on documentation only, including previous feasibility evaluations for SSD OMAs. In LAR Attachment S, Table S-3, Implementation Items 57, 58, and 62, the licensee included actions to revise post-fire SSD procedures and to complete load calculations supporting RAs associated with placing more than one instrument bus on its alternate source. The NRC staff considers these actions acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

Based on the above considerations, the NRC staff concludes that the licensee has followed the endorsed guidance of NEI 04-02 and RG 1.205 to identify and evaluate RAs in accordance with NFPA 805, and therefore, concludes that there is reasonable assurance of meeting the regulatory requirements of 10 CFR 50.48(c). The NRC staff also concludes that the feasibility criteria applied to RAs are acceptable, subject to completion of the implementation items required by a proposed license condition, based on conformance with the endorsed guidance contained in NEI 04-02.

3.2.6 Plant Specific Treatments or Technologies

3.2.6.1 Very Early Warning Fire Detection System

The licensee proposed the installation of several very early warning fire detection systems (VEWFDS) to monitor conditions, as well as provide indication and alarms inside key electrical cabinets during the incipient stage of a fire.

The licensee included an action in LAR Attachment S, Table S-2, modification item 5, to install a VEWFDS in fire area 18, relay room, that will continuously sample the air inside the risk

significant cabinets to identify fires based on the detection of the presence of small amounts of products of combustion and, if detected, will sound an alarm in the MCR. The licensee stated that the proposed modification will reduce risk by installing an incipient detection system that will notify operators of fires in their incipient state, and that this reduces the significance of the fire scenarios that could lead to control room abandonment.

In FPE RAI 04 (Reference 24), the NRC staff requested that the licensee provide information on the proposed VEWFDS modification related to the design and installation, testing, configuration and design control process, operations response procedures, and the credit taken in the FPRA as allowed by the criteria in NUREG/CR-6850, Supplement 1 (Reference 50). In its response to FPE RAI 04, the licensee stated the following:

1. The proposed modification identified in LAR Attachment S, Table S-2, Item 5, is to install an air aspirating incipient detection system inside low voltage (less than or equal to 250V) cabinets in the relay room, fire area 18. The system will be designed to meet the sensitivity criteria in NFPA 76 (Reference 67). The system will alarm at the existing fire alarm control panel in the control room and will be designed, installed, and maintained in accordance with NFPA 72 (Reference 66), and the manufacturer's recommendations. The guidance of FAQ 08-0046 (Reference 75) will be followed for the system design.

2. The factory and site acceptance testing will address transport time (maximum of 60 seconds from most remote sampling port), and sensitivity thresholds for alert (0.2% per foot obscuration) and alarm (1.0% per foot obscuration) at each sampling point. Alarm and response procedures and associated training will be revised and/or developed to describe actions to be taken in response to alert and alarm signals. Inspection, testing, and maintenance procedures will be developed in accordance with equipment manufacturer's recommendations and NFPA 72. Training will be developed with the assistance of manufacturer's recommendations for plant operations, inspection, testing and maintenance groups on the air aspirating incipient detection system.

3. Configuration and design control process that will control and maintain the setpoints for both alert and alarm functions from the VEWFDS will be in accordance with the site modification process and procedures.

4. Alarm response procedures for fire alarms and associated training will be revised and/or developed to describe actions to be taken in response to alert and alarm signals. These actions are still being developed and will be identified as part of the modification process.

5. Credit for incipient fire detection system in the FPRA is modeled as a multiplicative factor to the fire ignition frequency. The credited multiplication factor is 0.02 and is derived using the methods in NUREG/CR-6850, Supplement 1. Credit was taken in accordance with limitations and criteria of NUREG/CR-6850, Supplement 1 and Frequently Asked Question (FAQ) 08-0046. No deviations from NUREG/CR-6850, Supplement 1, exist within the credit for modeling of the VEWFDS.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided information on the proposed VEWFDS modification related to the design and

installation, testing, configuration and design control process, operations response procedures, and the credit taken in the FPRA. The NRC staff concludes that the fire protection aspects related to the proposed installation of the VEWFDS are acceptable because:

- The installation of the VEWFDS will be performed in accordance with the appropriate NFPA codes, the equipment manufacturers' requirements, and the guidance in FAQ 08-0046;
- The VEWFDS will be properly tested during commissioning such that the alert and alarm setpoints will be set to provide an appropriate level of sensitivity without unnecessary nuisance or spurious alarms;
- The licensee's design and configuration control process will control and maintain the setpoints for both alert and alarm functions for the VEWFDS;
- The VEWFDS equipment will be periodically tested and maintained in accordance with the vendor and manufacturer requirements, as well as guidance contained in FAQ 08-0046; and
- As part of the modification, which would be required by the proposed license condition, the licensee will revise or develop procedures to address system operation and alarm response.

In its letter dated December 14, 2016 (Reference 21), the licensee responded to PRA RAI 21 and discussed the results of a sensitivity analysis conducted to evaluate any changes in risk as a result of applying the recently revised guidance concerning VEWFDSs. The licensee stated that the total fire risk contribution for Fire Area 18 is within the limits described in RG 1.174 and that the total CDF, total LERF, total delta CDF and total delta LERF for all fire areas remain below RG 1.174 limits. See Section 3.4.2.2 of this SE for additional discussion regarding the VEWFDS credit.

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 concluded that upon completion of modification items 10, 20, 23, 24, and 38, as described in LAR Attachment S, Table S-2, and Implementation Items 34, 53, and 63, as described in LAR Attachment S, Table S-3, the declared safe and stable condition proposed will be 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. The NRC staff considers the process the licensee used to identify and analyze MSOs as 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 used for assessing the potential for MSO combinations acceptable, because it was performed in accordance with NRC-endorsed guidance.

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. Subject to completion of Implementation Items 57, 58, and 62, as described in LAR Attachment S, Table S-3, and required by a license condition, the NRC staff concludes that there will be reasonable assurance that the regulatory requirements of 10 CFR 50.48(c) and NFPA 805 for NSCA methods will be met.

The NRC staff reviewed the proposed installation of a VEWFDS to monitor conditions in certain key electrical cabinets. Based on the information provided in the LAR, as supplemented and subject to completion of modification item 5, as described in LAR Attachment S, Table S-2, and required by a license condition, 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.

3.3 Fire Modeling

NFPA 805 (Reference 3) allows both FM and FREs as performance-based alternatives to the deterministic approach outlined in the standard. These two performance-based approaches are described in NFPA 805, Sections 4.2.4.1 and 4.2.4.2, respectively. Although FM and FREs are presented as two different approaches for performance-based compliance, the FREs approach generally involves some degree of FM to support engineering analyses and fire scenario development. NFPA 805, Section 1.6.18, defines a FM as a "mathematical prediction of fire growth, environmental conditions, and potential effects on structures, systems, or components based on the conservation equations or empirical data."

The NRC staff reviewed LAR Section 4.5.2 (Reference 13), "Performance-Based Approaches," which describes how the licensee used FM as part of the transition to NFPA 805, 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 performance based 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 (NFPA 805 Section 4.2.4.1) was not used for the NFPA 805 transition. The licensee used the FRE PB method (i.e., Fire PRA) 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 nuclear safety performance criteria.

The licensee did not propose any FM methods to support performance-based evaluations in accordance with NFPA 805, Section 4.2.4.1, as the sole means for demonstrating compliance with the nuclear safety performance criteria. There are no plant-specific FM methods acceptable for use to support compliance with NFPA 805, Section 4.2.4.1, as part of this licensing action supporting the transition to NFPA 805 at PINGP.

3.4 Fire Risk Assessments

This section addresses the licensee's FRE PB method, which is based on NFPA 805, (Reference 3), 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, in part, 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 performance-based 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, "Defense-in-Depth," states that:

> 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.
> - Providing an adequate level of fire protection for structures, systems, and components important to safety, so that a fire that is not promptly extinguished will not prevent essential plant safety functions from being performed.

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, "NEI 04-02 Table B-3 – Fire Area Transition," as well as the associated supplemental information, in order to determine whether the licensee maintained the principles of DID in regard to the planned transition to NFPA 805 at PINGP.

When implementing the PB approach, the licensee followed the guidance contained in Section 5.3, "Plant Change Process," of NEI 04-02 (Reference 7), which includes detailed consideration of DID and safety margins as part of the change process. The results of the licensee's DID assessment, including the results of the licensee's review of the required fire suppression and fire detection systems, are provided in LAR Attachment C, as supplemented.

The licensee's methodology for evaluating DID refers to each of the three DID elements identified in NFPA 805, Section 1.2. In its response to PRA RAI 19 (Reference 14), the licensee provided a discussion in which, for each of the three elements, several examples of fire protection features that addressed that element are identified, along with a discussion of the considerations used in assessing those features. The assessment determined whether changes would be needed to assure that each element has been satisfactorily achieved or whether reliance on features in other elements were needed and should be developed. Many of the identified fire protection features are required to be in place in order to demonstrate compliance with the fundamental FPP and design elements of NFPA 805, Chapter 3 (e.g., combustible control program, hot work control program, etc.). However, the capabilities for some of the fire protection features for DID were evaluated and improved as needed based on the results of the PB analyses.

As described in its response to PRA RAI 19, the licensee indicated that this method for addressing DID was implemented in the FREs performed for each PB fire area. Per LAR Attachment C, the FRE: (1) documents the fire protection systems/features required to either meet the deterministic criteria of NFPA 805, Section 4.2.3, "Deterministic Approach," or to support the FPRA; (2) notes whether changes or improvements are necessary for each fire protection system/feature to maintain a balance among the DID elements; and, (3) provides a justification or basis for why the required fire protection systems/features are adequate for DID. As such, the FRE is the licensee's internal record of the systems required to meet the NSPC and DID requirements of NFPA 805. The NRC staff concludes that the licensee's response to PRA 19 is acceptable because the licensee demonstrated that it assessed the DID elements in the FRE and identified plant improvements as necessary to address any substantial imbalances between DID elements.

Based on its review of the LAR, the licensee's response to PRA RAI 19, and a sample of the FREs, the NRC staff concludes that the licensee has systematically and comprehensively evaluated fire hazards, area configuration, detection and suppression features, and administrative controls in each fire area and concludes that the methodology as proposed in its LAR 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 analysis acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or provides sufficient margin to account for analysis and data uncertainty.

LAR Section 4.5.2.2, "Fire Risk Approach," discusses how safety margins are addressed as part of the FRE process and states that this process is based on the requirements of NFPA 805, industry guidance in NEI 04-02, and RG 1.205 (Reference 4). An FRE was performed for each fire area containing a VFDR. The FREs contain the details of the licensee's review of safety margins for each PB fire area.

As discussed in LAR Section 4.5.1.2, "Fire PRA," and the licensee's response to PRA RAI 19 (Reference 14), the FPRA, including FM performed to support the FPRA, applies methodologies consistent with the guidance in NUREG/CR-6850 (References 48, 49, and 50), and NRC-approved FAQs according to LAR Attachment H, "NFPA 805 Frequently Asked Question Summary Table." LAR Attachment J, "Fire Modeling Verification and Validation (V&V)," and the licensee's response to PRA RAI 19 explain that FM, including V&V, performed in support of the FPRA used accepted codes and standards including NUREG/CR-6850, NUREG-1805 (Reference 55), and NUREG-1824 (Reference 56). In its response to PRA RAI 19, the licensee further described the methodology used to evaluate safety margins in the FREs to include the following evaluations and determinations:

- Fire Modeling: The conservatisms in the FM methods, inputs, tools, and results used in support of the FREs (i.e., as part of the FPRA) were reviewed to ensure safety margins are maintained.

- Plant System Performance: Plant system performance was evaluated using the safety analysis acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses, etc.).

- PRA Logic Model: The FPRA model was reviewed against the ASME/ANS RA-Sa-2009 PRA standard (Reference 43), consistent with the guidance in and RG 1.200, Revision 2 (Reference 42).

The results of the licensee's safety margin assessment by fire area are provided in LAR Attachment C, as supplemented.

The NRC staff considers that the safety margin criteria described in Section 5.3 in the LAR is consistent with the criteria described in RG 1.174 (Reference 41), and NEI 04-02, Section 5.3.5.3, and, therefore, acceptable. The licensee used appropriate codes and standards or NRC guidance, and demonstrated that it met the safety analyses acceptance criteria in the licensing basis. Based on its review of the LAR and a sample of the FREs during the audit, the NRC staff concludes that the licensee's approach adequately addressed 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 LAR, as supplemented, including industry peer review results and self-assessments performed by the licensee. 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," and LAR Attachment W, "Fire PRA Insights," as well as associated supplemental information.

The licensee developed its internal events PRA (IEPRA) during the individual plant examination process and continued to maintain and improve the PRA as RG 1.200 and supporting industry standards have evolved. The licensee developed its FPRA model 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 model to capture the effects of fire.

In LAR Section 4.8.2, "Plant Modifications and Items to be Completed During the Implementation Phase," the licensee stated that no significant 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. Based on this information, the NRC staff concludes that the FPRA model represents the current as-built, as-operated configuration and is, therefore, capable of being adapted to model both the post-transition and compliant plant configuration, as needed.

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 impact as a part of the routine change evaluation process. 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 would 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

As discussed in LAR Attachment U, the licensee's evaluation of the technical adequacy of the portions of its IEPRA model used to support development of the FPRA model consisted of a full-scope peer review that was performed using the NEI 05-04 process (Reference 39) and the combined ASME/ANS PRA standard (Reference 43), as clarified by RG 1.200, Revision 2 (Reference 42). Additionally, in LAR Attachment U, Section U.1, "Internal Events PRA Model," the licensee explained the revisions made to the IEPRA since the last full-scope peer review and stated that focused-scope peer reviews were performed on changes meeting the definition of a PRA upgrade as defined by the ASME/ANS PRA standard. In September 2012 and May 2014, the licensee, as clarified in its response to PRA RAI 17 (Reference 15), performed focused-scope peer reviews on the internal flooding analysis and a reactor coolant pump (RCP) seal PRA modeling upgrade, respectively, against the ASME/ANS PRA standard and RG 1.200, Revision 2. The IEPRA model that was reviewed for the full-scope and focused-scope peer reviews serves as the basis of the FPRA used in performing PRA evaluations for the LAR.

For SRs in the PRA standard, there are three degrees of "satisfaction" referred to as capability categories (CCs) (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 scope/level of detail, plant specificity, and realism. For many SRs, the CCs may be combined (e.g., the requirement for meeting CC-I may be combined with CC-II, or the requirement may be the same across all CCs so that the requirement is simply met or not met.

In general, facts and observations (F&Os) are written for any SR that is judged not to be met or does not fully satisfy CC-II of the ASME/ANS PRA standard, consistent with RG 1.200, Revision 2. LAR Attachment U, Table U-1, provides the licensee's resolutions to all 22 F&Os characterized as findings per peer review guidelines (Reference 39), from the full-scope peer review, whereas LAR Attachment U, Table U-2 provides the same for all 5 finding-level F&Os from the focused-scope peer review on the internal flooding analysis. In its response to PRA RAI 17 (Reference 15), the licensee clarified that all finding-level F&Os from the focused-scope peer review on the RCP seal PRA modeling upgrade were resolved and incorporated into the FPRA. The licensee also confirmed in its response to PRA RAI 03 (Reference 19) that it incorporated these resolutions into its integrated analysis.

As described in LAR Attachment U, 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 and the results for the NFPA 805 application. The NRC staff evaluated each F&O and the licensee's resolution in LAR Attachment U 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 is summarized in the NRC's Record of Review dated April 7, 2017 (Reference 102).

In PRA RAI 02.a (Reference 24), the NRC staff requested that the licensee provide additional information with respect to the minimum for joint HEPs assumed by the PRA. In its response to PRA RAI 02.a (Reference 15), the licensee indicated that it updated the FPRA to use no joint HEP value below 1.0E-05. In its response to PRA RAI 03 (Reference 19), the licensee confirmed that it incorporated this revised treatment of joint HEPs into its integrated analysis.

In its response to PRA RAI 02.a, the licensee stated that it will provide adequate justification for the future use of any value less than 1.0E-05. The NRC staff concludes the licensee's response to RPA RAI 02.a is acceptable because the licensee demonstrated that the FPRA includes the use of floor values or includes justification for the use of values less than the floor value which is consistent with guidance in NUREG-1921.

As a result of the review of the LAR and the licensee's responses to RAIs, the NRC staff concludes that the IEPRA has sufficient technical adequacy and that its quantitative results, considered together with sensitivity study results, can be used to demonstrate that the change in risk due to the transition to NFPA 805 meets the acceptance guidelines of RG 1.174. To reach this conclusion, the NRC staff reviewed all the F&Os provided by the peer reviewers and determined that the resolution of every F&O supports the determination that the quantitative results are adequate or have no significant impact on the FPRA. Accordingly, the NRC staff concludes that the licensee demonstrated that the IEPRA meets the guidance in RG 1.200, Revision 2, that it was reviewed against the applicable SRs in ASME/ANS-RA-Sa 2009, and that it is technically adequate to support the FREs and other risk calculations required for the LAR.

3.4.2.2 Fire PRA Model

The licensee evaluated the technical adequacy of the PINGP FPRA model for this application by conducting a full-scope peer review in May 2012, using the NEI 07-12 process (Reference 40), and the FPRA part (Part 4) of the ASME/ANS-RA-Sa-2009 PRA Standard, as clarified by RG 1.200, Revision 2. Additionally, in LAR Attachment V, the licensee clarified the revisions made to the FPRA since the last full-scope peer review and stated that in November 2013, a

focused-scope peer review against the ASME/ANS PRA standard and RG 1.200, Revision 2 performed on FM changes meeting the definition of a PRA upgrade as defined by the ASME/ANS PRA standard. The licensee stated that apart from the FM related changes, no others changes meeting the definition of a PRA upgrade were made to the FPRA since the last full-scope peer review.

LAR Attachment V, Table V-1, provides the licensee's dispositions to all F&Os written against SRs of Part 4 of the ASME/ANS RA-Sa-2009 PRA standard, as clarified by RG 1.200, Revision 2. LAR Attachment V, Table V-2 identifies all SRs determined by the peer review to be not met or only met at CC-I and provides an evaluation of those SRs. An F&O was written against each SR determined to be not met or only met at CC-I.

As described in LAR Attachment V, the licensee resolved each F&O by assessing the impact of the F&O on the FPRA and on the results for the LAR. The NRC staff requested additional information to assess the adequacy of some of the F&O dispositions for the review. The NRC staff evaluated each F&O and the licensee's respective resolution in LAR Attachment V to determine whether the issue had any significant impact for the LAR. The NRC staff's review and conclusions for the resolution of each F&O is summarized in the NRC's Record of Review dated April 7, 2017 (Reference 102).

In PRA RAI 01.d (Reference 24), the NRC staff requested that the licensee provide justification for excluding cable raceways located under the raised floor within the MCR for the MCR fire scenario development, either both as ignition sources and potential targets. In its response to PRA RAI 01.d (Reference 14), the licensee identified the following types of fire scenarios that could include the cable raceways under the raised floor within the MCR: electrical cabinet fires; self-ignited cable fires (SICF); cable fires due to welding and cutting (CFWC); junction box fires (JBF); transient fires; and, transient fires caused by welding and cutting (TFWC). With regard to electrical cabinet fires, the licensee stated that associated fire scenarios include the impact of cables that may be routed under the raised floor. The licensee justified the exclusion of SICF and further stated that CFWC and JBF are treated consistent with accepted guidance in FAQs 13-0005 (Reference 83), and 13-0006, (Reference 84), respectively. In its response to PRA RAI 01.d.01 (Reference 17), the licensee indicated that it updated the FPRA to address transient fires and TFWC consistent with guidance in FAQ 12-0064 (Reference 81). In its response to PRA RAI 03 (Reference 19), the licensee indicated that it incorporated this revised treatment of cable raceways located under the raised floor within the MCR into its integrated analysis. The NRC staff concludes the licensee's response to PRA RAI 01.d is acceptable because the licensee demonstrated that the FPRA assesses the impact of fire on the cable raceways located under the raised floor within the MCR consistent with accepted guidance.

In PRA RAI 01.e (Reference 24), the NRC staff requested that the licensee provide clarification on the approach used to develop and quantify scenarios associated with main control board (MCB) fires. In its response to PRA RAI 01.e (Reference 15), the licensee explained that MCB fires are modeled using a method that more comprehensively models the fire scenario than the method described in Appendix L of NUREG/CR-6850. The licensee explained that the method applies an event tree model for MCB scenarios that considers the likelihood of prompt suppression, a plant trip, propagation between MCB panels, and MCR abandonment. The licensee compared its method to the guidance in Appendix L of NUREG/CR-6850 and the comparison identified and discussed the differences between the methods. The discussion explained that the proposed method was consistent with or more detailed than the method in Appendix L. The NRC staff concludes that the licensee's response to PRA RAI 01.e is acceptable because the licensee demonstrated that the method it used to develop and quantify

MCB scenarios in the FPRA uses standard PRA techniques to develop a set of scenarios that are more detailed than those obtained using guidance in Appendix L of NUREG/CR-6850.

In its response to PRA RAIs 01.e and 12.e (Reference 15), the licensee indicated that it also applied the aforementioned event tree model developed to quantify the main control board (MCB) scenarios to address non-MCB electrical cabinet panel fires within the MCR, as well as transient fires that may impact the MCB panels. In PRA RAI 01.e.01 (Reference 26), the NRC staff requested that the licensee provide justification for providing more detailed modelling for fires outside the MCB since it may be inapplicable or too difficult to apply. In its response to PRA RAI 01.e.01 (Reference 17), the licensee updated the FPRA to address non-MCB electrical cabinet panel fires within the MCR as well as transient fires that may impact the MCB panels consistent with guidance in NUREG/CR-6850. In its response to PRA RAI 03 (Reference 19), the licensee confirmed that it incorporated this revised treatment into its integrated analysis. The NRC staff concludes the licensee's response to PRA RAI 01.e is acceptable because the licensee demonstrated that the FPRA applies accepted guidance from NUREG/CR-6850 to non-MCB electrical cabinet panel fires within the MCR and transient fires that may impact the MCB panels.

In PRA RAI 01.f (Reference 24), the NRC staff requested that the licensee provide clarification on the FPRA's treatment of SICF. In its response to PRA RAI 01.f (Reference 14), and PRA RAI 01.f.01 (Reference 17), the licensee explained that consistent with accepted guidance in NUREG/CR-6850, it screened SICF for qualified cables, which account for 86 percent of the cabling (by feet). The licensee further explained that the remaining 14 percent of its cabling was unqualified but that such cabling was either routed exclusively in conduits or deemed to be low energy. While guidance in NUREG-6850 states that SICF may be screened for cables within conduits, it does not address the energy of the cables. FAQ 13-0005 indicates that a substantial energy source is required to cause sustained ignition, and NUREG-1805 clarifies that low-energy cables, such as control and instrumentation cables, typically do not carry enough electrical energy to result in self-ignition. The NRC staff concludes that the licensee's responses to PRA RAI 01.f and PRA RAI 01.f.01 are acceptable because the licensee demonstrated that it screened SIC for qualified cables in accordance with NUREG/CR-6850 and the NRC staff finds that postulating SICF in a limited set of low-energy cables is not necessary because achieving the high currents required for SICF in such cables is unlikely.

In PRA RAI 01.g (Reference 24), the NRC staff requested that the licensee provide clarification on the FPRA's treatment of the total unavailability of credited detection and suppression systems. In its response to PRA RAI 01.g (Reference 15), and PRA RAI 03 (Reference 19), the licensee updated the FPRA to estimate the total unavailability of credited detection and suppression systems as the sum of the unreliability and the unavailability values corresponding to each system. In its response to PRA RAI 03, the licensee confirmed that it incorporate this revised treatment into the integrated analysis. The NRC staff concludes that the licensee's response to PRA RAI 01.g is acceptable because the licensee demonstrated that the FPRA's treatment of the total unavailability of credited detection and suppression systems is consistent with accepted guidance in NUREG/CR-6850.

In PRA RAI 04 (Reference 24), the NRC staff requested that the licensee provide further clarification on transient fire placement within physical access units (PAUs). In its response to PRA RAI 04 (Reference 14), the licensee stated that the FPRA postulated general transient fires and TFWC in all accessible floor areas within the scope of the FPRA. The licensee explained that so-called transient zones were defined to ensure that no portion of open floor area was excluded and further clarified that fire spread across such zones was considered. The

NRC staff concludes that the licensee response to PRA RAI 04 is acceptable because the licensee demonstrated that its method for locating transient fires appropriately addresses the potential for transient fires to damage all targets, including pinch points, for all PAUs, consistent with guidance in NUREG/CR-6850.

In PRA RAI 05 (Reference 24), the NRC staff requested that the licensee provide clarification regarding the FPRA's treatment of CFWC. In its response to PRA RAI 05 (Reference 14), and PRA RAI 03 (Reference 19), the licensee indicated that it updated the FPRA to be consistent with the guidance in FAQ 13-0005. In its response to PRA RAI 03, the licensee confirmed that it included this revised treatment in the integrated analysis. The NRC staff concludes that the licensee's response to PRA RAI 05 is acceptable because the licensee demonstrated that the PRA's treatment of CFWC is consistent with accepted guidance in FAQ 13-0005.

In PRA RAI 06 (Reference 24), the NRC staff requested that the licensee provide clarification regarding the FPRA's treatment of JBFs. In its response to PRA RAI 06 (Reference 14), and PRA RAI 03 (Reference 19), the licensee updated the FPRA to be consistent with the guidance in FAQ 13-0006. In its response to PRA RAI 03, the licensee confirmed that it incorporated the revised treatment in the integrated analysis. The NRC staff concludes that the licensee's response to PRA RAI 06 is acceptable because the licensee demonstrated that the FPRA's treatment of JBF is consistent with accepted guidance in FAQ 13-0006.

In PRA RAI 07 (Reference 24), NRC staff requested that the licensee provide clarification on its treatment of sensitive electronics. In its response to PRA RAI 07 (Reference 15), and PRA RAIs 07.01 and 07.02 (Reference 17), the licensee described its method which involves detailed fire modelling and using the results to determine when, and if, sensitive electronics reach their 65 degree Celsius failure temperature. The licensee indicated that if detailed modelling was not used, it used the guidance in FAQ 13-0004 (Reference 82), and NUREG/CR-6850. In its response to PRA RAI 03, the licensee confirmed that it included this revised treatment of sensitive electronics in its integrated analysis. The NRC staff concludes that the licensee's response to PRA RAI 07 is considered acceptable because the licensee demonstrated that the FPRA's treatment of sensitive electronics is based on detailed fire modelling and specific configuration evaluations or consistent with accepted guidance in FAQ 13-0004 and NUREG/CR-6850.

In PRA RAI 08 (Reference 24) , the NRC staff requested that the licensee to provide an assessment of their method for assigning conditional probabilities of spurious operations for control circuits relative to the guidance in NUREG/CR-7150 (Reference 58). In its response to PRA RAI 08 (Reference 15), and PRA RAI 03 (Reference 19), the licensee indicated that it updated the circuit failure probabilities and hot short duration probabilities in the FPRA to be consistent with guidance in NUREG/CR-7150. In its response to PRA RAI 03, the licensee confirmed that it included this revised treatment in its integrated analysis. The NRC staff concludes the licensee's response to PRA RAI 08 is acceptable because the licensee demonstrated that the FPRA's treatment of circuit failure probabilities and hot short duration probabilities is consistent with accepted guidance in NUREG/CR-7150.

In PRA RAI 11 (Reference 24), the NRC staff requested that the licensee justify the time to delayed detection assumed for fire scenarios in which either automatic detection is unavailable or a fire watch is not present. In its response to PRA RAI 11 (Reference 14), the licensee indicated that it updated the FPRA to use a 15-minute delayed detection time consistent with Appendix P of NUREG/CR-6850 for fire scenarios should automatic detection be unavailable or a fire watch not present. In its response to PRA RAI 03, the licensee confirmed that it included

this revised treatment in its integrated analysis. The NRC staff concludes that the licensee's response to PRA RAI 11 is acceptable because the licensee demonstrated that the FPRA addresses time to delayed detection consistent with the guidance in NUREG/CR-6850.

In PRA RAI 12 (Reference 24), the NRC staff requested that the licensee provide justification for the modeling of fire scenarios in which abandonment of the MCR is credited. In its response to PRA RAI 12 (Reference 15), the licensee explained that MCR abandonment is assessed for loss of function for fires in the relay room as well as for loss of MCR habitability for fires in the MCR. The license indicated that abandonment conditional core damage probabilities (CCDPs) and conditional large early release probabilities (CLERPs) are evaluated in its FPRA using detailed scenario analysis for each fixed and transient ignition source in the same manner as other fire scenarios. The licensee also indicated that loss of function is defined as "[a] loss of CR control of critical plant functions which cannot be adequately addressed by Alarm Response Procedure (ARP), Abnormal Operating Procedure (AOP), Instrument Failure Guide (IFG) or Emergency Operating Procedure (EOP) response actions." The licensee stated that fire scenarios in the FPRA that extend beyond the ignition source and localized targets (i.e., the first cable tray and nearby conduits) meet these conditions. For lesser fires, MCR abandonment and shutdown from the HSD panel is not postulated. In either case, the licensee's response to PRA RAI 12 indicates that the appropriate fault tree logic is applied. The NRC staff concludes the licensee's response to PRA RAI 12 is acceptable because the licensee demonstrated that the effects of individual fires in the MCR and relay room are evaluated, and should loss of function or MCR habitability occur, the FPRA models the shutdown of the plant from the HSD panel using detailed scenario analysis consistent with accepted methods.

In PRA RAI 16 (Reference 24), the NRC staff requested that the licensee explain how incipient detection is credited in the FPRA. In its response to PRA RAI 16 (Reference 15), the licensee explained that the FPRA credits incipient detection for electrical cabinet fires in Fire Area 18 consistent with guidance in FAQ 08-0046 (Reference 75). In PRA RAI 21 (Reference 29), the NRC staff indicated that this guidance (i.e., FAQ 08-0046) has been retired. In its response to PRA RAI 21 (Reference 21), the licensee provided the results of a sensitivity study that revised the credit for incipient detection to be consistent with accepted guidance in NUREG-2180 (Reference 103) . The licensee explained that for Fire Area 18, the sensitivity study incorporated: heat release rate distributions for electrical cabinets consistent with accepted guidance in NUREG-2178, "Refining And Characterizing Heat Release Rates From Electrical Enclosures During Fire (RACHELLE-FIRE) - Volume 1: Peak Heat Release Rates and Effect of Obstructed Plume, Final Report (NUREG-2178, Volume 1, EPRI 3002005578)," (Reference 104); updated fire ignition frequencies consistent with accepted guidance in NUREG-2169, "Nuclear Power Plant Fire Ignition Frequency and Non-Suppression Probability Estimation Using the Updated Fire Events Database: United States Fire Event Experience Through 2009 (NUREG-2169, EPRI 3002002936)," (Reference 105); and revisions to the hot gas layer (HGL) analysis to credit cable thermal response as described in SE Section 3.4.2.3. Subsequently, in its letter dated March 6, 2017 (Reference 22), the licensee identified a number of FPRA logic errors and updated the PRA and the results of the sensitivity study to correct the errors. The results of the sensitivity study demonstrated that the RG 1.174 risk acceptance guidelines would still be met given correction of licensee-identified FPRA logic errors and use of accepted guidance for crediting incipient detection in Fire Area 18. In its response to PRA RAI 21.c (Reference 21), the licensee added Implementation Item 70, to update the FPRA to apply an NRC accepted method for crediting incipient detection, to LAR Attachment S, Table S-3 and 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 found that the licensee's sensitivity study applied fire ignition frequencies from NUREG-2169 to Fire Area 18 and those from Supplement 1 to NUREG/CR-6850 to all other fire areas. In its response to PRA RAI 21 (Reference 21), the licensee explained that the fire ignition frequencies for ignition sources relevant to Fire Area 18; namely, Bins 5, 6, 7, 15.1 and 18, were apportioned, consistent with guidance in NUREG-2169, throughout all PAUs within the scope of the FPRA to obtain frequency estimates applicable to Fire Area 18. The selective application of fire ignition frequencies and non-suppression probabilities from different data sets (i.e., NUREG-2169 and Supplement 1 to NUREG/CR-6850) within a single FPRA is not consistent with accepted guidance and PRA practices. Had ignition frequencies from Supplement 1 to NUREG/CR-6850 been applied to Fire Area 18 instead of those from NUREG-2169, the frequencies for Bins 5 and 7 ignition sources would increase, whereas the frequencies for the other ignition sources in the fire area (i.e., Bins 6, 15.1 and 18) would decrease. Evaluating the quantitative impact of these changes on the sensitivity study result would require additional sensitivity studies. The NRC found that the licensee, in its response to PRA RAI 21, identified a number of conservatisms used in the sensitivity study. These conservatisms include, among others, not crediting reduced fire fuel loading configurations nor the obstructed plume methodology, as allowed by NUREG-2178, as well as applying a single bounding scenario for the HGL analysis. The NRC staff concludes that these conservatisms, in addition to the risk decrease that would occur if Supplement 1 to NUREG/CR-6850 was used for Bins 6, 15.1 and 18, provide assurance that the potential risk increase associated with the use of a single frequency data set, consistent with accepted guidance and PRA practices, has been adequately addressed for the purpose of evaluating the results of the licensee's sensitivity study. The NRC staff concludes that the licensee's response to PRA RAI 21 is acceptable because the sensitivity results and conservatisms identified by the licensee demonstrate that the risk results would continue to meet RG 1.174 risk acceptance guidelines upon correction of licensee-identified FPRA logic errors and use of accepted PRA methods and accepted guidance for crediting incipient detection in Fire Area 18.

In its response to PRA RAI 17 (Reference 15), the licensee indicated that a FlowServe RCP seal PRA model (i.e., logic structure and basic event values) was developed for the FlowServe RCP seal package that will be installed as is identified in LAR Attachment S, Tables S-1 and S-2 (Reference 21) and credited in the FPRA. Additionally, in its response to PRA RAI 15 (Reference 14) and (Reference 19), the licensee indicated that it revised LAR Attachment S, Table S-3 to include Implementation Item 66, which replaces the current RCP seal PRA model with a final, NRC-approved PRA model, if applicable, and requires PINGP to take action should RG 1.174 risk acceptance guidelines be exceeded. The NRC staff concludes that the licensee's response to PRA RAI 17 is acceptable because the licensee used the best available applicable information, (i.e., the FlowServe RCP seal PRA model, based on current technical evaluations), to estimate the associated change-in-risk and will take action if replacing the current model with a final, NRC-approved PRA model increases risk beyond risk acceptance guidelines.

In PRA RAI 20 (Reference 28), the NRC found that a RI approach was applied to model breaker coordination and circuit protection inadequacies and requested that the licensee provide an explanation of and a basis for how the modeling was performed. The NRC staff requested that the licensee provide specific information about how it addressed the potential for secondary fires and high energy arcing faults (HEAFs). In its response to PRA RAI 20 (Reference 20), the licensee explained that for inadequate breaker fuse coordination, it assumed fire damage by failing all uncoordinated buses, panels, and cables upstream of the fire damaged cable. The licensee also explained that it assumed equipment downstream of the fire damaged cable to be failed as result of the fire regardless of circuit inadequacies. The licensee further explained that for those scenarios in which the fire damages DC control power to 4.16 kV breaker protective

circuitry as well as one or more associated load cables, secondary fires for cables within a common enclosure and HEAFs were modeled in the FPRA. The licensee explained that it modeled secondary fires by conservatively assuming that all cables within a common enclosure with cables having inadequate overcurrent circuit protection were simultaneously failed using guidance from FAQ 13-0005 and added to the failures associated with fire scenarios involving the unprotected circuit. For HEAFs, the licensee clarified that such events were assumed to occur at the initial fault location and stated that the zone-of-influence (ZOI) applied bounds accepted guidance in Appendix M to NUREG/CR-6850. The NRC staff concludes that the licensee's response to PRA RAI 20 is acceptable because the licensee demonstrated that its modeling of inadequate breaker coordination and circuit protection follows the guidance from NUREG/CR-6850 to the best extent possible and because the modeling reflects the as-built plant.

LAR Section 4.5.1.2 states that no unreviewed methods were used in the FPRA model development. In PRA RAI 18 (Reference 24), the NRC staff requested that the licensee identify and justify any fire PRA methods that deviate from NRC-accepted guidance. In its response to PRA RAI 18 (Reference 15), the licensee identified no deviations beyond that addressed in its response to PRA RAI 01.e (Reference 15). The NRC staff concludes that the licensee's response to PRA RAI 18 is acceptable because other than those deviations addressed elsewhere in this SE section, the licensee identified no other deviations from accepted methods and approaches.

As a result of its review of the LAR, as supplemented, the NRC staff concludes that the PINGP FPRA is technically adequate and that its quantitative results, considered together with the sensitivity studies, can be used to demonstrate that the change in risk due to the transition to NFPA 805 meets the acceptance guidelines in RG 1.174 and are acceptable. To reach this conclusion, the NRC staff reviewed all F&Os provided by the peer reviewers and determined that the resolution of every F&O supports the determination that the quantitative results are adequate. In addition, the NRC staff reviewed FPRA related issues, and determined that the licensee's resolution of the identified issues supports the determination that the quantitative results are adequate to transition to NFPA 805 and to support subsequent self-approval as described in the applicable licensing condition. Accordingly, the NRC staff concludes that the licensee demonstrated that the FPRA meets the guidance in RG 1.200, Revision 2, and that it is technically adequate to support the FREs and other risk calculations required for the NFPA 805 application.

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, in part, 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 SE 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 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 PINGP fire risk evaluations. 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
- Ceiling Jet Temperature, Method of Alpert

The first three 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 55). Alpert's ceiling jet temperature correlation is described in, "EPRI Fire Induced Vulnerability Evaluation Methodology", (FIVE) Revision 1 (Reference 106). Validation and Verification (V&V) of these algebraic models is documented in NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," Volume 3 (Reference 56).

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 correlations were used to determine the potential for the development of an HGL:

- Method of McCaffrey, Quintiere and Harkleroad (MQH), for naturally ventilated compartments
- Method of Foote, Pagni, and Alvares (FPA), for mechanically ventilated compartments

These correlations are described in NUREG-1805 and their V&V is documented in NUREG-1824, Volume 3. The method of Beyler for closed compartments was not used, as discussed in the licensee's response to FM RAI 01.h.

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 walk-down 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 PINGP-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 heat release rate (HRR) from the NUREG/CR-6850 methodology (Reference 49).

The Consolidated Model of Fire and Smoke Transport (CFAST), Version 6 was used for HGL temperature calculations in the multi-compartment analysis and a detailed analysis to refine the estimated risk in the Relay Room (Fire Area 18). V&V of CFAST is documented in NUREG-1824, Volume 5.

Fire Dynamics Simulator (FDS), Version 5 was used for the abandonment time calculations based on HGL temperature and smoke concentration in the main control room. V&V of FDS is documented in NUREG-1824, Volume 7.

In LAR Section 4.5.1.2, the licensee also identified the use of the following empirical correlations that are not addressed in NUREG-1824:

- Corner and Wall HRR (Reference 107)
- Correlation for HRRs of Cables (Reference 55)
- 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 57)

The V&V of all correlations and fire models that were used to support the PINGP Fire PRA is discussed in detail in Section 3.8.3.2 of this SE.

3.4.2.3.2 Discussion of RAIs Pertaining to Fire Modeling

By letters dated March 30, 2015 (Reference 24), August 28, 2015 (Reference 26), November 18, 2016 (Reference 29), the NRC staff sought additional information concerning the FM conducted to support the FPRA. By letters dated May 28, 2015 (Reference 14), June 19, 2015 (Reference 15), October 6, 2015 (Reference 16), and December 14, 2016 (Reference 21), the licensee responded to these RAIs.

- In FM RAI 01.a (Reference 24), the NRC staff requested that the licensee identify and describe the application of any FM tools and methods that it used in the development of the LAR and that are not discussed in LAR Attachment J.

  In its response to FM RAI 01.a (Reference 15), the licensee explained that all fire models used in support of the transition are described in LAR Attachment J.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because all FM tools that were used in the development of the LAR are described in LAR Attachment J.

- In FM RAI 01.b (Reference 24), the NRC staff requested that the licensee provide information on how it identified and accounted for non-cable intervening combustibles in the FM analysis.

  In its response to FM RAI 01.b (Reference 15), the licensee explained that walkdowns were performed to identify non-cable secondary combustibles, and that only one area was found where such combustibles are present. The licensee further stated that the secondary combustibles in this area are covered with non-combustible thermal insulation, and that, therefore, non-cable secondary combustibles did not have to be considered in the FM analysis.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because it was determined from walkdowns that there are no exposed secondary combustibles in the areas of the plant where FM was performed.

- In FM RAI 01.c (Reference 24), the NRC staff requested that the licensee describe how it treated cable trays with covers, fire-resistive (FR) wraps and FR coated cables in the FM calculations in terms of ignition and fire propagation; and how it accounted for the presence of holes in cable tray covers.

  In its response to FM RAI 01.c (Reference 15), the licensee stated that cable tray covers and FR cable coatings were not credited in the FM analysis, and that holes in cable tray covers, therefore, did not have any effect on the ignition and fire propagation calculations. The licensee further stated that fire wraps with a fire resistance rating of at least one hour were credited to prevent ignition and fire propagation, except in HEAF and high hazard scenarios.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's approach is either consistent with or more conservative than the guidance provided in NUREG/CR-6850.

- In FM RAI 01.d (Reference 24), the NRC staff requested that the licensee explain what administrative controls are in place to minimize the likelihood of fires involving a cabinet with temporary open doors, and describe how it treated such cabinets in the FM analysis.

  In its response to FM RAI 01.d (Reference 15), the licensee stated that for most electrical cabinets, a 98th percentile HRR of 1002 kW corresponding to Case 5 in Table E-1 of NUREG/CR-6850, Volume 2 (cabinets with open doors and fire in multiple unqualified cable bundles) was postulated. The licensee further stated that for a small number of cabinets in the relay room a lower 98th percentile HRR of 702 kW (Case 2 in Table E-1 of NUREG/CR-6850, Volume 2) was assumed, and that justification for the lower HRR is provided in its response to PRA RAI 01.d. The licensee also referred to administrative controls which minimize the likelihood that electrical cabinets are left open when unattended.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee either assumed the highest electrical cabinet HRR from Table E-1 of NUREG/CR-6850, Volume 2, or provided justification for using a lower HRR; and because in those cases where a lower HRR was postulated, the NUREG/CR-6850 recommended HRR is not affected by whether the cabinet doors are open or closed.

- In FM RAI 01.e (Reference 24), the NRC staff requested that the licensee provide justification for the assumed fire areas and elevations that were used in the transient FM analysis, and 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 its response to FM RAI 01.e (Reference 15), the licensee stated that transient zones extend beyond the horizontal ZOI, that the elevation of transient fires is fixed at 0.61 m (2 ft.) above the floor, and that transient zones extend from the floor slab to the ceiling slab. The licensee further stated that it used the 98th percentile transient fire HRR from NUREG/CR-6850, and that the assumptions regarding the transient HRR will not be violated because plant procedures require control of transient combustibles in open areas.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because, to identify damaged targets in the vicinity of a postulated transient fire, the licensee used the concept of transient zones, which extend beyond the ZOI in the horizontal and vertical directions, and because administrative controls are in place to ensure that the location and HRR of transient fires assumed in the FM analysis will remain representative of plant conditions or conservative during and post-transition.

- In FM RAI 01.f (Reference 24), the NRC staff requested that the licensee describe how they created and analyzed transient zones, and explain how they

ensured that targets on the border of a transient zone were not missed in the analysis.

In its response to FM RAI 01.f (Reference 15), the licensee stated that it created transient zones as an extended transient fire ZOI that extends from floor to ceiling, and that the transient zones encompass the entire open floor area. The licensee further stated that it mapped targets at the border of a transient zone into adjacent zones, and that it defined transient zones so that transient fires at pinch-points and those that, in conjunction with the HRR contribution of secondary combustibles, result in damaging HGL conditions are included in the analysis. In addition, the licensee explained that it performed walkdowns to identify scenarios where fire propagation outside the transient zone is possible, and that damage states were added to the FPRA to capture the risk contribution associated with these scenarios.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's approach to defining transient zones is conservative in terms of identifying target damage and quantifying the associated plant risk.

- In FM RAI 01.g (Reference 24), the NRC staff requested that the licensee explain why target mapping based on the assumption that the ZOI for each ignition source is 10 ft. by 10 ft., regardless of the HRR of the ignition source, is conservative for fires that involve secondary combustibles.

  In its response to FM RAI 01.g (Reference 15), the licensee stated that the 10 x 10 ft. ZOI was used only for selected fixed ignition sources and small oil fires, and bounds the horizontal component of the ZOI determined from the point source flame radiation model with the 98th percentile HRR as described in Table G-1 in NUREG/CR-6850. The licensee further stated that it did not use this assumption for complex scenarios such as propagating fires, although the approach inherently accounts for some fire propagation since the 10 x 10 ft. extends beyond the point source model ZOI, and that the entire compartment was failed for larger oil fires.

  In FM RAI 01.g.01 (Reference 26), the NRC staff requested that the licensee identify the fire zones and areas outside of the turbine building where it considered "large" oil fires (i.e., oil fires with a ZOI that is larger than the generic 10-foot ZOI assumed for "small" oil fires), and explain how the ZOI for these large oil fires was determined.

  In its response to FM RAI 01.g.01 (Reference 16), the licensee identified six compartments where large oil fires were postulated, and explained that, except for large oil fires associated with the instrument air compressors located in two of the six compartments, the strategy for modeling these fires consisted of failing all targets in the fire compartment using the frequency of the large oil fire. The licensee further explained that the large oil fire scenarios for the instrument air compressors were modeled such that targets within the 10-foot ZOI for small oil fires are assumed failed without crediting automatic suppression, and that the targets outside this ZOI are then failed by the large oil fire for the frequency of fires where suppression is not successful.

The NRC staff concludes that the licensee's response to the RAIs is acceptable because the assumed damaged area for fixed ignition source fires and oil fires is conservative.

- In FM RAI 01.h (Reference 24), the NRC staff requested that the licensee describe the basis for selecting the method that was used for the HGL calculations in each individual compartment, and provide technical justification for the vent area of 1 m^2 that was assumed in the HGL calculations using the MQH method.

  In its response to FM RAI 01.h (Reference 15), the licensee stated that it did not use Beyler's method and that it used the MQH method for compartments with natural ventilation, and that it used the FPA method for rooms with forced (mechanical) ventilation. The licensee further explained that the vent area used in MQH correlation is smaller than the typical door opening in each compartment where the method was applied.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee used the appropriate methodology to estimate the HGL temperature in each compartment and made a conservative assumption for the vent size in the compartments where the MQH correlation was applied, compared to ventilation conditions within the NUREG-1824 validated range.

- In FM RAI 01.i (Reference 24), the NRC staff requested that the licensee provide technical justification for the assumption that, if no automatic detection or fire watch is present, a challenging fire will generally be detected within 10 minutes due to either personnel in the plant or indications of failed components or alarm conditions in the control room.

  In its response to FM RAI 01.i (Reference 15), the licensee stated that it is not currently using an assumption of 10 minutes. The licensee further stated that it is assuming a detection time of 15 minutes instead which is based on the example solution of the detection suppression event tree in Appendix P of NUREG/CR-6850.

  In FM RAI 01.i.01 (Reference 26), the NRC staff requested that the licensee provide the technical basis for the assumed detection delay of 15 minutes in compartments without a detection system and without a fire watch, and confirm that there are no outlying fire areas or zones where a 15-minute delay cannot be justified and a longer delay is appropriate.

  In its response to FM RAI 01.i.01 (Reference 16), the licensee explained that NUREG/CR-6850, Appendix P and NRC Inspection Manual Chapter 0609, Appendix F, Attachment 8 use 15 minutes for delayed detection. In addition, the licensee identified the 21 fire compartments where delayed detection is credited for the calculation of non-suppression probabilities and explained that these areas are equipped with automatic detection systems, contain plant equipment and cables credited for shutdown activities that will generate alarms or indications of abnormal conditions, and are routinely visited by plant personnel or are nearby the regular travel path of plant operations.

The NRC staff concludes that the licensee's response to the RAIs is acceptable because the licensee assumed a detection delay of 15 minutes in compartments where delayed detection is credited for the calculation of non-suppression probabilities which is consistent with NRC-endorsed guidance.

- In FM RAI 01.j (Reference 24), the NRC staff requested that the licensee provide technical justification for not considering horizontal flame spread beyond the 35° expansion cone in the cable tray growth model.

  In its response to FM RAI 01.j (Reference 15), the licensee stated that it used the FLASH-CAT model described in NUREG/CR-7010 to calculate fire propagation through a stack of cable trays for fires in the relay room and turbine building, and also in the multi-compartment analysis (MCA). The licensee further stated that ignoring flame spread beyond the 35° expansion cone in the remaining single compartment fire scenarios was offset by the assumed HRR per unit area of 328 kW/m^2 for cable trays and the use of an expanded ZOI for fixed and transient ignition sources (see discussion of FM RAIs 01.f and 01.g).

  The NRC staff concludes that the licensee's response to the RAI is acceptable because in cases where flame spread beyond the 35° expansion cone is ignored, the effect of this assumption on the HRR of cable trays is more than offset by the use of a conservative HRR per unit area and an expanded ZOI for fixed and transient ignition sources.

- In FM RAI 01k (Reference 24), the NRC staff requested that the licensee describe the criteria that it used to decide whether a cable tray in the vicinity of an electrical cabinet will ignite following a HEAF event in the cabinet; explain how the ignited area was determined and subsequent fire propagation was calculated; and describe the effect of cable tray covers, fire-resistant wraps and FR cable coatings on HEAF-induced cable tray ignition and subsequent fire propagation.

  In its response to FM RAI 01.k (Reference 15), the licensee stated that it assumed combustibles present in the ZOI of a HEAF to ignite and immediately start burning with the 98th percentile HRR, and that it modeled subsequent fire propagation through secondary combustibles according to Appendix M of NUREG/CR-6850. The licensee further stated that the ZOI of a HEAF fire is the same as that for fixed ignition sources, and that it did not credit cable tray covers, fire-resistant wraps and FR cable coatings in the analysis.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's approach to model HEAF-initiated fires involving cable trays as secondary combustibles and determine the resulting target damage is consistent with or more conservative than the guidance in NUREG/CR-6850.

- In FM RAI 01.l (Reference 24), the NRC staff requested that the licensee describe how it accounted for wall and corner effects in the relay room FM analysis.

  In its response to FM RAI 01.l (Reference 15), the licensee explained that there are no fixed ignition sources in the corners of the relay room, but that it considered wall effects in this compartment as there are numerous electrical

panels near a wall. The licensee further explained that it accounted for wall and corner effects in the HGL analysis of the turbine building and the single compartment ZOI analysis, and that this adjustment involved multiplying the HRR by 2 or 4 for wall and corner fires, respectively.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's approach to account for wall and corner effects follows the guidelines in Inspection Manual Chapter 0609, Appendix F (Fire Protection Significance Determination Process) (Reference 107), and is consistent with the "image" method, which is commonly used to simulate wall and corner fires in zone fire models, such as CFAST.

- In FM RAI 01.m (Reference 24), the NRC staff requested that the licensee provide technical justification for using a mass-weighted average approach to determine flame spread for trays in the relay room with a mixture of thermoplastic and thermoset cables.

  In its response to FM RAI 01.m (Reference 15), the licensee explained that the trays in the relay room contain at least 65% by mass thermoset cable, that a flame spread rate was therefore used throughout the compartment based on a weighted average for a 65%/35% thermoset/thermoplastic mixture, and that this results in a higher flame spread rate than that recommended in NUREG/CR-7010 for this type of mixture.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's approach to determine the flame spread rate for mixed trays in the relay room is conservative compared to the approach recommended in NUREG/CR-7010.

- In FM RAI 01.n (Reference 24), the NRC staff requested that the licensee provide the technical basis for the fuel properties used in the CFAST calculations in the relay room, and explain how it accounted for the CFAST bias for smoke concentration reported in NUREG-1934 in the smoke detector actuation calculation.

  In its response to FM RAI 01.n (Reference 15), the licensee explained that it used detection and CO_2 [carbon dioxide] delivery times of 2.5 and 3.5 minutes, respectively, for all fire scenarios postulated in the relay room. The licensee further stated that it based the former on the calculated time to actuation of the second detector for the fire scenario with the lowest HRR and fuel properties for PE/PVC cables taken from the SFPE handbook. The licensee further explained that for that scenario, the optical density (OD) of the smoke at 2.5 minutes is 0.27 m^{-1}, which is nearly twice the detection limit 0.14 m^{-1} reported by Geiman and Gottuk (Reference 108).

  The NRC staff concludes that the licensee's response to the RAI is acceptable because its approach to calculate detector activation time is conservative and not affected by the CFAST bias for the smoke concentration in the HGL.

- In FM RAI 01.o (Reference 24), the NRC staff requested that the licensee provide the technical basis for consolidating the cable tray and ignition source fires in the CFAST analysis of the relay room.

  In its response to FM RAI 01.o (Reference 15), the licensee explained that the time to damaging HGL conditions in most cases is within the time of ignition of the first few trays immediately above the ignition source and before significant fire propagation and always before the ignition source extinguishes.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because it is not practical to change the fire elevation during a CFAST simulation and the calculated time to damaging HGL formation never exceeds the time at which the HRR contribution of the fixed or transient ignition source ends.

- In FM RAI 01.p (Reference 24), the NRC staff requested that the licensee provide technical justification for the ventilation conditions assumed in the Relay Room CFAST analysis.

  In its response to FM RAI 01.p (Reference 15), the licensee explained that the Relay Room does not have a forced ventilation system and has a localized re-circulation system, which it did not include in the CFAST model. The licensee further stated that it assumed a ½ in. leakage gap for natural ventilation.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee did not include mechanical ventilation, which is conservative, and its approach to model natural convection is consistent with the guidance in NUREG/CR-6850.

- In FM RAI 01.q (Reference 24), the NRC staff requested that the licensee provide technical justification for using CFAST in the relay room, which has a complex geometry with beam pockets.

  In its response to FM RAI 01.q (Reference 15), the licensee stated that in an actual fire, obstructions will absorb heat causing a lower HGL temperature, whereas ignoring those obstructions in the model will result in higher calculated HGL temperatures. The licensee further stated that ignoring the room volume reduction due to the space occupied by obstructions in the model will result in lower calculated HGL temperatures, but will also result in conservative calculated smoke detector actuation times since it will take longer for the HGL to descend below the bottom of the beams separating the beam pockets.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because ignoring the obstructions in the relay room has a conservative effect on the results of the CFAST smoke detector actuation calculations.

- In FM RAI 01.r (Reference 24), the NRC staff requested that the licensee explain how it modeled fire spread to secondary combustibles in the turbine building.

  In its response to FM RAI 01.r (Reference 15), the licensee explained that it used the same approach in the relay room to model fire propagation in secondary

combustibles in the turbine building, and that this approach relied on the FLASH-CAT model as described in the response to FM RAI 01.j.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's approach to model fire propagation in the turbine building is based on the FLASH-CAT model described in NUREG/CR-7010.

- In FM RAI 01.s (Reference 24), the NRC staff requested that the licensee explain how it screened the HGL damage state in the FPRA based on a sensitivity analysis.

  In its response to FM RAI 01.s (Reference 15), the licensee explained that it did not use a sensitivity analysis to screen the HGL damage state, and that detailed FM was performed to determine HGL temperature and timing for the worst-case scenario (highest HRR) in each fire compartment. The licensee further explained that it evaluated individual scenarios for progression to full room burnout in compartments that were not screened based on the FM for the worst-case scenario.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee based its screening of the HGL damage state on a comprehensive FM analysis of the worst-case scenario, which included the contribution of secondary combustibles when applicable.

- In FM RAI 01.t (Reference 24), the NRC staff requested that the licensee provide technical justification for assuming a vent size of 1 m^2 in the HGL calculations using the MQH method, and perform a sensitivity analysis with varying vent opening sizes as recommended as a possible resolution in F&O FSS-D6-01.

  In its response to FM RAI 01.t (Reference 15), the licensee explained that a 1.0 m^2 vent size corresponds to an equivalence ratio that is slightly outside the NUREG-1824 validation range and showed that using a 1.2 m^2 opening, which corresponds to an equivalence ratio within the validation range, extends the time to reach damaging HGL conditions and reduces the maximum HGL temperature. The licensee further stated that the model bias for the HGL temperature is 1.44, and showed that a 44% increase in the calculated HGL temperature is obtained by reducing the vent size to 0.25 m^2.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the assumption of a 1 m^2 vent size is conservative when compared to ventilation conditions within the NUREG-1824 validation range, and the model bias indicates that the MQH method estimates the HGL temperature for a significantly smaller vent size.

- In FM RAI 01.u (Reference 24), the NRC staff requested that the licensee describe the assumptions that it made concerning the HVAC status in the MCR abandonment calculations.

  In its response to FM RAI 01.u (Reference 15), the licensee stated that it assumed mechanical ventilation to be inoperative, the dampers to be closed, and a conservative leakage area. In addition, the licensee performed a sensitivity

study to show that variations in the leakage area have a negligible effect on abandonment time.

The NRC staff concludes that the licensee's response to the RAI is acceptable because an inoperative HVAC system is the most conservative condition in terms of MCR habitability.

- In FM RAI 01.v (Reference 24), the NRC staff requested that the licensee explain which values it used for the soot yield and heat of combustion of cables in the MCR abandonment calculations for electrical cabinet fires, and confirm that these values lead to conservative estimates of the soot generation rate.

  In its response to FM RAI 01.v (Reference 15), the licensee stated that a high value for the soot yield and a low value for the heat of combustion were selected based on values reported in the SFPE handbook for the cable types that are present in the MCR. The licensee further stated that using these two values ensures that the calculated smoke generation rate and optical density are conservative.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the soot yield and heat of combustion used in the MCR abandonment calculations for electrical cabinet fires are representative of the cable types present in the MCR and lead to conservative estimates of the soot generation rate.

- In FM RAI 01.w (Reference 24), the NRC staff requested that the licensee describe the approach it used to assess the ability of an ignition source to create an uninhabitable condition in the MCR.

  In its response to FM RAI 01.w (Reference 15), the licensee explained that it considered four ignition source/location combinations and that both transient and electrical cabinet fires were placed inside and outside the MCR horseshoe. The licensee further stated that it placed transients on the floor spaced evenly between cabinets so that the plume can merge into the HGL without any obstructions, and that one electrical cabinet was placed along a wall to capture "wall effects."

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the assumed locations reasonably capture the effects on habitability of fires anywhere in the MCR.

- In FM RAI 01.x (Reference 24), the NRC staff requested that the licensee describe the basis for selecting the locations of the heat flux and optical density devices used in FDS MCR abandonment calculations, and explain how it used the output from the devices to assess control room habitability.

  In its response to FM RAI 01.x (Reference 15), the licensee stated that it placed the FDS devices at a height of 6' above the floor at locations throughout the open space in the MCR where an operator could be present, and that it assumed the need for control room abandonment as soon as a heat flux of 1 kW/m^2 or an optical density of 3.0 m^{-1} was recorded at any of the FDS devices.

The NRC staff concludes that the licensee's response to the RAI is acceptable because its approach follows the guidelines in NUREG/CR-6850.

- In FM RAI 02.a (Reference 24), the NRC staff requested that the licensee describe how it characterized the installed cabling in the power block.

  In its response to FM RAI 02.a (Reference 15), the licensee stated that, even though it has a mix of thermoset and thermoplastic cables, it assumed thermoplastic damage criteria recommended in NUREG/CR-6850 (6 kW/m^2 and 205 °C) for all cable targets in the FPRA.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee conservatively assumed that all FPRA cable targets have thermoplastic damage thresholds.

- In FM RAI 02.b (Reference 24), the NRC staff requested that the licensee describe how it treated cable trays with covers, FR wraps and FR coated cables FM calculations in terms of damage, and how it accounted for the presence of holes in cable tray covers was accounted for.

  In its response to FM RAI 02.b (Reference 15), the licensee stated that it did not credit cable tray covers and FR cable coatings, and that only fire wraps with a fire resistance rating of at least one hour were credited to prevent damage, except for HEAF-initiated fires.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because its approach is either consistent with or more conservative than the guidance provided in NUREG/CR-6850.

- In FM RAI 02.c (Reference 24), the NRC staff requested that the licensee explain how it determined the damage thresholds for non-cable components.

  In its response to FM RAI 02.c (Reference 15), the licensee stated that it assumed equipment made of ferrous materials such as pipes and tanks along with passive components such as flow check valves were assumed to be invulnerable to fire, and that it assumed the fire vulnerability of major active components, such as motors, too be limited to the power, control, or instrument cables connected to the component.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the damage thresholds for non-cable components were established in accordance with the guidance in Appendix H of NUREG/CR-6850.

- In FM RAI 02.d (Reference 24), the NRC staff requested that the licensee describe the damage criteria that it used for exposed temperature-sensitive equipment, and explain how temperature-sensitive equipment inside an enclosure was treated.

In its response to FM RAI 02.d (Reference 15), the licensee stated that sensitive electronics considered in the FPRA are located in fire area-18 (cable spreading room/relay room) and the MCR. The licensee further stated that all sensitive electronics in both areas are enclosed in a cabinet, and that the damage criteria for sensitive electronics were therefore established based on the guidance in FAQ 13-0004 (Reference 82).

The NRC staff concludes that the licensee's response to the RAI is acceptable because all sensitive electronics are located in cabinets and the licensee followed the guidance in FAQ 13-0004 to establish their damage thresholds.

- In PRA RAI 21 (Reference 29), the NRC staff requested that the licensee provide additional information regarding installation of the VEWFDS. The NRC staff requested that the licensee provide various risk results, an explanation of how the total risk and increases in risk are consistent with RG 1.174, and an explanation of how any additional methods used would be incorporated into the PRA.

  In its response to PRA RAI 21 (Reference 21), the licensee referred to the use of a refinement made to Appendix H of NUREG/CR-6850, to determine cable thermal response when exposed to a heated environment, also referred to as a damage accrual method. However, the NRC staff found that the method described by the licensee did not appear to account for the effect of the preheating, or damage accrued, that would occur prior to the cable being exposed to the cable damage temperatures specified in Appendix H of NUREG/CR-6850. Subsequently, in PRA RAI 21.01 (Reference 30), the NRC staff requested that for the damage accrual method, the licensee provide the technical basis and the verification and validation to justify its use to determine ignition and damage delays, and also to discuss whether the method accounts for the effect of the preheating.

  In its response to PRA RAI 21.01 (Reference 22), the licensee stated that it compared the model results against the failure time-temperature and failure time-heat flux relationship tables in Appendix H of NUREG/CR-6850, assuming targets were exposed to steady state (i.e., constant) fire conditions, and the results indicated that the damage accrual method reproduced the time to failure results listed in the corresponding Appendix H tables in NUREG/CR-6850. The licensee further explained that the accrual method performs the damage integral computation at all times, even when the current exposure is below the minimum thresholds in Appendix H of NUREG/CR-6850 which means that if a cable is exposed long enough to ambient conditions, the results of the damage accrual method will exceed 1.0. The licensee further stated that to avoid damage predictions in these scenarios, the damage accrual method only considers a cable damaged if both the integration result is greater than 1.0 and the exposure is above the damage threshold. The licensee provided three tables in its response to illustrate this. The licensee further stated that the computer code was verified against hand calculations which was done by solving the damage accrual method by hand and comparing the results with the computer implementation. The licensee further stated that each type of cable (i.e., thermoset or thermoplastic) was exposed to an exponentially increasing temperature or heat flux exposure with the accrual method computed both by

hand and by using the computer model. The licensee provided results that indicated that the model was correctly implemented. The licensee further stated that validation of the damage accrual method was conducted using test data from NUREG/CR-6931 and that the time dependent exposures from the tests documented in NUREG/CR-6931 were evaluated using the THIEF model in NUREG-1805, the damage accrual method, and a strict application of tables in Appendix H of NUREG/CR-6850. The licensee further stated that the verification and validation supporting the use of the damage accrual method to determine cable damage times demonstrates that the model is correctly implemented and agrees with predictions from the THIEF model. The licensee further stated that the damage accrual method accounts for the effect of the preheating, or damage accrued, that would occur prior to the cable being exposed to the cable damage temperatures specified in Appendix H of NUREG/CR-6850.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided an appropriate technical basis and verification and validation to justify the use of the particular damage accrual method used at PINGP to determine ignition and damage delays, and also demonstrated that its method appropriately accounts for the effect of preheating.

3.4.2.3.3 Conclusion for Section 3.4.2.3

Based on 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 47), Section III.2.2.4.1, summarizing the NRC staff's review of PRA quality required for a LAR, the NRC staff concludes that the licensee's PRA satisfies the guidance in RG 1.174, Section 2.3 and RG 1.205, Section 4.3 regarding the technical adequacy of the PRA used to support risk assessment for transition to NFPA 805.

The NRC staff concludes that the PRA approach, methods and data are acceptable, and, therefore, that NFPA 805 Section 2.4.3.3 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 model conforms sufficiently to the applicable industry PRA standards for internal events and fires at an appropriate capability category, considering the acceptable disposition of the peer review and NRC staff 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 baseline FPRA model to incorporate acceptable methods, as detailed in the licensee's response to PRA RAI 03 (Reference 19), discussed above and following completion of all implementation items described in LAR Attachment S, Table S-3, as supplemented,

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 Section 3.8.3 of this SE), the NRC staff concludes that the PRA maintenance process is adequate to maintain the quality of the PRA to support self-approval of future RI changes to the FPP under the NFPA 805 license condition.

3.4.3 Fire Risk Evaluations

For those fire areas for which the licensee used a PB approach to meet the NSPC, the licensee used FREs in accordance with NFPA 805, Section 4.2.4.2 to demonstrate the acceptability of the plant configuration. In accordance with the guidance in RG 1.205 (Reference 4), (Reference 4)Section C.2.2.4, "Risk Evaluations," the licensee used a RI approach to justify acceptable alternatives to complying with NFPA 805 deterministic criteria. The NRC staff reviewed the following information during its evaluation of the FREs: 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," as well as associated supplemental information.

Plant configurations that did not meet the deterministic requirements of NFPA 805, Section 4.2.3.1 were considered VFDRs. VFDRs that will be brought into deterministic compliance through plant modifications need no risk evaluation. The licensee identified the VFDRs that it does not intend to bring into deterministic compliance in Attachment C of the LAR. For these VFDRs that will be retained and become part of the licensing basis, the licensee used the risk-informed approach, in accordance with NFPA 805, Section 4.2.4.2, to demonstrate that the increased risk from the retained VFDRs is acceptable.

All of the VFDRs identified by the licensee were categorized as a separation issue or a degraded fire protection system or feature. The VFDRs categorized as separation issues can generally be categorized into the following four 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; or (4) combinations of the above configurations. More detailed discussion about how VFDRs are identified is provided in SE Section 3.5.

The licensee described how an FRE is performed for VFDRs in LAR Attachment W and its response to PRA RAI 13 (Reference 14). The licensee explained that the change in risk associated with each fire area is obtained by calculating the difference between the CDF and LERF of a compliant plant configuration and the post-transition plant configuration. The total change in risk was obtained by summing the change in risk for each fire area and comparing the total for each unit to the RG 1.174 acceptance guidelines.

The licensee further explained that some risk-reduction modifications (i.e., non-VFDR modifications) are planned that do not resolve a VFDR but, instead, reduce risk. Non-VFDR modifications are included in both the compliant and post-transition plant configurations. For cases in which the FPRA did not model equipment associated with a VFDR, as identified in the

NSCA, the change in risk is not estimated with the FPRA but rather designated as having an insignificant risk impact based on qualitative evaluation.

The post-transition plant is modeled with fire-induced component failures included for retained VFDRs, with all RAs at their nominal values and all non-VFDR modifications incorporated into the FPRA. In general, VFDRs are removed from the compliant plant by assuming that the components and cables required to resolve a VFDR are not affected by fire. However, for some VFDRs crediting RAs in the post-transition plant, the execution portion of HEP's for RA failure was set to zero while the cognitive failure portion was retained. This approach was selected to represent a compliant plant where the operator action is assumed to take place in the MCR or at a hypothetical PCS (explained in SE Section 3.4.4) when the control room is abandoned. The licensee stated that setting the execution portion to zero is otherwise an adequate proxy to represent the fact that, in the compliant plant, operator actions would be easier to execute than in the variant plant, where these actions are performed away from the control room or a PCS. This approach differs from previously accepted approaches where all VFDR associated RAs have the HEP set to zero in the compliant plant. The NRC staff notes that this approach is only used to support the transition change-in-risk estimates and the change-in-risk estimates include many sources of variability that need only be reasonably addressed. NRC staff finds the approach implemented by the licensee acceptable without additional justification because it provides a logical basis for reasonably modifying the HEPs to support the transition change-in-risk estimate.

The NRC staff concludes that the licensee's methods for calculating the change in risk associated with VFDRs are acceptable because they are consistent with RG 1.205 (Reference 4), Section 2.2.4.1, "Fire Risk Evaluations (Including Recovery Actions) by Fire Area," and FAQ 08-0054. The NRC staff further concludes that the results of these calculations for each fire area, which are summarized in LAR Attachment W, Tables W-6 and W-7, as supplemented, demonstrate that the difference between the risk associated with implementation of the deterministic requirements 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 identified recovery actions in LAR Attachment G, Table G-1.

The licensee used the guidance in RG 1.205, Revision 1 (Reference 4) and FAQ 07-0030 (Reference 70) for addressing RAs, which included the definition of PCS and recovery action.

In LAR Attachment G, the licensee clarified that PINGP does not have alternate or dedicated shutdown controls that meet the definition of a PCS, as defined by RG 1.205 and stated that no credit was taken for PCS actions in the FPRA. However, in its response to PRA RAI 13.a (Reference 14), the licensee indicated that the compliant plant PRA assumed that a compliant plant would have PCSs (i.e., a hypothetical PCS) for all actions needed after MCR abandonment. In LAR Attachment W, Section W.2.2, as clarified by its response to PRA RAI 13 (Reference 14), the licensee stated that the additional risk of RAs for a given fire area was estimated as the sum of the delta risks of the VFDRs that are resolved in the post-transition plant by crediting a RA.

In LAR Attachment W, as supplemented, the additional risk of RAs is an increase in CDF of 7.4E-06/year and an increase in LERF of 1.5E-07/yr for PINGP Unit 1, and an increase in CDF of 5.7E-06/yr and an increase in LERF of 1.1E-07/yr for PINGP Unit 2. These values are below the change in risk acceptance guidelines in RG 1.174, and RG 1.205, Position 2.2.4.1, indicates that the RG 1.174 guidelines are also applicable to the additional risk of RAs. Additionally, the licensee confirmed that the additional risk of RAs in each area is also below the RG 1.174 acceptance guidelines.

Per LAR Attachment G, the licensee reviewed all of the RAs for adverse impact on plant risk per FAQ 07-0030, and stated that no RAs listed in LAR Attachment G, Table G-1, were found to have an adverse impact. Furthermore, all RAs listed in LAR Attachment G were evaluated against the feasibility criteria provided in NEI 04-02, FAQ 07-0030, and RG 1.205. Implementation items in LAR Attachment S, Table S-3, require the licensee to complete revisions to the post-fire shutdown procedures and associated training to incorporate updated NSCA strategies.

The NRC staff concludes that the licensee evaluated the additional risk of RAs as required by NFPA 805, Section 4.2.4, and that the licensee's methods for evaluating the additional risk are acceptable because they are consistent with RG 1.205, Section 2.2.4.1, and FAQ 07-0030. Furthermore, the estimated values are less than the acceptance guidelines, and therefore, the NRC concludes that the additional risk of RAs meets the requirements of NFPA 805, Sections 4.2.4 and 2.4.4.1.

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 LAR Attachment S, Tables S-1 and S-2, the licensee identified planned NFPA 805 transition modifications that decrease risk rather than bring the plant into compliance with the deterministic requirements of NFPA 805. LAR Attachment W, Section W.2.1 indicates that non-VFDR modifications are credited in both the compliant and post-transition plant PRA models used to calculate the fire area change-in-risk estimates presented in LAR Attachment W, Tables W-6 and W-7. Accordingly, non-VFDR modifications are not used to offset the change in risk. The licensee's application to transition to a RI/PB FPP is, therefore, not a combined change request per Section 1.1, "Combined Change Requests," of RG 1.174, Revision 2.

As outlined in LAR Attachment W, Table W-1, as supplemented, the total CDF and total LERF are estimated by adding the risk assessment results for internal (including internal flooding), fire, and seismic hazard events. In its response to PRA RAI 03 (Reference 19), the licensee identified a number of modifications made to the PRA and its methods, as discussed above, and provided revised estimates of total fire CDF and LERF for each unit. Total CDF and LERF results for PINGP Units 1 and 2, including the revised estimates for total fire CDF and LERF, are summarized in Table 3.4.6. The estimated total CDF and LERF for both units are below the RG 1.174 risk guidelines for Region II of 1E-04/yr and 1E-05/yr, respectively. The NRC staff determined that this conclusion still holds even if the seismic risk is estimated using the preliminary results for the weakest link model from the NRC staff's safety/risk assessment for

Generic Issue 199 (GI-199), "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants" (Reference 109).

Table 3.4.6: CDF and LERF for PINGP after Transition to NFPA 805

Hazard Group	Unit 1		Unit 2	
	CDF (/year)	LERF (/year)	CDF (/year)	LERF (/year)
Internal Events (including Internal Flooding)	2.0E-05	2.2E-07	2.0E-05	2.2E-07
Seismic	7.8E-06	Not Calculated	7.8E-06	Not Calculated
Fire	6.4E-05	9.9E-07	6.5E-05	9.7E-07
TOTAL	9.2E-05	1.2E-06	9.3E-05	1.2E-06

In LAR Attachment W, Tables W-6 and W-7, the licensee provided the delta (Δ) CDF and Δ LERF estimated for each Unit 1 and Unit 2 fire area, respectively, that is not deterministically compliant, in accordance with NFPA 805, Section 4.2.3, "Deterministic Approach." The risk estimates for these fire areas result from planned modifications and administrative controls that will be implemented as part of the transition to NFPA 805 at PINGP, as well as RAs, to reduce VFDR risk. In its letter dated May 24, 2016 (Reference 19), the licensee responded to PRA RAI 03 and provided an integrated analysis and also a revised LAR Attachment W that reports change-in-risk estimates after implementing a number of FPRA model and method refinements to use NRC accepted methods. A total CDF increase of 9.3E-06/year and a LERF increase of 1.8E-07/year were reported for PINGP Unit 1; a total CDF increase of 5.7E-06/year and a LERF increase of 1.1E-07/year for PINGP Unit 2. The estimated Δ CDF and Δ LERF for both units are below the RG 1.174 risk guidelines for Region II of 1E-05/year and 1E-06/year, respectively.

With regard to individual fire areas, the largest fire area risk increases are: 6.0E-06/year and 1.0E-07/year for PINGP Unit 1 CDF and LERF, respectively, and 4.5E-06/year and 6.3E-08/year for PINGP Unit 2 CDF and LERF, respectively which are well below the RG 1.174 acceptance guidelines. Based on the results of the licensee's fire risk assessments, the cumulative change-in-risk estimates for all fire areas subject to PB approaches are within the RG 1.174 risk acceptance guidelines.

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 and in accordance with NFPA 805, Section 2.4.4.1. Additionally, the NRC staff concludes that the licensee 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 RAIs.

The licensee used updated fire bin frequencies provided in NUREG/CR-6850, Supplement 1 (i.e., FAQ 08-0048). The guidance in FAQ 08-0048 (Reference 76), states that a sensitivity study should be performed 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 01.h (Reference 19), the licensee provided the results of such a study. The

licensee reported that while no individual fire area exceeds the RG 1.174 risk acceptance guidelines, the resultant ΔCDF of 1.28E-5/year for Unit 1 does. In its response to PRA RAI 01.h.01 (Reference 20), the licensee identified those fire areas that contribute most to the risk increases associated with use of those frequencies from Section 6 of NUREG/CR-6850. In addition to discussing relevant conservatisms associated with the identified fire areas, the licensee also identified fire protection, or related measures that can be taken to provide additional DID, consistent with the guidance in FAQ 08-0048. Owing to the existence of fire protection, or related measures that provide additional DID for risk-significant fire areas, the NRC staff concludes that the additional risk associated with the use of the FAQ 08-0048 fire bin frequencies has been adequately addressed.

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 transition to NFPA 805, the NRC staff concludes that:

- The licensee's PRA used to perform the risk assessments in accordance with NFPA 805, Section 2.4.4 (PCE) and Section 4.2.4.2 (Use of Fire Risk Evaluation), is of sufficient quality to support the application to transition to NFPA 805. The NRC staff concludes that the PRA approach, methods, tools, and data are acceptable in accordance with NFPA 805, Section 2.4.3.3.

- The licensee stated that, aside from the RCP seal and VEWFDS models, it has completed the changes to the baseline PRA model, which replaces unacceptable approaches, data, and methods identified during the LAR review with acceptable approaches, data, and methods as described. LAR Attachment S, Table S-3, Implementation Items 66 and 70 direct that the RCP and VEWFDS models be updated when approved methods become available. Therefore, the NRC staff concludes that the baseline PRA model may be used to support post-transition self-approval of FPP changes following completion of all implementation items because acceptable methods will be used until and unless replaced by other acceptable methods.

- After completing implementation items and modifications for transition to NFPA-805, the licensee will correct some logic errors and re-evaluate the risk and change-in-risk results and confirm that the risk metrics do not exceed RG 1.174 risk acceptance guidelines. If these guidelines are exceeded, the licensee will perform additional analytical efforts, procedure changes, and/or plant modifications to assure the risk acceptance guidelines are met.

- Other PRA changes that were partially used in the sensitivity study (e.g., the latest fire ignition frequencies and non-suppression probabilities) will be applied throughout the PRA as part of the normal PRA maintenance and update process.

- LAR Attachment S, Implementation Item 66, adequately addresses the lack of a fully accepted PRA RCP seal model because it states that the licensee will evaluate the change in risk associated with replacing the current RCP seal model with an acceptable model, when one becomes available, and will take

action to reduce risk results should they exceed RG 1.174 risk acceptance guidelines.

- The licensee's PRA maintenance process is adequate to support self-approval of future risk informed changes to the FPP.

- The transition process included a detailed review of fire protection DID and safety margin as required by NFPA 805. The NRC staff concludes that the licensee's evaluation of DID and safety margin is acceptable. The licensee's process followed the NRC-endorsed guidance in NEI 04-02, Revision 2, and is consistent with the approved NRC guidance in RG 1.205, Revision 1, which provides an acceptable approach for meeting the requirements of 10 CFR 50.48(c).

- The changes in risk (i.e., Δ CDF and Δ LERF) associated with the proposed alternatives to compliance with the deterministic criteria of NFPA 805 (FREs) are acceptable and 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 have been concluded to be acceptable to the NRC staff, and therefore meet the requirements of NFPA 805.

- The risk presented by the use of RAs was determined to be in accordance with NFPA 805, Section 4.2.4, and the guidance in RG 1.205, Revision 1. The NRC staff concluded that the additional risk associated with the NFPA 805 recovery actions is acceptable, because the risk for each fire area that relies on a RA is below the acceptance guidelines in RG 1.174, and, therefore, meets the acceptance criteria in RG 1.205, Revision 1.

- The licensee did not use any RI/PB alternatives to compliance to NFPA 805 which fall under the requirements of 10 CFR 50.48(c)(4).

3.5 Nuclear Safety Capability Assessment Results

NFPA 805 (Reference 3), Section 2.2.3, "Evaluating Performance Criteria," states that:

> 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 that:

> 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 that:

> 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 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 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 that:

> 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 that:

> 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, "Modifications and Implementation Items," and LAR Attachment W, "Fire PRA Insights," during its evaluation of the ability of each fire area to meet the NSPC of NFPA 805.

PINGP is a dual unit PWR with fifty-eight (58) individual fire areas and each fire area is composed of one or more fire areas/zones. Based on the information provided by the licensee in the LAR, the licensee performed the NSCA on a fire area basis. LAR Attachment C provides the results of these analyses on a fire area basis and also identified the fire areas/zones within the fire areas.

SE Tables 3.5-1a (PINGP Unit 1) and Table 3.5-1b (PINGP Unit 2) identify those fire areas 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," and the licensee's letter dated May 24, 2016 (Reference 19).

Table 3.5-1a PINGP Unit 1 Fire Area and Compliance Strategy Summary

Fire Area	Area Description	NFPA 805 Compliance Basis
1	Containment Unit 1	Performance-Based
2	Ventilation Fan Room Unit 1 & 2	Deterministic
3	Water Chiller Room	Deterministic
4	Fuel Handling Area	Deterministic
8	Turbine Building	Deterministic
10	Train A Event Monitoring Equipment Room	Deterministic
11	Unit 1 Normal Switchgear & Control Rod Drive Room	Deterministic
12	OSC Room	Deterministic
13	Control Room	Performance-Based
15	Access Control	Deterministic
16	Train B Event Monitoring Equipment Room	Deterministic
17	Unit 2 Normal Switchgear Room & Control Rod Drive Room	Deterministic
18	Relay and Cable Spreading Room	Performance-Based
20	Unit 1 4.16 KV Safeguards Swgr, (Bus 16)	Performance-Based
22	480V Safeguards Switchgear (Bus 121)	Performance-Based
24	Oil Storage Area	Deterministic
25	Diesel Generator 1	Performance-Based
26	Diesel Generator 2	Deterministic
28	Transformers	Deterministic
29	Administration Bldg Elect & Piping #1	Performance-Based
30	Administration Bldg Elect & Piping #2	Performance-Based
31	"A" Train Hot Shutdown Panel & Air Compressor/Aux 695' Feedwater Room	Performance-Based

Fire Area	Area Description	NFPA 805 Compliance Basis
32	"B" Train Hot Shutdown Panel & Air Compressor/Aux 695' Feedwater Room	Performance-Based
33	Battery Room 11	Deterministic
34	Battery Room 12	Deterministic
35	Battery Room 21	Deterministic
36	Battery Room 22	Deterministic
37	Unit 1 480V Normal Switchgear Room	Performance-Based
38	Unit 2 480V Normal Switchgear Room	Performance-Based
41	Screenhouse (General Area)	Deterministic
46	Cooling Tower Equipment House and Transformers	Deterministic
58	Auxiliary Building Ground Floor Units 1 and 2	Performance-Based
59	Auxiliary Building Mezzanine Units 1 and 2	Performance-Based
60	Auxiliary Building Operating Level Unit 1	Deterministic
63	Filter Room	Deterministic
64	Auxiliary Building Low Level Decay Area Unit 1	Deterministic
65	Spent Fuel Pool Heat Exchanger & Pumps	Deterministic
66	D3 Lunch Room	Performance-Based
71	Containment Unit 2	Deterministic
75	Auxiliary Building Operating Level Unit 2	Deterministic
77	Auxiliary Building Low Level Decay Area Unit 2	Deterministic
78	Waste Gas Compressor Area	Deterministic
79	480V Safeguard Switchgear Room (Bus 112)	Deterministic
80	480V Safeguard Switchgear Room (Bus 111)	Performance-Based
81	4.16 kV Safeguard Switchgear Room (Bus 15)	Performance-Based
82	480V Safeguard Switchgear Room (Bus 122)	Deterministic
83	Operators Lounge	Deterministic
84	Counting Room and Labs	Deterministic
85	Hold-up Tank Area/Demineralizer Area	Deterministic
86	Intake Screen house	Deterministic
92	Water Chiller Room Unit 2	Deterministic
94	Service Building/Computer Room	Deterministic
97	D5 Diesel Generator Building	Performance-Based
98	D6 Diesel Generator Building	Deterministic
100	#21 D5/D6 Fuel Oil Receiving Tank (South of D6 695'Room)	Deterministic
41A	Screen house (DDCWP Rooms)	Performance-Based
41B	Screen house Basement Below Grade	Performance-Based

Table 3.5-1b PINGP Unit 2 Fire Area and Compliance Strategy Summary

Fire Area	Area Description	NFPA 805 Compliance Basis
1	Containment Unit 1	Deterministic
2	Ventilation Fan Room Unit 1 & 2	Deterministic
3	Water Chiller Room	Deterministic

Fire Area	Area Description	NFPA 805 Compliance Basis
4	Fuel Handling Area	Deterministic
8	Turbine Building	Deterministic
10	Train A Event Monitoring Equipment Room	Deterministic
11	Unit 1 Normal Switchgear & Control Rod Drive Room	Deterministic
12	OSC Room	Deterministic
13	Control Room	Performance-Based
15	Access Control	Deterministic
16	Train B Event Monitoring Equipment Room	Deterministic
17	Unit 2 Normal Switchgear Room & Control Rod Drive Room	Deterministic
18	Relay and Cable Spreading Room	Performance-Based
20	Unit 1 4.16 KV Safeguards Swgr, (Bus 16)	Deterministic
22	480V Safeguards Switchgear (Bus 121)	Performance-Based
24	Oil Storage Area	Deterministic
25	Diesel Generator 1	Performance-Based
26	Diesel Generator 2	Deterministic
28	Transformers	Deterministic
29	Administration Bldg Elect & Piping #1	Performance-Based
30	Administration Bldg Elect & Piping #2	Performance-Based
31	"A" Train Hot Shutdown Panel & Air Compressor/Aux 695' Feedwater Room	Performance-Based
32	"B" Train Hot Shutdown Panel & Air Compressor/Aux 695' Feedwater Room	Performance-Based
33	Battery Room 11	Deterministic
34	Battery Room 12	Deterministic
35	Battery Room 21	Deterministic
36	Battery Room 22	Deterministic
37	Unit 1 480V Normal Switchgear Room	Performance-Based
38	Unit 2 480V Normal Switchgear Room	Performance-Based
41	Screen house (General Area)	Deterministic
46	Cooling Tower Equipment House and Transformers	Deterministic
58	Auxiliary Building Ground Floor Units 1 and 2	Performance-Based
59	Auxiliary Building Mezzanine Units 1 and 2	Performance-Based
60	Auxiliary Building Operating Level Unit 1	Deterministic
63	Filter Room	Deterministic
64	Auxiliary Building Low Level Decay Area Unit 1	Deterministic
65	Spent Fuel Pool Heat Exchanger & Pumps	Deterministic
66	D3 Lunch Room	Performance-Based
71	Containment Unit 2	Deterministic
75	Auxiliary Building Operating Level Unit 2	Deterministic
77	Auxiliary Building Low Level Decay Area Unit 2	Deterministic
78	Waste Gas Compressor Area	Deterministic

Fire Area	Area Description	NFPA 805 Compliance Basis
79	480V Safeguard Switchgear Room (Bus 112)	Deterministic
80	480V Safeguard Switchgear Room (Bus 111)	Performance-Based
81	4.16 kV Safeguard Switchgear Room (Bus 15)	Performance-Based
82	480V Safeguard Switchgear Room (Bus 122)	Deterministic
83	Operators Lounge	Deterministic
84	Counting Room and Labs	Deterministic
85	Hold-up Tank Area/Demineralizer Area	Deterministic
86	Intake Screenhouse	Deterministic
92	Water Chiller Room Unit 2	Deterministic
94	Service Building/Computer Room	Deterministic
97	D5 Diesel Generator Building	Performance-Based
98	D6 Diesel Generator Building	Deterministic
100	#21 D5/D6 Fuel Oil Receiving Tank (South of D6 695'Room)	Deterministic
41a	Screen house (DDCWP Rooms)	Performance-Based
41b	Screen house Basement Below Grade	Performance-Based

LAR Attachment C provides the results of these analyses on a fire area basis. For each fire area, 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 resolution of each VFDR using either modifications (completed or committed) or the performance of a FRE in accordance with NFPA 805, Section 4.2.4.2.

3.5.1.1 Fire Detection and Suppression Systems Required to Meet the Nuclear Safety Performance Criteria

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 required to meet the NSPC for each fire area. LAR Attachment C, "Table B-3 Fire Area Transition," lists the fire areas, 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 area 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, as supplemented, the NRC staff concludes that the PINGP 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 area described 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. In fire areas where automatic fire suppressions systems were not installed, the licensee stated that water from other sources including firefighting were considered to drain outdoors which will minimize the potential for flooding damage, such that the standing water would not affect safety-related electrical equipment which is mounted on pedestals above the floor level minimizing the potential for flooding damage. The licensee stated that fire suppression activities will not adversely affect achievement of the NSPC. In all cases the licensee stated that the fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and portable extinguishers at the base of the fire to limit the amount of overspray beyond the immediate fire area. For this reason, the licensee stated fire brigade activities are not expected to fail components not already considered damaged.

The NRC staff concludes that the licensee's evaluation of the suppression effects on the NSPC is acceptable because the licensee evaluated the fire suppression effects on meeting the NSPC and determined that fire suppression activities will not adversely affect achievement of the NSPC.

3.5.1.3 Licensing Actions

Based on the information provided in LAR Attachment C, the licensee identified exemptions from the deterministic licensing basis for each fire area that were previously approved by the NRC and will be transitioned with the NFPA 805 FPP. Each of these exemptions is summarized in LAR Attachment C on a fire area basis and described in further detail in LAR Attachment K, "Existing Licensing Action Transition."

The licensee 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 Table 3.5-2.

Table 3.5-2 Previously Approved Licensing Actions Being Transitioned

Licensing Action Description	Applicable Fire Areas	Clarification	NRC Staff Evaluation
Appendix R Exemption, RCP Oil Collection, RCP oil collection system is not in strict compliance (III.O criteria),(dated July 31, 1984)	1, 71 - Containment Units 1 and 2	None	The licensee stated that the basis is as follows for the lack of a closed vented container inside containment capable of holding the entire inventory of the reactor coolant pump (RCP) lube oil collection system: The sump is a concrete pit in the basement of containment with a capacity of 990 gallons, which is more capacity needed to contain the total inventory of lube oil for the two RCPs for each unit. There is no safe shutdown equipment in the area surrounding the RCPs or Sump A. The sump is designed to automatically pump down at a prescribed sump level and an alarm will sound in the control room if this level is exceeded. The sump can also manually be pumped down at any time. The sump is normally drained to vented containers in the auxiliary building which have a total capacity of 2600 gallons. This system is designed to collect contaminated water from pump seal leakage as well as oil leakage. The pipe from the sump to the vented container in the auxiliary building has been designed to seismic category III which meets the requirement of Regulatory Guide 1.29, paragraph C-2 (Reference 110). Based on the previous staff approval of this exemption in Safety Evaluation Report dated July 31, 1984 (Reference 92), and the statement by the licensee

			that the bases remain valid, the NRC staff concludes that the applicability of this licensing action is acceptable.
Appendix R Exemption, Control Room, Use of repair to remove fuses (III.G.1 criteria), dated February 21, 1995	13 - Control Room 18 - Relay and Cable Spreading Room	Clarification Request 1: The exemption allowed operators to close the Unit 1 and 2 PORV block valves prior to evacuating the control room, and then take a follow-on action to remove control power fuses from the PORV control circuits for both units at their respective branch circuit panels. The requested Clarifications are: 1) To allow the previous exemption for operator actions to be extended to the NFPA 805 program. 2) To extend the previous approval to pull fuses to instead allow the operation of disconnect switches. In response to SSA RAI 02 (Reference 14), the licensee clarified that the manual operation to pull fuses is replaced with the operator action to open disconnect switches, and is	The licensee stated that the basis is as follows for the use of a manual action to remove fuses from the power-operated relief valve (PORV) control circuit: Closing the block valve and pulling the PORV control circuit fuses is an effective means of preventing potential loss of RCS inventory in the event of a control room fire that could result in a hot short or short to ground that may cause the PORV to open or be maintained open. The requirement to remove/pull the PORV fuses is included in plant procedures as an immediate action in response to a control room evacuation. The fuse panels are readily accessible and the fuses are clearly identified in the panels. Sufficient space is available to permit access for pulling fuses and emergency lights and fuse pullers are provided in the vicinity of each panel. The operators are trained for a control room evacuation and to remove these fuses. Based on the previous staff approval of this exemption in Safety Evaluation Report dated February 21, 1995 (Reference 111), as clarified in LAR Attachment T and evaluated in SE Section 3.5.2 below, 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 addition, the NRC staff concludes that the identified clarifications are acceptable based on the following:

		discussed further in Section 3.5.2. 3) The term "control room fire," as referred to in the exemption letter, applies to fires occurring in Fire Area 013 (Control Room) and Fire Area 018 (Relay Room). Under the pre-transition (Appendix R) program, both Fire Area 013 and Fire Area 018 were analyzed as one analysis area.	1) Operation of disconnect switches is equivalent in intent and function as pulling fuses. 2) The operation of disconnect switches, demonstrated by PINGP to be feasible and reliable, is simpler than pulling fuses.

The NRC staff reviewed the exemptions from the pre-NFPA 805 licensing basis identified in SE Table 3.5-2, including the description of the previously approved exemptions from the deterministic requirements, the basis for and continuing validity of the exemptions, and the NRC staff's original evaluation or basis for approval of the exemptions. 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 is still valid, except as identified in LAR Attachment T and further described in Section 3.5.2 of this SE.

Based on the NRC staff's review of the licensing actions identified and described in LAR Attachment C and Attachment K, and the clarification in Attachment T, 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 used 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 the statement by the licensee that the basis remains valid, 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 77), was followed. EEEEs that demonstrate that a fire protection system or feature is "adequate for the hazard" are to be 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 did not request the NRC staff to review and approve any of these EEEEs.

Based on the NRC staff's review of the licensee's methodology for review of EEEE's and identification of the applicable EEEEs in LAR Attachment C, the NRC staff concludes that the 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 areas 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 area. Documented variances were all represented as separation issues. The following strategies were used by the licensee in resolving the VFDRs:

- A FRE determined that applicable risk, DID, and safety margin criteria were satisfied without further action; or
- A FRE determined that applicable risk, DID, and safety margin criteria were satisfied with a credited RA; or
- A FRE determined that applicable risk, DID, and safety margin criteria were satisfied with a plant modification(s), as identified in the LAR; or
- A FRE determined that applicable risk, DID, and safety margin criteria were satisfied with a RA and a plant modification(s), as identified in the LAR.

For all fire areas where the licensee used the PB approach to meet the NSPC, each VFDR and the associated resolution has been described in LAR Attachment C.

In LAR Attachment C, the FREs for fire areas 13 and 18 credited various RAs and modifications to resolve VFDR-013-1-02 and VFDR-018-1-02 for Unit 1, and VFDR-013-2-02 and VFDR-018-2-02 for Unit 2. In SSA RAI 07a (Reference 24), the NRC staff requested that the licensee provide information regarding the acceptability of the RAs credited for the containment sump B valves in the resolution of VFDR-18-2-02. In its response to SSA RAI 07a (Reference 14), the licensee stated that it re-evaluated the RWST to containment sump B drain down scenario and determined that the RAs are no longer required to support the FRE. The licensee stated that the revised delta risk values were calculated in a sensitivity analysis and meet the acceptance criteria identified in RG 1.174 (Reference 41), and will be included in the response to PRA RAI 03. LAR Attachment C does not discuss the modifications listed in LAR Attachment S to address Information Notice 92-18, "Potential for Loss of Remote Shutdown Capability During a Control Room Fire" (Reference 112) related to RHR pump isolation valves MV-32085 and MV-32185. In SSA RAI 07b (Reference 24), the NRC staff requested justification for not identifying these modifications in the resolution of the VFDR. In its response to SSA RAI 07b (Reference 14), the licensee stated that it had performed a sensitivity analysis and determined that the modifications to MV-32085 and MV-32188 are no longer needed. The NRC staff concludes that the licensee's response to SSA RAI 07 is acceptable because the results of the sensitivity analysis determined that Modification Item 36 to address IN 92-18 and the RAs for the sump valves are no longer needed to meet the NSPC of NFPA 805 Section 1.5.

In its letter dated May 24, 2016 (Reference 19), the licensee stated that it re-evaluated the RAs that were credited for VFDRs 013-1-02, 013-2-02, 018-1-02, 018-2-02 which were described in its response to SSA RAI 07a (Reference 14). The licensee determined that it no longer needs to credit the RAs that involve isolating valves (e.g., letdown, excess letdown, head vents, and pressurizer vents) and de-energizing containment sump B valves because the delta risk values meet the acceptance criteria defined in RG 1.174. The NRC staff concludes that the licensee's changes to the RA are acceptable because it demonstrated that it met the NSPC without crediting the RAs.

In LAR Attachment S, Table S-2, Modification Items 34 and 35, the licensee stated that it will be protecting cables from fire damage in fire areas 32 and 58 to ensure electrical power availability to support the NSPC, however, LAR Attachment C does not identify a VFDR that credits these modifications in the fire area assessment for fire areas 32 and 58. In SSA RAI 10a (Reference 24), the NRC staff requested that the licensee provide information on how the modifications are credited in the NSCA for fire areas 32 and 58. In its response to SSA RAI 10a (Reference 14),

the licensee clarified that LAR Attachment S, modification items 34 and 35, along with Modification 6, are credited in the FRE for resolution of VFDR-058-1-11, and Modifications 34 and 35 are credited in the FRE for resolution of VFDR 032-1-02. The NRC staff concludes that the licensee's response to SSA RAI 10a is acceptable because the licensee identified the VFDRs associated with the modifications and revised LAR Attachment S to clarify the scope for one modification.

In LAR Attachment S, Table S-2, the licensee described several modifications that specify "protecting cables or circuits." In SSA RAI 10b (Reference 24), the NRC staff requested that the licensee describe the protection schemes that may be used for "protecting" cables. In its response to SSA RAI 10b (Reference 14), the licensee stated that cables will be protected in accordance with the requirements of NFPA 805, Sections 4.2.3.2, 4.2.3.3, or 4.2.3.4 as applicable, or will be re-routed outside the ZOI of the fire initiators of concern to achieve compliance with the PB approach of NFPA 805, Section 4.2.4.2. The NRC staff concludes that the licensee's response to SSA RAI 10b is acceptable because the licensee clarified that the methods used to "protect cables or circuits" will be in accordance with the requirements of NFPA 805, Section 4.2.3 or will be re-routed in the affected fire area to meet a PB analysis that meets the requirements of NFPA 805, Section 4.2.4.

Based on the NRC staff review of the VFDRs and associated resolutions as described in LAR Attachment C, as supplemented, the NRC staff concludes that the licensee's identification and resolution of the VFDRs is acceptable because the licensee identified, characterized, and resolved appropriate VFDRs as summarized in LAR Attachment C for each fire area to determine whether the plant design will satisfy the appropriate performance criteria.

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 area. 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). In the LAR, the licensee stated that RAs that are necessary to demonstrate the availability of a success path for the NSPC were evaluated for additional risk using the process described in NEI 04-02 (Reference 7), FAQ 07-0030, Revision 5 (Reference 70), and RG 1.205 (Reference 4), and compared against the acceptance guidelines of RG 1.174 (Reference 41) and RG 1.205.

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 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." 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.

3.5.1.7 Recovery Actions Credited for Defense in Depth

In LAR Attachment G, the licensee stated that each VFDR not brought into compliance with the deterministic approach was evaluated using the PB approach of NFPA 805, Section 4.2.4, and the evaluations resulted in the need for RAs to meet the risk acceptance criteria or maintain a sufficient level of DID. The licensee described the final set of RAs in LAR Attachment G, Table G-1, and did not identify any RAs credited to maintain a sufficient level of DID to resolve a VFDR.

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 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."

3.5.1.8 Plant Fire Barriers and Separations

With the exception of ERFBS, passive fire protection features include the fire barriers used to form fire area 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, except for those fire areas identified in LAR Attachment C, which combine multiple fire areas and analyzed as one fire area in the NSCA.

Fire area 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 resolve 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 are addressed in SE Section 3.1.

In LAR Attachment C, the licensee stated that radiant energy shields are credited for risk in fire area 1 to protect raceway 1CV-T421 and in Fire Area 32 to protect raceway 1SG-LB22. In SSA RAI 09 (Reference 24), the NRC staff requested that the licensee provide the details of the nuclear safety functions that credit these radiant energy shields and a discussion of how the radiant energy shields are credited in the FREs, including how the fire resistance rating claimed in the risk analysis has been established through fire testing. In its response to SSA RAI 09 (Reference 14), the licensee clarified that there is no nuclear safety function credit taken for the radiant energy shields and that the radiant energy shields are not credited in FREs and revised the LAR to delete the radiant energy shields as a required feature to meet NFPA Chapter 4 requirements. The NRC concludes that the licensee's response to SSA RAI 09 is acceptable because it clarified that the radiant energy shields are not credited to meet NFPA 805 requirements.

3.5.1.9 Electrical Raceway Fire Barrier Systems

The licensee stated that the ERFBS meet the deterministic requirements of NFPA 805, Chapter 3 with the use of EEEEs. Each fire area using ERFBS is identified in LAR Attachment C. In fire areas with deterministic compliance, the ERFBS met the requirements of NFPA 805, Section 4.2.3. In fire areas with PB compliance, the ERFBS were analyzed using the PB approach in accordance with NFPA 805 Section 4.2.4. The NRC staff found that there were no VFDRs associated with ERFBS.

In LAR Attachment C, Table B-3, the licensee indicated that the regulatory basis for fire area 71 is the deterministic approach as described in NFPA 805, Section 4.2.3, however, in the table titled "Required Fire Protection Systems and Features", an ERFBS was identified as being required for risk. In SSA RAI 08 (Reference 24), the NRC staff requested that the licensee clarify if the ERFBS is credited to protect a nuclear safety performance function, and if fire area 71 was evaluated using a deterministic or PB approach. In its response to SSA RAI 08 (Reference 14), the licensee stated that the ERFBS is credited to protect one train of

pressurizer level indication (1L-433) and meets the requirements of NFPA 805, Section 3.11.5, and that fire area 71 meets the deterministic requirements of NFPA 805. The NRC staff concludes that the licensee's response to SSA RAI 08 is acceptable because the licensee demonstrated that the ERFBS complies with NFPA 805, Chapter 3, and that fire area 71 meets the deterministic requirements of NFPA 805 Chapter 4.

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 meet 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 statements 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 is demonstrated as follows:

- Exemptions from the pre-NFPA 805 fire protection licensing basis that are being 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.
- The licensee's analysis appropriately identified fire area boundaries (ceilings, walls, and floors), such as fire barriers, fire barrier penetrations, and through penetration fire stops.
- ERFBS credited were documented on a fire area basis, verified to be installed consistent with tested configurations and rated accordingly.

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.

In LAR Attachment T, the licensee stated that a clarification is requested to extend the previous allowance to pull fuses to also allow the operation of disconnect switches. The licensee further stated that although the fuse removal remains an option, the manual operation to open disconnect switches is simpler than pulling fuses and is requested to be deemed equivalent in intent and function. In SSA RAI 02 (Reference 24), the NRC staff requested that the licensee clarify which action, or both, is credited for disabling the PORV control circuits and to describe the procedural steps and the feasibility analysis performed for these actions. In its response to SSA RAI 02 (Reference 14), the licensee stated that it will revise the description in LAR Attachment T to allow for the opening of disconnect switches in lieu of the original exemption action of pulling fuses as a follow-up action taken outside the control room to prevent fire-induced spurious opening of the PORVs. The licensee demonstrated that the manual operation to open disconnect switches is feasible and reliable, is simpler than pulling fuses, and is equivalent in intent and function. The licensee further stated that Modification Item 27 in LAR Attachment S, Table S-2, which installs isolation switches for the PORVs, is credited in the FPRA for risk reduction purposes only, and as such, will not eliminate the need to take the follow-on action of opening the disconnect switches for fire scenarios that involve a control room evacuation. The licensee summarized the procedural steps taken to perform the operator actions to prevent spurious operation of the PORVs. The licensee identified an action in LAR Attachment S, Table S-3, Implementation Item 53 to update plant documentation to describe its transition to NFPA 805, including the addition of new RAs, actions to maintain safe and stable conditions, and to document how the criteria, as defined by FAQ 07-0030 are met. 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 SSA RAI 02 is acceptable because it clarified the RA to mitigate spurious operation of a PORV and provided a description of the procedural steps to perform the RAs.

The NRC staff concludes that 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).

3.5.3 Fire Protection during Non-Power Operational Modes

NFPA 805, Section 1.1 "Scope," states that:

> 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 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.

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 licensee used the process described in NEI 04-02, as modified by FAQ 07-0040 (Reference 74), 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. The licensee stated that its outage management procedures implement its philosophy of outage risk management for Modes 4 through 6, and when the reactor is defueled. The licensee further stated that its procedures identify the KSFs that need to be maintained and provided guidelines for maintaining them and the procedures identify special requirements for reduced inventory and mid-loop conditions. The licensee stated that these conditions are based on short times to boil, limited methods available for decay heat removal (e.g. only the RHR system is available), and low RCS inventory. The licensee stated that these conditions are also consistent with FAQ 07-0040, Revision 4, guidance which considers these conditions to be generally the period of highest risk. HREs are "outage activities, plant configurations, or conditions during shutdown where the plant is more susceptible to an event causing the loss of a key safety function." The strategy contains specific actions to address reduced inventory conditions that consider short time to boil, limited methods for decay heat removal, and low RCS inventory. The licensee stated that the NPO assessment consists of the following "HREs" when the Plant Operating States (POSs) meet the conditions identified immediately below, thus constituting a "higher risk condition":

- Fuel is in the reactor vessel, AND
- Thermal margin is low with time to core boil less than or equal to 40 minutes, OR
- The plant is in a reduced inventory condition (i.e. water level is 36 inches below the reactor vessel flange)

As described in the LAR, the licensee identified equipment and cables necessary to support the key safety functions' (KSFs) success paths. The operational modes and functional requirements for the systems and components were reviewed. The KSF success path equipment and cables were incorporated in the NPO database model. Following identification of KSF equipment and cables, the licensee performed analysis on a fire area basis to identify areas where redundant equipment and cables credited for a given KSF might fail due to fire damage (i.e., pinch-points). The licensee used a deterministic approach to identify these pinch-points and mitigated these pinch-points through the use of RAs and/or fire prevention/protection controls. As stated in LAR Section 4.3.2, FM was not used to eliminate any pinch-points.

3.5.3.2 NPO Analysis Process

The licensee stated that its goal is to ensure that contingency plans are established when the plant is in an HRE and it is possible to lose a KSF due to fire. LAR Section 4.3.2 discusses these additional controls and measures. However, during low-risk periods, normal risk management controls, as well as fire prevention/protection processes and procedures will be used.

As described in LAR Section 4.3.2, POS considered for equipment and cable selection were defined in licensee engineering analyses, and components were identified to support the KSFs of reactivity, core decay heat removal, containment, inventory, and associated support functions. The licensee stated that a model was developed in the NFPA 805 analysis database; equipment was logically tied to the supported KSF; and power supplies, interlocks, and supporting equipment, were logically tied to their parent component. The licensee stated that for those components which had not been previously analyzed in support of the at-power analysis or whose functional requirements may have been different for the NPO analysis, cable selection was performed in accordance with approved project procedures. Cables necessary to support the selected function of a component were selected and analyzed for fire impact.

3.5.3.3 NPO Key Safety Functions and SSCs Used to Achieve Performance

LAR Attachment D defines the KSFs, defines the success paths to achieve the KSFs, and defines the components required for the success paths. The KSFs identified for each unit, are:

- Decay Heat Removal – RCS.
- Decay Heat Removal – Spent Fuel Pool (SFP).
- Inventory Control.
- Power Availability (4160 Volts, 480 Volts, 120 Volt Instrument Buses, 120 Volt Uninterruptable Power Supply (UPS) Loads, direct current (dc)).
- Reactivity Control.
- Containment.

The licensee stated that the NPO model includes the component cooling water and the cooling water system as a supporting function to the other KSFs. The licensee further stated that these systems are not specifically identified as unique KSFs in the NPO model, but the systems are included as a supporting function to other NPO systems/functions and/or equipment.

The licensee stated that the initial identification of plant equipment required for NPO was performed from a review of the NPO flowpaths / systems / functions and equipment identified in operations procedures, and the NPO equipment was identified primarily from system and paths identified in the SSD assessment procedure. The licensee stated that additional components were added as needed to support these paths and as necessary to provide success paths for fires occurring during the HREs (e.g., reduced inventory).

The licensee stated that the identification of NPO equipment also included review of the piping and instrumentation drawings to select: (1) electrically operated plant equipment whose active function would be required to support the associated NPO flowpaths / systems / functions, and (2) electrically operated plant equipment whose spurious operation could be adverse to the successful performance of the associated NPO flowpaths/systems/functions.

The licensee stated that the functional attribute(s) required of each NPO component to support the associated NPO flowpaths/systems/functions were identified (i.e., valve required to be open, to be closed, to remain operable, motor control center required to be energized, instrument loop required "available" to provide reliable indication, etc.).

The licensee further stated that most of the plant equipment that was determined to be required for the NPO model was already included in the NFPA 805 at-power NSPC model and/or the FPRA model. The licensee further stated that most of these components were determined to have been analyzed consistently with the functional attributes required for the associated NPO flow path/system/function (i.e., valve required to be operable for FPRA – same valve required to be operable for NPO). The licensee stated that most of the existing circuit analysis/cable selection for the NFPA 805 at-power NSPC model and the FPRA model was determined to be adequate for use in the NPO model.

The licensee stated that circuit analysis/cable selection was performed for each "NPO only" component based on the functional attribute(s) required of each NPO component. The circuit analysis/cable selection identified the plant cable(s) required to remain free of fire damage in order for the NPO component to be credited as "available" in the subsequent NPO analysis. The cable to equipment relationships were incorporated into the database as cable logics.

Following component identification, as described by the licensee in LAR Section 4.3.2 and LAR Attachment D, fire area assessments and pinch point identification was performed. Pinch points refer to a particular location in an area where the damage from a single fire scenario could result in failure of multiple components or trains of a system such that the maximum detriment on that system's performance would be realized from the single fire scenario. Typically, this involves close vertical proximity of cables which support redundant components or trains of a system such that all such cables can be damaged by just one fire scenario.

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 RG 1.205 and FAQ 07-0040 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 will have a process in place to ensure that fire protection DID measures will be implemented to achieve the KSFs during plant outages by completing the action described in LAR Attachment S, Table S-3, Implementation Item 35 to revise the refueling outage management procedure for inclusion of NPO requirements. 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.

3.5.3.4 NPO Pinch Point Resolutions and Program Implementation

The licensee identified power-operated components needed to support an NPO KSF that were not included in the post-fire safe shutdown equipment list and required additional circuit analysis. As described in LAR Section 4.3.2, for those components which were not previously analyzed in support of the at-power analysis or whose functional requirements may have been different for the NPO analysis, cable selection was performed in accordance with approved project procedures. Cables necessary to support the selected function of a component were selected and analyzed for fire impact using the safe shutdown model for NPO.

In LAR Attachment D, the licensee stated that a deterministic fire separation analysis (i.e., assuming full area burn) was performed as documented in an engineering evaluation to identify

pinch points (i.e., areas where redundant equipment and cables credited for a given KSF fail due to fire damage). The licensee stated there are a total of 58 fire areas.

- 26 fire areas were found to have an adequate number of KSF success paths to survive the entire loss of the fire area.
- 32 fire areas were found to have pinch points resulting in the potential loss of one or more KSFs success paths.

In its letter dated May 24, 2016 (Reference 19), the licensee stated that it updated its NPO analysis in revised LAR Attachment D and clarified that there were 57 fire areas reviewed in the NPO analysis. The licensee further stated that 28 fire areas have an adequate number of KSF success paths to survive loss of the entire fire area, and 29 fire areas have pinch points resulting in the potential loss of one or more KSF success paths. The NRC staff concludes that the licensee-identified changes are acceptable because the changes incorporate the results of a revision to the NPO analysis and it continues to meet the NSPC of NFPA 805 Section 1.5 during non-power modes.

The licensee stated that FM was not used to eliminate identification of pinch point fire areas as part of the implementation process and that it aligns with FAQ 07-0040 implementing guidance in performing fire area assessments.

The licensee stated that a KSF pinch point analysis was performed for all fire areas in accordance with NFPA 805 and FAQ 07-0040 Revision 4. The licensee stated that for fire areas where the pinch point analysis identified areas of single-point KSF vulnerability and higher risk, combinations of the following options to reduce fire risk were considered, depending upon the significance of the potential damage:

- Prohibition or limitation of hot work in fire areas during periods of increased vulnerability.
- Verification of operable fire detection and /or suppression in the vulnerable areas.
- Prohibition or limitation of combustible materials in fire areas during periods of increased vulnerability.
- 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 (such as surveillance cameras) during increased vulnerability.
- Use of recovery actions to mitigate potential losses of key safety functions.
- Identification and monitoring in-situ ignition sources for “fire precursors” (e.g., equipment temperatures).
- Reschedule the work to a period with lower risk or higher DID.

The licensee stated that operator actions taken to mitigate the loss of a KSF are credited in the NPO analysis contained within an engineering evaluation. In SSA RAI 05a and 05c (Reference 24), the NRC staff requested that the licensee provide a description of any actions being credited to minimize the impact of fire-induced spurious actuations on power operated valves, the actions credited to maintain KSF, and the feasibility analysis performed for these actions. In its response to SSA RAI 05a and 05c (Reference 14), the licensee stated that the types of actions credited to maintain KSF included de-energizing power operated valves to preclude or mitigate spurious operation, adding procedural actions to open a redundant flow path, re-power an instrument bus from the alternate panel, and closing manual valves to isolate flow diversion paths. The licensee stated that a pre-fire action is taken prior to entering HREs to tag open the breakers associated with two of the four RHR suction valves for Unit 1 (MV-32164 and MV-32231) and Unit 2 (MV-32192 and MV-32233) during shutdown cooling, mode 5, to minimize the impact of fire-induced spurious actuations of RHR suction valves from the RCS hot-leg. The licensee further stated that during HREs, it will use administrative controls to minimize the risk of potential fire damage that could impact operation of the following RHR suction valves: MV-32165, MV-32230, MV-32193, and MV-32232. The licensee stated that the feasibility analysis will be revised as described in LAR Attachment S, Table S-3, Implementation Item 53. 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 actions taken are within the guidance for RAs as described in FAQ 07-0040.

In SSA RAI 05b (Reference 24), the NRC staff stated that during normal outage evolutions, certain credited NPO equipment may be removed from service and requested a description of the types of compensatory actions that will be used during such equipment down-time and the method for determining if the compensatory measure is adequate. In its response to SSA RAI 05b (Reference 14), the licensee stated that it revised its shutdown safety procedure to ensure that NPO credited equipment is not removed from service during HRE without adequate compensatory measures. The licensee further stated that plant procedures will provide guidelines and identify compensatory actions that can be taken when fire safe shutdown components are out of service and included actions in LAR Attachment S, Table S-3, Implementation Items 37 and 40 to do so. The licensee described that the compensatory actions that may be implemented for fire risk mitigation may include hot work restrictions, transient combustible controls, access limitations, automatic detection and suppression systems, and fire watch patrols. The licensee further stated that additional KSF pinch points introduced by removal of credited equipment from service will be identified through administrative procedures, shutdown risk management, and work control, and that in the unlikely event that such equipment is deliberately removed from service coincident with a planned or emergent HRE, the plant's fire protection organization will consider appropriate contingency measures to reduce fire risk at the additional locations. The NRC staff concludes that the licensee's response to SSA RAI 05b is acceptable because the compensatory measures identified by the licensee are consistent with the guidance provided in FAQ 07-0040.

The licensee stated that its outage and other procedures as well as fire protection program documentation will be revised to implement NPO guidance and analysis results. These actions are included in LAR Attachment S, Table S-3, Implementation Items 2, 27, 35, 38, 39, 40, 41, 42, 45, 46, 47, 48, 49, 50, and 62. In a letter dated May 24, 2016 (Reference 19), the licensee indicated that it had deleted Implementation Items 41 and 42 because they were no longer required to support NPO. The NRC staff considers these actions acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

NFPA 805 requires that the NSPC be met during any operational mode or condition, including NPO. As described above, the licensee 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 changes to appropriate procedures in order to employ a fire protection strategy for reducing risk at these pinch points during HREs.

Accordingly, based on 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 actions to revise 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, and would be required by a 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 as supplemented, to evaluate the NSCA results. The licensee used a combination of the deterministic approach and the PB approach, in accordance with NFPA 805, Sections 4.2.3 and 4.2.4.

For those fire areas that used a deterministic approach, the NRC staff verified the following:

- The engineering evaluations for exemptions 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.
- 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 deterministic approach does so in accordance with NFPA 805, Section 4.2.3.

For those fire areas that used a PB approach, the NRC staff verified the following:

- The engineering evaluations for exemptions 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.

- 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 and is able to achieve and maintain the NSPC. Furthermore, there is reasonable assurance that the associated FREs meet the requirements for risk, DID, and safety margin.

The NRC staff's review of the licensee's analysis and outage management process during NPO modes concludes 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 concludes that actions are credited to maintain KSF to preclude or mitigate spurious operations and that a pre-fire action and administrative controls are credited prior to entering HREs. 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 a 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 [is] reasonably achievable [(ALARA)] and shall not exceed applicable 10 CFR, Part 20, limits.

In RG 1.205, the NRC staff endorsed (with certain exceptions) the methodology given in NEI 04-02 as providing methods acceptable to the staff for establishing an FPP consistent with NFPA 805 and 10 CFR 50.48(c). Using these methods, the licensee assessed the capability of its FPP to meet the NFPA 805 performance criteria as contained in NEI 04-02 and FAQ 09-0056 (Reference 78).

The NRC staff reviewed the licensee's assessment provided in the LAR in order to determine if the existing FPP with its planned modifications would meet the radioactive release performance criteria requirements of NFPA 805, in accordance with 10 CFR 50.48(a) and (c) using the guidance in RG 1.205 and NUREG-0800, Section 9.5.1.2.

The licensee's assessment of its capability to meet the goals, objectives, and performance criteria of NFPA 805 was performed for all plant operating modes (power and NPO) and plant areas using the methodology contained in NEI 04-02 and subsequent guidance provided in FAQ 09-0056. The methodology comprised a review of existing pre-fire plans (fire strategies), fire brigade training materials, and engineering controls.

The licensee's review documented in the LAR determined that the fire suppression activities, as defined in the pre-fire plans, and fire brigade training and procedures will be compliant with the requirements of NFPA 805 and the guidance in NEI 04-02 and RG 1.205 upon completion of the actions described in LAR, Attachment S, Table S-3, Implementation Items 6 through 13, 15, and 16. The identification of radiological areas where the potential for radioactive materials were present was performed and documented in an engineering evaluation. Areas were identified where there was no radioactive or contaminated materials and eliminated (screened-out) from further review. Areas were also identified where there was a potential for generation of radioactive effluents created by firefighting activities and included (screened-in) for further evaluation. The NRC staff's review concludes that the scope of the licensee's assessment was adequate because the review included all modes of plant operation and all plant areas.

The screened-in areas included those areas where radioactive materials were present such as in the auxiliary building and containment (i.e., the reactor building). The licensee's review determined these areas had adequate engineered controls for containment of liquid and gaseous effluent. Engineering controls credited for containment of gaseous effluents (e.g., exhaust ventilation routed through HEPA and charcoal filters) and liquid effluents (e.g., floor drains and sumps routed to the radioactive waste system) are documented in the LAR, Attachment E, "NEI 04-02 Radioactive Release Transition." Operator actions were not credited for mitigating a potential radioactive release. The NRC staff's review determined that the existing engineering controls in these areas were 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.

The licensee's review identified other plant areas such as the fuel handling area, the auxiliary building hatch area, and the low level rad waste area where there were engineered controls for

containment of liquid effluent from fire suppression activities but lacked ventilation controls to minimize the release of gaseous effluents. To minimize the release of gaseous effluents from the fuel handling area and the auxiliary building hatch area, the licensee will take mitigating actions for gaseous releases based on radiological conditions as monitored by Radiation Protection personnel and communicated to the fire brigade leader during fire event. Mitigating actions may include the use of portable HEPA filters for potentially contaminated smoke and opening the doors to the spent fuel area to direct potentially contaminated smoke to the spent fuel pool normal ventilation system. In addition, these two areas are part of the common area of the auxiliary building (CAAB) which provides containment for gaseous effluents due to the large volume of the CAAB.

For the low level rad waste area, the licensee will employ administrative controls to minimize the amount of radioactive material stored. To minimize the potential release, radioactive waste will be stored in metal containers in the truck loading area. Additionally, equipment such as booms, portable filtered ventilation and other appropriate equipment to contain effluent releases from this area will be pre-staged in a location adjacent to this area. These administrative controls, containerization, and staging of mitigating equipment as well as the revised fire strategies are identified in the LAR, Attachment S, as actions to be completed.

In other plant areas where there were no engineered controls to contain radioactive gaseous and liquid effluents, the licensee performed a bounding quantitative analysis of the potential release of contaminated gaseous and liquid effluents resulting from a fire as described in technical basis document. The calculation results bound the dose consequences for all types of low specific activity containers stored in an outside fenced off area west of the switchyard area.

The bounding case was a fire in a sea land storage container fully loaded with radioactive waste. The licensee performed a dose assessment based on the type and quantity of radionuclides that are stored in a sea land container whose contents were then assumed to be released during a fire. The NRC's evaluation of the licensee's analysis determined the bounding assessment was 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 was performed using acceptable methodologies, and the results demonstrate that the maximum offsite dose from the liquid and gaseous effluents at the exclusion area boundary are less than the 10 CFR 20 dose limits for members of the public and are therefore acceptable.

The licensee reviewed the pre-fire plans and determined that the plans need to be revised to direct the fire brigade leader and radiation protection personnel to determine the best available methods for minimizing radiological releases based on the location of the fire. In addition, fire-fighting instructions will be revised to provide additional instructions on the control of a radiological release as a result of fire-fighting activities.

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 training materials need revision to reinforce the use of radiation protection procedures and pre-fire plans to provide for containment and monitoring of potentially radioactive effluents. Pre-fire plan revisions will be made as described in LAR Attachment S to identify potentially contaminated areas, provide instructions for communication with radiation protection staff, and describe precautions to minimize, contain and safely remove contaminated smoke and water runoff in these potentially contaminated areas.

LAR Attachment S contains the actions that include the revisions to plant documents needed to support the fire-fighting efforts including the revision of the pre-fire plans and training materials to address radioactive release requirements of NFPA 805. As described in LAR Attachment S, Table S-3, Implementation Item 10, the fire strategies will be revised to include information on potential cross-contamination for each fire area. In addition, fire-fighting instructions and brigade lesson plans will be revised to provide additional instructions on the control of a radiological release as a result of fire-fighting activities (see LAR Attachment S, Table S-3, Implementation Items 7, 8, 9, and 11). LAR Attachment S, Table S-3, Implementation Item 12 indicates that radiation protection continuing training will be revised to address control of contamination during firefighting activities.

LAR Attachment S, Table S-3, Implementation Item 13, indicates that procedures will be revised to address the ability to use various plant systems for the removal of potentially contaminated smoke in fire areas identified in LAR Attachment E. For those fire areas without installed ventilation controls, mitigating actions will be taken to use a combination of exhausting potentially contaminated smoke through adjacent areas with filtered ventilation or the use of portable filtered ventilation equipment. Potentially contaminated water will be controlled by the use of booms to contain liquid effluent to onsite areas.

The NRC staff considers the actions described in LAR Attachment S, Table S-3, Implementation Items 6 through 13, 15, and 16, acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

Based on: (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 the licensee's RI/PB FPP provides reasonable assurance that radiation releases to any unrestricted area resulting from the direct effects of fire suppression activities at PINGP are ALARA and are not expected to exceed the public dose limits in 10 CFR Part 20. In conclusion, the NRC staff finds that the licensee's RI/PB FPP complies with the requirements specified in 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 FAQ 10-0059 (Reference 79), and that development of the monitoring program will include a review of existing surveillance, inspection, testing, compensatory measures, and oversight processes for adequacy. The licensee further stated that the review will examine adequacy of the scope of SSCs within the existing plant programs, performance criteria for availability and reliability of SSCs, and the adequacy of the plant corrective action program. 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, fire protection programmatic elements, and radioactive release engineered systems and features.

Based on the information provided in the LAR, as supplemented, 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 action included in LAR Attachment S, Table S-3, Implementation Item 1. 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 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 no later than 12 months after issuance of the license amendments, which is prior to completion of the modifications to achieve full compliance with 10 CFR 50.48(c) (which is before the end of the second full operating cycle for each unit after approval of the amendment).

3.7.2 Conclusion for Section 3.7

The NRC staff reviewed the licensee's RI/PB FPP and concludes that the licensee's approach for meeting the requirements of NFPA 805, Section 2.6, regarding the monitoring program is acceptable and that there is reasonable assurance that the licensee will develop a monitoring program that meets the requirements specified in NFPA 805, Sections 2.6.1, 2.6.2, and 2.6.3 because the licensee identified an action to develop and implement the monitoring program per NFPA 805, Section 2.6 and included that action as an implementation item which will incorporate the provisions of NFPA 805 in the FPP and 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 PINGP FPP transition to NFPA 805.

NFPA 805, Section 2.7.1.1, "General," states:

> 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:

> 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 FPP design basis document and supporting documentation.

The licensee stated that in accordance with the requirements and guidance in NFPA 805 Section 2.7.1 and NEI 04-02, PINGP has documented analyses to support compliance with 10 CFR 50.48(c). The licensee further stated that the analyses are performed in accordance with its processes for ensuring assumptions are clearly defined, that results are easily understood, that results are clearly and consistently described, and that sufficient detail is provided to allow future review of the entire analyses.

The licensee stated that the 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 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 will be created as part of transition to 10 CFR 50.48(c) to ensure program implementation following receipt of the SE, and identified these documents in LAR Figure 4-9, "NFPA 805 Planned Post-Transition Documents and Relationships."

Specifically, the licensee's design analysis and calculation procedure provide the methods and requirements to ensure that design inputs and assumptions are clearly defined, results are easily understood by being clearly and consistently described, and that sufficient detail is provided to allow future review of the entire analysis. In addition, the approved analyses are considered controlled documents, and are accessible via the licensee's document control system. Being analyses, they are also subject to review and revision consistent with the other plant calculations and analyses, as required by the plant design change process.

Based on the LAR description, 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 Sections 2.7.2 and 2.2.9 of NFPA 805," in order to evaluate the licensee's configuration control process.

The licensee stated that program documentation established, revised, or used in support of compliance with 10 CFR 50.48(c) is subject to its configuration control processes that meet the requirements of Section 2.7.2 of NFPA 805, and that this includes the appropriate procedures and configuration control processes for ensuring that changes impacting the FPP are reviewed appropriately. The licensee further stated that the RI/PB post transition change process methodology is based upon the requirements of NFPA 805, and industry guidance contained in NEI 04-02, and RG 1.205.

The licensee stated that is FPP configuration is defined by the program documentation and that to the greatest extent possible, the existing configuration control processes for modifications, calculations and analyses, and FPP license basis reviews will be used to maintain configuration control of the FPP documents. The licensee stated that the configuration control procedures which govern the various PINGP documents and databases that currently exist will be revised to reflect the new NFPA 805 licensing bases requirements. The licensee included this action in LAR Attachment S, Table S-3, Implementation Item 28 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 configuration control of the FPRA model will be maintained by integrating the FPRA model into the existing processes used to ensure configuration control of the IEPRA model and that this process complies with Section 5 of the ASME Standard for PRA Quality and ensures that NSPM maintains an as-built, as-operated PRA model of the plant. The licensee further stated that the process has been peer reviewed and that quality assurance of the FPRA is assured via the same processes applied to the IE model. 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 included in SE Section 3.4.

Based on the description of the PINGP configuration control process, which indicate 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 there is reasonable assurance that the requirements of NFPA 805 Sections 2.7.2.1 and 2.7.2.2 will be met subject to completion of LAR Attachment S, Table S 3, Implementation Item 28.

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 its procedures require independent review of analyses, calculations, and evaluations, including those performed in support of compliance with 10 CFR 50.48(c). The LAR stated that the transition to NFPA 805 was independently reviewed, and that analyses, calculations, and evaluations to be performed post-transition will be independently reviewed, as required by existing 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 (V&V)

NFPA 805, Section 2.7.3.2, requires that each calculational model or numerical method used be V&V 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 V&V. 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 56), 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) as part of an approved PB approach in accordance with NFPA 805, Chapter 4.

Accordingly, for those FM elements performed by the licensee using the V&V applications contained in NUREG-1824 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.

In LAR Section 4.5.1.2, the licensee identified the use of several empirical correlations that are not addressed in NUREG-1824 (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 guidance.

Table 3.8-1, "V&V Basis for Fire Modeling Correlations Used at PINGP," in SE Attachment A and Table 3.8-2, "V&V Basis for Other Fire Models and Related Calculations Used at PINGP," in SE Attachment B identify these empirical correlations and algebraic models, respectively, as well as a staff resolution for each.

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 were identified and described in authoritative publications (References 57, 113, 114, 115, 116, 117, 118, 119, 120, and 121). SE Table 3.8-1 summarizes the additional fire models, and the NRC staff's evaluation of the acceptability of each.

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.

3.8.3.2.2 Discussion of RAIs

By letters dated March 30, 2015 (Reference 24) and August 28, 2015 (Reference 26), the NRC staff sought additional information concerning the FM conducted to support the FPRA. By letters dated May 28, 2015 (Reference 14), June 19, 2015 (Reference 15), and October 6, 2015 (Reference 16), the licensee responded to these RAIs.

- In FM RAI 03.a (Reference 24), the NRC staff requested that the licensee provide the V&V basis for any tool or method identified in the response to FM RAI 01.a, and provide technical details to demonstrate that it applied the models within the validated range of input parameters.

  In its response to FM RAI 03.a (Reference 15), the licensee stated that LAR Attachment J lists all FM tools and methods that it used in support of the LAR.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided the V&V basis for all FM tools and methods used in support of the NFPA 805 transition in LAR Attachment J.

- In FM RAI 03.b (Reference 24), the NRC staff requested that the licensee explain how it verified the cable tray fire propagation calculations based on the models described in Appendix R of NUREG/CR-6850 and Chapter 9 of NUREG/CR-7010.

  In its response to FM RAI 03.b (Reference 15), the licensee stated that it used the FLASH-CAT model to calculate fire propagation in cable trays, and that it verified the spreadsheet implementation of the model by comparing the spreadsheet results for various cable tray tests reported in NUREG/CR-7010 with the FLASH-CAT model calculations for these tests documented in the NUREG.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because its verification method ensured that its spreadsheet implementation of the FLASH-CAT model is capable of reproducing the calculations reported in NUREG/CR-7010.

- In FM RAI 03.c (Reference 24), the NRC staff requested that the licensee provide the validation basis for the optical density threshold used in the relay room CFAST analysis to estimate smoke detector actuation.

  In its response to FM RAI 03.c (Reference 15), the licensee referred to a peer-reviewed conference paper, "Alarm Thresholds for Smoke Detector Modeling" by Geiman and Gottuk (Reference 108), as the validation basis, and stated that, since the smoke detectors installed in the Relay Room have an alarm sensitivity of 1.0%/ft, the use of an alarm threshold of 0.14 OD/m recommended in the paper is conservative as it corresponds to a sensitivity of 9.4%/ft.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee referred to an authoritative publication as the validation basis for the optical density threshold used in the smoke detector actuation calculations in the relay room and demonstrated that the alarm threshold used in the FM analysis is conservative.

3.8.3.2.3 Post-Transition

The licensee also stated that it will revise the appropriate processes and procedures to include NFPA 805 quality requirements for use during the performance of post-transition FPP changes, including those for V&V. Revision of the applicable post-transition processes and procedures to include NFPA 805 requirements for V&V is identified in LAR Attachment S, Table S-3, as Implementation Item 29. The NRC staff concludes that these actions are acceptable because they will incorporate the provisions of NFPA 805 in the FPP and because they would be required by the proposed license condition.

3.8.3.2.4 Conclusion for Section 3.8.3.2

Based on the licensee's description of the process for V&V of calculational models and numerical methods and its commitment for 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 other authoritative publications and the licensee identified actions that will result in compliance with NFPA 805 that would be required by the proposed license condition.

The NRC staff concludes that the licensee's approach provides reasonable assurance that the FM used in the development of the fire scenarios for the FPRA 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 or authoritative publications, such as the SFPE Handbook of Fire Protection Engineering.

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 compliance with 10CFR50.48(c) are used and were used appropriately as required by Section 2.7.3.3 of NFPA 805.

3.8.3.3.1 General

The NRC staff assessed the acceptability of each empirical correlation and fire model in terms of their limitations of use. Table 3.8-1 in SE Attachment A and Table 3.8-2 in SE Attachment B, summarize the fire models used, how each was applied in the FREs, the V&V basis for each, and the NRC staff evaluation.

3.8.3.3.2 Discussion of RAIs

By letters dated March 30, 2015 (Reference 24), and August 28, 2015 (Reference 26), the NRC staff sought additional information concerning the FM conducted to support the FPRA. By letters dated May 28, 2015 (Reference 14), June 19, 2015 (Reference 15), and October 6, 2015 (Reference 16), the licensee responded to these RAIs.

- In FM RAI 04.a (Reference 24), the NRC staff requested that the licensee explain how it ensured that it did not use the algebraic models outside their limits of applicability as described in NUREG-1805.

In its response to FM RAI 04.a (Reference 14), the licensee explained that it either used the algebraic models within their limits of applicability, or when it did use the models outside their range of applicability, sensitivity studies were conducted to show that they provide conservative results. The licensee also provided technical supporting details for every individual algebraic model it used.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee used the algebraic models within their applicable range as described in NUREG-1824, or demonstrated conservative results for cases in which the models were used outside this range.

- In FM RAI 04.b (Reference 24), the NRC staff requested that the licensee explain how it ensured that it did not use the ceiling jet correlation outside its limitations.

  In its response to FM RAI 04.b (Reference 14), the licensee stated that it did not use the ceiling jet correlation in the FPRA, and that, per guidance in Chapter 8 and Appendix F of NUREG/CR-6850, the values for the horizontal component of the ZOI are at least bounded by the point source radiation model, which is a validated model in NUREG-1824.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because it did not use the ceiling jet correlation and its V&V does not need to be provided in LAR Attachment J.

- In FM RAI 04.c (Reference 24), the NRC staff requested that the licensee provide technical justification for the application of FDS with input parameters outside the acceptable range, and for using the corresponding calculated control room abandonment times in the FPRA.

  In its response to FM RAI 04.c (Reference 14), the licensee provided a detailed discussion of the pertinent normalized parameters (fire Froude number, flame height ratio, equivalence ratio, and enclosure aspect ratio) for each electrical and transient fire scenario. The licensee stated that for the majority of cases, it applied FDS within the validated range. The licensee also explained that in cases where it used FDS outside the validated range, input parameters were varied so that the model produced conservative results.

  The NRC staff determined that the licensee's response to the RAI was incomplete because the licensee's justification for using FDS with a flame-height ratio below the limit may not be valid if MCR abandonment is due to excessive HGL temperature. In FM RAI 04.c.01 (Reference 26), the NRC staff requested that the licensee confirm that MCR abandonment in all scenarios for which the flame height ratio falls outside the validated range in NUREG-1824 is due to visibility.

  In its response to FM RAI 04.c.01 (Reference 16), the licensee confirmed that abandonment in the scenarios for which the flame height ratio falls outside the validated range is due to lack of visibility in the MCR.

> The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided technical justification for the application of FDS with input parameters outside the NUREG-1824 validated range.

3.8.3.3.3 Post-Transition

The licensee stated that it will revise the appropriate processes and procedures to include the NFPA 805 quality requirements for use during the performance of post-transition FPP changes, including those for limitations of use. Revision of the applicable post-transition processes and procedures to include NFPA 805 requirements for limitations of use are identified in LAR Attachment S, Table S-3, Implementation Item 29 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.

3.8.3.3.4 Conclusion for Section 3.8.3.3

Based on the licensee's statements that it used the fire models to support development of the FREs within their limitations, and the description of the licensee's 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 result in compliance with NFPA 805 and would be required by the proposed license condition.

3.8.3.4 Qualification of Users

NFPA 805, Section 2.7.3.4 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 NPP, NPP fire protection, and power plant operations. LAR Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805 Fire Protection Quality," states that:

> ... Post-transition, for personnel performing fire modeling or Fire PRA development and evaluation, NSPM will develop and maintain qualification requirements for individuals assigned various tasks. Position Specific Guides will be developed to identify and document required training and mentoring to ensure individuals are appropriately qualified per the requirements of NFPA 805 Section 2.7.3.4 to perform assigned work....

Specifically, these requirements are being addressed through the implementation of an engineering qualification process. 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). These requirements are being addressed through the implementation of an engineering qualification process. The licensee has developed qualification or training requirements for personnel performing engineering analyses and numerical methods.

3.8.3.4.1 General

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). These requirements are being addressed through the implementation of an engineering qualification process. The NRC staff found that the licensee has developed qualification or training requirements for personnel performing engineering analyses and numerical methods.

3.8.3.4.2 Discussion of RAIs

By letters dated March 30, 2015 (Reference 24), and August 28, 2015 (Reference 26), the NRC staff sought additional information concerning the FM conducted to support the FPRA. By letters dated May 28, 2015 (Reference 14), June 19, 2015 (Reference 15), and October 6, 2015 (Reference 16), the licensee responded to these RAIs.

- In FM RAI 05.a (Reference 24), 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 14), the licensee stated that the FM was performed by qualified contractors, whose credentials were reviewed to ensure consistency with NFPA 805, Section 2.7.3.4 requirements. The licensee further ensured that analysts are and will continue to be knowledgeable in fire modeling techniques, including interpreting and maintaining fire modeling software.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because PINGP does and will continue to meet the requirements in NFPA 805, Section 2.7.3.4.

- In FM RAI 05.b (Reference 24), 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 14), the licensee stated that pre-transition FM activities were performed by qualified vendors, whose credentials it vetted. The licensee further indicated that post-transition FM will be performed by a fire protection or PRA engineer who meets the qualification requirements of Section 2.7.3.4 of NFPA 805. In addition, the licensee explained that qualification requirements will be developed as described in Table S-3, Implementation Item 26, and that post-transition FM personnel will meet those qualifications before performing the task.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee does and will continue to meet the requirements of NFPA 805, Section 2.7.3.4.

- In FM RAI 05.c (Reference 24), 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 14), the licensee explained that there was frequent communication between the FM and FPRA personnel, that the FM personnel populated the databases or spreadsheets that were subsequently used by the PRA engineers who performed the risk quantification, and that the FPEs and the PRA engineers participated in the cutset review meetings during the development of the fire PRA. The licensee further explained that NSPM qualification for FM precludes the use of FM in the Fire PRA unless it is reviewed by a qualified Fire PRA Engineer.

The NRC staff concludes that the licensee's response to the RAI is acceptable because communication between the fire modeling and fire PRA personnel was adequate during transition and will continue to be adequate post-transition.

Based on its review and above explanation, the NRC staff concludes that appropriately competent and experienced personnel developed the PINGP FREs, including the supporting FM calculations including the additional documentation for models and empirical correlations not identified in previous NRC approved V&V documents.

3.8.3.4.3 Post-Transition

The post-transition qualification training program that will be implemented to include NFPA 805 requirements for qualification of users is included in LAR Attachment S, Table S-3, Implementation Item 26, and 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.

3.8.3.4.4 Conclusion for Section 3.8.3.4

The NRC staff concludes that appropriately competent and experienced personnel developed the FREs, including the supporting FM calculations including the additional documentation for models and empirical correlations not identified in previous NRC approved V&V documents.

Based on the licensee's description of the procedures for ensuring personnel who use and apply engineering analyses and numerical methods are competent and experienced, the NRC staff concludes that the licensee's approach for meeting the requirements of NFPA 805, Section 2.7.3.4, is acceptable.

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 43)) includes requirements to address uncertainty. Accordingly, the licensee addressed uncertainty as a part of the development of the PINGP 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 RI Decision Making" (Reference 59), 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 via 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 61).

(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 letters dated March 30, 2015 (Reference 24), and August 28, 2015 (Reference 26), the NRC staff sought additional information concerning the FM conducted to support the FPRA. By letters dated May 28, 2015 (Reference 14), June 19, 2015 (Reference 15), and October 6, 2015 (Reference 16), the licensee responded to these RAIs.

- In FM RAI 06.a (Reference 24), the NRC staff requested that the licensee describe how it accounted for the uncertainty associated with the fire model input parameters in the FM analysis.

  In its response to FM RAI 06.a (Reference 14), the licensee explained that it accounted for the uncertainty associated with the fire model input parameters by using conservative input parameters, and stated that it used bounding HRRs and the lowest radiant heat flux and temperature damage threshold. The licensee further stated that it performed sensitivity cases when normalized parameters were outside of the validation range.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee properly accounted for parameter uncertainty.

- In FM RAI 06.b (Reference 24), the NRC staff requested that the licensee describe how it accounted for the "model" and "completeness" uncertainty in the FM analysis.

  In its response to FM RAI 06.b (Reference 14), the licensee explained that it performed a detailed V&V analysis for all fire models that it used in the development of the FPRA,

and that, when necessary, it shifted input parameters in the conservative direction to ensure that it used the models within the validated range while providing conservative results. In addition, the licensee summarized the treatment of uncertainties associated with fire scenario development and detailed FM for single compartment fire scenarios, which include uncertainties related to the selection of transient zones, fire location, fire growth and propagation, activation and function of the detection and suppression system, the selection of damage criteria, conduit routing, selection of fire models, and the inputs to the chosen fire models. The licensee further stated that completeness associated with fire models is addressed within the overall quantification process, and that the FPRA allows the analyst to conservatively compensate for the lack of FM capabilities outside the FM analysis

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee properly accounted for model and completeness uncertainty.

3.8.3.5.3 Post-Transition

The licensee stated that it will revise the appropriate processes and procedures to include the NFPA 805 quality requirements for use during the performance of post-transition FPP changes, including those regarding uncertainty analysis. Revision of the applicable post-transition processes and procedures to include NFPA 805 requirements regarding uncertainty analysis are identified in LAR Attachment S, Table S-3, Implementation Item 29 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.

3.8.3.5.4 Conclusion for Section 3.8.3.5

Based on the licensee's description of its 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 the above discussions, the NRC staff concludes that the RI/PB FPP quality assurance program adequately addresses each of the requirements of NFPA 805, Section 2.7.3, which includes 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, as discussed below.

In LAR Section 4.7.3, the licensee stated that it will maintain the existing fire protection quality assurance 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, but indicated that the QA program would be updated to meet the applicable requirements of NFPA 805 Section 2.7.3.4. The licensee included an action to develop position specific guides to identify and document required training and mentoring to ensure individuals are appropriately qualified in accordance with NFPA 805, Section 2.7.3.4 in LAR Attachment S, Table S-3, Implementation Item 26. The NRC staff concludes that this action is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and because it would be required by the proposed license condition.

Based on its review and the above explanation, the NRC staff concludes that the licensee's fire protection QA program is acceptable, subject to completion of the implementation item, 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 quality assurance requirements. The NRC staff concludes that the licensee's approach for meeting the requirements specified in Section 2.7 of NFPA 805 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 PINGP and the NRC staff concludes that it is acceptable.

The following license condition is included in the revised licenses and will replace Renewed Facility Operating License Nos. DPR-42 and DPR-60, Condition 2.C.(4):

> Fire Protection
>
> NSPM 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 licensee amendment request dated September 28, 2012 (and supplements dated November 8, 2012, December 18, 2012, May 3, 2013, October 17, 2013, April 30, 2014, May 28, 2015, June 19, 2015, October 6, 2015, October 22, 2015, January 20, 2016, May 24, 2016, August 17, 2016, December 14, 2016, and March 6, 2017), and as approved in the safety evaluation dated August 8, 2017. 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 changes that clearly result in a 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 for individual changes that result in a risk increase less than 1×10-7/year (yr) for CDF and less than 1×10-8/yr for LERF. 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); and
- "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 safety evaluation dated August 8, 2017, 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. and 3. 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.C.(4)(b)2.

2. The licensee shall implement the modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," in Northern States Power - Minnesota letter L-PI-16-090, dated December 14, 2016, to complete the transition to full compliance with 10 CFR 50.48(c), before the end of the second full operating cycle for each unit after approval of the LAR. 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 Northern States Power – Minnesota letter L-PI-16-090, dated December 14, 2016, within twelve months after NRC approval, with the exception of Implementation Items 20, 66, and 70 which are associated with modifications and will be completed 180 days after modifications are complete.

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 Minnesota State official was notified of the proposed issuance of the amendments on June 16, 2017. 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 FR on April 2, 2013 (78 FR 19753). 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.

9.0 REFERENCES

1 U.S. Nuclear Regulatory Commission, "Branch Technical Position (BTP) APCSB 9.5-1, Guidelines for Fire Protection for Nuclear Power Plants," (ADAMS Accession No. ML070660461).

2 U.S. Nuclear Regulatory Commission, Appendix A to BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976," (ADAMS Accession No. ML070660458).

3 National Fire Protection Association, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," Standard 805 (NFPA 805), 2001 Edition, Quincy, Massachusetts.

4 U.S. Nuclear Regulatory Commission, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," Regulatory Guide 1.205, Revision 1, December 2009 (ADAMS Accession No. ML092730314).

5 U.S. Nuclear Regulatory Commission, "Development of a Risk-Informed, Performance-Based Regulation for Fire Protection at Nuclear Power Plants," SECY-98-058, March 1998 (ADAMS Accession No. ML992910106).

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Attachments:

A. Table 3.8-1 - V&V Basis for Fire Modeling Correlations Used at Prairie Island
B. Table 3.8-2 - V&V Basis for Fire Modeling Calculations of Other Models Used at Prairie Island
C. Abbreviations and Acronyms

Attachment A: Table 3.8-1, V&V Basis for Fire Modeling Correlations Used at PINGP

Correlation	Application at PINGP	V&V Basis	NRC Staff Evaluation of Acceptability
Heskestad flame height correlation	Calculating vertical ZOI dimension	NUREG-1805 Chapter 3 (Reference 55) NUREG-1824 Volume 3 (Reference 56) SFPE Handbook Chapter 2-1 (Reference 113)	• The correlation is validated in NUREG-1824 and the Society of Fire Protection Engineers (SFPE) Handbook. • The licensee stated that in most cases, the correlation has been applied within the validated range reported in NUREG-1824. The licensee provided justification for cases where the correlation was used outside the validated range reported in NUREG-1824 (Response to FM RAI 04.a, (Reference 14)). (Reference 14) Based on its review and evaluation, the NRC staff concludes that the use of this correlation is acceptable.
Heskestad plume temperature correlation	Calculating vertical ZOI dimension	NUREG-1805 Chapter 9 (Reference 55) NUREG-1824 Volume 3 (Reference 56) SFPE Handbook Chapter 2-1 (Reference 113)	• The correlation is validated in NUREG-1824 and the SFPE Handbook. • The licensee stated that in most cases, the correlation has been applied within the validated range reported in NUREG-1824. The licensee provided justification for cases where the correlation was used outside the validated range reported in NUREG-1824 (Response to FM RAI 04.a (Reference 14)). Based on its review and evaluation, the NRC staff concludes that the use of this correlation is acceptable.

Attachment A: Table 3.8-1, V&V Basis for Fire Modeling Correlations Used at PINGP

Correlation	Application at PINGP	V&V Basis	NRC Staff Evaluation of Acceptability
Modak point source radiation model	Calculating horizontal ZOI dimension	NUREG-1805 Chapter 5 (Reference 55) NUREG-1824 Volume 3 (Reference 56) SFPE Handbook Chapter 3-10 (Reference 114)	• The correlation is validated in NUREG-1824 and the SFPE Handbook. • The licensee stated that in most cases, the correlation has been applied within the validated range reported in NUREG-1824. The licensee provided justification for cases where the correlation was used outside the validated range reported in NUREG-1824 (Response to FM RAI 04.a (Reference 14)). Based on its review and evaluation, the NRC staff concludes that the use of this correlation is acceptable.
Hot Gas Layer (Method of McCaffrey, Quintiere, and Harkleroad)	The correlation was used to calculate the HGL temperature for a room with natural ventilation	NUREG-1805 Chapter 3 (Reference 55) NUREG-1824 Volume 3 (Reference 56) SFPE Handbook Chapter 3-6 (Reference 115)	• The correlation is validated in NUREG-1824 and the SFPE Handbook. • The licensee stated that in most cases, the correlation has been applied within the validated range reported in NUREG-1824. The licensee provided justification for cases where the correlation was used outside the validated range reported in NUREG-1824 (Response to FM RAI 04.a (Reference 14)). 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 Fire Modeling Correlations Used at PINGP

Correlation	Application at PINGP	V&V Basis	NRC Staff Evaluation of Acceptability
Hot Gas Layer (Method of Foote, Pagni, and Alvares)	Calculating the HGL temperature for a room with forced ventilation	NUREG-1805 Chapter 2 (Reference 55) NUREG-1824 Volume 3 (Reference 56) SFPE Handbook Chapter 3-6 (Reference 115)	• The correlation is validated in NUREG-1824 and the SFPE Handbook. • Licensee stated that in most cases, the correlation has been applied within the validated range reported in NUREG-1824. Licensee provided justification for cases where the correlation was used outside the validated range reported in NUREG-1824 (Response to FM RAI 04.a (Reference 14)). Based on these observations, the NRC staff concludes the use of this correlation is acceptable.
Corner and Wall HRR	Determines a HRR adjustment factor for fires that are proximate to a wall or corner	IMC 0609, App. F (Reference 107) SFPE Handbook Chapter 2-14 (Reference 116)	• The correlation is validated in IMC 0809, Appendix F (Fire Protection Significance Determination Process) and the SFPE Handbook. • The licensee stated that the correlation has been applied exactly according to the guidelines in IMC 0609, Appendix F (See LAR, Attachment J). Based on these observations, the NRC staff concludes the use of this correlation is acceptable.
Correlation for Heat Release Rates of Cables (Method of Lee)	Correlate bench scale data to heat release rates from cable tray fires	SFPE Handbook Chapter 3-1 (Reference 117) NBSIR 85-3195 (Reference 118)	• The modeling technique is documented in the SFPE Handbook and an authoritative publication of NIST, formerly NBS. • The licensee stated that the correlation has been conservatively applied (See LAR, Attachment J). 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 Fire Modeling Correlations Used at PINGP

Correlation	**Application at PINGP**	**V&V Basis**	**NRC Staff Evaluation of Acceptability**
Correlation for Flame Spread over Horizontal Cable Trays (FLASH-CAT)	Calculate the growth and spread of a fire within a vertical stack of horizontal cable trays	NUREG/CR-7010 Chapter 9 (Reference 57)	• The licensee provided evidence of the verification of its implementation of the correlation (Response to FM RAI 03.b (Reference 15)). • The modeling technique is validated in an authoritative publication of NIST. • The licensee stated that the correlation has been conservatively applied (See LAR, Attachment J). 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 PINGP

Model	**Application at PINGP**	**V&V Basis**	**NRC Staff Evaluation of Acceptability**
Consolidated Model of Fire and Smoke Transport (CFAST, Version 6)	HGL calculations in the multi-compartment analysis and detailed fire modeling in the Relay Room	NUREG-1824, Volume 5 (Reference 56) NIST Special Publication (Reference 119)	• The modeling technique is validated in NUREG-1824 and an authoritative publication of NIST. • The licensee stated that in most cases, the correlation has been applied within the validated range reported in NUREG-1824. The licensee provided justification for cases where the correlation was used 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 CFAST in the PINGP application is acceptable.
Fire Dynamics Simulator (FDS, Version 5)	Calculating control room abandonment	NUREG-1824 Volume 7 (Reference 56) NIST SP 1018-5 Volume 2 (Reference 120) NIST SP 1018-5 Volume 3 (Reference 121)	• The modeling technique is validated in NUREG-1824 and authoritative publications of NIST. • The licensee stated that in most cases, the correlation has been applied within the validated range reported in NUREG-1824. The licensee provided justification for cases where the correlation was used outside the validated range reported in NUREG-1824 (Response to RAI 04.c, (Reference 14)). Based on its review and evaluation, the NRC staff concludes that the use of FDS in the PINGP application for the MCR abandonment time is acceptable.

Attachment C
Abbreviations and Acronyms

ADAMS	Agencywide Documents Access and Management System
ADV	atmospheric dump valve
AFD	aspirating fire detector
AFW	auxiliary feedwater
AHJ	authority having jurisdiction
ANS	American Nuclear Society
ANSI	American National Standards Institute
APCSB	Auxiliary and Power Conversion Systems Branch
ASME	American Society of Mechanical Engineers
ASP	alternate shutdown panel
ASTM	American Society for Testing and Materials
BTP	Branch Technical Position
BWR	boiling-water reactor
CC	Capability Categories
CCDP	conditional core damage probability
CCF	common-cause failure
CCW	component cooling water
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
CPT	control power transformer
CRS	control room supervisor
CSD	cold shutdown
CSR	Cable Spreading Room
CST	condensate storage tank
°F	degrees Fahrenheit
DC	direct current
DID	defense-in-depth
DID RA	defense-in-depth recovery action
ECA	equipment cabinet area
EDG	emergency diesel generator
EEEE	existing engineering equivalency evaluation
EPRI	Electric Power Research Institute
ERFBS	electrical raceway fire barrier system
F&O	fact and observation
FAQ	frequently asked question
FCV	flow control valve
FDT	fire dynamics tool
FLASH-CAT	Flame Spread over Horizontal Cable Trays
FM	fire modeling
FMDB	fire modeling database
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
ft.	foot/feet
GDC	General Design Criterion/Criteria
GFMT	generic fire modeling treatment
GL	generic letter
HDPE	high-density polyethylene
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
HSD	hot shutdown
HVAC	heating, ventilation, and air conditioning
IN	information notice
IEEE	Institute of Electrical and Electronics Engineers
IEPRA	internal events probabilistic risk assessment
IN	Information Notice
KSF	Key Safety Function
kW	kilowatt
LAR	license amendment request
LERF	large early release frequency
LOCA	loss-of-coolant accident
MCA	multi-compartment analysis
MCB	main control board
MCC	motor control center
MCR	main control room
MOV	motor operated valve
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
NSP	nuclear safety performance
NSPC	nuclear safety performance criteria
NSPM	Northern States Power - Minnesota
OMA	operator manual action
PAU	physical analysis unit
PB	performance-based
PCE	plant change evaluation
PCS	primary control station
PE	polyethylene
PORV	power-operated relief valve

PRA	probabilistic risk assessment
PINGP	Prairie Island Nuclear Generating Plant, Unit Nos. 1 and 2
PSA	probabilistic safety assessment
psig	pounds per square inch gauge
PVC	polyvinyl chloride
PWR	pressurized-water reactor
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
SR	supporting requirement
SSA	safe shutdown analysis
SSC	structures, systems, and components
SSD	safe shutdown
TR	Technical/Topical Report
TS	technical specifications
UAM	unreviewed analysis method
UFSAR	Updated Final Safety Analysis Report
V&V	verification and validation
VCT	volume control tank
VEWFDS	Very Early Warning Fire Detection System
VFDR	variance from deterministic requirement
WOG	Westinghouse Owners Group
yr	year
ZOI	zone of influence

SUBJECT: PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 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. ME9734 AND ME9735) DATED AUGUST 8, 2017

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