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

September 8, 2016

Mr. Robert Coffey
Site Vice President
NextEra Energy Point Beach, LLC
6610 Nuclear Road
Two Rivers, WI 54241

SUBJECT: POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2 - ISSUANCE OF AMENDMENTS REGARDING TRANSITION TO A RISK-INFORMED, PERFORMANCE-BASED FIRE PROTECTION PROGRAM IN ACCORDANCE WITH 10 CFR 50.48(c) (CAC NOS. MF2372 AND MF2373)

Dear Mr. Coffey:

The U.S. Nuclear Regulatory Commission (NRC or Commission) has issued the enclosed Amendment Nos. 256 and 260 to Renewed Facility Operating License Nos. DPR-24 and DPR-27 for the Point Beach Nuclear Plant (Point Beach), Units 1 and 2, respectively. The amendments change the licenses and the Technical Specifications (TSs) in response to your application dated June 26, 2013, as supplemented by letters dated September 16, 2013, July 29, August 28, September 25, November 14, December 19, 2014; January 16, May 12, August 26, 2015; and February 22, April 7, and May 3, 2016.

These amendments authorize the transition of the Point Beach fire protection program to a risk-informed, performance-based program based on National Fire Protection Association Standard 805 (NFPA 805), "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition, in accordance with 10 CFR 50.48(c). NFPA 805 allows the use of performance-based methods, such as fire modeling, and risk-informed methods such as fire probabilistic risk assessment, to demonstrate compliance with the nuclear safety performance criteria.

The amendment revises the fire protection license condition in Point Beach's licenses and TS 5.4.1.h. As a result of placing the new license condition in the licenses, the NRC is issuing additional pages due to repagination of subsequent license pages. The only changes to the licenses are the changes to the fire protection license condition.

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,

Mahesh L. Chawla, Project Manager
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-266 and 50-301

Enclosures:
1. Amendment No.256 to DPR-24
2. Amendment No. 260 to DPR-27
3. Safety Evaluation

cc w/encls: Distribution via ListServ

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

NEXTERA ENERGY POINT BEACH, LLC

DOCKET NO. 50-266

POINT BEACH NUCLEAR PLANT, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 256
License No. DPR-24

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

   A. The application for amendment by NextEra Energy Point Beach, LLC (the licensee), dated application dated June 26, 2013, as supplemented by letters dated September 16, 2013; July 29, August 28, September 25, November 14, December 19, 2014; January 16, May 12, August 26, 2015; and February 22, April 7, and May 3, 2016, 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 4.B of the Renewed Facility Operating License No. DPR-24 is hereby amended to read as follows:

B. Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 256, are hereby incorporated in the renewed operating license. NextEra Energy Point Beach 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, and Paragraph 4.F of Renewed Facility Operating License No. DPR-24 is hereby amended to read as follows:

F. NextEra Energy Point Beach 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 June 26, 2013, and supplements dated September 16, 2013, July 29, 2014, August 28, 2014, September 25, 2014, November 14, 2014, December 19, 2014, January 16, 2015, May 12, 2015, August 26, 2015, February 22, 2016, April 7, 2016 (two letters), and May 3, 2016, and as approved in the safety evaluation dated September 8, 2016. 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 license condition, and the criteria listed below are satisfied.

1. 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.

a. 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.

b. Prior NRC review and approval is not required for individual changes that result in a risk increase less than $1X10^{-7}$/year (yr) for CDF and less than $1X10^{-8}$/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.

2. Other Changes that May Be Made Without Prior NRC Approval

   a. 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.)

   b. 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 report dated September 8, 2016 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.

3. Transition License Conditions

   a. Before achieving full compliance with 10 CFR 50.48(c), as specified by 3.b and 3.c 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.b above.

   b. The licensee shall implement the modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," of NextEra Energy Point Beach letter NRC-2016-0021, to complete the transition to full compliance with 10 CFR 50.48(c) no later than prior to startup from the second refueling outage (for each unit) after receipt of the license amendment. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

   c. The licensee shall implement the items listed in Attachment S, Table S-3, "Implementation Items," of NextEra Energy Point Beach letter NRC-2016-0021, with the exception of the items noted below, within 12 months after NRC approval unless that falls within a scheduled outage window; then in that case, completion will occur 60 days after startup from that scheduled outage.

      i. Implementation item IMP-120 is an exception as the industry guidance is under review by the NRC and the final resolution will occur 12 months after the guidance is available unless that falls within a scheduled outage window; then in that case, completion will occur 60 days after startup from that scheduled outage.

      ii. Implementation items IMP-142 and IMP-150 are exceptions because they are associated with completion of committed modifications identified in LAR, Attachment S, Table S-2 and will not be completed until 3 months following the last refueling outage identified in item 3.b above.

3. This license amendment is effective as of its date of issuance and shall be implemented as described in the transition license conditions.

FOR THE NUCLEAR REGULATORY COMMISSION

David J. Wrona, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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

Date of issuance: September 8, 2016

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

NEXTERA ENERGY POINT BEACH, LLC

DOCKET NO. 50-301

POINT BEACH NUCLEAR PLANT, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 260
License No. DPR-27

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

   A. The application for amendment by NextEra Energy Point Beach, LLC (the licensee), dated June 26, 2013, as supplemented by letters dated September 16, 2013; July 29, August 28, September 25, November 14, December 19, 2014; January 16, May 12, August 26, 2015; February 22, April 7, and May 3, 2016, 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 4.B of the Renewed Facility Operating License No. DPR-27 is hereby amended to read as follows:

   B. Technical Specifications

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 260, are hereby incorporated in the renewed operating license. NextEra Point Beach shall operate the facility in accordance with Technical Specifications.

In addition, the license is amended as indicated in the attachment to this license amendment, and Paragraph 4.F of Renewed Facility Operating License No. DPR-27 is hereby amended to read as follows:

F. NextEra Energy Point Beach 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 June 26, 2013, and supplements dated September 16, 2013, July 29, 2014, August 28, 2014, September 25, 2014, November 14, 2014, December 19, 2014, January 16, 2015, May 12, 2015, August 26, 2015, February 22, 2016, April 7, 2016 (two letters), and May 3, 2016, and as approved in the safety evaluation dated September 8, 2016. 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 license condition, and the criteria listed below are satisfied.

1. 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.

   a. 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.

   b. Prior NRC review and approval is not required for individual changes that result in a risk increase less than $1X10^{-7}$/year (yr) for CDF and less than $1X10^{-8}$/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.

2. Other Changes that May Be Made Without Prior NRC Approval

   a. 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.)

   b. 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 report dated September 8, 2016 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.

3. Transition License Conditions

   a. Before achieving full compliance with 10 CFR 50.48(c), as specified by 3.b and 3.c 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.b above.

   b. The licensee shall implement the modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," of NextEra Energy Point Beach letter NRC-2016-0021, to complete the transition to full compliance with 10 CFR 50.48(c) no later than prior to startup from the second refueling outage (for each unit) after receipt of the license amendment. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

   c. The licensee shall implement the items listed in Attachment S, Table S-3, "Implementation Items," of NextEra Energy Point Beach letter NRC-2016-0021, with the exception of the items noted below, within 12 months after NRC approval unless that falls within a scheduled outage window; then in that case, completion will occur 60 days after startup from that scheduled outage.

      i. Implementation item IMP-120 is an exception as the industry guidance is under review by the NRC and the final resolution will occur 12 months after the guidance is available unless that falls within a scheduled outage window; then in that case, completion will occur 60 days after startup from that scheduled outage.

      ii. Implementation Items IMP-142 and IMP-150 are exceptions because they are associated with completion of committed modifications identified in LAR, Attachment S, Table S-2 and will not be completed until 3 months following the last refueling outage identified in item 3.b above.

3. This license amendment is effective as of its date of issuance and shall be implemented as described in the transition license conditions.

FOR THE NUCLEAR REGULATORY COMMISSION

David J. Wrona, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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

Date of issuance: September 8, 2016

ATTACHMENT

POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT NO. 256

TO RENEWED FACILITY OPERATING LICENSE NO. DPR-24

AND LICENSE AMENDMENT NO. 260

TO RENEWED FACILITY OPERATING LICENSE NO. DPR-27

DOCKET NOS. 50-266 AND 50-301

Replace the following pages of Renewed Facility Operating License Nos. DPR-24 and DPR-27, and Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Renewed Facility Operating License

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| | -9- |

Technical Specifications

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| 5.4-1 | 5.4-1 |

D. Pursuant to the Act and 10 CFR Parts 30, 40 and 70, NextEra Energy Point Beach 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 calibration or associated with radioactive apparatus or components; and

E. Pursuant to the Act and 10 CFR Parts 30 and 70, NextEra Energy Point Beach to possess such byproduct and special nuclear materials as may be produced by the operation of the facility, but not to separate such materials retained within the fuel cladding.

4. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations: 10 CFR Part 20, Section 30.34 of 10 CFR Part 30, Section 40.41 of 10 CFR Part 40, Sections 50.54 and 50.59 of 10 CFR Part 50, and Section 70.32 of 10 CFR Part 70; and 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 below:

A. Maximum Power Levels

NextEra Energy Point Beach is authorized to operate the facility at reactor core power levels not in excess of 1800 megawatts thermal.

B. Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 256, are hereby incorporated in the renewed operating license. NextEra Energy Point Beach shall operate the facility in accordance with Technical Specifications.

C. Spent Fuel Pool Modification

The licensee is authorized to modify the spent fuel storage pool to increase its storage capacity from 351 to 1502 assemblies as described in licensee's application dated March 21, 1978, as supplemented and amended. In the event that the on-site verification check for poison material in the poison assemblies discloses any missing boron plates, the NRC shall be notified and an on-site test on every poison assembly shall be performed.

D. Physical Protection

NextEra Energy Point Beach shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification, and safeguards contingency plans, including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The combined set of plans, which contain Safeguards Information protected under 10 CFR 73.21, is entitled: "Point Beach Nuclear Plant Physical Security Plan, (Revision 4)," submitted by letter dated May 10, 2006. NextEra Energy Point Beach, LLC shall fully implement and maintain in effect all provisions of the Commission-approved Point Beach Nuclear Plant Cyber Security Plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The NextEra Energy Point Beach CSP was approved by License Amendment No. 243 as supplemented by a change approved by License Amendment No. 247 and License Amendment No. 252.

E. Safety Injection Logic

The licensee is authorized to modify the safety injection actuation logic and actuation power supplies and related changes as described in licensee's application for amendment dated April 27, 1979, as supplemented May 7, 1979. In the interim period until the power supply modification has been completed, should any DC powered safety injection actuation channel be in a failed condition for greater than one hour, the unit shall thereafter be shutdown using normal procedures and placed in a block-permissive condition for safety injection actuation.

F. NextEra Energy Point Beach Unit 1 shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the license amendment request dated June 26, 2013, and supplements dated September 16, 2013, July 29, 2014, August 28, 2014, September 25, 2014, November 14, 2014, December 19, 2014, January 16, 2015, May 12, 2015, August 26, 2015, February 22, 2016, April 07, 2016, and May 3, 2016, and as approved in the safety evaluation report dated September 8, 2016. 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 license condition, and the criteria listed below are satisfied.

1. 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.

a. 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.

b. 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.

2. Other Changes that May Be Made Without Prior NRC Approval

a. 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.)

b. 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 report dated September 8, 2016 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.

3. Transition License Conditions

a. Before achieving full compliance with 10 CFR 50.48(c), as specified by 3.b and 3.c 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.b above.

b. The licensee shall implement the modifications to its facility as described in Attachment S, Table S-2 "Plant Modifications Committed," of NextEra Energy Point Beach letter NRC-2016-0013 to complete the transition to full compliance with 10 CFR 50.48(c) no later than prior to startup from the second refueling outage (for each unit) after receipt of the license amendment. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

c. The licensee shall implement the items in Attachment S, Table S-3, "Implementation Items," of NextEra Energy Point Beach letter NRC-2016-0021, with the exception of items noted below, within 12 months after NRC approval unless that falls within a scheduled outage window; then in that case, completion will occur 60 days after the startup from that scheduled outage.

i. Implementation item 120 is an exception as the industry guidance is under review by the NRC and the final resolution will occur 12 months after the guidance is available unless that falls within a scheduled outage window; then in that case, completion will occur 60 days after startup from that scheduled outage.

ii. Implementation items 142 and 150 are exceptions because they are associated with completion of committed modifications identified in LAR Attachment S, Table S-2 and will not be completed until 3 months following the last refueling outage identified in item 3.b above.

G. Secondary Water Chemistry Monitoring Program

NextEra Energy Point Beach shall implement a secondary water chemistry monitoring program to inhibit steam generator tube degradation. This program shall include:

1. Identification of a sampling schedule for the critical parameters and control points for these parameters;
2. Identification of the procedures used to quantify parameters that are critical to control points;
3 Identification of process sampling points;
4. Procedure for the recording and management of data;
5. Procedures defining corrective actions for off control point chemistry condition; and
6. A procedure for identifying the authority responsible for the interpretation of the data, and the sequence and timing of administrative events required to initiate corrective action.

H. The licensee is authorized to repair Unit 1 steam generators by replacement of major components. Repairs shall be conducted in accordance with the licensee's commitments identified in the Commission approved Point Beach Nuclear Plant Unit No. 1 Steam Generator Repair Report dated August 9, 1982 and revised March 1, 1983 and additional commitments identified in the staff's related safety evaluation.

I. The FSAR supplement, dated February 25, 2004, as revised, submitted pursuant to 10 CFR 54.21(d), shall be included in the next scheduled update to the FSAR required by 10 CFR 50.71(e)(4) following the issuance of this renewed operating license. Until that update is complete, FPLE Point Beach[1] may make changes to the programs and activities described in the supplement without prior Commission approval, provided that FPLE Point Beach* evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

J. The FSAR supplement, dated February 25, 2004, as revised, describes certain future activities to be completed prior to the period of extended operation. NextEra Energy Point Beach shall complete these activities no later than October 5, 2010, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

[1] On April 16, 2009, the name "FPLE Point Beach, LLC" was changed to "NextEra Energy Point Beach, LLC."

K. 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, as required by 10 CFR Part 50, Appendix H.

L. Mitigation Strategy

Strategies shall be developed and maintained for addressing large fires and explosions that include the following key areas:

1. Fire fighting response strategy with the following elements:

   a. Pre-defined coordinated fire response strategy and guidance
   b. Assessment of mutual aid fire fighting assets
   c. Designated staging areas for equipment and materials
   d. Command and control
   e. Training of response personnel

2. Operations to mitigate fuel damage considering the following:

   a. Protection and use of personnel assets
   b. Communications
   c. Minimizing fire spread
   d. Procedures for implementing integrated fire response strategy
   e. Identification of readily-available pre-staged equipment
   f. Training on integrated fire response strategy
   g. Spent fuel pool mitigation measures

3. Actions to minimize release to include consideration of:

   a. Water spray scrubbing
   b. Dose to onsite responders

M. Additional Conditions

The additional conditions contained in Appendix C, as revised through Amendment No. 241, are hereby incorporated into this license. NextEra Energy Point Beach shall operate the facility in accordance with the additional conditions.

5. The issuance of this renewed operating license is without prejudice to subsequent licensing action which may be taken by the Commission with regard to the ongoing rulemaking hearing on the Interim Acceptance Criteria for Emergency Core Cooling Systems (Docket No. RM 50-1).

6. This renewed operating license is effective as of the date of issuance, and shall expire at midnight on October 5, 2030.

FOR THE NUCLEAR REGULATORY COMMISSION

***Original Signed By***

R. W. Borchardt, Deputy Director
Office of Nuclear Reactor Regulation

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

Date of Issuance: December 22, 2005

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

D. Pursuant to the Act and 10 CFR Parts 30, 40 and 70, NextEra Energy Point Beach to receive, possess and use in amounts as required any byproduct, source of special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and

E. Pursuant to the Act and 10 CFR Parts 30 and 70, NextEra Energy Point Beach to possess such byproduct and special nuclear materials as may be produced by the operation of the facility, but not to separate such materials retained within the fuel cladding.

4. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations: 10 CFR Part 20, Section 30.34 of 10 CFR Part 30, Section 40.41 of 10 CFR Part 40, Sections 50.54 and 50.59 of 10 CFR Part 50, and Section 70.32 of 10 CFR Part 70; and 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 below:

A. Maximum Power Levels

NextEra Energy Point Beach is authorized to operate the facility at reactor core power levels not in excess of 1800 megawatts thermal.

B. Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 260, are hereby incorporated in the renewed operating license. NextEra Energy Point Beach shall operate the facility in accordance with Technical Specifications.

C. Spent Fuel Pool Modification

The licensee is authorized to modify the spent fuel storage pool to increase its storage capacity from 351 to 1502 assemblies as described in licensee's application dated March 21, 1978, as supplemented and amended. In the event that the on-site verification check for poison material in the poison assemblies discloses any missing boron plates, the NRC shall be notified and an on-site test on every poison assembly shall be performed.

D. Physical Protection

NextEra Energy Point Beach shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification, and safeguards contingency plans, including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The combined set of plans, which contain Safeguards Information protected under 10 CFR 73.21, is entitled: "Point Beach Nuclear Plant Physical Security Plan, (Revision 4)," submitted by letter dated May 10, 2006. NextEra Energy Point Beach, LLC shall fully implement and maintain in effect all provisions of the Commission-approved Point Beach Nuclear Plant Cyber Security Plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The NextEra Energy Point Beach CSP was approved by License Amendment No. 247 as supplemented by a change approved by License Amendment No. 251 and License Amendment No. 256.

E. Safety Injection Logic

The licensee is authorized to modify the safety injection actuation logic and actuation power supplies and related changes as described in licensee's application for amendment dated April 27, 1979, as supplemented May 7, 1979. In the interim period until the power supply modification has been completed, should any DC powered safety injection actuation channel be in a failed condition for greater than one hour, the unit shall thereafter be shut down using normal procedures and placed in a block-permissive condition for safety injection actuation.

F. NextEra Energy Point Beach Unit 2 shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the license amendment request dated June 26, 2013, and supplements dated September 16, 2013, July 29, 2014, August 28, 2014, September 25, 2014, November 14, 2014, December 19, 2014, January 16, 2015, May 12, 2015, August 26, 2015, February 22, 2016, April 07, 2016, and May 3, 2016 and as approved in the safety evaluation report dated September 8, 2016. 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 license condition, and the criteria listed below are satisfied.

1. 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

a. 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.

b. 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.

2. Other Changes that May Be Made Without Prior NRC Approval

a. 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.)

b. 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 report dated September 8, 2016 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.

3. Transition License Conditions

a. Before achieving full compliance with 10 CFR 50.48(c), as specified by 3.b and 3.c 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.b above.

b. The licensee shall implement the modifications to its facility as described in Attachment S, Table S-2 "Plant Modifications Committed," of NextEra Energy Point Beach letter NRC-2016-0013 to complete the transition to full compliance with 10 CFR 50.48(c) no later than prior to startup from the second refueling outage (for each unit) after receipt of the license amendment. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

c. The licensee shall implement the items in Attachment S, Table S-3, "Implementation Items," of NextEra Energy Point Beach letter NRC-2016-0021, with the exception of items noted below, within 12 months after NRC approval unless that falls within a scheduled outage window; then in that case, completion will occur 60 days after the startup from that scheduled outage.

i. Implementation item 120 is an exception as the industry guidance is under review by the NRC and the final resolution will occur 12 months after the guidance is available unless that falls within a scheduled outage window; then in that case, completion will occur 60 days after startup from that scheduled outage.

ii. Implementation items 142 and 150 are exceptions because they are associated with completion of committed modifications identified in

LAR Attachment S, Table S-2 and will not be completed until 3 months following the last refueling outage identified in item 3.b above.

G. Secondary Water Chemistry Monitoring Program

NextEra Energy Point Beach shall implement a secondary water chemistry monitoring program to inhibit steam generator tube degradation. This program shall include:

1. Identification of a sampling schedule for the critical parameters and control points for these parameters;
2. Identification of the procedures used to quantify parameters that are critical to control points;
3. Identification of process sampling points;
4. Procedure for the recording and management of data;
5. Procedures defining corrective actions for off control point chemistry condition; and
6. A procedure for identifying the authority responsible for the interpretation of the data, and the sequence and timing of administrative events required to initiate corrective action.

H. The FSAR supplement, dated February 25, 2004, as revised, submitted pursuant to 10 CFR 54.21(d), shall be included in the next scheduled update to the FSAR required by 10 CFR 50.71(e)(4) following the issuance of this renewed operating license. Until that update is complete, FPLE Point Beach[†] may make changes to the programs and activities described in the supplement without prior Commission approval, provided that FPLE Point Beach[*] evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59 and otherwise complies with the requirements in that section.

I. The FSAR supplement, dated February 25, 2004, as revised, describes certain future activities to be completed prior to the period of extended operation. NextEra Energy Point Beach shall complete these activities no later than March 8, 2013, and shall notify the NRC in writing when implementation of these activities is complete and can be verified by NRC inspection.

J. 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, as required by 10 CFR Part 50, Appendix H.

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[†] On April 16, 2009, the name "FPLE Point Beach, LLC" was changed to "NextEra Energy Point Beach, LLC."

K. Mitigation Strategy

Strategies shall be developed and maintained for addressing large fires and explosions that include the following key areas:

1. Fire fighting response strategy with the following elements:

   a. Pre-defined coordinated fire response strategy and guidance
   b. Assessment of mutual aid fire fighting assets
   c. Designated staging areas for equipment and materials
   d. Command and control
   e. Training of response personnel

2. Operations to mitigate fuel damage considering the following:

   a. Protection and use of personnel assets
   b. Communications
   c. Minimizing fire spread
   d. Procedures for implementing integrated fire response strategy
   e. Identification of readily-available pre-staged equipment
   f. Training on integrated fire response strategy
   g. Spent fuel pool mitigation measures

3. Actions to minimize release to include consideration of:

   a. Water spray scrubbing
   b. Dose to onsite responders

L. Additional Conditions

The additional conditions contained in Appendix C, as revised through Amendment No. 245, are hereby incorporated into this license. NextEra Energy Point Beach shall operate the facility in accordance with the additional conditions.

5. The issuance of this renewed operating license is without prejudice to subsequent licensing action which may be taken by the Commission with regard to the ongoing rulemaking hearing on the Interim Acceptance Criteria for Emergency Core Cooling Systems (Docket No. RM 50-1).

6. This renewed operating license is effective as of the date of issuance, and shall expire at midnight on March 8, 2033.

FOR THE NUCLEAR REGULATORY COMMISSION

***Original Signed By***

R. W. Borchardt, Deputy Director
Office of Nuclear Reactor Regulation

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

Date of Issuance: December 22, 2005

# 5.0 ADMINISTRATIVE CONTROLS

## 5.4 Procedures

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

a. Normal sequences of startup, operation and shutdown of components, systems and overall plant;
b. Refueling;
c. Specific and foreseen potential malfunctions of systems or components including abnormal reactivity changes;
d. Security Plan Implementation;
e. The emergency operating procedures required to implement the requirements of NUREG-0737 and to NUREG-0737, Supplement 1, as stated in Generic Letter 82-33;
f. Nuclear core testing;
g. Surveillance and Testing of safety related equipment;
h. (Deleted)
i. Quality Assurance for effluent and environmental monitoring;
j. All programs specified in Specification 5.5.

**ENCLOSURE 3**

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO TRANSITION TO A RISK-INFORMED, PERFORMANCE-BASED

FIRE PROTECTION PROGRAM IN ACCORDANCE WITH 10 CFR 50.48(c)

AMENDMENT NO. 255 TO RENEWED FACILITY OPERATING LICENSE DPR-24

AMENDMENT NO. 259 TO RENEWED FACILITY OPERATING LICENSE DPR-27

NEXTERA ENERGY POINT BEACH, LLC

POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-266 AND 50-301

# Table of Contents

**ATTACHMENTS**

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

# SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATED TO TRANSITION TO A RISK-INFORMED, PERFORMANCE-BASED FIRE PROTECTION PROGRAM IN ACCORDANCE WITH 10 CFR 50.48(c)

## AMENDMENT NO. 256 TO RENEWED FACILITY OPERATING LICENSE DPR-24

## AMENDMENT NO. 260 TO RENEWED FACILITY OPERATING LICENSE DPR-27

## NEXTERA ENERGY POINT BEACH, LLC

## POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

## DOCKET NOS. 50-266 AND 50-301

## 1.0 INTRODUCTION

### 1.1 Background

The U.S. Nuclear Regulatory Commission (NRC or Commission) started developing fire protection requirements in the 1970s, and 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; 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, performance-based (RI/PB), consensus standard for fire protection. In 2001, the NFPA Standards Council issued NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants" (Reference 3), which describes a methodology for establishing fundamental FPP design requirements and elements, determining required fire protection systems and features, applying PB requirements, and administering fire protection for existing light water reactors during operation, decommissioning, and permanent shutdown. It provides for the establishment of a minimum set of fire protection requirements but allows PB or deterministic approaches to be used to meet performance criteria.

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

> On March 26, 1998, the 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 [RI/PB] 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 a rulemaking to permit operating reactor licensees to adopt an NFPA 805 as an alternative to existing fire protection requirements. On February 9, 2001, the NFPA Standards Council approved the 2001 edition of NFPA 805, ["Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants,"] 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, a 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, a 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 meeting the requirements of) NFPA 805, the NRC staff is referring to the 2001 edition of NFPA 805 with the exceptions, modifications, and supplementation described in 10 CFR 50.48(c)(2).

RG 1.205 also states, in part, that:

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

RG 1.205 provides the NRC staff's position on NEI 04-02, Revision 2, and offers additional information and guidance to supplement the NEI document and assist licensees in meeting the NRC's regulations in 10 CFR 50.48(c) related to adopting a 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 NRC staff for adopting an FPP consistent with the 2001 edition of NFPA 805 and complying with the regulations in 10 CFR 50.48(c).

Accordingly, NextEra Energy Point Beach, LLC, (the licensee), requested license amendments to allow it to establish and maintain the Point Beach Nuclear Plant, Units 1 and 2, (PBNP) 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 June 26, 2013 (Reference 8), as supplemented by letters dated September 16, 2013 (Reference 9), July 29, 2014 (Reference 10), August 28, 2014 (Reference 11), September 25, 2014 (Reference 12), November 14, 2014 (Reference 13), December 19, 2014 (Reference 14), January 16, 2015 (Reference 15), May 12, 2015 (Reference 16), August 26, 2015

(Reference 17), February 22, 2016 (Reference 18), April 7, 2016 (Reference 19), April 7, 2016 (Reference 20), and May 3, 2016 (Reference 21), the licensee submitted an application for license amendments to transition the PBNP 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 July 8, 2014 (Reference 22), October 20, 2014 (Reference 23), November 14, 2014 (Reference 24), November 19, 2014 (Reference 25), October 9, 2015 (Reference 26), and January 20, 2016 (Reference 27). The licensee's supplemental letters dated July 29, August 28, September 25, November 14, and December 19, 2014; January 16, May 12, and August 26, 2015; and February 22, April 7 (two letters), and May 3, 2016, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* (FR) on July 8, 2014 (79 FR 38580).

The licensee requested an amendment to the PBNP renewed facility operating licenses and TSs to establish and maintain a 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 Final Safety Analysis Report (FSAR) for PBNP and as approved in the safety evaluation report (SER) dated August 2, 1979 (Reference 28), and supplements dated October 21, 1980 (Reference 29), January 22, 1981 (Reference 30), and July 27, 1988 (Reference 31), and the SE issued January 8, 1997 (Reference 32), which implements the fire protection requirements of 10 CFR 50.48 and 10 CFR 50, Appendix R, to a 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 PBNP 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 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 conditions, as required by 10 CFR 50.48(c)(3)(ii).

The licensee proposed new fire protection license conditions reflecting the new RI/PB FPP licensing basis, as well as revisions to the TS that address this change to the current FPP licensing basis. SE Sections 2.4.2 and 4.0 discuss in detail the license conditions, 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. The NRC regulations include specific requirements for requesting approval for a RI/PB FPP based on the provisions of NFPA 805 (Reference 3). Paragraph 50.48(c)(3)(i) of 10 CFR states, in part, that:

> 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 that:

> 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, that:

> 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 LAR to obtain approval in accordance with 10 CFR 50.48(c)(2)(vii). This regulation further provides that:

> The Director of NRR, 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 a LAR in accordance with 10 CFR 50.48(c)(4). This regulation further provides that:

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

In addition to the conditions outlined by the rule that require licensees to submit an LAR for NRC review and approval in order to adopt a 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. 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 the 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 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:
>
> (1) Preventing fires from starting;
>
> (2) Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage; and
>
> (3) Providing an adequate level of fire protection for SSCs important to safety, so that a fire that is not promptly extinguished will not prevent essential plant safety functions from being performed.

2.1 Other Applicable Regulations

The following regulations address fire protection:

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

  > Structures, systems, and components [SSCs] 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 a RI/PB FPP in conformance with NFPA 805 as an alternative to the requirements associated with 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, RGs, and standards:

- RG 1.205, "Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants," 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 an 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 a 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 FPP 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 33), which 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 License Basis) that may be used in conjunction with the deterministic methods for resolving circuit failure issues related to multiple spurious operations (MSOs). The RI method is intended for application by licensees to determine the risk significance of identified circuit failure issues related to MSOs. In RG 1.205, the NRC staff indicated that Chapter 3 of NEI 00-01, when used in conjunction with NFPA 805 and RG 1.205, provides an acceptable approach to circuit analysis for a plant implementing an FPP under 10 CFR 50.48(c).

- RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2, issued May 2011 (Reference 34), which provides the NRC staff's recommendations for using risk information in support of licensee-initiated licensing basis (LB) changes to a NPP that require such review and approval. The guidance provided does not preclude other approaches for requesting LB 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 LB 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 35), which provides guidance to licensees for use in determining the technical adequacy of the base probabilistic risk assessment (PRA) used in a RI regulatory activity, and endorses standards and industry peer review guidance. The RG provides guidance in four areas:

  1. A definition of a technically acceptable PRA;

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

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

  4. Documentation to support a regulatory submittal.

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

- American Society of Mechanical Engineers/American Nuclear Society (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 36), which provides guidance PRAs used to support RI decisions for commercial light water reactor NPPs and prescribes a method for applying these requirements for specific applications. The standard gives guidance for a Level 1 PRA of internal and external hazards for all plant operating modes. In addition, the Standard provides guidance for a limited Level 2 PRA sufficient to evaluate large early release frequency (LERF). The only hazards explicitly excluded from the scope are accidents resulting from purposeful human-induced security threats (e.g., sabotage). The standard applies to PRAs used to support applications of RI decisionmaking related to design, licensing, procurement, construction, operation, and maintenance.

- RG 1.189, "Fire Protection for Nuclear Power Plants," Revision 2, issued October 2009 (Reference 37), 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 NRC 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 38), which

provides guidance for the NRC staff for evaluation of LARs that seek to implement a 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 39), which provides guidance for the NRC staff for evaluation of 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 40), which provides guidance for the NRC staff for evaluation of the risk information used by a licensee to support permanent, RI changes to the licensing basis for the plant.

- NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," Volumes 1 (Reference 41) and 2 (Reference 42), and Supplement 1 (Reference 43), which presents a compendium of methods, data and tools to perform a fire PRA (FPRA) and develop associated insights. In order to address the need for improved methods, the NRC Office of Nuclear Regulatory Research (RES) and Electric Power Research Institute (EPRI) embarked upon a program to develop state-of-art FPRA methodology. Both RES and EPRI have provided specialists in fire risk analysis, FM, electrical engineering, human reliability analysis (HRA), and systems engineering for methods development. A formal technical issue resolution process was developed to direct the deliberative process between RES and EPRI. The process ensures that divergent technical views are fully considered, yet encourages consensus at many points during the deliberation. Significantly, the process provides that each party maintain its own point of view if consensus is not reached. Consensus was reached on all technical issues documented in NUREG/CR-6850. The methodology documented in this report reflects the current state-of-the-art in FPRA. These methods are expected to form a basis for RI analyses related to the plant FPP. Volume 1, the Executive Summary, provides general background and overview information including both programmatic and technical, and project insights and conclusions. Volume 2 provides the detailed discussion of the recommended approach, methods, data and tools for conduct of a 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 44) notes that, based on new experimental information documented in NUREG/CR-6931, "Cable Response to Live Fire (CAROLFIRE)" issued April 2008 (Reference 45), and NUREG/CR- 7100, "Direct Current Electrical Shorting in Response to Exposure Fire (DESIREE-Fire): Test Results," issued April 2012 (Reference 46), 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-1805, "Fire Dynamics Tools (FDTs): Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program," (Reference 47) which provides quantitative methods, known as FDTs, to assist regional fire protection inspectors in performing fire hazard analysis. The FDTs are intended to assist fire protection inspectors in performing RI evaluations of credible fires that may cause critical damage to essential SSD equipment, as required by the new reactor oversight process defined in the NRC's inspection manual.

- NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," Volumes 1 through 7 (Reference 48), 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 (FIVE)-Revision 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 Electricite de France (Volume 6); and

  5. The computational fluid dynamics model fire dynamics simulator (FDS) 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), Volume 1: Horizontal Trays," (Reference 49), which describes Phase 1 of the CHRISTIFIRE testing program conducted by NIST. The overall goal of this multiyear program is to quantify the burning characteristics of grouped electrical cables installed in cable trays. This first phase of the program focuses on horizontal tray configurations. CHRISTIFIRE addresses the burning behavior of a cable in a fire beyond the point of electrical failure. The data obtained from this project can be used for the development of fire models to calculate the heat release rate (HRR) and flame spread of a cable fire.

- NUREG-1855, Volume 1, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making," (Reference 50), which provides guidance on how to treat uncertainties associated with PRA in RI

decisionmaking. The objectives of this guidance include fostering an understanding of the uncertainties associated with PRA and their impact on the results of PRA and providing a pragmatic approach to addressing these uncertainties in the context of the decisionmaking. To meet the objective of the NUREG, it is necessary to understand the role that PRA results play in the context of the decision process. To define this context, NUREG-1855 provides an overview of the RI decisionmaking process itself.

- NUREG-1921, "EPRI/NRC-RES Fire Human Reliability Analysis Guidelines – Final Report," (Reference 51), 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 for human failure events following the fire-induced initiating events of a FPRA. The report builds on existing human reliability analysis methods, and is intended primarily for practitioners conducting a fire HRA to support a FPRA.

- NUREG-1934, "Nuclear Power Plant Fire Modeling Analysis Guidelines (NPP FIRE MAG)" (Reference 52), describes the implications of the verification and validation (V&V) results from NUREG-1824 for fire model users. The features and limitations of the fire models documented in NUREG-1824 are discussed relative to their use to support NPP fire hazard analyses. The report also provides information to assist fire model users in applying this technology in the NPP environment.

- NUREG/CR-0381, "A Preliminary Report on Fire Protection Research Program Fire Barriers and Fire Retardant Coatings Tests," (Reference 53), describes the results of a series of tests on fire detardant coatings that provide a basis for measuring the effectiveness of coatings in preventing initiation or propagation of fires.

- Generic Letter (GL) 2006-03, "Potentially Nonconforming Hemyc and MT Fire Barrier Configurations," (Reference 54), 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 55), provides the minimum requirements for egress, features of fire protection, sprinkler systems, alarms, emergency lighting, smoke barriers, and special hazard protection.

- NFPA 20, "Standard for the Installation of Stationary Pumps for Fire Protection" (Reference 56), provides requirements for the selection and installation of pumps to ensure that systems will work as intended to deliver adequate and reliable water supplies in a fire emergency.

- NFPA 30, "Flammable and Combustible Liquids Code" (Reference 57), provides requirements for the safe storage, handling, and use of flammable and combustible liquids.

## 2.3 NFPA 805 Frequently Asked Questions (FAQs)

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 section(s) to which each FAQ was referenced.

Table 2.3-1: NFPA 805 Frequently Asked Questions

| FAQ # | FAQ Title and Summary | Reference | SE Section |
|---|---|---|---|
| 06-0022 | "Electrical Cable Flame Propagation Tests"<br>• This FAQ provides a list of acceptable electrical cable flame propagation tests. | (Reference 58) | 3.1.1.4 |
| 07-0030 | "Establishing Recovery Actions"<br>• This FAQ provides an acceptable process for determining the recovery actions (RAs) for NFPA 805 Chapter 4 compliance. The process includes:<br>▪ Differentiation between RAs and activities in the main control room (MCR) or at primary control station(s) (PCSs).<br>▪ Determination of which RAs are required by the NFPA 805 FPP.<br>▪ Evaluate the additional risk presented by the use of RAs.<br>▪ Evaluate the feasibility of the identified RAs.<br>▪ Evaluate the reliability of the identified RAs. | (Reference 59) | 3.2.5<br>3.4.4 |
| 07-0038 | "Lessons Learned on Multiple Spurious Operations"<br>• This FAQ reflects an acceptable process for the treatment of MSOs during transition to NFPA 805:<br>▪ Step 1 – Identify potential MSO combinations of concern.<br>▪ Step 2 – Expert panel assesses plant specific vulnerabilities and reviews MSOs of concern.<br>▪ Step 3 – Update the FPRA and Nuclear Safety Capability Assessment (NSCA) to include MSOs of concern.<br>▪ Step 4 – Evaluate for NFPA 805 compliance.<br>▪ Step 5 – Document the results. | (Reference 60) | 3.2.4<br>3.2.6 |

| FAQ # | FAQ Title and Summary | Reference | SE Section |
|---|---|---|---|
| 07-0039 | "Incorporation of Pilot Plant Lessons Learned – Table B-2"<br>• This FAQ provides additional detail for the comparison of the licensee's SSD strategy to the endorsed industry guidance, NEI 00-01, "Guidance for Post-Fire Safe Shutdown Circuit Analysis," Revision 1 (Reference 61). In short, the process has the licensees:<br>▪ Assemble industry and plant-specific documentation;<br>▪ Determine which sections of the guidance are applicable;<br>▪ Compare the existing SSD methodology to the applicable guidance; and<br>▪ Document any discrepancies. | (Reference 62) | 3.2.1 |
| 07-0040 | "Non-Power Operations (NPO) Clarifications"<br>• This FAQ clarifies an acceptable NFPA 805 NPO program. The process includes:<br>▪ Selecting NPO equipment and cabling.<br>▪ Evaluation of NPO Higher Risk Evolutions (HRE).<br>▪ Analyzing NPO key safety functions (KSF).<br>▪ Identifying plant areas to protect or "pinch points" during NPO HREs and actions to be taken if KSFs are lost. | (Reference 63) | 3.5.3<br>3.5.3.1<br>3.5.3.3<br>3.5.4 |
| 08-0048 | "Revised Fire Ignition Frequencies"<br>• This FAQ provides an acceptable method for using updated fire ignition frequencies in the licensee's FPRA. The method involves the use of sensitivity studies when the updated fire ignition frequencies are used. | (Reference 64) | 3.4.7 |
| 08-0054 | "Compliance with Chapter 4 of NFPA 805"<br>• This FAQ provides an acceptable process to demonstrate Chapter 4 compliance for transition:<br>▪ Step 1 – Assemble documentation.<br>▪ Step 2 – Document Fulfillment of NSPC.<br>▪ Step 3 – Variance From Deterministic Requirement (VFDR) Identification, Characterization, and Resolution Considerations.<br>▪ Step 4 – PB Evaluations.<br>▪ Step 5 – Final VFDR Evaluation.<br>▪ Step 6 – Document Required Fire Protection Systems and Features. | (Reference 65) | 3.4.3<br>3.5.1.4 |

| FAQ # | FAQ Title and Summary | Reference | SE Section |
|---|---|---|---|
| 09-0056 | "Radioactive Release Transition"<br>• This FAQ provides an acceptable level of detail and content for the radioactive release section of the LAR. It includes:<br>▪ Justification of the compartmentation, if the radioactive release review is not performed on a fire area basis.<br>▪ Pre-fire plan and fire brigade training review results.<br>▪ Results from the review of engineering controls for gaseous and liquid effluents. | (Reference 66) | 3.6.1<br>3.6.2 |
| 10-0059 | "Monitoring Program"<br>• This FAQ provides clarification regarding the implementation of an NFPA 805 monitoring program for transition. It includes:<br>▪ Monitoring program analysis units;<br>▪ Screening of low safety significant SSCs;<br>▪ Action level thresholds; and<br>▪ The use of existing monitoring programs. | (Reference 67) | 3.7 |
| 12-0062 | "Updated Final Safety Analysis Report (UFSAR) Content"<br>• This FAQ provides the necessary level of detail for the transition of the fire protection sections within the UFSAR. | (Reference 68) | 2.4.4 |
| 13-0004 | "Clarifications on Treatment of Sensitive Electronics"<br>• 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 69) | 3.4.2.2 |
| 13-0005 | "Cable Fires Special Cases: Self-Ignited and Caused by Welding and Cutting"<br>• This FAQ outlines a proposed approach for addressing self-ignited or hot work fires. | (Reference 70) | 3.4.2.2 |
| 13-0006 | "Modeling Junction Box Scenarios in a Fire PRA"<br>• 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 71) | 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" of the LAR, with regard to NRC-issued Orders that are being revised or superseded by the NFPA 805 transition process. The LAR stated that the licensee conducted a review of 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 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 a FPP at PBNP that complies with 10 CFR 50.48(c).

The licensee's review included an assessment of docketed correspondence files and electronic searches, including the NRC's Agencywide Documents Access and Management System (ADAMS). The review was performed to ensure that compliance with the physical protection requirements, security orders, and adherence to commitments applicable to PBNP are maintained. The NRC staff accepts the licensee's determination that no Orders need to be superseded or revised to implement NFPA 805 at PBNP.

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 in order to comply with 10 CFR 50.48(c) do not invalidate existing commitments applicable to PBNP. The licensee's review of this regulation and the related license amendments demonstrated that changes to the FPP during transition to NFPA 805 will not affect the mitigation measures required by Section B.5.b of Commission Order EA-02-026. The NRC staff concludes that the licensee's determination in regard to Commission Order EA-02-026 is acceptable.

2.4.2 License Conditions

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

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

The revised license conditions provide a structure and detailed criteria to allow self-approval for RI/PB as well as other types of changes to the FPP. The structure and detailed criteria result in a process that meets the requirements in NFPA 805, Sections 2.4, "Engineering Analyses," 2.4.3, "Fire Risk Evaluations," and 2.4.4, "Plant Change Evaluation." These sections establish the requirements for the content and quality of the engineering evaluations to be used for approval of changes.

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

Overall, the licensee's revised license conditions 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 conditions also reference the plant-specific modifications, and associated implementation schedules that must be accomplished at PBNP to complete transition to NFPA 805 and comply with 10 CFR 50.48(c). In addition, the license conditions include a requirement that appropriate compensatory measures will remain in place until implementation of the specified plant modifications is completed. These modifications and implementation schedules are identical to those identified elsewhere in the LAR, as discussed in Sections 2.7.1 and 2.7.2, and explicitly reviewed in SE, Section 3.0.

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

2.4.3 Technical Specifications (TS)

The NRC staff reviewed LAR, Section 5.2.2, "Technical Specifications" and LAR, Attachment N, "Technical Specification Changes," with regard to proposed changes to the PBNP TSs that are being revised or superseded during the NFPA 805 transition process. According to the LAR, the licensee conducted a review of the PBNP TSs to determine which, if any, TS sections will be impacted by the transition to a RI/PB FPP based on 10 CFR 50.48(c). The licensee identified a change to the TSs needed for PBNP adoption of the new fire protection licensing basis and provided applicable justification in LAR, Attachment N.

The licensee identified one change that involved deleting TS 5.4.1.h which requires procedures be established, implemented, and maintained for fire protection implementation. The licensee stated that deleting TS 5.4.1.h is adequate for adoption of the new fire protection licensing basis since the requirement for establishing, implementing, and maintaining fire protection procedures is contained in 10 CFR 50.48(a) and 50.48(c), and NFPA 805, Chapter 3. The regulations in 10 CFR 50.48(c) approve the incorporation of NFPA 805 by reference and NFPA 805, Section 3.2.3, "Procedures," states that "Procedures shall be established for implementation of the fire protection program."

Based on the information provided by the licensee, the NRC staff concludes that the proposed change to the TSs is acceptable because TS 5.4.1.h is an administrative control, would be redundant to the NFPA 805 requirement to establish FPP procedures, and not establishing FPP procedures would result in regulatory non-compliance with 10 CFR 50.48(a) and CFR 50.48(c)(1). Changes to fire protection administrative controls are controlled by the proposed fire protection license conditions (see SE, Section 4.0).

2.4.4 Updated Final Safety Analysis Report (UFSAR)

The NRC staff reviewed LAR, Section 5.4, "Revision to the UFSAR" with regard to changes the licensee is proposing to make to the UFSAR. LAR, Section 5.4, states that in accordance with 10 CFR 50.71(e), the FSAR will be revised and the format and content will be consistent with NEI 04-02 and FAQ 12-0062.

The licensee included an action to update the FSAR in accordance with 10 CFR 50.71(e) and FAQ 12-0062, in LAR, Attachment S, Table S-3, Implementation Item IMP-154. The NRC staff concludes that this action is acceptable because it would be required by the proposed license conditions.

Since the licensee will update the UFSAR in accordance with 10 CFR 50.71(e), and the content will be consistent with the guidance contained in NEI 04-02, the NRC staff concludes that the licensee's method to update the UFSAR following the guidance in FAQ 12-0062 is acceptable.

2.5 Rescission of Exemptions

Since PBNP, Unit 1, was licensed to operate on October 5, 1970, and PBNP, Unit 2, was licensed to operate on March 8, 1973, the PBNP FPP is based on compliance with 10 CFR 50.48 Parts (a) and (b), Appendix R, and the PBNP fire protection license conditions.

The NRC staff reviewed LAR, Section 5.2.3, "Orders and Exemptions," LAR, Attachment O, "Orders and Exemptions," and LAR, Attachment K, "Existing Licensing Action Transition," with regard to previously-approved exemptions to Appendix R to 10 CFR Part 50, which the transition to a FPP licensing basis in conformance with NFPA 805 will supersede. 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 PBNP.

The licensee previously requested and received NRC approval for 17 exemptions from 10 CFR Part 50 Appendix R. The licensee discussed these exemptions in detail in LAR, Attachment K. The licensee stated that the exemptions are no longer required because the underlying condition no longer exists, because there is no requirement under NFPA 805, or because the underlying condition has been evaluated using RI/PB methods and found to be acceptable with no further actions because the philosophy of DID and sufficient safety margins are maintained. The licensee requested in accordance with the requirements of 10 CFR 50.48(c)(3)(i), that all the exemptions be rescinded and the NRC staff accepts the licensee's determination regarding the exemptions.

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 FPP methods (FM and/or FRE) and found to be acceptable and no further actions are necessary by the licensee.

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

The following exemptions are rescinded as requested by the LAR because the underlying condition no longer exists, because there is no requirement under NFPA 805, or because the underlying condition has been evaluated using RI/PB methods and found to be acceptable with no further actions because the philosophy of DID and sufficient safety margins are maintained:

- Exemption from Appendix R, Section III.G.3, regarding the lack of a fixed fire suppression system in the control room.

- Exemption from Appendix R, Section III.G.2.b, regarding the lack of 20-foot separation and automatic fire suppression in the unit 1 motor control center room.

- Exemption from Appendix R, Section III.G.2.b, regarding the lack of 20-foot separation and automatic fire suppression in the component cooling water pump room.

- Exemption from Appendix R, Section III.G.2.b, regarding the lack of 20-foot separation and automatic fire suppression in the unit 2 motor control center room.

- Exemption from Appendix R, Section III.G.3, regarding the lack of fixed fire suppression system in an area where alternative shutdown capability has been provided, in the containment spray additive tank and monitor area.

- Exemption from Appendix R, Section III.G.2.b, regarding the lack of 20-foot separation and automatic fire suppression in the safety injection and containment spray pump room.

- Exemption from Appendix R, Section III.G.2.b, regarding the lack of 20-foot separation without intervening combustibles in the auxiliary feedwater pump room.

- Exemption from Appendix R, Section III.G.2.b, regarding the lack of 20-foot separation without intervening combustibles in the cable spreading room.

- Exemption from Appendix R, Section III.G.2.b, regarding the lack of 20-foot separation without intervening combustibles in the service water pump room.

- Exemption from Appendix R, Section III.G.2.b, regarding the lack of an automatic suppression system in the residual heat removal pump zone.

- Exemption from Appendix R, Section III.G.2.b, regarding the lack of automatic suppression in the auxiliary building fire area.

- Exemption from Appendix R, Section III.G.2.a, regarding the lack of a 3-hour rated barrier in the auxiliary building fire area.

- Exemption from Appendix R, Section III.G.3, regarding the lack of fixed fire suppression system in the component cooling water heat exchanger and BAT room.

- Exemption from Appendix R, Section III.G.3, regarding the lack of a fixed fire suppression system in the computer and instrument rack room.

- Exemption from Appendix R, Section III.G.2.b, regarding the lack of 20-foot separation without intervening combustibles in the auxiliary feedwater pump room.

- Exemption from Appendix R, Section III.J, regarding emergency lighting.

- Exemption from Appendix R, Section III.G.I.a, regarding hot shutdown requirements.

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 Sections 2.7.2 and 2.2.9 of NFPA 805," for compliance with the NFPA 805 PCE process requirements to address potential changes to the NFPA 805 RI/PB FPP after implementation is completed. The licensee developed a change process that is based on the guidance provided in NEI 04-02, Revision 2 (Reference 7), Section 5.3, "Plant Change Process," as well as Appendices B, I and J, as modified by RG 1.205, Revision 1 (Reference 4), Regulatory Positions 2.2.4, 3.1, 3.2, and 4.3.

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

1. Defining the change;

2. Performing the preliminary risk screening;

3. Performing the risk evaluation; and

4. Evaluating the acceptance criteria.

In the LAR, the licensee stated that the PCE process begins by defining the change or altered condition in the LAR to be examined and the baseline configuration. The baseline is defined by the design basis and licensing basis. The licensee also stated that the baseline is defined as that plant condition or configuration that is consistent with the design basis and licensing basis and that the changed or altered condition or configuration that is not consistent with the design basis 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 that 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 72), and that the process will address most administrative changes (e.g., changes to the combustible control program, organizational changes, etc.).

The licensee stated that once the screening process is completed, it will be followed by engineering evaluations that may include FM and risk assessment techniques and that 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 fire protection license condition can be implemented within the framework provided by NFPA 805, and that changes that do not satisfy the acceptance criteria cannot be implemented within this framework. The licensee further stated that the acceptance criteria will require that the resultant change in core damage frequency (CDF) and LERF be consistent with the license condition, and that the acceptance criteria will also include consideration of DID and safety margin, which would typically be qualitative in nature.

The licensee stated that the risk evaluation will involve 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 delta ($\Delta$) CDF (change in CDF) and $\Delta$ LERF (change in LERF) criteria from the license condition and that the proposed changes are also assessed to ensure they are consistent with the DID philosophy and that sufficient safety margins were maintained.

The licensee stated that its FPP configuration is defined by the program documentation and, to the greatest extent possible, the existing configuration control processes for modifications, calculations and analyses, and FPP license basis reviews will be utilized to maintain configuration control of the FPP documents. The licensee further stated that the configuration control procedures that govern the various PBNP 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 IMP-135. The NRC staff concludes that this action is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

The licensee stated that several NFPA 805 document types such as: NSCA supporting information, non-power mode NSCA 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 that the new procedures will be modeled after the existing processes for similar types of documents and databases and that 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 IMP-135. 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 on the FPP will continue to be a multiple step review and that the first step of the review will be 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 that reviews that identify potential FPP impacts will be sent to qualified individuals (e.g., Fire Protection, SSD/NSCA, and/or 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 4.2.3 requirements.

- PB Approach: Utilize the NFPA 805 change process developed in accordance with NEI 04-02, RG 1.205, and the NFPA 805 fire protection license condition to assess the acceptability of the proposed change. This process will be used to

determine if the proposed change could be implemented "as-is" or whether prior NRC approval of the proposed change is required.

The licensee stated that this process follows the requirements in NFPA 805 and the guidance outlined in RG 1.174, (Reference 34). NFPA 805 requires the use of qualified individuals, procedures that require calculations be subject to independent review and verification, record retention, peer review, and a corrective action program that ensures appropriate actions are taken when errors are discovered.

Since NFPA 805 always requires the use of a PCE, regardless of what element requires the change, the NRC staff concludes that, in accordance with the requirements of NFPA 805, if FPP impacts are determined to exist as a result of the proposed change, the issue would be resolved by utilizing the NFPA 805 change process developed in accordance with NEI 04-02, RG 1.205, and the PBNP 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, (Reference 7), as well as RG 1.205, Revision 1, (Reference 4), and addresses attributes for using FREs in accordance with NFPA 805. NFPA 805, Section 2.4.4, requires that PCEs consist of an integrated assessment of risk, DID, and safety margins. NFPA 805, Section 2.4.3.1, requires that the PSA use CDF and LERF as measures for risk. NFPA 805, Section 2.4.3.3, requires that the risk assessment approach, methods, and data shall be acceptable to the Authority Having Jurisdiction (AHJ) which is the NRC, and 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 a 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 utilize 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 used in developing the peer-reviewed FPRA model, methods that have been 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 methods that have been 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, as well as RG 1.205, Revision 1, (Reference 4). The NRC staff concludes that the proposed PCE process at PBNP, 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 a 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 listed in SE, Section 2.7.1 (i.e., during full implementation of the transition to NFPA 805), the proposed license conditions 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 condition ensures 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 condition also includes a provision for self-approval of changes to the FPP that may be made on a qualitative, rather than quantitative basis. Specifically, the license condition states 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. NFPA 805, Section 1.7, 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 a FPP against performance criteria. Engineering analyses shall be permitted to be qualitative or quantitative. Use of qualitative engineering analyses by a qualified fire protection engineer to determine that a change has not affected the functionality of the component, system, procedure or physical arrangement is allowed by NFPA 805, Section 2.4.

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

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

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

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

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

The engineering evaluations described above (i.e., functionally equivalent and adequate for the hazard) are engineering analyses governed by NFPA 805. 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 in NFPA 805, Section 2.7.1, "Content") and quality requirements (as outlined in NFPA 805, Section 2.7.3, "Quality") of the standard in order to be considered adequate. Note that the NRC staff's review of the licensee's compliance with NFPA 805, Sections 2.7.1 and 2.7.3, is provided in SE, Section 3.8.

According to the LAR, the licensee intends to use a FPRA to evaluate the risk of proposed future plant changes. Section 3.4.2, "Quality of the Fire Probabilistic Risk Assessment," of this SE 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, and, therefore, 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 PBNP to model the cause and effect relationship of associated changes as a means of assessing the risk of plant changes during transition to NFPA 805 may continue to be used after implementation of the RI/PB FPP, based on the licensee's administrative controls to ensure that the models remain current and to assure continued quality (see SE, Section 3.4.2, "Quality of the Fire Probabilistic Risk Assessment"). Accordingly, these cause and effect relationship models may be used after

transition to NFPA 805 as a part of the PCEs conducted to determine the change in risk associated with proposed plant changes.

## 2.7 Modifications and Implementation Items

Regulatory Position C.3.1 of RG 1.205, Revision 1, (Reference 4), says 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 NRC staff noted that the list of modifications and implementation items originally submitted in the LAR have been updated by the licensee with the final version of LAR, Attachment S, "Plant Modifications and Items to be Completed during Implementation." The updated LAR, Attachment S, is provided in the licensee's letter dated May 3, 2016 (Reference 21).

### 2.7.1 Modifications

The NRC staff reviewed LAR, Attachment S, "Plant Modifications and Items to be Completed During Implementation," 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 PBNP 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's review confirmed that the modifications identified in LAR Table S-2 are the same as those identified in LAR, Table C-1, NEI 04-02 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 the 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 five 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 PBNP 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 10CFR 50.48(c). The modifications will be completed in accordance with the schedule provided in the proposed NFPA 805 license conditions, which states that all modifications will be completed by the startup of the second refueling outage (for each unit) after the issuance of the SE. In addition, the licensee has agreed to keep the appropriate compensatory measures in place until the modifications are complete.

### 2.7.2 Implementation Items

Implementation Items are items that the licensee has not fully completed or implemented as of the issuance date of the license amendments, but which will be completed during implementation of the license amendments to transition to NFPA 805 (e.g., procedure changes

that are still in process, or NFPA 805 programs that have not been fully implemented). The licensee identified the implementation items in LAR, Attachment S, Table S-3. 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.

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 licenses (i.e., implementation period) which states that completion of the implementation items listed in LAR, Attachment S, Table S-3, will occur 12 months after NRC approval unless that falls within a scheduled outage window, then it will occur 60 days after startup from that scheduled outage. The licensee further stated that Implementation Items IMP-142 and IMP-150 will be completed after the last modification is complete and as-built, and that Implementation Item IMP-154 will be completed in accordance with 10 CFR 50.71(e).

The NRC staff, through an onsite audit or during a future fire protection inspection, may choose to examine the closure of the implementation items, with the expectation that any variations discovered during this review, or concerns with regard to adequate completion of the implementation items, would be tracked and resolved appropriately under the licensee's corrective action program and could be subject to appropriate NRC enforcement action as they are required by the proposed license condition.

2.7.3 Schedule

LAR, Section 5.5, provides the overall schedule for completing the NFPA 805 transition at PBNP. The licensee stated that the implementation of new NFPA 805 FPP to include procedure changes, process updates, and training to affected plant personnel will occur within 12 months after NRC approval unless that falls within a schedule outage window, then it that case, completion will occur 60 days after the startup from the scheduled outage. The licensee further stated that Implementation Item IMP-120 is an exception and the final resolution will occur 12 months after the guidance is available unless that falls within a schedule outage window; then in that case, completion will occur 60 days after startup from that scheduled outage. The licensee further stated that Implementation Item IMP-142 and IMP-150 will not be completed until 3 months following the last refueling outage identified in the revised fire protection license condition 4.F.3.c.ii after the last modification is complete, and that Implementation Item IMP-154 will be completed in accordance with 10 CFR 50.71(e).

In LAR, Attachment M, the licensee stated that modifications will be completed no later than prior to startup of the second refueling outage (for each unit) after receipt of the license amendments and that appropriate compensatory measures will be maintained until 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 requested license amendments to transition the FPP at PBNP 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 utilized the guidance provided in NUREG-0800, Section 9.5.1.2, "Risk-Informed, Performance-Based Fire Protection" (Reference 38), to determine whether the licensee had provided sufficient information in both scope and level of detail to adequately demonstrate compliance with the requirements of NFPA 805, as well as the other associated regulations and guidance documents discussed in SE, Section 2.0. Specifically:

- Section 3.1 provides the results of the NRC staff review of the licensee's transition of the FPP from the existing deterministic guidance to that of NFPA 805 Chapter 3, "Fundamental Fire Protection Program 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 a 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 a 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 a 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.

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

## 3.1 NFPA 805 Fundamental FPP 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, NFPA 805, Section 3.1, 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 PBNP 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 PBNP 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 PBNP, and others are provided with multiple compliance statements to fully document compliance with the element.

The methods used by PBNP 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" (see discussion in SE, Section 3.1.1.1).

2. The existing FPP element complies through the use of an explanation or clarification: noted in LAR, Attachment A, as "Complies with Clarification" (see discussion in SE, Section 3.1.1.2).

3. The existing FPP element complies through the use of EEEEs whose bases remain valid and are of sufficient quality: noted in LAR, Attachment A, as "Complies with Use of EEEEs" (see discussion in SE, Section 3.1.1.3).

4. The existing FPP element complies with the requirement based on prior NRC approval of an alternative to the fundamental FPP attribute and the bases for the NRC approval remain valid: noted in LAR, Attachment A, as "Complies by Previous NRC Approval" (see discussion in SE, Section 3.1.1.4).

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, as "Submit for NRC Approval" (see discussion in SE, Section 3.1.1.5).

6. The existing FPP element does not comply with the requirement, but will be in direct compliance with the completion of a required action; noted in LAR, Attachment A, as "Complies, with Required Action." These outstanding actions are identified as implementation items in LAR, Attachment S, Table S-3 (see discussion in SE, Section 3.1.1.6).

Compliance approach 6, "Complies with Required Action," is a modification from the NEI 04-02 based approach in that it is a new category not included in NEI 04-02. The intent of this 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, Table S-3, as implementation items.

The NRC staff has determined that taken together, these methods compose an acceptable approach for documenting compliance with the NFPA 805, Chapter 3, requirements, because the licensee has followed the compliance strategies identified in the endorsed NEI 04-02 guidance document.

In LAR, Section 4.2.2, "Existing Engineering Equivalency Evaluation Transition [EEEE]," 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 PBNP configuration and determined that no EEEE used to support compliance with NFPA 805 required NRC approval.

EEEEs (previously known as Generic Letter (GL) 86-10 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.

Additionally, 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, 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 certain 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 section identified in LAR, Attachment A, as complying via this method, required additional review by the NRC staff:

- Section 3.11.4(b)

NFPA 805, Section 3.11.4(b), requires that conduits be provided with an internal fire seal that has an equivalent fire resistive rating to that of the fire barrier through opening fire stop and shall be permitted to be installed on either side of the barrier in a location that is as close to the barrier as possible. The licensee stated that small conduits provided for items such as lighting circuits are not considered to be paths for the spread of fire and have not been sealed. In FPE RAI 04 (Reference 22), the NRC staff notified the licensee that NFPA 805, Section 3.11.4(b), does not exclude small conduits from the requirements and requested that the licensee describe how compliance is achieved for these small conduits. In its response to FPE RAI 04 (Reference 10), the licensee stated that its treatment of small conduits is based on utility sponsored research conducted in 1986, the results of which were submitted to the NRC on June 19, 1987, in a proprietary report entitled "Conduit Fire Protection Research Program." The licensee also stated that the NRC issued the results of its review in a technical evaluation report and accompanying SE on October 23, 1989. The licensee stated that the compliance basis statement in LAR, Attachment A, for this attribute is consistent with the Conduit Fire Protection Research Program results. The licensee further stated that the LAR is amended to revise the compliance statement for this attribute to "Complies by Previous NRC Approval" and to revise

the compliance basis to incorporate the supporting documentation and references. The NRC staff concludes that the licensee's response FPE RAI 04 is acceptable because the licensee revised the compliance statement in the LAR and included the supporting documentation that demonstrates previous NRC approval of the fire protection approach for treatment of small conduits.

3.1.1.2 Compliance Strategy -- Complies with Clarification

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

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

- Sections 3.3.5.2
  3.4.1(c)

NFPA 805, Section 3.3.5.2, requires that only metal trays or conduits be used for electrical raceways. In LAR, Attachment A, the licensee clarified that in limited circumstances, exposed conduits have a thin plastic coating but the base material is metal and is considered to meet the requirement for metal conduit. In fire protection engineering (FPE) RAI 02 (Reference 22), the NRC staff requested that the licensee provide additional information regarding the extent of installation and application of this type of conduit, and whether these conduits present an exposure hazard to other SSD circuits or could propagate a fire to locations containing SSD circuits. The NRC staff also requested that the licensee describe whether this potential for fire exposure or propagation was considered in the assessment of fire damage. In its response to FPE RAI 02 (Reference 10), the licensee identified 26 conduits and stated the use of plastic coated conduits is limited to reactor nuclear instrumentation circuits to prevent grounding of the conduit and associated "noise" in the circuitry. The licensee also stated that the plastic coating is exceptionally thin with an estimated thickness of 0.060-inches and is not expected to provide any credible influence on fire propagation behavior. The licensee further stated that existing fire protection controls ensure that redundant cabling and circuitry would not be affected by a fire involving the plastic coated conduits and that the coating would not impact the ability of the plant to safely shutdown for fires in areas containing the plastic conduits. The NRC staff concludes that the licensee's response to the RAI is acceptable because the plastic coating on limited conduit installations is very thin and not likely to be a significant contributor to fire propagation; the application is limited to nuclear instrumentation circuits; and the licensee stated that redundant circuitry and cabling, as well as the ability to achieve SSD is not affected by a fire involving these conduits.

NFPA 805, Section 3.4.1(c), requires that the fire brigade leader and at least two members have sufficient training and knowledge of nuclear safety systems to understand the effects of fire and fire suppressants on the NSPC. In LAR, Attachment A, the licensee stated that fire brigade members are also plant operators and the qualifications of individuals in the fire protection organization are administratively controlled to ensure qualification of the individual commensurate with the position being held and activities being performed. In FPE RAI 01

(Reference 22), the NRC staff requested that the licensee provide an additional description of how the brigade leader and members have sufficient training and knowledge of nuclear safety systems and understand the effects of fire and fire suppression on the NSPC. In its response to FPE RAI 01 (Reference 10), the licensee stated that one responsibility of being an auxiliary operator is to be a fire brigade member and training includes primary systems, secondary systems, electrical systems, and plant systems. The licensee further stated that the training also includes plant operating procedures, fire brigade specific training, and required reading regarding potential fire affected SSD components. The NRC staff concludes that the licensee's statement of compliance and response to the RAI is acceptable because the licensee will maintain a fire brigade in accordance with the provisions of NFPA 805 and demonstrated that the fire brigade leader and members have the requisite training and knowledge regarding the effects of fire and fire suppression on the NSPC in accordance with NFPA 805, Section 3.4.1(c).

3.1.1.3 Compliance Strategy -- Complies with Use of EEEEs

For certain NFPA 805, Chapter 3, requirements, the licensee demonstrated compliance with the fundamental FPP element through the use of EEEEs. The NRC staff reviewed the licensee's statement of continued validity for the EEEEs 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 because the licensee followed the NRC staff guidance in RG 1.205 (Reference 4), and the endorsed guidance in NEI 04-02 (Reference 7), for documenting and validating the continued use of EEEEs in meeting the requirements of NFPA 805.

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: (1) original August 2, 1979, FPP safety evaluation report (SER) (Reference 28), (2) March 5, 1980, NRC letter on the evaluation of fire protection open items (Reference 73), (3) October 21, 1980, supplement to the original SER (Reference 29), (4) January 22, 1981, supplement to the original SER (Reference 30), (5) the May 4, 1981, fire protection SE (Reference 74), and (6) the April 21, 1982, SE (Reference 75).

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 approval had been demonstrated using suitable documentation that meets the approved guidance contained in RG 1.205, Revision 1. The NRC staff concludes that the licensee's statements of compliance in these instances are acceptable because the NRC determined that previous approval had been demonstrated and the licensee provided justification for the continued validity of the previously approved alternatives to the NFPA 805, Chapter 3, requirements.

The licensee identified licensing actions which required clarification for the following NFPA 805, Chapter 3, elements:

- Section 3.3.8

The NRC staff review and evaluation of this clarification is documented in SE, Section 3.5.2.

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

- Sections 3.3.5.3
  3.11.3

NFPA 805, Section 3.3.5.3, requires that electric cable construction comply with a flame propagation test that is acceptable to the AHJ. In LAR, Attachment A, the licensee stated that cable qualification was evaluated and previously approved and cites the appropriate documentation that provides the basis of approval. This basis for previous approval contained a statement from the 1979 SER that a qualified flame retardant coating or material would be applied where rapid flame propagation from an electrical fire could compromise redundant safety-related divisions. In FPE RAI 06 (Reference 22), the NRC staff requested that the licensee explain how its existing configuration control mechanisms have maintained compliance to the original 1979 SER since there is reliance on the original SER approval as the basis for compliance with this element. In its response to FPE RAI 06 (Reference 10), the licensee indicated that existing fire protection program guidance documents have incorporated requirements to ensure compliance with the 1979 SER commitment that new cable installations are qualified per standards IEEE 383 (Reference 76), Underwriters Laboratories, Inc. (UL) -910 (Reference 77), UL-1581 (Reference 78), NFPA 262 (Reference 79), or equivalent cable fire standards. The licensee also indicated that in transitioning to NFPA 805, these requirements will be incorporated into the plant's insulated electrical cable installation design guideline to maintain compliance with the 1979 SER commitment to use a qualified flame retardant material when plant changes involve new cable installations. The licensee stated that the design guideline will be revised to reference the existing fire protection documentation that specifies acceptable cable qualification standards to meet the 1979 SER commitment. The NRC staff concludes the licensee's response to FPE RAI 06 is acceptable because the licensee stated that the commitment from the 1979 SER has been maintained and the qualification standards cited for new cable installations meet the guidance in FAQ 06-0022 (Reference 58).

NFPA 805, Section 3.11.3, provides requirements for fire barrier penetrations. LAR, Attachment A, cites previous NRC approval per an exemption request for use of water curtains installed in doorless entranceways through fire separations. In FPE RAI 08 (Reference 22), the NRC staff notified the licensee that the exemption cited as the basis for previous approval is not identified in LAR, Attachment K, as a licensing action to be transitioned in support of NFPA 805 compliance. The NRC staff requested that the licensee describe whether this approval basis is being transitioned and the reasoning for the decision. In its response to FPE RAI 08 (Reference 10), the licensee stated that the areas identified as having the water curtains are the Unit 1 motor control center (MCC) room and component cooling water pump room, and the Unit 2 MCC room and safety injection and containment spray pump room. The licensee also stated that the water curtains were installed to support exemptions from the requirements of 10 CFR 50 Appendix R, Section III.G.2.b. The licensee described that the subject fire areas are transitioning as PB fire areas under NFPA 805 and that the water curtains are not required for separation, which is addressed in the FREs for the fire areas. The licensee further stated that the water curtains in these fire areas are credited for an EEEE and fire risk as indicated in LAR, Table 4-3. The licensee further stated the exemptions are no longer necessary to support

the deterministic separation criteria and that compliance by previous approval is requested in LAR, Attachment A, Section 3.11.3, to support continued reliance on the water curtains in the EEEE and for fire risk. The NRC staff concludes that the licensee's response to FPE RAI 08 is acceptable. The licensee used PB analysis to evaluate fire area separation as allowed by NFPA 805. This alleviates the need for the licensing action to be transitioned, and has specifically identified the water curtains as required systems/features for EEEE and fire risk in LAR, Table 4-3, which provides reasonable assurance that protection systems/features are included in the NFPA 805 FPP.

3.1.1.5 Compliance Strategy -- Submit for NRC Approval

The licensee also 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 amendments approving the transition to NFPA 805. The NFPA 805 sections identified in LAR, Attachment A, as complying via this method are as follows:

- Section 3.2.3(1), concerns establishing procedures for inspection, testing, and maintenance of fire protection systems and features. The licensee requested NRC staff approval for the use of EPRI [Technical Report] TR1006756, "Fire Protection Equipment Surveillance Optimization and Maintenance Guide," (Reference 80), to establish fire protection system inspection, testing, and maintenance frequencies for fire protection systems/features required by NFPA 805. (See SE, Section 3.1.4.1, for the NRC staff's SE of this request.)

- Section 3.3.3, concerns the classification of interior floor finish in accordance with NFPA 101 (Reference 55), Class I criteria. The licensee requested NRC approval for the use of a PB method to justify the use of epoxy floor coatings, thereby, meeting the requirements of NFPA 805. (See SE, Section 3.1.4.2, for the NRC staff's SE of this request.)

- Section 3.3.5.1, concerns minimizing wiring above suspended ceilings, and where installed, requires electrical wiring to be listed for plenum use, or routed in armored cable, metal conduit, or cable trays with solid metal top and bottom covers. The licensee requested NRC approval for the use of a PB method to justify limited amounts of wiring above suspended ceilings in the power block, thereby, meeting the requirements of NFPA 805. (See Section 3.1.4.3 for the NRC staff's SE on this request.)

- Section 3.3.5.2, concerns the use of metal tray and metal conduit for electrical raceways and prohibits the use of thin-wall metallic tubing for power, instrumentation, and control cables. The licensee stated that thin-wall tubing, or electrical metallic tubing (EMT) is installed throughout the plant and requested NRC staff approval for the use of a PB method to justify the EMT conduit installations, thereby, meeting the requirements of NFPA 805. (See SE, Section 3.1.4.4, for the NRC staff's SE on this request.)

- Section 3.3.7.1, concerns the location of flammable gas storage either outdoors or in separate buildings and requires that NFPA 50A (Reference 81), be followed for hydrogen storage. The licensee requested NRC approval for the use of a PB method to justify the existing plant hydrogen storage installation, thereby, meeting the requirements of NFPA 805. (See Section 3.1.4.5 for the NRC staff's SE of this request.)

- Sections 3.5.3 and 3.5.6, concern the design and installation of fire pumps. Section 3.5.3 is concerned with design and installation of fire pumps in accordance with NFPA 20 (Reference 56), and Section 3.5.6 is concerned with design of the start and stop capability of the fire pumps. The license requested NRC staff approval for the use of a PB method to justify the electric fire pump installation, thereby, meeting the requirements of NFPA 805. The licensee also requested NRC approval for the use of a PB method to justify the electric fire pump stopping automatically, thereby, meeting the requirements of NFPA 805. (See SE, Section 3.1.4.6, for the NRC staff's SE of this request.)

- Sections 3.5.13 and 3.6.1, concern the design and installation of sprinkler and standpipe system shutoff valves and the installation of standpipe and hose systems, respectively. The licensee requested NRC approval for the use of a PB method for the use of certain valves for the containment hose stations, thereby, meeting the requirements of NFPA 805. (See SE, Section 3.1.4.7, for the NRC staff's SE of this request.)

- Section 3.5.16, concerns the dedication of fire protection water supply system for fire protection use only. The licensee requested NRC approval for the use of a PB method to justify the non-fire protection use of the fire protection water system under controlled conditions, thereby, meeting the requirements of NFPA 805. (See SE, Section 3.1.4.8, for the NRC staff's SE of this request.)

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

3.1.1.6 Compliance Strategy – Complies with Required Action

For several NFPA 805, Chapter 3, requirements, the licensee stated that compliance will be achieved following completion of a required action. The following NFPA 805 Chapter 3 sections identified in LAR, Attachment A, as complying via this method, and the applicable modification or implementation items in LAR, Attachment S, Tables S-2 or S-3, required additional review by the NRC staff:

Sections -

- 3.2.2.4
- 3.2.3(1)
- 3.3.1.2(5)
- 3.3.3
- 3.3.5.1
- 3.3.7
- 3.3.7.1
- 3.3.8
- 3.4.1(a)(1)
- 3.4.1(b)
- 3.4.2
- 3.4.2.1
- 3.4.3(a)(1)
- 3.4.3(a)(2)
- 3.5.16
- 3.7
- 3.8.1
- 3.8.2
- 3.9.1(1)
- 3.10.1
- 3.11.3(1)
- 3.11.3(2)
- 3.11.4(a)
- 3.11.4(b)
- 3.11.5

NFPA 805, Section 3.2.2.4, requires that the policy document identify the appropriate AHJ for the various areas of the FPP. In LAR, Attachment S, Table S-3, Implementation Item IMP-8, the licensee identified an action to revise the applicable plant procedure to incorporate this requirement in the FPP. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.2.3(1), requires procedures be established for the inspection, testing, and maintenance of fire protection systems and features credited by the FPP. In LAR, Attachment S, Table S-3, Implementation Item IMP-122, the licensee identified an action to establish, as necessary, PB surveillance frequencies in accordance with EPRI TR-1006756. The licensee's request for NRC approval to use the EPRI methodology is addressed in SE, Section 3.1.1.5. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.3.1.2(5), requires controls on the use of flammable and combustible liquids in accordance with NFPA 30 (Reference 57), or other applicable NFPA standards. In LAR, Attachment S, Table S-3, Implementation Item IMP-23, the licensee identified an action to revise plant documentation and procedures to include an inspection and maintenance program to ensure proper location, condition, and contents of flammable liquid storage cabinets. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.3.3, requires interior finishes meet the classification criteria in NFPA 101 for walls, ceilings, and floors. In LAR, Attachment S, Table S-3, Implementation Item IMP-134, the licensee identified an action to revise plant procedures to incorporate the NFPA 101, Class A, criteria for walls and ceilings, and the Class 1 criteria for floor finishes. The licensee's request for NRC approval of epoxy floor coatings is addressed in SE, Section 3.1.1.5. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.3.5.1, requires wiring above suspended ceilings to be kept to a minimum and where installed, be listed for plenum use, routed in armored cable, routed in metal conduit or trays with metal top and bottom covers. In LAR, Attachment S, Table S-3, Implementation Item IMP-30, the licensee identified an action to revise plant procedures to incorporate this NFPA 805 requirement. The licensee's request for NRC approval of installed wiring above suspended ceilings is addressed in SE Section 3.1.1.5. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.3.7, prohibits bulk compressed or cryogenic flammable gas storage inside structures housing equipment or components important to nuclear safety. In LAR, Attachment S, Table S-3, Implementation Item IMP-31, the licensee identified an action to revise plant procedures to incorporate this NFPA 805 requirement. The NRC staff concludes that this is

acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.3.7.1, requires that flammable gas storage be located outdoors or in separate detached buildings so that a fire or explosion will not impact systems, equipment or components important to nuclear safety. This section also requires that hydrogen storage meet the provisions of NFPA 50A (Reference 81). In LAR, Attachment S, Table S-3, Implementation Item IMP-88, the licensee identified an action to revise plant documentation and procedures to address flammable gas storage in the power block. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.3.8, prohibits bulk storage of flammable and combustible liquids inside structures containing systems, equipment, or components important to nuclear safety. This section also requires that bulk storage and use of flammable and combustible liquids comply with NFPA 30. In LAR, Attachment S, Table S-3, Implementation Item IMP-25, the licensee identified an action to prepare a procedure for inspection, maintenance, and repairs of fuel and lube oil tanks and associated piping. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.4.1(a)(1), cites NFPA 600 (Reference 82), as the applicable standard for fire brigades. In LAR, Attachment S, Table S-3, Implementation Item IMP-121, the licensee identified an action to update the fire brigade to meet the applicable requirements of NFPA 600, 2000 edition. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.4.1(b), requires that fire brigade members have no other assigned plant duties that would prevent immediate response to a fire or other emergency. In LAR, Attachment S, Table S-3, Implementation Item IMP-9, the licensee identified an action to update plant procedures to incorporate this NFPA 805 requirement. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.4.2, requires pre-fire plans be available to the fire brigade for all areas in which fire could jeopardize the ability to meet the performance criteria. In LAR, Attachment S, Table S-3, Implementation Items IMP-92 and IMP-130, the licensee identified actions to: (1) develop a pre-fire plan document to provide off-site responders with a plan to address special considerations concerning radioactive release due to fire suppression activities in the steam generator storage facility and other places outside the protected area of the plant, and (2) revise pre-fire plans and training to address the radioactive release requirements of NFPA 805. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.4.2.1, requires that pre-fire plans detail the fire area configuration, hazards, nuclear safety components and fire protection systems and features that are present.

In LAR, Attachment S, Table S-3, Implementation Item IMP-56, the licensee identified an action to update fire brigade documentation for the gas turbine building to show locations for manual actuation of the dry chemical suppression system. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Sections 3.4.3(a)(1) and 3.4.3(a)(2), require fire brigade training consistent with the requirements of NFPA 600. NFPA 805, Section 3.4.3(a)(2), requires quarterly training and practice that includes training to address radioactivity and health physics considerations. In LAR, Attachment S, Table S-3, Implementation Item IMP-121, the licensee identified an action to update the fire brigade training in accordance with NFPA 600, 2000 edition. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.5.16, requires the fire water supply system to be dedicated for fire protection use only. In addition to previous approval for the use of fire water to provide bearing cooling water to the turbine-driven auxiliary feedwater pump, the licensee requested NRC approval to use fire protection water for non-fire protection use. The licensee's request for NRC approval of the licensee's use of the fire water supply for non-fire use is addressed in SE, Section 3.1.1.5. In LAR, Attachment S, Table S-3, Implementation Item IMP-119, the licensee identified an action to revise plant procedures to address controls and communication protocols necessary to support non-fire protection use of the fire water supply system. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.7, requires that fire extinguishers be provided in accordance with NFPA 10 (Reference 83). In LAR, Attachment S, Table S-3, Implementation Items IMP-16, IMP-17, IMP-40, IMP-41, IMP-43, IMP-44, IMP-45, and IMP-46, the licensee identified several actions to install additional fire extinguishers and to revise the fire extinguisher inspection procedure to address the requirement of NFPA 10. The NRC staff concludes that this is acceptable because the implementation items will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions. In its letter dated May 3, 2016 (Reference 21), the licensee indicated in LAR, Attachment S, Table S-3, that Implementation Items IMP-16 and IMP-17 were complete.

NFPA 805, Section 3.8.1, requires fire alarm initiating devices to be installed in accordance with NFPA 72 (Reference 84), and allows alarm annunciation to be transmitted to the control room or other constantly attended location from which required notifications and response can be initiated. In LAR, Attachment S, Table S-2, Modification LTAM PB-12-0038, the licensee identified an action to upgrade the fire alarm system in accordance with NFPA 72. The NRC staff concludes that this is acceptable because the modification will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.8.2, requires automatic fire detection to be installed in accordance with NFPA 72 where the detection is required to meet the requirements of NFPA 805, Chapter 4. In LAR, Attachment S, Table S-3, Implementation Item IMP-66, the licensee identified an action to

install a mechanical guard to protect a heat detector in the battery charger room, fire zone 323. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.9.1(1), requires that automatic sprinkler systems be installed in accordance with NFPA 13 (Reference 85), where the sprinkler system is required to meet the requirements of NFPA 805, Chapter 4. In LAR, Attachment S, Table S-3, Implementation Items IMP-110 and IMP-124, the licensee identified actions to modify existing sprinkler systems to install baffles between sprinklers in the Unit 1 charging pump area where sprinklers are location within 6 feet of each other, and to correct the installation of pendent sprinkler not installed in the fire brigade locker room on return bends. The NRC staff concludes that these are acceptable because the implementation items will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions. In its letter dated May 3, 2016 (Reference 21), the licensee indicated in LAR, Attachment S, Table S-3, that Implementation Items IMP-110 and IMP-124, were complete.

NFPA 805, Section 3.10.1, requires that automatic total flooding or local gaseous fire suppression systems be installed in accordance with the applicable NFPA codes, where the systems are required to meet the requirements of NFPA 805, Chapter 4. In LAR, Attachment S, Table S-3, Implementation Items IMP-55 and IMP-132, the licensee identified actions to update drawings in fire emergency procedures to indicate the manual connection locations for the turbine bearing dry chemical suppression system, as well as the location of the wheeled dry chemical extinguishers and to establish PB surveillance frequencies for the turbine bearing dry chemical suppression system in accordance with EPRI TR-1006756 (see SE, Section 3.1.1.5). The NRC staff concludes that these are acceptable because the implementation items will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.11.3(1), requires that fire doors installed in fire barriers required to meet the performance requirements of NFPA 805, Chapter 4, be installed in accordance with the requirements of NFPA 80 (Reference 86). In LAR, Attachment S, Table S-3, Implementation Items IMP-12, IMP-13, IMP-19, and IMP-37, the licensee identified actions to update inspection procedures, revise barrier evaluations, to remove a door and close the opening, and to replace fire door glazing with fire rated material. The NRC staff concludes that these are acceptable because the implementation items will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.11.3(2), requires that fire dampers installed in fire barriers required to meet the performance requirements of NFPA 805, Chapter 4, be installed in accordance with the requirements of NFPA 90A (Reference 87). In LAR, Attachment S, Table S-3, Implementation Items IMP-69 and IMP-133, the licensee identified actions to update drawings of installed fire dampers and to establish fire damper surveillance frequencies using the methodology in EPRI TR-1006756 (see Section 3.1.1.5). The NRC staff concludes that these are acceptable because the implementation items will incorporate the provisions of NFPA 805, Chapter 3 in the FPP and would be required by the proposed license conditions. In its letter dated May 3, 2016 (Reference 21), the licensee indicated in LAR, Attachment S, Table S-3, that Implementation Item IMP-69 was complete.

NFPA 805, Section 3.11.4(a), requires that annular space in fire barrier penetrations between the barrier and the penetrating item be filled with a qualified fire-resistive penetration seal assembly that maintains the fire rating of the barrier. In LAR, Attachment S, Table S-2, Modifications EC-271218, EC-278396, and MOD-27, the licensee identified actions to install fire-resistive seals in unsealed bus duct penetrations between the cable spreading room and auxiliary feedwater pump rooms, and bus duct penetrations between the non-vital and vital switchgear rooms. The NRC staff concludes that these are acceptable because the modifications will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.11.4(b), requires internal fire seals in conduits that penetration fire barriers. In LAR, Attachment S, Table S-2, Modifications EC-271218, EC-278396, and MOD-27, the licensee identified actions to install fire-resistive seals in unsealed bus ducts between the cable spreading room and auxiliary feedwater pump rooms, and bus duct penetrations between the non-vital and vital switchgear rooms. The NRC staff concludes that these are acceptable because the modifications will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

NFPA 805, Section 3.11.5, describes the acceptance criteria for qualified electrical raceway fire barrier systems (ERFBS) where the ERFBS are required to meet the deterministic or PB requirements of NFPA 805, Chapter 4. In LAR, Attachment S, Table S-3, Implementation Item IMP-129, the licensee identified an action to revise plant procedures to include the inspection, testing, and maintenance requirements and criteria for all raceways credited for compliance with NFPA 805. The NRC staff concludes that this is acceptable because the implementation item will incorporate the provisions of NFPA 805, Chapter 3, in the FPP and would be required by the proposed license conditions.

In FPE RAI 09 (Reference 22), the NRC staff identified that LAR, Attachment A, Section 3.11.5, stated the ERFBS used at PBNP is 1-hour rated except for that installed in containment, which is qualified as radiant energy shielding; however, the LAR also described a number of locations with 3-hour rated wrap. The NRC staff requested that the licensee describe whether 1-hour or 3-hour ERFBS is installed or planned to be installed; whether the ERFBS described in this section is associated with cable protection modifications in LAR, Attachment S, Table S-1; and to describe what the word "protected" means with regard to cable protection modifications in LAR, Attachment S. In its response to FPE RAI 09 (Reference 12), the licensee stated that the statement that ERFBS at PBNP is 1-hour rated with the exception of containment radiant energy shields is incorrect, and that both 1-hour and 3-hour rated fire wrap is used at PBNP, and provided revised pages for LAR, Attachment A. The licensee stated there are three completed modifications in LAR, Attachment S, Table S-1, and these did not install ERFBS. The licensee identified modifications in LAR, Attachment S, Table S-2, will install ERFBS as MOD-11 and MOD-20. (In a letter dated August 26, 2015 (Reference 17), the licensee changed modification strategy of MOD-20 by rerouting the affected cables in lieu of installing ERFBS.) The NRC concludes the licensee's response to FPE RAI 09 is acceptable because the licensee revised the LAR to clarify that ERFBS is used in 1-hour and 3-hour rated configurations and clarified which modifications in LAR, Attachment S, involve installation of ERFBS and that the installations will meet the requirements of NFPA 805.

Based on the licensee's statement of compliance and the associated modifications or implementation items as described in LAR, Attachment A, and listed in LAR, Attachment S, for the individual attributes described above, as well as the statements that these items will be complete prior to implementation, the NRC staff concludes that the licensee's statements of compliance are acceptable subject to completion of the modifications or implementation items which will bring these attributes into compliance with the requirements of NFPA 805.

3.1.1.7 Compliance Strategy -- Multiple Strategies

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

In each of these cases, the NRC staff concludes that the individual compliance statements are acceptable, that the combination of compliance strategies is acceptable, and that holistic compliance with the fundamental FPP 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 PBNP because of the following:

  — The licensee stated that PBNP does not have systems of this type installed (e.g., Section 3.6.5 which applies fire flow requirements for seismic required hose stations that are cross-connected to essential seismic non-fire protection systems, Section 3.9.1(3) which applies to water mist systems, or Section 3.9.1(4) that applies to foam-water systems).

  — The requirements are structured with an applicability statement (e.g., Sections 3.4.1(a)(2) and 3.4.1(a)(3), which apply to the type of fire brigade specified in the FPP at the site).

3.1.1.9 Compliance with NFPA 805, 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 PBNP's 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 PBNP structures identified in LAR, 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 PBNP RI/PB FPP that have additional requirements in accordance with 10 CFR 50.48(c) and NFPA 805. As stated in the LAR, Section 4.1.3, the power block includes structures that contain equipment that is required to meet the nuclear safety and radioactive release criteria in NFPA 805, Section 1.5. The NRC staff concludes that the licensee appropriately evaluated the structures and equipment at PBNP, and adequately documented a list of those structures that fall under the definition of "power block" in NFPA 805.

3.1.3 Closure of Generic Letter 2006-03, "Potentially Nonconforming Hemyc and MT Fire Barrier Configurations," Issues

Generic Letter 2006-03 requested that licensees evaluate their facilities to confirm compliance with existing applicable regulatory requirements in light of the results of NRC testing that determined that both Hemyc/MT fire barrier systems failed to provide the protective function intended for compliance with existing regulations, for the configurations tested using the NRC's thermal acceptance criteria. In a letter dated June 8, 2006 (Reference 88), the licensee stated that it does not utilize Hemyc or MT fire barrier materials for separation and/or SSD purposes.

The NRC staff concludes that since Hemyc or MT ERFBS are not used, the generic issue (GL 2006-03 (Reference 54), related to the use of ERFBS is not applicable to PBNP.

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. The Director or designee may approve PB methods if the Director or designee determines that the PB 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 DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown 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 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 Attachment L, "NFPA 805, Chapter 3, Requirements for Approval (10 CFR 50.48(c)(2)(vii)," of the LAR, the licensee requested NRC staff review and approval of PB methods to demonstrate

an equivalent level of fire protection for 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 3.2.3(1) – Inspection, Testing, and Maintenance [IT&M] Procedures

In LAR, Attachment L, Approval Request 1, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.2.3(1), requirement to establish procedures for IT&M of fire protection systems and features credited by the FPP. Specifically, the licensee requested approval to use PB methods to establish the IT&M frequencies for fire protection systems and features required by NFPA 805.

The licensee stated that PB IT&M frequencies will be established as described in EPRI Technical Report TR-1006756, "Fire Protection Equipment Surveillance Optimization and Maintenance Guide," Final Report, July 2003 (Reference 80).

The licensee stated that its request is specific to the use of EPRI Technical Report TR-1006756 to establish the appropriate IT&M frequencies for fire protection systems and features credited by the FPP. The licensee further stated that EPRI Technical Report TR-1006756, Section 10.1, states that "The goal of a performance-based surveillance program is to adjust test and inspection frequencies commensurate with equipment performance and desired reliability," and that this goal is consistent with the stated requirements of NFPA 805, Section 2.6. The licensee further stated that the EPRI Technical Report TR-1006756 provides an accepted method to establish appropriate IT&M frequencies which ensure the required NFPA 805 availability, reliability, and performance goals are maintained.

The licensee stated that the target tests, inspections, and maintenance will be those activities for the NFPA 805 required fire protection systems and features and that the reliability and frequency goals will be established to ensure the assumptions in the NFPA 805 engineering analysis remain valid. The licensee further stated that the failure criterion will be established based on the required fire protection systems and features credited functions and will ensure those functions are maintained and that the failure probability will be determined based on EPRI Technical Report TR-1006756 guidance and a 95 percent confidence level will be utilized. The licensee further stated that data collection and analysis will also follow EPRI Technical Report TR-1006756 document guidance and that the performance monitoring will be performed in conjunction with the monitoring program required by NFPA 805, Section 2.6, and will ensure site specific operating experience is considered in the monitoring process.

The licensee stated that the use of PB test frequencies established in accordance with EPRI Technical Report 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, therefore, there is no adverse impact to the NSPC.

The licensee stated that the radiological release performance criteria are satisfied based on the determination of limiting radioactive release (LAR, Attachment E) and that fire protection systems and features are credited as part of that evaluation. The licensee further stated that the use of PB test frequencies established per EPRI Technical Report TR-1006756 methods,

combined with NFPA 805, Section 2.6, "Monitoring Program," will ensure that the availability and reliability of the 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 and, therefore, there is no adverse impact on meeting the radioactive release performance criteria.

The licensee stated that the use of PB test frequencies established per EPRI Technical Report 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 therefore, the safety margin inherent and credited in the analysis has been preserved.

The licensee stated that the three echelons of DID described in NFPA 805, Section 1.2, 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 stated that echelon 1 is not affected by the use of EPRI Technical Report TR-1006756 methods. The licensee further stated that the use of PB test frequencies established per EPRI Technical Report TR-1006756 methods, combined with the NFPA 805, Section 2.6, "Monitoring Program," will ensure that the availability and reliability of the fire protection systems and features credited for DID are maintained to the levels assumed in the NFPA 805 engineering analysis and therefore, there is no adverse impact to echelons 2 and 3 for the DID.

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, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains safety margins; and, maintains fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.2 NFPA 805, Section 3.3.3 – Interior Finishes

In LAR, Attachment L, Approval Request 2, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.3.3, requirement regarding interior finishes. Specifically, PBNP requested approval for the use of existing epoxy based coatings as interior finishes.

The licensee stated that its interior finishes were reviewed against the following sections of NFPA 101, 2000 edition:

> Section 10.2.3.2(a) which states the requirements for Class A interior wall and ceiling finishes which are a flame spread rating of 0-25 and a smoke development rating of 0-450 and includes any material classified at 25 or less on the flame spread test scale and

> 450 or less on the smoke test scale, and that any element thereof, when so tested, shall not continue to propagate fire.
>
> Section 10.2.7.2(a) which states the requirements for Class I interior floor finishes as having a critical radiant flux not less than 0.45 W/cm2 as determined by the test described in NFPA 253 (Reference 89).

The licensee stated that the NRC issued Information Notice (IN) 2007-26 (Reference 90), to address the combustibility of epoxy floor coatings at commercial NPPs and that per IN 2007-26, the NRC defined a noncombustible material as:

> A material which in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat; and
>
> Material having a structural base of noncombustible material, as defined above, with a surfacing not over 1/8-inch thick that has a flame spread rating not higher than 50 when measured using the test protocol of American Society for Testing and Materials (ASTM) E 84, Standard Test Method for Surface Burning Characteristics of Building Materials (Reference 91).

The licensee stated that NFPA 805 has re-defined the IN 2007-26 definition of non-combustible material to limited combustible material which is material that, in the form in which it is used, has a potential heat value not exceeding 3500 British thermal unit (Btu)/lb (8141 kJ/kg) and either has a structural base of noncombustible material with a surfacing not exceeding a thickness of 1/8 in. (3.2 mm) that has a flame spread rating not greater than 50, or has another material having neither a flame spread rating greater than 25 nor evidence of continued progressive combustion, even on surfaces exposed by cutting through the material on any plane.

The licensee stated that NFPA 805 defines non-combustible material as material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.

The licensee stated that a PBNP operating experience evaluation of the acceptability of epoxy coatings was performed in response to IN 2007-26 and that the use of interior finish products satisfies the intent of Appendix A to BTP APCSB 9-5.1 guidelines (Reference 2), and NFPA 101 (Reference 55), requirements for non-combustibility and flame/smoke spread characteristics based on the following items described in the operating experience evaluation and a letter from Wisconsin Electric Power Company dated June 20, 1977 (Reference 92).

- Materials less than 125 mils thick have a flame spread rating less than 50 under ASTM E-84 testing. Coatings (all epoxy-based) have flame spread ratings of less than 50 and are applied at thicknesses much less than 125 mils per maintenance procedures.

- A study was performed by the PBNP Coating Specialist to identify epoxy floor coating thicknesses in specific areas which have been recently recoated. The study concluded that thicknesses ranged from 8 to 12 mils, with a maximum

thickness of 14 mils in one spot that was visibly thicker than the surrounding areas. Therefore, coatings are considered "non-combustible" per the IN 2007-26 definition and "limited-combustible" per NFPA 805 definition.

- The epoxy coatings specified in procedures have also been confirmed by the manufacturers to have been ASTM E-84 tested with a flame spread rating less than 50.

- Most of the painted areas at the PBNP are administrative areas remote from safety-related equipment. The paints and coatings used are limited by specification to industrial quality products with a proven history of satisfactory performance. Paintings and coatings used in safety-related areas are selected for their resistance to contamination and for surface qualities that facilitate cleanup activities. Combustible storage is prohibited in safety-related areas and presence of transient combustible materials is administratively controlled. Plant areas, where combustible materials are allowed, are of unpainted masonry construction. The possibility of igniting wall and floor coatings is very remote.

The licensee stated that the use of interior finish products at PBNP does not adversely affect nuclear safety capability, as they meet the NFPA 805 definition of a limited combustible material with minimal application thickness. The licensee also stated that the combustible loading and potential for flame spread of the coatings have been evaluated to be negligible and highly unlikely to ignite and support flame propagation. The licensee further stated that the application of interior finish coatings is controlled by plant procedures to ensure that the amount of material does not add appreciable amounts of combustible materials to the plant. The licensee concluded that there is no impact on the NSPC.

The licensee stated the use of interior finishes applied to walls, ceilings, and floors has no impact on the radiological release performance criteria. The licensee also stated that the radioactive release review was performed based on the potential location of radiological concerns and is not dependent on the "class" or "listing" of interior finishes and that the coatings do not add additional radiological materials to the area or challenge plant boundaries.

The licensee stated that the use of interior finish products does not adversely affect safety margin, as they meet the NFPA 805 definition of a limited combustible material with minimal application thickness. The licensee also stated that the combustible loading and potential for flame spread of the coatings have been evaluated to be negligible and highly unlikely to ignite and support flame propagation and that application of interior finish coatings is controlled by plant procedures. The licensee concluded that the safety margin inherent in the analysis for the fire event has been preserved.

The licensee stated the three echelons of DID are: (1) to prevent fires from starting, (2) to rapidly detect, control and extinguish fires that do occur, thereby, limiting damage, and (3) to provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee stated that the use of interior finish products does not affect echelons 1, 2 and 3. The licensee stated that based on the thickness of the coatings installed (8 to 12 mils, with a maximum of 14 mils) that the coatings are considered non-combustible per IN 2007-26, and limited-combustible per NFPA 805. The

licensee further stated that the combustible loading and potential for flame spread of the coatings have been evaluated to be negligible and highly unlikely to ignite and support flame propagation. The licensee further stated that combustible storage is prohibited in safety-related areas, that the presence of transient combustible materials is administratively controlled, and that the possibility of igniting wall and floor coatings is very remote. The licensee further stated that the use of interior finish products does not directly result in compromising automatic or manual fire suppression fire suppression functions and does not result in compromising post-fire SSD 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 3.3.3, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains safety margins; and, maintains fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.3 NFPA 805, Section 3.3.5.1 – Wiring above Suspended Ceilings

In LAR, Attachment L, Approval Request 3, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.3.5.1, requirement for electrical wiring installed above suspended ceilings to be listed for plenum use, routed in armored cable, routed in metallic conduit, or routed in cable trays with solid metal top and bottom covers. Specifically, the licensee requested approval of a PB method to justify the installation of limited amounts of wiring above suspended ceilings in the power block.

The licensee stated that with the exception of the Computer Room (north side), there are insignificant quantities of data cables routed in plenum spaces above suspended ceilings. The licensee also stated that most of the cables are installed above a suspended ceiling in conduit and/or are listed for plenum use; however, some of the data cables installed above suspended ceilings in the following areas have been identified as having compliance issues:

- Outage Control Center
- Work Control Center
- Operations Office outside Control Room
- Computer Room (north side)
- Fire Protection Coordinator's Office
- Kelly Building (44'-0" Unit 1 turbine building)
- South Service Building 1st Floor (outside Radiological Control Area (RCA))
- South Service Building 2nd Floor (outside RCA)
- South Service Building 1st Floor east side (inside RCA)
- South Service Building 1st Floor west side (inside RCA)

The licensee stated small quantities of data cables in these locations were observed as either being exposed or routed in open top metal trays and although some of the observed cables were identified as being listed for installation in plenum spaces, a small quantity could not be identified for such use. The licensee also stated for the remaining quantities of the non-plenum rated cables, identification markings were observed on most, but not all of the cable jackets and

the markings indicated fire/flame resistant characteristics consistent with IEEE-383, "Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations," (Reference 76), and/or UL 1581 (Reference 78). The licensee further stated that for cables without observed identification markings, it could not be confirmed with certainty that this exposed cabling is listed for plenum use and this request is therefore based on the assumption that some small percentage of the exposed cabling is also not listed for plenum use. The licensee stated these are referred to as "unverified" cables in the approval request and it is undetermined whether these unverified cables meet IEEE-383, or other qualification standards; and therefore, these cables are assumed to be unqualified for the purpose of this analysis.

The licensee stated that with the exception of the Computer Room (north side), which has a smoke detection system present in the plenum space, fire suppression and detection systems are not present in the above ceiling spaces.

The licensee stated that the basis for the approval request is as follows:

- With the exception of the Computer Room (north side), there are insignificant quantities of data cables routed throughout the plenum space in the identified locations. Typical routing configurations consist of singular data cables or data cables tie-wrapped in bundles of 2 to 7 cables. The South Service Building 1st Floor outside radiologically controlled area (RCA) contains singular data cables or data cables tie-wrapped in bundles of 5 to 15 cables. Much of the cabling is either listed for plenum use or identified as having fire/flame resistant characteristics consistent with IEEE-383 and/or UL 1581 qualifications. For areas containing the small quantities of unverified cables (without any observable markings), fire propagation is not expected as the amount of combustibles and presence of ignition sources is negligible to support any sustained combustion.

- A low concentration of cabling is installed in the Computer Room (north side) plenum space. Data cables air drop into cabinets from conduits above. All cables in this area were identified as either being listed for plenum installation or as having IEEE 383/UL 1581 markings. In addition, a smoke detection system is installed above the suspended ceiling for early warning fire notification in the Control Room.

- Data cabling is low voltage. Low voltage is not susceptible to heat generating overload faults causing a fire.

- A PBNP fire protection technical evaluation requires that purchased cables/wiring meet current fire protection standards and plenum requirements.

- Procedures will be revised to provide instruction to minimize cabling above suspended ceilings and where installed, shall be listed for plenum use or be routed in armored cable, metal conduit, or enclosed metal cable trays. Electrical installation revisions for wiring above suspended ceilings are being tracked in Implementation Item IMP-30 in Attachment S of the LAR.

- NSCA-credited cables are routed throughout the Control Room, the Operations Office outside the Control Room, and the South Service Building. The exact location of these NSCA cables within these areas and whether they are located above the suspended ceilings cannot be determined with 100 percent certainty. However, for reasons stated above, potential fire damage to NSCA-credited cables which may be located above the suspended ceilings in these areas is not considered credible.

The licensee stated the presence of non-rated plenum cables above the identified suspended ceiling locations does not affect nuclear safety. The licensee stated that the quantities of non-rated plenum cables, which are not installed in code required metal conduit, armored cable, or enclosed metal cable trays, is limited and combustible loading and the presence of ignition sources above the suspended ceilings is negligible per visual inspection. The licensee concluded there is no impact on the NSPC.

The licensee stated that the location of non-rated plenum cables above suspended ceilings has no impact on the radiological release performance criteria. The licensee also stated that the radiological review was performed based on the potential location of radiological concerns and is not dependent on the type of cables or locations of suspended ceilings. The licensee further stated that the location of non-rated plenum cables above suspended ceilings does not add additional radiological materials to the area or challenge plant boundaries.

The licensee stated that the quantities of nonrated plenum cables above the identified suspended ceiling locations are not significant and that the safety margin inherent in the analysis for the fire event has been preserved.

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 insignificant amount of nonrated plenum cables (cables without observable marking) routed above the suspended ceilings does not impact fire protection DID since these data cables are of low voltage and are not susceptible to heat generating overload faults causing a fire. In the Computer Room, where a low concentration of data cables is installed, a smoke detection system is installed above the suspended ceiling to provide for prompt detection. Also, due to the insignificant amount of cables routed in the affected areas, fire propagation and sustained combustion is not expected. The licensee also stated the cabling in the identified areas does not compromise automatic or manual fire suppression functions, fire suppression for systems and structures, or post-fire SSD capability.

Based on its review of the information submitted by the licensee, and subject to completion of LAR, Attachment S, Table S-3, Implementation Item IMP-30 (see SE Section 3.1.1.6), and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.3.5.1, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains safety

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

3.1.4.4 NFPA 805, Section 3.3.5.2 – Metal Tray and Conduit Electrical Raceways

In LAR, Attachment L, Approval Request 4, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.3.5.2 requirement regarding use of metal tray or conduit for electrical raceways. Specifically, this section of NFPA 805 requires that thin-wall metallic tubing, also known as EMT, not be used for power, instrumentation, or control cables. The licensee stated that PBNP currently uses exposed EMT to route cables in various locations throughout the plant.

The licensee stated that Article 358.10(A) of the National Electric Code (NEC), 2011 Edition (Reference 93), states, "The use of EMT shall be permitted for both exposed and concealed work." The licensee further stated that according to the NFPA Report on Proposals for revision to NFPA 805, 2001 Edition, Section 3.3.5.2 was revised for consistency with NFPA 70 to remove the sentence regarding thin-wall metallic tubing and the current edition (2010) of NFPA 805 (Reference 94), retains this change. The licensee stated, the revised section (which is Section 5.3.7.2 in the 2010 Edition) states that "only metal tray and metal conduits shall be used for exposed electrical raceways."

The licensee stated that the change to this code was made by the NFPA Technical Committee on Fire Protection for Nuclear Facilities, which is made up of experts representing varied viewpoints and interests concerning nuclear facility fire protection, through a consensus standards development process.

The licensee stated that the basis for the approval request is:

- EMT is non-combustible.
- The NEC permits the use of EMT in applications where it is not subject to physical damage.
- The 2010 edition of NFPA 805 allows the use of EMT.
- EMT conduit has been installed at PBNP since its original construction, in accordance with original electrical design specifications which allowed for the use of EMT conduit. Its presence has not adversely affected NSPC, radiological release performance criteria, safety margin, or DID.

The licensee stated that the use of EMT conduit in the plant does not affect nuclear safety. The licensee also stated that when installed such that it is not subject to physical damage, EMT is not subject to failure mechanisms resulting in damage to internal circuits or to external targets. The licensee further stated that although EMT is not as robust as traditional rigid metal conduit, EMT is noncombustible and it has some fire resistant properties due to its metal composition, and therefore, the use of EMT does not impact the NSPC.

The licensee stated that the use of EMT has no impact on the radiological release performance criteria. The licensee stated the radiological review was performed based on the potential location of radiological concerns and is not dependent on the construction of metallic conduits.

The licensee further stated that the use of EMT does not add additional radiological materials to the area or challenge plant boundaries.

The licensee stated that the use of EMT conduit will not adversely impact the ability of the plant to achieve and maintain fire SSD. The licensee also stated EMT is noncombustible due to its metallic construction, and, therefore, the safety margin inherent in the analysis for the fire event has been preserved.

The licensee stated the three echelons of DID are: (1) to prevent fires from starting, (2) to rapidly detect, control and extinguish fires that do occur, thereby, limiting damage, and (3) to provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee stated the use of EMT conduit does not affect echelons 1, 2, and 3. The licensee stated that EMT is noncombustible, so it would be resistant to the external fire/heat exposure that would result in structural failure, contribution to fire load, or damage to the circuits routed in the conduit when installed such that it is not subject to physical damage. The licensee further stated that areas where EMT is used are protected by manual fire suppression functions, such as portable fire extinguishers and hose reel stations that are available for manual firefighting activities by the site fire brigade to assure that if a fire was to occur that the damage from the fire would be limited. The licensee further stated the use of these conduits does not directly result in compromising automatic fire suppression functions or manual fire suppression functions and that the use of the EMT conduit does not compromise post-fire SSD capabilities and will not prevent essential safety functions from being performed.

Based on its review of the LAR, and in accordance with 10 CFR 50.48(c)(2)(vii), and notwithstanding the licensee's statements regarding the current edition of NFPA 805, which is not cited or endorsed by the NRC, the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.3.5.2, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains safety margins; and, maintains fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.5 NFPA 805, Section 3.3.7.1 – Storage of Flammable Gas

In LAR, Attachment L, Approval Request 5, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.3.7.1 requirement that flammable gas be stored outdoors or in separate detached buildings so that a fire or explosion will not adversely impact systems, equipment or components important to nuclear safety. NFPA 805, Section 3.3.7.1, further requires that hydrogen storage follow the provisions of NFPA 50A (Reference 81). Specifically, the licensee requested approval of a PB method to justify the separation distances between the hydrogen storage system and the adjacent turbine building.

The licensee stated that the following engineering analysis is provided for purposes of requesting NRC approval of the separation distance between the existing exterior hydrogen system and the turbine building, which is within the minimum distances described below in the Code Requirements Summary:

- Hydrogen System Configuration:

  The hydrogen storage system at PBNP is located outside at ground level, just east of the turbine building. The hydrogen system consists of horizontal hydrogen vessels in a stacked configuration and each of these high-pressure hydrogen vessels measures 24 feet in length and 2 feet in diameter, and each has a volume of 9,346 standard cubic feet. The vessels are ASME Section VIII rated steel tubes having a maximum working pressure of 2,800 psi (pounds per square inch) and the vessels are hydrostatically tested to 4,200 psi . In addition, Underwriters Laboratory (UL) listed pressure regulators, ASME Section VIII rated pressure relief valves, and vessel vent tubes are installed for the hydrogen storage system. The entire pre-fabricated assembly is electrically grounded and secured to a concrete foundation embedded in the ground.

  The hydrogen system is surrounded by fixed barriers on all sides. A ten foot high continuous sheet steel crash barrier is located to the north and east of the hydrogen system. A steel crash guard assembly consisting of two (2) steel vertical poles and ten (10) horizontal steel bars spaced approximately one (1) foot vertically on center is located to the south of the hydrogen system. This barrier is 14 feet wide by 12 feet high. The turbine building east wall is located 20.7 feet (measured horizontally) to the west of the system. The lower 20 vertical feet of this wall measured from grade is of concrete construction with the remainder of the wall constructed of unprotected sheet metal. The bottom of the unprotected sheet metal portion of the building wall is 25.5 feet from the hydrogen system, measured diagonally.

  An unprotected rolling steel door, an unprotected single leaf swinging door, and a louver are present in the turbine building east wall opposite the hydrogen system at grade. Several louvers are present just below the roof line at an elevation of approximately 100 feet. Roll-up doors are present in the turbine building east wall above the hydrogen storage location.

  A liquid nitrogen storage tank is located approximately 14.5 feet from the hydrogen system and is near the turbine building rolling steel door. The tank is surrounded on three (3) sides by guardrails standing approximately one (1) foot off the ground.

- Code Requirements Summary:

  NFPA 567 (Reference 95), Table 2 specifies the minimum separation distances of the hydrogen system from an outdoor exposure. The separation distances are based primarily on three criteria: size/volume of the hydrogen system, type of outdoor exposure, and the construction type of the outdoor exposure. For PBNP, the total hydrogen system volume is in excess of 15,000 scf, therefore the criteria for hydrogen quantity "in excess of 15,000 cubic feet" contained in Table 2 apply to this plant configuration. The code requirements of Table 2 are summarized as follows:

- The turbine building is constructed of non-combustible concrete and sheet metal. Although the lower portion of the concrete wall is horizontally adjacent to the hydrogen system, the more restrictive separation distance criteria for "non-combustible construction" in Table 2 is used, as the higher portions of the wall is constructed of sheet steel. Therefore, the required separation distance between the turbine building and the hydrogen system is 25 feet.
- Table 2 also specifies that the turbine building wall openings, such as the doors and louver located at grade, be separated from the hydrogen system by a minimum 10 feet when the openings are not above any part of the hydrogen system. The turbine building east wall and openings located at grade are approximately 35 feet away from the hydrogen system.

In FPE RAI 07 (Reference 22), the NRC staff requested that the license provide additional information depicting the layout and cross sections of the hydrogen storage facility and the turbine building wall with sufficient detail to understand the separation distances, openings and any protective features being credited, including an explanation of the apparent discrepancy between the 20.7 feet and 35 feet distances from the hydrogen storage system and the turbine building east wall, and a description of how the openings above the hydrogen storage system meet the separation requirements. In its response to FPE RAI 07 (Reference 10), the licensee confirmed that the horizontal distance from the hydrogen tanks to the east wall of the turbine building is 20.7 feet, which is less than the 25 feet required by NFPA 567, and the distance from the tanks to the closest opening on the east wall that is not above any part of the system is 35 feet (i.e., a louver located south of the tanks and adjacent to the ground floor roll-up door). The licensee also stated the 35 feet exceeds the 10 feet separation distance required by the code for openings at grade and not located above the system. The licensee further stated there are no openings on the east wall of the turbine building located directly above the hydrogen tanks and that the closest opening on the east wall that is above the upper hydrogen tanks is a (second floor) roll-up door located 13 feet north and 12 above the elevation of the tank with a line-of-sight distance of 26.8 feet, which is greater than the 25 feet required by NFPA 567.

In its review of the licensee's response to FPE RAI 07, the NRC staff found that ventilation ducts are located on the exterior of the turbine building wall adjacent to the hydrogen storage tanks. In FPE RAI 07.01 (Reference 24), the NRC staff requested that the licensee provide additional descriptions of the turbine building ducts, including construction details and location of ventilation openings. The NRC staff also requested that the licensee provide justification for citing the 25-foot separation requirement of NFPA 567 in lieu of the 50-foot requirement for ventilation inlets. In its response to FPE RAI 07.01 (Reference 14), the licensee stated that the air shafts on the exterior of the turbine building are uninsulated metal siding on steel frame. The licensee also stated that the shafts are fully enclosed on the exterior with the exception of intake louvers located at the 97'-10" elevation, which are located approximately 70 feet above the highest point of the hydrogen storage tank vent pipe and is the highest point of the hydrogen storage system. The licensee further stated that this distance is greater than the 50 foot minimum required by NFPA 567-1963, Table 2, Item 11, for the separation of hydrogen system from air compressor intakes or inlets to ventilating or air conditioning equipment. The licensee further stated that the 50-foot separation requirement of NFPA 567, Table 2, Item 11, also applies to hydrogen system separation from air compressor intakes and that the closest air

compressor intakes to the hydrogen system are located on the east side of the turbine building wall between columns 12.1 and 13.1, approximately 60 feet to the south of the hydrogen storage area, and thus meet the 50 foot requirement. The NRC concludes the licensee's responses to FPE RAI 07 and FPE RAI 07.01 are acceptable because the licensee provided sufficient detail of the layout and orientation of the hydrogen storages tanks relative to the turbine building and associated openings to allow the NRC staff to complete its evaluation and also because the openings in the ventilation shafts and intakes for the air compressors meet the separation requirements of the applicable NFPA code as required by NFPA 805.

The licensee stated that the basis for the approval request is:

- The turbine building east wall, excluding openings, does not meet the required minimum separation requirements. However, based on analysis, the existing separation distance between the turbine building and hydrogen system is acceptable per field survey and review of the PBNP Fire Hazards Analysis Report (FHAR), plant drawings, and combustible loading analysis; which summarizes the following applicable hazards inside the east wall of the turbine building, identified as Fire Zones 547, 583, and 588, and the existing fire protection features within these zones:

    - All fire zones along the east wall of the turbine building in the vicinity of the hydrogen storage area have low combustible loading;
    - Fire Zone 547 is equipped with portable fire extinguishers and hose reels;
    - Fire Zone 583 is equipped with a partial wet pipe sprinkler system, a partial water spray suppression system, portable fire extinguishers, and hose reels;
    - Fire Zone 588 is provided with a partial wet pipe sprinkler system, portable fire extinguishers and hose reels;
    - Suppression systems are monitored by the Control Room for the primary purpose of initiating Fire Brigade response and firefighting activities if deemed necessary. No plausible fire initiating in the turbine building is anticipated to impact the exterior hydrogen system.
    - The turbine wall at grade is concrete and the likelihood of a fire propagating through the wall and providing an exposure fire to the nearby hydrogen system is remote given the mitigating factors discussed herein.

- Field survey confirmed that the separation distance of the unprotected wall openings exceeds the minimum required distance of 10 feet from the hydrogen system.
- The liquid nitrogen in the proximity of the hydrogen system is not a combustible or flammable liquid/gas hazard and therefore is not considered a hazard to the hydrogen system.
- Combustible loading and ignition source/hot work controls are implemented at PBNP to significantly reduce the likelihood of a fire throughout the plant or involving the exterior hydrogen system.

The licensee stated the location of the hydrogen system at PBNP does not affect nuclear safety as the hydrogen system is located outside and is protected from exposing fire hazards as

discussed above. The licensee also stated that given the system configuration relative to the turbine building, a hydrogen system fire or explosion at this exterior location would not impact any safety related targets in the adjacent turbine building. The licensee further stated that the hydrogen system is provided with listed/certified equipment and inherent safety features to prevent a hydrogen fire and/or explosion and that combustible loading and ignition source/hot work controls are implemented at PBNP to significantly reduce the likelihood of a fire throughout the plant or involving the exterior hydrogen system, and therefore, there is no impact on the NSPC.

The licensee stated the presence of the exterior hydrogen system has no impact on the radiological release performance criteria. The licensee stated that the radioactive release review was performed based on the potential location of radiological concerns and is not dependent on the presence of the exterior hydrogen system. The licensee further stated that the hydrogen system does not add additional radiological materials to the area or challenge plant boundaries.

The licensee stated the hydrogen storage system located outside will not adversely impact the ability of the plant to achieve and maintain fire SSD even if a fire occurred in the exposing turbine building. The licensee stated that given the system configuration relative to the turbine building, a hydrogen system fire or explosion at this exterior location would not impact any safety related targets in the adjacent turbine building and the hydrogen system is provided with listed/certified equipment and inherent safety features to prevent a hydrogen fire and/or explosion. The licensee further stated that combustible loading and ignition source/hot work controls are implemented at PBNP to significantly reduce the likelihood of a fire throughout the plant or involving the exterior hydrogen system, and, therefore, the safety margin inherent in the analysis for the fire event has been preserved.

The licensee stated the three echelons of DID are: (1) to prevent fires from starting, (2) to rapidly detect, control and extinguish fires that do occur thereby limiting damage, and (3) to provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee stated the presence of the exterior hydrogen storage system does not affect echelons 1, 2 and 3. The licensee stated that combustible loading and ignition source/hot work controls are implemented to significantly reduce the likelihood of a fire throughout the plant or involving the exterior hydrogen storage system. The licensee also stated that the presence of the exterior hydrogen storage system does not directly result in compromising automatic fire suppression functions or manual fire suppression functions, and does not compromise post-fire SSD capabilities.

Based on its review of the LAR, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.3.7.1, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains safety margins; and, maintains fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.6 NFPA 805, Sections 3.5.3 and 3.5.6 – Fire Pump Design, Installation, and Control

In LAR, Attachment L, Approval Request 6, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.5.3, requirement for fire pumps to be designed and installed in accordance with NFPA 20 (Reference 56), and the NFPA 805, Section 3.5.6, requirement that fire pumps be provided with automatic start and manual stop only. Specifically, the licensee has requested approval of a PB method to justify that the circuit breaker for the electric motor-driven fire pump be capable of holding stalled rotor current indefinitely and have a minimum rating of 14,000 amps. The NRC staff found that LAR, Section 4.1.2.3, and LAR, Attachment A, indicate that approval is needed for an automatic stop function per NFPA 805 Section 3.5.6; however, the approval request did not address NFPA 805, Section 3.5.6, beyond citation of the actual requirement.

In FPE RAI 05 (Reference 22), the NRC staff requested that the licensee provide the basis for approving the automatic stop capability of the fire pump. In its response to FPE RAI 05 (Reference 10), the licensee stated that the electric motor-driven and diesel engine-driven fire pumps meet the requirements of NFPA 805, Section 3.5.6, by design as the pumps are both configured to start automatically on low system pressure and can also be started manually, and must be shut down manually at their respective local control panels. The licensee clarified that the applicability of NFPA 805, Section 3.5.6, to the approval request is to address two instances by which the electric motor-driven fire pump can stop automatically without manipulation of local fire pump controls which are: (1) a trip of the Class IE emergency power circuit breaker for the pump motor, and (2) in the event of an engineered safety feature (ESF) actuation that initiates an automatic load shedding sequence to avoid overloading the emergency diesel generator (EDG) upon startup. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the fire pump controls meet the requirements of NFPA 805 since the pumps must be shut down manually at the local control panel as required by NFPA 805, Section 3.5.6, and only inadvertent power failure or an ESF initiated load-shedding of the emergency power bus supplying the motor-driven pump would result in automatic shutdown, and because for loss of power events, the redundant diesel-driven fire pump can provide fire water supply.

The licensee stated that one electric motor-driven fire pump and one diesel-driven fire pump, each capable of supplying 100 percent of the maximum sprinkler system and hose stream hydraulic demand, are installed in the service water pump room of the circulating water pumphouse. The licensee also stated that the electric motor-driven fire pump is connected to a Class IE emergency power supply, that the two fire pumps have independent power supplies and controls, and that the fire pumps were reviewed against the requirements of the 1968 edition of NFPA 20 (Reference 56).

The licensee stated that specifically for this approval request:

- Section 433a of NFPA 20 states: "Such devices (i.e. power supply protective device-circuit breaker) when installed in the power supply circuits at utility plants, substations, or plant load distribution centers ahead of the fire pump feeder circuits shall hold indefinitely stalled rotor current conditions of the fire pump motor(s) under maximum plant load";

- Section 433b of NFPA 20 states: "Such devices (i.e. power supply protective device-circuit breaker) when installed in the fire pump feeder circuit shall hold

indefinitely stalled rotor current of the fire pump motor(s) and other necessary associated fire pump installation electrical accessories"; and

- Section 514b8 of NFPA 20 states: "Its interrupting rating shall be adequate for the circuit in which it is used, and in no case be less than 14,000 amperes (symmetrical)."

The licensee stated that the circuit breaker for the electric motor-driven fire pump was not designed to hold stalled rotor current indefinitely and does not have a minimum rating of 14,000 amps (amperes). The licensee also stated that the current arrangement has existed since original installation and was based on providing adequate coordination at the switchgear and sufficient electrical protection for the fire pump's electric motor. The licensee further stated that features are provided to ensure the electric motor does not inadvertently trip, or fail the primary incoming power supply to the switchgear.

The licensee stated that the basis for the approval request for use of the existing Class IE emergency power supply circuit breaker for the electric motor-driven fire pump is:

- The existing circuit breaker provided for the motor-driven fire pump has been designed with considerable overload protection which assures that the motor does not inadvertently trip even under dead start, full load conditions. The existing circuit breaker protection provided for the motor-driven fire pump uses a 480V switchgear breaker with an instantaneous setting of 3,000 amps (magnetic pickup) and a long time pickup of 500 amps. Comparing the circuit breaker longtime current setting with the motor full load current value indicates a ratio of approximately 1.6 to 1. This "current" ratio is significantly greater than standard industry "current" ratio for motors in general. In addition, comparing the circuit breaker instantaneous setting of 3,000 amps to the locked rotor current of the motor results in a ratio of approximately 10 to 1. Therefore, considerable safety margin has been provided in the design of the existing circuit breaker with regard to operation of the motor-driven fire pump.

- Operating experience and test results have confirmed the adequacy of the existing circuit breaker and electric motor-driven fire pump configuration. The circuit breaker has a history of reliability and has proven not to fail the primary incoming power supply to the switchgear or cause inadvertent trips and/or pump start failure under dead start, full load conditions or normal operating load conditions.

- In the unlikely event of a circuit breaker trip, administrative procedures require Operations to immediately investigate the condition and restore this power supply when it is confirmed it is electrically safe to perform such action. In the interim, a diesel-driven fire pump is available and is designed to automatically start if the electric pump has stopped. NFPA 20, Sections 433a, 433b, and 514b8 do not discuss the presence of a redundant diesel-driven fire pump in a NPP application; they discuss the circuit breaker requirement for a single electric motor-driven fire pump. Under normal operating conditions, two redundant fire pumps with independent power supplies and controls are available to serve 100

percent of the maximum sprinkler system and hose stream hydraulic demand at PBNP. As indicated in IT&M test results, the redundant fire pumps remain capable of performing their intended design function.

- In accordance with the plant operations manual, in the unlikely event that both fire pumps are inoperable, a backup fire main loop water supply is established within 24 hours. A fire department pumper connection is provided to supply the site fire main, and a separate fire department suction connection is provided from the circulating water pumphouse forebay to allow suction directly from Lake Michigan. The Two Creeks Volunteer Fire Department is available to respond with a fire pumper truck in a fire emergency.

- In accordance with the plant operations manual, if both fire pumps are inoperable and a backup fire main loop water supply cannot be made operable within 24 hours, both reactors are placed in MODE 3 within the next 6 hours and in Mode 5 within the following thirty (30) hours.

- The current circuit breaker protection for the motor provides adequate electrical protection at the switchgear. Installing a larger circuit breaker would disrupt the bus protection and would require a total re-design to ensure the power supply remains available. Additionally, a larger size breaker will not physically fit inside the switchgear. For reasons stated above, installation of a larger circuit breaker is not feasible and does not significantly increase the level of fire and life safety provided by the existing configuration. Therefore, modification of the existing configuration is not warranted.

The licensee stated that the use of the power supply circuit breaker for the electric motor-driven fire pump does not adversely affect nuclear safety capability, given the significant safety margin provided in the circuit breaker design, a history of reliability of the existing configuration in addition to the backup capability of the diesel-driven fire pump, and the precautions implemented per the PBNP operations manual; and therefore, there is no impact on the NSPC.

The licensee stated that the use of the power supply circuit breaker for the electric motor-driven fire pump has no impact on the radiological release performance criteria. The licensee stated the radioactive release review was performed based on the potential location of radiological concerns and is not dependent on the capacity of the power supply circuit breaker for the electric motor-driven fire pump.

The licensee stated the use of the power supply circuit breaker for the electric motor-driven fire pump does not adversely affect safety margin, given the significant safety margin provided in the circuit breaker design, a history of reliability of the existing configuration in addition to the backup capability of the diesel-driven fire pump, and the precautions implemented per the PBNP operations manual. The licensee concluded that the safety margin inherent in the analysis for the fire event has been preserved.

The licensee stated the three echelons of DID are: (1) to prevent fires from starting, (2) to rapidly detect, control and extinguish fires that do occur, thereby, limiting damage, and (3) to provide adequate level of fire protection for systems and structures so that a fire will not prevent

essential safety functions from being performed. The licensee stated the use of the Class IE emergency power supply circuit breaker for the electric motor-driven fire pump does not affect echelons 1, 2 and 3. The licensee stated that the existing circuit breaker provided for the motor-driven fire pump has been designed with considerable overload protection which assures that the motor does not inadvertently trip even under dead start, full load conditions. The licensee further stated that in the unlikely event of a circuit breaker trip, administrative procedures require operations to immediately investigate the condition and restore the power supply when it is confirmed it is electrically safe to perform such action, and that in the interim, a diesel-driven fire pump is available and is designed to automatically start if the electric pump has stopped. The licensee further stated that in the unlikely event that both fire pumps are inoperable, a backup fire main loop water supply is established within 24 hours, and that if a backup fire main loop water supply cannot be made operable within 24 hours, both reactors are placed in mode 3 within the next 6 hours and in mode 5 within the following thirty (30) hours. The licensee also stated that the circuit breaker and fire pump configuration does not directly result in compromising automatic or manual fire suppression functions, and does not directly result in compromising post-fire SSD capability.

In its letter dated August 26, 2015 (Reference 17), the licensee clarifed that upon the emergency diesel generator loading, electric fire pump P-35A will be stripped from bus 1B-03. The availability of the redundant diesel-driven fire pump and backup fire main loop water supply as discussed above satisfies the intent of the NFPA 20 code requirement.

Based on its review of the LAR, as supplemented, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Sections 3.5.3 and 3.5.6, requirements because it 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 (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.7 NFPA 805, Sections 3.5.13 and 3.6.1 – Design and Installation of Standpipes

In LAR, Attachment L, Approval Request 7, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the requirement of NFPA 805, Sections 3.5.13 and 3.6.1, regarding the design of standpipe and hose stations. Specifically, the licensee requested approval of a PB method to justify the use of non-listed or approved control valves in fire protection systems.

The licensee stated that the Unit 1 and Unit 2 containment structure hose station assemblies were reviewed against NFPA 14, 1963 Edition (Reference 96). The licensee stated that Section 413 of NFPA 14 states, "Valves of approved type should be provided at the main riser for controlling branch lines to hose outlets so that in the event that the branch is broken during the fire, the fire department may shut off this branch, conserving the water for their use."

The licensee stated that as documented in the August 2, 1979, SER (Reference 28), each unit contains five fire hose stations within each containment structure. The licensee stated that in each unit, there is one hose reel station located at the 8'-0" elevation, a hose reel station located at the 21'-0" elevation, two hose reel stations at the 46'-0" elevation, and one hose reel station

at the 66'-0" elevation. The licensee also stated that per Section 4.3.1(3) of the SER, each containment hose reel system is served by the service water system. The licensee further stated that all interior fire protection systems are supplied from two directions assuring continuity of service even if one feed is shut off or a break should occur in one of the supply mains. The licensee further stated the hydraulic flow demands of these fire protection systems have been designed to be well within the capabilities of the service water pumps and that hose reel station control valves are not UL listed and/or Factory Mutual approved.

The licensee stated that the basis for the approval request for use of service water system (SWS) hose reel station control valves not listed or approved for fire protection service in the containment structures is:

- The hydraulic flow demands of these fire protection systems have been designed to be well within the capabilities of the service water pumps. The design and manufacturing criteria for the service water system control valves is adequate to ensure that these valves function properly when used for fire hose reel station control valve purposes. Replacement of these valves with valves approved for fire service is not warranted and does not significantly enhance the level of fire and life safety.

- The SWS hose reel station control valves are standard heavy-duty industrial type valves for which their functionality is not expected to be affected during a fire emergency. The valves are capable of withstanding the static and residual pressures expected for this fire protection function.

- The SWS hose reel station control valves are provided with identification tags and are administratively controlled. The position of the valves is verified locally during periodic inspections.

- The SWS that supplies the containment hose reel systems also supplies the automatic sprinkler systems in the G-01 and G-02 Diesel Generator (DG) rooms. In Section 4.3.1(5)(d) of the August 2, 1979, NRC SER, the NRC accepted the Service Water supply configuration to the DG Rooms G-01 and G-02 sprinkler systems, contingent upon upgrading the manual deluge sprinkler systems to automatic type sprinkler systems. The NRC approved sprinkler systems permitted the use of existing non-listed control valves supplied by the SWS. Therefore, acceptance of similar non-listed containment hose reel station control valves is requested.

The licensee stated that the use of SWS hose reel station control valves not listed or approved for fire protection service in the containment structures does not adversely affect nuclear safety capability. The licensee also stated that the SWS control valves are standard heavy-duty industrial type valves which are capable of satisfying NFPA 14 hydraulic design criteria during a fire emergency. The licensee further stated that the design and manufacturing criteria for the SWS control valves is adequate to ensure that these valves function properly when used for fire hose reel station control valve purposes. The licensee concluded that there is no impact on the NSPC.

The licensee stated the use of SWS hose reel station control valves not listed or approved for fire protection service in the containment structure has no impact on the radiological release performance criteria. The licensee also stated that the radioactive release review was performed based on the potential location of radiological concerns and is not dependent on the "listing" of the hose valves. The licensee further stated as the service water system control valves are standard heavy-duty industrial type valves expected to function properly during a fire event, flooding in the containment structures (i.e., potentially contaminated areas) due to faulty or "unlisted" equipment used for fire protection purposes is not expected.

The licensee stated that the SWS control valves are standard heavy-duty industrial type valves which are capable of satisfying NFPA 14 hydraulic design criteria during a fire emergency. The licensee also stated that the design and manufacturing criteria for the SWS control valves is adequate to ensure that these valves function properly when used for fire hose reel station control valve purposes. The licensee further stated that replacement of these valves with valves approved for fire service is not warranted and does not significantly enhance the level of fire and life safety. The licensee concluded that the safety margin inherent in the analysis for the fire event has been preserved.

The licensee stated the three echelons of DID are: (1) to prevent fires from starting, (2) to rapidly detect, control and extinguish fires that do occur, thereby, limiting damage, and (3) to provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee stated the use of the service water system control valves does not affect echelons 1, 2 and 3. The licensee stated that the hydraulic flow demands of these fire protection systems have been designed to be well within the capabilities of the service water pumps and that the design and manufacturing criteria for the SWS control valves is adequate to ensure that these valves function properly when used for fire hose reel station control valve purposes. The licensee further stated that the service water system hose reel station control valves are standard heavy-duty industrial type valves for which their functionality is not expected to be affected during a fire emergency. The licensee stated that the use of the SWS control valves does not directly result in compromising automatic or manual fire suppression functions, and does not directly result in compromising post-fire SSD capability.

Based on its review of the LAR, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Sections 3.5.13 and 3.6.1, requirement because it satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains safety margins; and, maintains fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire SSD capability).

3.1.4.8 NFPA 805, Section 3.5.16 – Dedicated Fire Protection Water Supply

In LAR, Attachment L, Approval Request 8, the licensee requested approval of a PB method to demonstrate an equivalent level of fire protection for the NFPA 805, Section 3.5.16, requirement regarding the dedication of the fire water supply system for fire protection use only. Specifically, the licensee requested approval of a PB method to justify the use of the fire protection water supply for non-fire protection functions.

The licensee stated the Control Room currently has the authority to approve manual use of fire protection systems for augmented non-fire protection functions under the following conditions:

- Approval from the control room is documented;
- As discussed below, the augmented non-FP functions for which approval is requested involve manual operator actions and direct communication and instruction from the control room. As such, controls are in place to ensure the non-FP system water demand can be secured if a fire occurs.
- The non-FP system water demand must be less than 500 [gallons per minute] gpm, which is less than the maximum calculated site hose stream demand of 750 gpm.

The licensee stated that the basis for the approval request is:

- Per plant documentation, the 500 gpm is less than the 750 gpm manual hose stream demand calculated in determining the minimum fire protection hydraulic flow requirements. Therefore there is no adverse impact on the flow and pressure available to any automatic water based suppression system. The Control Room and manual operator have the ability to adjust the hose stream flow rate for manual non-fire protection functions as deemed necessary. The water demand of any non-fire protection application will be administratively controlled by plant procedures to never be more than 500 gpm , which is conservative given the hose stream allowance at PBNP is 750 gpm.
- Manual operators using the fire protection water are in contact with the Control Room, therefore ensuring the ability to secure the non-fire protection system water demand should a fire condition occur. Therefore, water flow will be available for the manual fire suppression hose stream application demands as calculated.

The licensee stated that although procedures will address controls in place to cease the non-fire protection system functions should a fire condition occur (see Implementation Item IMP-119 in Attachment S), there is an inherent safeguard in place which accounts for the potential "dual" use of the fire protection system during the initial actuation of an automatic fixed fire suppression system. The licensee also stated that as determined in the fire protection hydraulic calculations, the maximum hydraulic demand of the automatic fire suppression system will be available even if 500 gpm of fire protection hose stream water is being used in a non-fire protection system application. The licensee further stated that it is reasonable to expect that the maximum hydraulic demand for the automatic suppression system will be available in the unlikely event that a delay in ceasing non-fire protection system operations was to occur. The licensee further stated that due to control room and manual operation communications, it is reasonable to expect that non-fire protection system functions will be stopped at fire initiation, or very shortly thereafter, and prior to application of fire brigade manual hose streams.

The licensee stated that the manual use of fire protection water for augmented non-fire protection functions is an "off-normal" occurrence requiring control room approval as will be addressed in site procedures (see Implementation Item IMP-119 in Attachment S). The licensee stated the non-fire protection flow demands ensure that there is no impact on the ability of the automatic suppression systems to perform their function as hydraulically designed. The

licensee further stated that the ability to isolate/cease the non-fire protection flow applications ensures there is no impact on manual fire suppression efforts. The licensee concluded that there is no impact on the NSPC.

The licensee stated that the manual use of fire protection water for augmented non-fire protection functions has no impact on the radiological release performance criteria. The licensee also stated that the radioactive release review was performed based on the potential location of radiological concerns and is not dependent on the use of fire protection water for augmented non-fire protection functions. The licensee further stated that such augmented non-fire protection water applications do not add additional radiological materials to any plant area or challenge plant boundaries.

The licensee stated that the manual use of fire protection water for augmented non-fire protection functions is an "off-normal" occurrence requiring control room approval and will be addressed in site procedures (see Implementation Item IMP-119 in Attachment S). The licensee also stated the non-fire protection flow demands ensure that there is no impact on the ability of the automatic suppression systems to perform their function as hydraulically designed. The licensee further stated that the ability to isolate/cease the non-fire protection flow applications ensures there is no impact on manual fire suppression efforts. The licensee concluded that the safety margin inherent in the analysis for the fire event has been preserved.

The licensee stated the three echelons of DID are: (1) to prevent fires from starting, (2) to rapidly detect, control and extinguish fires that do occur thereby limiting damage, and (3) to provide adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed. The licensee stated the manual use of fire protection water for augmented non-fire protection functions does not affect echelons 1, 2, and 3. The licensee stated that the 500 gpm is less than the 750 gpm manual hose stream demand calculated in determining the minimum fire protection hydraulic flow requirements, and therefore, there is no adverse impact on the flow and pressure available to any automatic water-based suppression system. The licensee further stated that manual operators using the fire protection water are in contact with the Control Room which ensures the ability to secure the non-fire protection system water demand should a fire condition occur. The licensee further stated that the manual use of fire protection water for augmented non-fire protection functions is an off normal occurrence requiring control room approval (see Implementation Item IMP-119 in Attachment S) and that the non-fire protection flow demands ensure that there is no impact on the ability of the automatic suppression systems to perform their function as hydraulically designed. The licensee also stated that the manual use of fire protection water for augmented non-fire protection functions does not directly result in compromising automatic or manual fire suppression functions, and does not directly result in compromising post-fire SSD capability.

Based on its review of the LAR and subject to completion of LAR, Attachment S, Table S-3, Implementation Item IMP-119 (see SE, Section 3.1.1.6), 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, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release; maintains safety margins; and, maintains fire protection DID (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 that:

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

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

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

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

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

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

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

> Fire protection features shall be capable of providing reasonable assurance that, in the event of a fire, the plant is not placed in an unrecoverable condition. To demonstrate this, the following performance criteria shall be met.
>
> (a) *Reactivity Control.* Reactivity control shall be capable of inserting negative reactivity to achieve and maintain subcritical conditions.

Negative reactivity inserting shall occur rapidly enough such that fuel design limits are not exceeded.

(b) *Inventory and Pressure Control.* With fuel in the reactor vessel, head on and tensioned, inventory and pressure control shall be capable of controlling coolant level such that subcooling is maintained for a PWR 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; and

(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. SE, Section 3.5, addresses the assessment of the fourth topic.

Revision 1 of RG 1.205 (Reference 4), endorses NEI 04-02, Revision 2 (Reference 7), and Chapter 3 of NEI 00-01, Revision 2, (Reference 33), 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 Worksheet," and NEI 00-01, Chapter 3, has been determined to address the related requirements of NFPA 805, Section 2.4.2. The NRC staff reviewed LAR, Section 4.2.1, "Nuclear Safety Capability Assessment Methodology," and LAR, Attachment B, "NEI 04-02, Table B-2 – Nuclear Safety Capability Assessment – Methodology Review," against these guidelines.

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

- Selecting systems and components required to meet the NSPC;
- Selecting the cables necessary to achieve the NSPC;
- Identifying the location of nuclear safety equipment and cables; and
- Selecting 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. Based on the information provided in the licensee's submittal, as supplemented, the NRC staff concludes that the licensee used a systematic process to evaluate the post-fire SSA 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 62), provides one acceptable method for documenting the comparison of the SSA 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 2, and documenting the results of the review in the LAR, Attachment B, "NEI 04-02 Table B-2 – Nuclear Safety Capability Assessment – Methodology Review," in accordance with NEI 04-02, Revision 2.

The licensee used the following categories to describe alignment with the NEI 00-01, Chapter 3, attributes:

1. The SSA directly aligns with the attribute: noted in LAR, Table B-2, as "Aligns." (see discussion in SE, Section 3.2.1.1)
2. The SSA aligns with the intent of the attribute: noted in LAR, Table B-2, as "Aligns with Intent." (see discussion in SE, Section 3.2.1.2)

The licensee did not use any of the following categories to describe alignment with the NEI 00-01, Chapter 3, attributes, and as such there is no discussion of these in the SE:

1. The SSA does not align with the attribute, but there is a prior NRC approval of an alternative to the attribute, and the bases for the NRC approval remain valid: noted in LAR, Table B-2, as "Not in Alignment, but Prior NRC Approval."

2. The SSA does not align with the attribute, but there are no adverse consequences because of the non-alignment: noted in LAR, Table B-2, as "Not in Alignment, but No Adverse Consequences."
3. The SSA does not align with the attribute: noted in LAR Table B-2 as "Not in Alignment."

For attributes that may not be applicable to the SSA (e.g., the attribute may be applicable only to boiling-water reactors (BWRs) or pressurized-water reactors (PWRs) were noted by the licensee in LAR, Attachment B, as "Not Applicable."

The NRC staff 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. The process defined in the endorsed guidance provides an organized structure to document each attribute in NEI 00-01, Chapter 3, allowing the licensee to provide significant detail 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 licensee in the LAR, as supplemented, the NRC staff concludes that the licensee's statements of alignment are acceptable because the analyses are consistent with regulatory guidance for selecting the systems and equipment and their interrelationships necessary to achieve the NSPC, selection of the cables necessary to achieve the NSPC, and the identification of the location of nuclear safety equipment and cables.

3.2.1.2 Attribute Alignment -- Aligns with Intent

For several of the NEI 00-01, Chapter 3, attributes, the licensee determined that the SSA aligns with the intent of the attribute, and provided additional clarification when describing its means of alignment. The attributes identified in LAR, Attachment B, as having this condition are:

Sections:

- 3.2.2.1
- 3.5.2.2
- 3.5.2.4
- 3.5.2.5

For Attribute 3.2.2.1, the licensee applied a similar means or method to achieve the intended result of the NEI 00-01 guidance to identify SSD equipment. Rather than highlight piping and

instrumentation diagram (P&ID) drawings, the licensee reviewed P&IDs, electrical drawings, instrument loop diagrams, and other design documents to identify logical relationships between systems-to-components and components-to-components and modeled these logical relationships in the analysis software used to perform the NSCA. The NRC staff concludes that the methods as described by the licensee are acceptable because they are similar to the specific methods in NEI 00-01, and, therefore, align with the intent of NRC-endorsed guidance which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2.

For Attributes 3.5.2.2, 3.5.2.4, and 3.5.2.5, the licensee stated that the methods applied to evaluate the circuit failure modes described in these attributes are consistent with the NEI 00-01 guidance, but evaluations have identified circuit coordination and common enclosure issues that require resolution. The licensee identified in LAR, Attachment B, where modifications are necessary to address these issues and referred to LAR, Attachment S, Table S-2, "Modifications and Implementation Items." In SSA RAI 01.a (Reference 22), the NRC staff requested that the licensee clarify which modifications listed in LAR, Attachment S, are associated with the Attributes 3.5.2.4 and 3.5.2.5. In its response to SSA RAI 01.a (Reference 12), the licensee stated that LAR, Attachment B, Element 3.5.2.4, "Circuit Failures Due to Inadequate Circuit Coordination," indicates four references to LAR, Attachment S. The licensee stated the specific modifications in LAR, Attachment S, that correspond with these references are:

- MOD-26-1 for 480V Motor Control Centers - MCC B-21 Coordination.
- MOD-26-3 for 120VAC Distribution Panel Coordination.
- MOD-26-2 for 125VDC Distribution Panel Coordination.
-

In the LAR supplement dated August 26, 2015 (Reference 17), the licensee changed the alignment strategy for Attribute 3.5.2.4 to aligns.

The licensee further stated that LAR, Attachment B, Element 3.5.2.5, "Circuit Failures Due to Common Enclosure Concerns," indicates two references to LAR, Attachment S. The specific modifications in LAR, Attachment S, that correspond with these references are:

- MOD-24 for 480V MCC cables not protected for overload.
- MOD-24 for 120VAC power cables thermal withstand capability.

The licensee provided revised pages to LAR, Attachment B, (Reference 17), that include the specific identification of the LAR, Attachment S, modifications described above. The NRC staff concludes that the licensee's response to SSA RAI 01.a is acceptable because it identifies the specific modifications from LAR, Attachment S, that are referenced in LAR, Attachment B, as necessary to meet the NRC-endorsed guidance of NEI 00-01, Revision 2.

The NRC staff concludes that the methods as described by the licensee are acceptable because they are similar to the specific methods in NEI 00-01, and, therefore align with the

intent of NRC-endorsed guidance which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2. The NRC staff also concludes that the actions identified by the licensee and included in LAR, Attachment S, Table S-2, are acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

3.2.1.3 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 the NRC-endorsed process described in NEI 00-01, Revision 2, Chapter 3. The results of the licensee's review 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:

- Met the NRC-endorsed guidance directly; or

- Met the intent of the endorsed guidance and adequate justification was provided.

3.2.2 Maintaining Fuel in a Safe and Stable Condition

The nuclear safety goals, objectives and performance criteria of NFPA 805 allow more flexibility than the previous deterministic FPPs based on Appendix R to 10 CFR 50 and NUREG-0800, Section 9.5.1.1 (Reference 97), 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 achieve and maintain hot standby (Mode 3) conditions. The licensee also stated that although not required to achieve it, the plant should also be capable of maintaining safe and stable conditions while in hot shutdown (Mode 4).

The licensee stated that PBNP has design features and procedures to assure long-term decay heat removal indefinitely in sustained Mode 3 and Mode 4 conditions. The licensee stated that auxiliary feedwater (AFW) is initially supplied from the condensate storage tanks (CSTs), but has an essentially indefinite supply of cooling water from Lake Michigan via the SWS. The licensee further stated that a minimum number of service water pumps needed to provide AFW suction have been demonstrated to be operable for all fire scenarios.

The licensee stated that PBNP has design features and procedures to assure reactor coolant system (RCS) inventory control and reactivity control in sustained Mode 3 or 4 conditions. The licensee stated that the minimum refueling water storage tank (RWST) inventory required by TSs is capable of providing injection of borated water well in excess of 72 hours considering the make-up needs for a maximum postulated reactor coolant pump RCP seal leakage plus the

maximum TS allowable leakage from the RCS. The licensee further stated that consideration of the worst-case spurious operation of equipment that can divert some of the RWST inventory which still allows injection of borated water for at least 45 hours, which should provide sufficient time to provide for make-up inventory to the RWST from onsite or offsite sources.

The licensee stated that PBNP has design features and procedures to maintain RCS pressure control without the use of pressurizer heaters (i.e., charging to maintain pressurizer level and/or establish water-solid conditions) in sustained Mode 3 or 4 conditions. The licensee stated that the operators are instructed to secure the RCPs to help prevent excess depressurization that can result in a loss of sub-cooling margin and they are also instructed to use the charging pumps to help maintain sub-cooling margin, including allowing the pressurizers to go solid, and therefore, the use of pressurizer heaters is not required.

The licensee stated that the plant design and operating procedures will maintain a safe and stable condition such that sufficient time is available for technical support center personnel and additional resources to muster and assess the extent of fire damage, and design and implement actions and/or repairs required to transition to and establish long term cooling.

The licensee described the following methods to maintain safe and stable conditions:

- PBNP has design features and procedures to ensure that an adequate source of inventory is provided for decay heat removal in sustained Mode 3 conditions. If the CST inventory is depleted the AFW pump(s) suction will automatically transfer to the service water supply. Transfer can be automatic or manual from the MCR.

- RCS pressure control is maintained by a combination of charging pump operation, pressurizer power operated relief valves (PORVs) or reactor pressure vessel head vent valves, and steam generator atmospheric dump valves (ADVs). Core decay heat in Mode 3 is rejected to the secondary plant through one or more of the steam generators (SGs), and then to atmosphere through the ADVs.

- The PBNP reactor core design ensures that K-effective is maintained <0.99 while the plant is in sustained Mode 3. Gravity insertion of the control rods into the reactor core will ensure reactivity control is achieved for Mode 3 for the first 24 hours. Subsequently, maintaining K-effective <0.99 for "Safe and Stable" conditions will require boration of the RCS as described in FSAR Chapter 3.2 (Reactor Design).

- Inventory makeup to the RCS may be required to account for expected RCS leakage and minimal RCS shrinkage as well as RCP seal injection. PBNP has design features and procedures to ensure that an adequate source of borated inventory (RWST) is provided for RCS inventory control in sustained Mode 3 utilizing the CVCS [changing and volume control] system and the reactor pressure vessel head vent valves. In addition, the station has determined that Westinghouse SHIELD™ low leakage RCP seals will be installed to reduce or eliminate RCP seal leakage in event of loss of seal cooling. In its letter dated May 3, 2016 (Reference 21), the licensee indicated in LAR, Attachment S, Table

S-1, that MOD-3 to upgrade the RCP seals to Westinghouse shutdown seals has been completed.

- Instrument air supports selected safety related equipment required to achieve a safe and stable condition. Critical loads (Pressurizer PORVs , AFW AOVs [air operated valves]) will be provided with accumulators sized for 24 hours of expected usage (See LAR, Attachment S, Table S-2, MOD-6 and MOD-23).

- Fuel for the emergency diesel generators (EDGs) is provided by a combination of fuel oil (FO) day tanks and FO storage tanks. Sufficient fuel is normally maintained between the two (2) FO Storage Tanks to allow one diesel to operate continuously at the required load for 7 days. At the minimum required level, which is 11,000 gallons in each EDG FO storage tank, one tank could provide enough fuel for an EDG to operate for over 48 hours (FSAR Section 8.8). The maximum load demand is calculated based on the fuel consumption by one EDG for operation at continuous rating for 7 days. This onsite fuel oil capacity is sufficient to operate the EDGs for longer than the time to replenish the onsite supply from outside sources.

The licensee stated that based on the initial achievement of safe and stable conditions, recovery of NSCA equipment that may be required beyond 24 hours has been qualitatively evaluated and determined to have no significant measurable contribution to risk based on:

- The actions required to maintain "safe and stable" conditions are limited.

- Procedures are in place for the "safe and stable" actions described in the LAR.

- Its staff will be trained in the use of the post-fire operating and long-term restoration procedures.

- The lengthy coping period provides reasonable assurance that adequate time is provided for the emergency response organization to be available to augment the minimum plant staffing to support the longer term "safe and stable" actions.

On the basis of the licensee's analysis as described in the LAR, and subject to completion of the modifications described in LAR, Attachment S, Table S-2, the NRC staff concludes that the licensee 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

10 CFR 50.48(c)(2)(iii) limits the use of feed and bleed and states that:

> In demonstrating compliance with the performance criteria of Sections 1.5.1(b) and (c), a high-pressure charging/injection pump coupled with the pressurizer power-operated relief valves (PORVs) as the sole fire-protected safe shutdown path for maintaining reactor coolant inventory, pressure control, and decay heat

> removal capability (i.e., feed-and-bleed) for pressurized-water reactors (PWRs) is not permitted.

The NRC staff reviewed LAR Table 5-3, "10 CFR 50.48(c) – Applicability/Compliance References," and LAR, Attachment C, "NEI 04-02 Table B-3 – Fire Area Transition," to evaluate whether PBNP meets the feed and bleed requirements. The licensee stated in LAR Table 5-3, that feed and bleed is not utilized as the sole fire protected SSD path at PBNP for any scenario. The NRC staff confirmed this by reviewing the designated SSD path listed in LAR, Attachment C, for each fire area. The NRC staff confirmed that all fire area analyses include the SSD equipment necessary to provide decay heat removal without relying on feed and bleed. In addition, the NRC staff found that all fire areas either meet the deterministic requirements of NFPA 805, Section 4.2.3, or the PB evaluation performed in accordance with NFPA 805, Section 4.2.4, demonstrates that the integrated assessment of risk, DID, and safety margins for the fire area is acceptable.

The NRC staff concludes that, based on the information provided in LAR Table 5-3 as well as the fire area analyses documented in LAR, Attachment C, that the licensee meets the requirements of 10 CFR 50.48(c)(2)(iii) because feed and bleed is not utilized as the sole fire-protected SSD path at PBNP.

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 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. As described in LAR, Section 4.2.1.4, the licensee's process for identification and evaluation of MSOs used an expert panel and followed the guidance of NEI 04-02, RG 1.205, and FAQ 07-0038, (Reference 60).

LAR, Attachment F, stated that the licensee conducted an expert panel review in 2008 and a second review of the updated PWR Generic List of MSOs in 2010. The licensee conducted a

training session for the panel members prior to starting the review and stated that the expert panel sources of information for identifying MSOs included the PWR generic MSO lists; NEI 00-01, Revision 2; a systematic review of all plant systems; and internal events PRA (IEPRA) insights.

As described in LAR, Section 4.2.1.4, and LAR, Attachment F, the licensee followed the process described in FAQ 07-0038 to address MSOs, which includes the following 5 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 following information sources were used to identify the potential MSOs that could be of concern:

- The Pressurized Water Reactor Owners Group (PWROG) Generic MSO List;

- NEI 00-01, Revision 2, "Guidance for Post Fire Safe Shutdown Circuit Analysis," May 2009 with inclusion of omitted Appendix G Scenario #56b from "PWR Generic MSO List," Revision 1, 2009.

- In addition to the expert panel meeting, a systematic evaluation of all plant systems was performed to determine if single or MSO events within a system or across systems could impact the initial conditions of a fire event, or impact the reliability of systems required for accident mitigation (e.g., flow interruption, flow diversion, equipment damage). This review identified 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 systematic review scope included all mechanical systems, including water, oil and air, but specifically excluded electrical systems. 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 PWROG generic MSO List. The output from this review includes the following:

    - A summary of the systematic review of systems for spurious operations combinations potentially affecting the function of mitigating systems.

    - A listing of the resulting SSO and MSO combinations identified.

- Since the completion of the initial MSO tasks, plant modifications have been reviewed periodically to determine potential impacts to the PRA models or SAFE

> analysis. The follow-up impact reviews would identify new spurious or MSO concerns for incorporation into the analysis (Note: No additional concerns have been identified).

For Step 2, the licensee stated a MSO expert panel was conducted on November 19 and 20, 2008, at PBNP and a second review of the updated PWR generic list of MSOs was conducted in June of 2010. The licensee stated that the purpose of the expert panel was to review the applicable industry developed generic owner's group list of MSOs for applicability to PBNP. The licensee further stated that the expert panel commented on whether or not applicable MSOs were accounted for in the plant PRA and SSA. The licensee further stated that a training session for the panel members was conducted prior to starting the actual assessment.

For Step 3, the licensee stated that the results of the MSO reviews (expert panel - June 2010, delta review, and the systematic review of MSOs for the FPRA) were evaluated for incorporation into the FPRA model. The licensee stated that some of the MSO combinations identified during the expert panel reviews were shown by means of thermal hydraulic analyses to have a negligible impact. The licensee stated that this task included components susceptible to single and MSOs identified in the post-fire SSA as well as those from the expert panel and systematic reviews. The licensee further stated that the PRA model was also reviewed to identify components that do not have circuit routing. The licensee stated that cable selection and circuit analysis were then performed for those important components identified above that did not already have this performed for the current SSA. The licensee stated that for some SSO basic events, probabilities were generated in the circuit failure mode likelihood analysis.

For Step 4, the licensee stated the PRA quantified the fire-induced risk model containing the MSO failure modes; the quantification addressed the specific electrical cables and the failure mode in each fire area and fire zone that was quantified; and thus, the MSO contribution is included in the FPRA results, and in the FPRA results associated with evaluation of VFDRs as documented in applicable FREs. The licensee stated that the MSO component combinations identified to be of concern were also evaluated as a part of the NSCA and combinations that did not meet the deterministic compliance requirements were added to the scope of VFDRs to be evaluated by PB 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. Furthermore, the NRC staff concludes that the licensee's process provides reasonable assurance that the FRE appropriately identifies and includes risk significant MSO combinations. Based on these conclusions, the NRC staff concludes that the licensee's approach for assessing the potential for MSO combinations is acceptable.

3.2.5 Establishing Recovery Actions

NFPA 805, Section 1.6.52, "Recovery Action," defines a RA as follows:

> 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 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.

As described in LAR, Section 4.2.1.3, and LAR, Attachment G, the licensee used the endorsed guidance provided in NEI 04-02, RG 1.205, and FAQ 07-0030 (Reference 59), to establish the population of RAs being carried forward in the RI/PB FPP. The process as described in FAQ 07-0030, consists of the following steps:

- Step 1: Define the PCSs and determine which pre-transition OMAs [operator manual actions] 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.

- Step 5: Evaluate the reliability of the RAs.

The review results are documented in site-specific engineering analyses and reports. LAR, Attachment G, includes the summary of the results from the process described above.

LAR, Attachment G, stated that PBNP does not have any locations considered to be PCSs as defined in RG 1.205, and as such, the actions listed in LAR, Attachment G, Table G-1, "Recovery Actions," must be evaluated for the additional risk of these actions. 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 is 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 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 (PPE) 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 unrecoverable 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, 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 licensee based its feasibility review on documentation, including previous feasibility evaluations for SSD OMAs. In SSA RAI 01.b (Reference 22), the NRC staff requested that the licensee identify the specific implementation items that address revision to the training program and drill procedures as described in LAR, Attachment G. In its response to SSA RAI 01.b (Reference 12), the licensee identified Implementation Items, IMP-135, IMP-143, and IMP-152 as being related to the feasibility evaluation. In addition to the implementation items identified in the licensee's response to SSA RAI 01.b, the licensee also identified Implementation Item, IMP-153, in LAR, Attachment S, Table S-3, as applicable to implementation of RAs in LAR, Attachment G. The licensee included these implementation items in LAR, Attachment S, Table S-3, as supplemented, to perform field validation of RA feasibility and to revise FPP documentation, procedures, training, and drills, as necessary to incorporate updated NSCA strategies. The NRC staff concludes that the licensee response to the RAI is acceptable because the licensee identified the specific implementation items that address revision to the training program and drill procedures as described in LAR, Attachment G, and those implementation items will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions. The additional risk of the use of RAs is discussed in SE, Section 3.4.4, "Additional Risk Presented by Recovery Actions."

Based on the above considerations, the NRC staff concludes that the licensee followed the endorsed guidance of NEI 04-02 and RG 1.205 to identify and evaluate RAs in accordance with NFPA 805, and therefore, 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 based on conformance with the endorsed guidance contained in NEI 04-02 and subject to completion of Implementation Items IMP-135, IMP-143, IMP-152, and IMP-153, in LAR, Attachment S, Table S-3, which will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

### 3.2.6 Conclusion for Section 3.2

The NRC staff reviewed the licensee's LAR, as supplemented, for conformity with the requirements contained in NFPA 805, Section 2.4.2, regarding the process used to perform the NSCA. Subject to completion of modifications MOD-6, MOD-23, MOD-24, and MOD-26, as described in LAR, Attachment S, Table S-2, as supplemented, the NRC staff concludes that the proposed safe and stable condition is acceptable and that the licensee's process is adequate to appropriately identify and locate the systems, equipment, and cables, required to provide reasonable assurance of achieving and maintaining the fuel in a safe and stable condition, as well as to meet the NFPA 805 NSPC.

In accordance with 10 CFR 50.48(c)(2)(iii), the NRC staff confirmed, through review of the documentation provided in the LAR, that feed and bleed is not the sole fire-protected SSD path for maintaining reactor coolant inventory, pressure control, and decay heat removal capability.

The NRC staff also reviewed the licensee's process to identify and analyze MSOs. Based on the LAR, as supplemented, the process used to identify and analyze MSOs is considered comprehensive and thorough. Through the use of an expert panel process, in accordance with the guidance of RG 1.205, NEI 04-02, and FAQ 07-0038, potential MSO combinations were identified and included as necessary in the NSCA, as well as the applicable FREs. The NRC staff also considers the approach the licensee used for assessing the potential for MSO combinations acceptable, because the licensee performed it in accordance with NRC-endorsed guidance.

Subject to completion of LAR, Attachment S, Table S-3, Implementation Items IMP-135, IMP-143, IMP-152, and IMP-153, the NRC staff concludes that the process used by the licensee to review, categorize, and address RAs during the transition from the existing deterministic fire protection licensing basis to a RI/PB FPP is consistent with RG 1.205 and the NRC-endorsed guidance contained in NEI 04-02. Therefore, subject to completion of the implementation items, the information provided by the licensee provides reasonable assurance that the regulatory requirements of 10 CFR 50.48(c) and NFPA 805 for NSCA methods are met.

3.3 Fire Modeling (FM)

NFPA 805 (Reference 3), allows both FM and FREs as PB alternatives to the deterministic approach outlined in the standard. These two PB approaches are described in NFPA 805, Sections 4.2.4.1 and 4.2.4.2, respectively. Although FM and FREs are presented as two different approaches for PB compliance, the FRE 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 SSCs based on the conservation equations or empirical data."

The NRC staff reviewed LAR (Reference 8), Section 4.5.2, "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 PB evaluation quality requirements for fire protection systems and features, to determine whether the FM used to support transition to NFPA 805 is acceptable.

In LAR, Section 4.5.2.1, the licensee indicated that it did not use the FM approach (NFPA 805, Section 4.2.4.1) for the NFPA 805 transition. The licensee used the FRE PB method (i.e., FPRA) with input from FM analyses. Therefore, the NRC staff reviewed the technical adequacy of the FREs, including the supporting FM analyses, as documented in SE, Section 3.4.2, to evaluate compliance with the NSPC.

The licensee did not propose any FM methods to support PB evaluations in accordance with NFPA 805, Section 4.2.4.1, as the sole means for demonstrating compliance with the NSPC.

## 3.4 Fire Risk Assessments

This section addresses the licensee's fire risk evaluation (FRE) method, which is based on NFPA 805, Section 4.2.4.2. The licensee chose to use only the FRE PB method in NFPA 805, Section 4.2.4.2. The FM PB method of NFPA 805, Section 4.2.4.1, was not used for this application.

NFPA 805, Section 4.2.4.2, "Use of Fire Risk Evaluations," states that:

> Use of fire risk evaluation for the performance-based approach shall consist of an integrated assessment of the acceptability of risk, defense-in-depth (DID), and safety margins.
>
> The evaluation process shall compare the risk associated with implementation of the deterministic requirements with the proposed alternative. The difference in risk between the two approaches shall meet the risk acceptance criteria described in NFPA 805, Section 2.4.4.1 ["Risk Acceptance Criteria"]. The fire risk shall be calculated using the approach described in NFPA 805, Section 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, defense-in-depth, and safety margins."

#### 3.4.1.1 Defense-in-Depth

NFPA 805, Section 1.2, 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:
>
> (1) Preventing fires from starting.
>
> (2) Rapidly detecting fires and controlling and extinguishing promptly those fires that do occur, thereby limiting fire damage.
>
> (3) 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 (Reference 8), and (Reference 9), Section 4.2.4, "Fire Area Transition," LAR, Section 4.5.2.2, "Fire Risk Approach," LAR, Section 4.8.1, "Results of the Fire Area Review," and LAR, Attachment C, Table C-1, NEI 04-02 Table B-3, "Fire Area Transition,"

as well as the associated supplemental information, in order to determine whether the principles of DID were maintained in regard to the planned transition to NFPA 805.

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 a detailed consideration of DID and safety margins as part of the change process. The licensee documented the method used to meet the DID requirements of NFPA 805 in LAR, Attachment C, Table C-1. LAR, Attachment C, Table C-1, and LAR Table 4.3, document the results of the licensee's review of fire suppression and fire detection systems.

The licensee developed a methodology for evaluating DID which evaluated each of the three elements in NFPA 805, Section 1.2, referred to as echelons 1, 2, and 3, respectively. This evaluation method is described in LAR, Section 4.5.2.2, as part of the FRE process performed on PB fire areas. In its response to PRA RAI 20 (Reference 10), the licensee provided an assessment table where, for each of the three echelons, it provided several examples of fire protection features addressing each echelon along with a discussion of the considerations used in assessing those features. The assessment determined whether changes would be needed to assure that each echelon of DID had been satisfactorily achieved. Many of the identified fire protection features are required to be in place in order to demonstrate compliance with the fundamental fire protection and design elements of NFPA 805, Chapter 3, such as the combustible control and hot work programs.

In its response to PRA RAI 20 (Reference 10), the licensee defined the term: "potentially risk significant fire scenarios" as a means of providing additional criteria for when DID measures should be considered. The licensee also defined "potentially risk significant fire scenarios" for the purposes of evaluating the need for DID as:

- Scenarios in which the calculated risk is equal to or greater than 1E-6/year (yr) for CDF and/or 1E-7/yr for LERF;

- Scenarios in which the calculated risk falls between 1E-6/yr and 1E-8/yr for CDF, or between 1E-7/yr and 1E-9/yr for LERF, and where defense-in-depth echelon 1 and 2 attributes are causing a significant reduction in risk; or,

- Scenarios with a high consequence (i.e., Conditional Core Damage Probability (CCDP) >1E-1).

LAR, Attachment C, (1) documents the fire protection systems/features required to either meet the deterministic criteria of NFPA 805, Section 4.2.3, or to support the fire probabilistic risk assessment (FPRA), (2) indicates whether changes or improvements are necessary for each fire protection system/feature to maintain a balance among the DID echelons, and (3) provides justification or basis for why the required fire protection systems/features are adequate for DID. As such, this portion of the FRE documentation is the licensee's internal record of the systems required to meet the NSPC and DID requirements of NFPA 805.

Based on the review of the LAR, the response to PRA RAI 20, 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, as supplemented, adequately evaluates DID against fires as required by NFPA 805 and, therefore, the proposed RI/PB FPP adequately maintains DID.

3.4.1.2 Safety Margins

NFPA 805, Section 2.4.4.3, states that:

> The plant change evaluation shall ensure that sufficient safety margins are maintained.

NEI 04-02, Section 5.3.5.3, "Safety Margins," lists two specific criteria that should be addressed when considering the impact of plant changes on safety margins:

- Codes and Standards or their alternatives accepted for use by the NRC are met, and

- Safety analyses acceptance criteria in the licensing basis (e.g., FSAR and supporting analyses) are met, or the change provides sufficient margin to account for analysis and data uncertainty.

LAR, Section 4.5.2.2, "Fire Risk Approach," states that safety margins were considered as part of the FRE process and that each retained VFDR was evaluated against the safety margin criteria of NEI 04-02 and RG 1.205 (Reference 4). An FRE was performed for each fire area containing VFDRs. The FREs contain the details of the licensee's review of safety margins for each performance-based fire area.

In its response to PRA RAI 20 (Reference 10), the licensee indicated that it performed the following evaluations and reviews to evaluate safety margin:

- FM for the FPRA was specifically reviewed for adequate safety margin and, in general, was developed utilizing accepted codes and standards, and industry and NRC guidance, including NUREG/CR-6850 (Reference 41), (Reference 42), and (Reference 43), NEI 04-02, and associated Frequently Asked Questions (FAQs).

- Plant system performance was evaluated by the licensee given the specific demands associated with postulated fire events. The methods, input parameters, and acceptance criteria utilized in the RI/PB analysis were reviewed by the licensee against the plant design basis events. This evaluation determined the safety margin established in the plant design basis events was preserved.

- The FPRA logic model, including supporting FM, was developed by the licensee in accordance with NUREG/CR-6850 and ASME/ANS RA-Sa-2009 (Reference

36). The contribution to CDF and LERF of failure contributors was reviewed by the licensee to confirm the reasonableness of the logic model.

The NRC staff concludes that the safety margin criteria described in NEI 04-02, Section 5.3.5.3, and the LAR, as supplemented, are consistent with the criteria as described in RG 1.174 (Reference 34), and, therefore, acceptable. Based on its review of the LAR and the response to PRA RAI 20, the NRC staff concludes that the licensee's approach adequately addresses the issue of safety margins in the implementation of the FRE process.

3.4.2 Quality of the Fire Probabilistic Risk Assessment

The objective of the PRA quality review is to determine whether the plant-specific PRA used in evaluating the proposed LAR is of sufficient scope, level of detail, and technical adequacy for the application. The NRC staff evaluated the PRA quality information provided by the licensee in its NFPA 805 submittal including industry peer review results. The NRC staff reviewed LAR Section 4.5.1, "FPRA 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 supplemented.

The licensee developed an internal events PRA (IEPRA) to support its Individual Plant Examination process and continued to maintain and improve the PRA as RG 1.200 (Reference 35), 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.

The licensee did not identify any: (1) known outstanding plant changes that would require a change to the FPRA model, or (2) any planned plant changes that would significantly impact the PRA model, beyond those identified and scheduled to be implemented as part of the transition to a FPP based on NFPA 805. 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 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. Further, as described in SE, Section 3.8.3, the licensee has a program for ensuring that developers and users of these models are appropriately trained and qualified. Therefore, the NRC staff concludes that the PRA is 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 (IEPRA) Model

The licensee's evaluation of the technical adequacy of its IEPRA model used to support development of the FPRA model consisted of a full-scope peer review and two focused peer

reviews performed to the NEI 05-04 process (Reference 98), and the combined ASME/ANS PRA Standard, as clarified by RG 1.200, Revision 2. The full-scope peer review was performed in November 2010, a focused-scope peer review on the internal flooding PRA was performed in August 2011. A limited scope review of the licensee's responses to F&Os from the previous full-scope and focused review was performed in October 2011. The IEPRA model revised in response to these reviews serves as the basis of the FPRA used in performing PRA evaluations for the LAR.

For each supporting requirement (SR) in the ASME/ANS RA-Sa-2009, there are three possible degrees of "satisfaction" referred to as capability categories (CC) (i.e., CC-I, CC-II, and CC-III), with CC-I being the minimum, CC-II considered widely acceptable, and CC-III indicating the maximum achievable level of detail, plant specificity, and realism. For many SRs the CCs are combined (e.g., the requirement for meeting CC-I is combined with CC-II) or the requirement is the same across all CCs so that the requirement is simply met or not met. For each SR, the PRA reviewer from the peer review team designates one of the CCs or indicates that the SR is met or not met.

LAR, Attachment U, Table U-1, provides the licensee's dispositions to all 39 facts and observations (F&Os) from the full-scope and focused peer reviews. All of the F&Os are considered findings as defined in NEI 05-04 and include eight F&Os on internal flooding. In general, an F&O is written for any SR that is judged not to be met or does not fully satisfy CC-II of the ASME standard, consistent with RG 1.200, Revision 2.

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 and basis of acceptability of SRs that are "not met" or only meet at CC-I is summarized in the NRC's IEPRA Record of Review dated June 8, 2016 (Reference 99).

In PRA RAI-22 (Reference 22), the NRC staff requested that the licensee identify any changes made to the IEPRA that are consistent with the definition of a "PRA upgrade" since the last full-scope peer review of PRA models as defined by ASME/ANS RA-Sa-2009. In its response to the RAI (Reference 10), the licensee stated that none of the changes made to the IEPRA to resolve F&Os in response to the peer reviews resulted in a PRA upgrade.

As a result of its review of the LAR, as supplemented and modified in its responses to PRA RAIs (Reference 10), (Reference 11), and (Reference 12), the NRC staff concludes that the IEPRA is technically adequate and its quantitative results 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. The NRC staff has 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 or had no significant impact on the FPRA. Accordingly, the NRC staff concludes that the licensee has demonstrated that the IEPRA meets the guidance in RG 1.200, Revision 2, that it is 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 NFPA 805 application.

3.4.2.2 Fire PRA (FPRA) Model

The licensee evaluated the technical adequacy of the FPRA model by conducting a peer review using the NEI 07-12 process (Reference 100), and Part 4, "Requirements For Fires At-Power" of the ASME/ANS RA-Sa-2009 PRA standard as clarified by RG 1.200, Revision 2. Follow-on focus-scoped peer reviews were conducted on the licensee's responses to previous F&Os for two technical elements. The full-scope peer review of the FPRA was performed in June 2011. One of the two follow-on focused scope peer reviews was performed in May 2013 on the fire scenario selection (FSS) element of the PRA standard SRs, and the other was performed in June 2013, on the fire risk quantification (FQ) element.

LAR, Attachment V, Table V-1, provides the licensee's resolutions to 41 F&Os from the full-scope and focused scope peer reviews. LAR, Attachment V, Table V-2, identifies all SRs that were determined by the peer review to be met only at CC-I and provides an evaluation of those SRs, only two of which are not already addressed by F&Os in LAR, Attachment V, Table V-1.

The NRC staff evaluated each F&O and the licensee's resolution in LAR, Attachment V, to determine whether the F&O had any significant impact for the application. The NRC staff's review and conclusion for the licensee's resolution of each F&O and basis of acceptability of SRs that are "not met" or only meet CC-I is summarized in the NRC's FPRA Record of Review dated June 8, 2016 (Reference 101).

In PRA RAI 1.a (Reference 22), associated with F&O CF-B1-01, the NRC staff found that the licensee used Option #2 from NUREG/CR-6850, Section 10.5.3.2, but that Option #2 does not provide an adequate method for quantifying the likelihood of hot short-induced failures as explained in NRC memorandum from Richard Correia, U.S. Nuclear Regulatory Commission, to Joseph Giitter, U.S. Nuclear Regulatory Commission, dated February 12, 2014 (Reference 102). In its response to PRA RAI 1.a (Reference 12), and PRA RAI 3 (Reference 12), the licensee explained that it reevaluated the FPRA using Option #1 from NUREG/CR-6850 for the integrated analysis provided in its response to PRA RAI 3. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the revised treatment of quantifying the likelihood of hot short-induced failures is consistent with acceptable guidance in NUREG/CR-6850.

In PRA RAI 1.c (Reference 22), concerning F&O FQ-A4-01 and related F&Os IGN-A10 and UNC-A1, the NRC staff found that the F&O stated that the uncertainty analysis to address the state of knowledge correlation (SOKC) had not been performed for the FPRA. In its response to PRA RAI 1.c (Reference 12), and PRA RAI 3 (Reference 12), the licensee explained that the FPRA was updated to include uncertainty parameters and SOKC for component failure types, ignition frequencies, non-suppression probabilities, and induced hot short probabilities as part of the integrated analysis provided in its response to PRA RAI 3. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that this updated treatment of parametric uncertainty includes the effect of SOKC in the final risk estimates.

In PRA RAI 1.e (Reference 22), concerning F&O FSS-A1-01, the NRC staff noted that the licensee's analysis screened all junction box fires as non-damaging ignition sources because they are well sealed, and explained that unlike electrical cabinets, junction boxes cannot be excluded for being well sealed. In its response to PRA RAI 1.e (Reference 12), and PRA RAI 3 (Reference 12), the licensee explained that it updated the FPRA to treat junction boxes consistent with FAQ 13-0006 (Reference 71), using cable loading fractions to determine fire ignition frequency. The licensee also explained that it conservatively applied the conditional core damage probability for the most risk significant junction box for each unit to each fire compartment as part of the integrated analysis provided in its response to PRA RAI 3. The NRC staff concludes the licensee's response to the RAI is acceptable because the licensee demonstrated that its revised treatment of junction boxes is consistent with the guidance in FAQ 13-0006.

In PRA RAI 1.f (Reference 22), associated with F&O FSS-C5-01, the NRC staff found that the F&O disposition stated that the licensee would resolve the F&O when FAQ 13-0004 (Reference 69), was closed by NRC. The NRC staff requested that the licensee provide information about the status of its treatment of sensitive electronics given that FAQ 13-0004 has been finalized. In its response to PRA RAI 1.f (Reference 12), and PRA RAI 3 (Reference 12), the licensee stated that it performed walkdowns to confirm that treatment of sensitive electronics was consistent with FAQ 13-0004. The licensee explained that in thirteen instances the configuration associated with the housing of sensitive electronics did not provide the protection from damaging heat flux in accordance with FAQ 13-0004. However, the licensee explained that in these cases, it determined that the sensitive electronics have no impact on fire risk, and as a result it made no changes to the FPRA model. The NRC staff concludes the licensee's response to the RAI is acceptable because the licensee demonstrated that the treatment of sensitive electronics is consistent with guidance in FAQ 13-0004, and because exceptions to the use of this guidance applied only to sensitive electronics that do not impact fire risk.

In PRA RAI 4 (Reference 22), the NRC staff found that a reduction factor of two appeared to be credited for CPTs in the circuit failure mode probabilities which is inconsistent with the guidance in the NRC memorandum from Richard Correia, U.S. Nuclear Regulatory Commission, to Joseph Giitter, U.S. Nuclear Regulatory Commission, dated February 12, 2014 (Reference 102). In its response to PRA RAI 4 (Reference 12), and PRA RAI 3 (Reference 12), the licensee explained that it reevaluated the FPRA with the CPT credit removed and included that in the integrated analysis provided in its response to PRA RAI 3. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee removed the unacceptable credit for CPTs in circuit failure mode probabilities from the FPRA.

In PRA RAI 5 (Reference 22), the NRC staff requested that the licensee provide additional information about fire areas that it credited for reduced heat release rates (HRRs), and about the new administrative controls and review of transient combustibles violations that justify using a HRR of 142 kW and 69 kW, instead of the NUREG/CR-6850 value for transient fires of 317 kW. In its response to PRA RAI 5 (Reference 10), PRA RAI 5.01 (Reference 15), and PRA RAI 3 (Reference 12), the licensee explained that administrative procedures will implement a "zero transient control criteria" except for maintenance or testing activities in which case specific compensatory actions will be in place when transient combustibles are

used for those activities. These controls will include monitoring and corrective actions to ensure that the reduced HRRs used in the FPRA of 142 kW for the cable spreading room and 69 kW for the vital switchgear room are applicable. The licensee further explained that review of condition reports between May 2010, and May 2014, determined that only three transient combustible controls violations occurred and that none of the violations resulted in a fire and the combustibles would not have resulted in a HRR exceeding the reduced HRRs used in the FPRA. The NRC staff concludes that the licensee's responses to the RAIs are acceptable because the licensee demonstrated that it has reviewed past violations and established additional controls on transient combustibles consistent with the NRC guidance related to the use of reduced HRRs.

In PRA RAI 6 (Reference 22), the NRC staff requested that the licensee provide information on whether it used any methods not yet accepted by the NRC in the FPRA. In its response to PRA RAI 6 (Reference 10), the licensee explained that it used several unreviewed analysis methods that are discussed in its RAI responses. The licensee also indicated that, if the method was not accepted during the review of the LAR, an alternative and acceptable method was used in the integrated analysis provided in its response to PRA RAI 3 and associated RAIs. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee replaced unacceptable methods with acceptable methods in its integrated analysis provided in its response to PRA RAI 3.

In PRA RAI 7 (Reference 22), the NRC staff requested that the licensee provide information on how placement of transient and hotwork fires at pinch points was performed. In its response to PRA RAI 7 (Reference 10), the licensee explained that transient and hotwork fires are postulated everywhere a transient fire is reasonably expected to occur associated with accessible floor area (i.e., not covered by plant equipment). The licensee further explained that to reduce the number of fire scenarios, it placed fire scenarios where risk significant targets or target combinations are located, and also where secondary combustibles are at a low enough elevation to be ignited by the transient fire. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that it addressed any existing pinch points and locations where damage from transients can occur.

In PRA RAI 8 (Reference 22), the NRC staff requested that the licensee explain how only eight fire scenarios based on "minimum target set[s]" that were developed for the main control board (MCB) for both units adequately represent the risk from MCB fires. In its response to PRA RAI 8 (Reference 11), the licensee explained that a "minimum target set" consists of a set of controls that can fail redundant trains/systems, jeopardizing plant safe shutdown. The minimum distance between these targets was determined and additional targets within the area covered by the distance were included. The licensee explained that scenario distances were limited in most cases to less than approximately seven feet in distance because main control room (MCR) abandonment was assumed for fires inside the MCB damaging internal targets 2.13 m (7') apart. The licensee stated that four scenarios per unit covered all of the applicable target sets and that additional scenarios would only address subsets or less significant equipment. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that a full range of MCB scenarios across target sets were developed by both: (1) applying Appendix L of NUREG/CR-6850 to evaluate target sets comprised of targets in close proximity to one another which could fail redundant

trains and systems, and (2) assuming MCR abandonment on habitability with a separate risk assessment for larger fires.

In PRA RAI 9 (Reference 22), the NRC staff found that in applying the NUREG/CR-6850, Appendix L, method, the frequency of a scenario involving specific targets damage in the MCB should be determined by multiplying the probability of target damage by the entire MCB frequency. In its response to PRA RAI 9 (Reference 12), and PRA RAI 3 (Reference 12), the licensee stated that it updated the fire ignition frequency used for non-abandonment MCB fire scenarios by using the full MCB fire ignition frequency in the integrated analysis provided in its response to PRA RAI 3. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee removed the unacceptable application of frequency for MCB scenarios and replaced it with an acceptable method.

In PRA RAI 10 (Reference 22), the NRC staff requested that the licensee provide additional information regarding how it treated MCR abandonment. In its response to PRA RAI 10 (Reference 10), the licensee explained that MCR abandonment is modeled differently for the compliant plant and the post-transition plant. The modeling of the post-transition plant is discussed below. The modeling of the compliant plant is only needed to support the change in risk estimate and is discussed in SE, Section 3.4.3.

In its response to PRA RAI 10 (Reference 10), the licensee explained that it modeled MCR abandonment for loss of habitability (LOH) in the post-transition plant as the failure of operators to successfully execute a minimum set of actions determined to accomplish SSD outside the MCR as described in its procedure. Random hardware failures were not explicitly treated since the failure of operator actions dominated. Thus, the CCDP for abandonment due to loss of habitability was derived from summing the human error probabilities (HEPs), producing conditional core damage probabilities (CCDPs of 5.65E-01 for Unit 1 and 5.66E-01 for Unit 2, representing the complexity of the shutdown procedure for severe fires, with LERF values one order of magnitude less. In PRA RAI 10.01 (Reference 25), the NRC staff requested that the licensee provide justification for using a single scenario given that a range of CCDPs is possible depending on the fire damage and resulting plant response. In its response to PRA RAI 10.01 (Reference 15), the licensee explained that all fires leading to MCR abandonment use the same procedure, that the procedure accommodates potential fire induced failures from the most severe fire damage, and that it is justified for the post-transition model to use the risk estimate as a bound for the variety of possible fire induced failures for fire scenarios that lead to MCR abandonment due to loss of habitability. The staff expects that the effect of the range of CCDPs that generally are evaluated for the LOH abandonment scenarios are bounded by the application of this single CCDP across all scenarios, given the magnitude of the CCDP for LOH applied in this LAR for post transition. In its response to PRA RAI 16.01 (Reference 15), the licensee also explained that MCR abandonment for loss of control is conservatively not credited in the post-transition plant. The NRC finds the licensee's responses to the RAIs acceptable because the licensee demonstrated that future post-transition risk evaluations can recognize and appropriately incorporate the bounding value into the evaluation and because conservative post-transition estimates can support a conservative transition change-in-risk estimate.

In PRA RAI 11 (Reference 22), the NRC staff found that the licensee does not have any locations considered primary control stations (PSCs) and therefore it was unclear how

centralized command, control, and communication would be performed for MCR abandonment actions. In its response to PRA RAI 11 (Reference 10), the licensee explained that the duty operating supervisor provides command and control of MCR abandonment actions by communicating with Gai-tronics and/or portable radios, and receiving regular feedback from operators performing the actions. The licensee explained that the feasibility of MCR abandonment actions has been demonstrated through assessment of the actions, plant walkdowns, and training and drills, and that these actions are directed by their current fire response procedures. The licensee also explained that the HRA, per NUREG 1921, considers performance shaping factors associated with the stress of command, control, and communication. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee performed a feasibility assessment of the MCR abandonment actions, and the complexity of command and control is reflected in the relatively little credit (i.e., CCDP of 5.6E-01) that results from modeling MCR abandonment in the post-transition plant.

In PRA RAI 12 (Reference 22), the NRC staff requested that the licensee provide further explanation about exclusion of systems with untraced cables from the PRA, which is equivalent to assuming they are always failed. Of concern is the possibility that this treatment of untraced cables is conservative with respect to CDF and LERF but non-conservative with respect to ΔCDF and ΔLERF. In its response to PRA RAI 12 (Reference 10), and PRA RAI 3 (Reference 12), the licensee confirmed that all systems with untraced cables are assumed to fail but that, with the exception of the instrument air (IA) system, these systems do not support fire mitigation scenarios and, therefore, are not modeled in the FPRA. The IA system is credited in the compliant model but not credited in the post-transition plant model, except for scenarios where crediting this system in the post transition model would yield a non-conservative change-in-risk value. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the excluded systems represent cooling options not associated with credited shutdown systems and therefore do not impact the change-in-risk calculations, and the treatment of IA does not yield a non-conservative result to change in risk.

In PRA RAI 13 (Reference 22), the NRC staff requested that the licensee provide information regarding which Westinghouse RCP shutdown seals will be installed and whether the credit taken in the FPRA and the basis for that credit is consistent with the RCP seals to be installed. In its response to PRA RAI 13 (Reference 10), and PRA RAI 13.01 (Reference 15), the licensee explained that the Westinghouse Generation III Shutdown seals will be installed and that the basis for the credit taken in the integrated analysis provided in its response to PRA RAI 3 (Reference 12), is included in PWROG 14001-NP, "PRA Model for Generation III Westinghouse Shutdown Seal." In its updated LAR, Attachment S, Table S-3 (Reference 17), the licensee added implementation item IMP-160 to use NRC accepted shutdown seal models as they become available, confirm that the transition change-in-risk estimates will not exceed the RG 1.174 acceptance guidelines, and that self-approved changes relying on the shutdown seal failure model will not be undertaken before acceptable models have been developed. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the modeling of RCP seals in the FPRA is based on the best available modeling guidance for the RCP seals that will be installed, and because the actions described in LAR, Attachment S, Table S-3, implementation item IMP-160 would be required by the proposed license condition.

In PRA RAI 15 (Reference 22), the NRC staff requested that the licensee explain and justify its modeling of the fire impacts and system interdependencies between units. In its response to PRA RAI 15 (Reference 10), and PRA RAI 3 (Reference 12), the licensee explained that: (1) with exception of fires originating in the unit-specific containment buildings, each postulated fire is evaluated twice, once for each unit, (2) the logic structure for each unit's PRA model includes equipment from the opposite unit that could affect its risk, and (3) cables that could be damaged from fires originating in common areas are used in the risk calculations for both units. The NRC staff concludes the licensee's response to the RAI is acceptable because the licensee demonstrated that the FPRA modeling associated with the possible impacts of shared systems and physical proximity addresses fire impacts of the opposite unit and system interdependencies between units.

In PRA RAI 18 (Reference 22), the NRC requested that the licensee provide additional information about the contributors to the large negative change-in-risk values reported, particularly for Unit 2 since a conservative calculation of the compliant plant CDF and LERF can lead to non-conservative calculation of $\Delta$CDF and $\Delta$LERF. In its response to PRA RAI 18 (Reference 12), the licensee provided a table of the dominant scenarios contributing to the complaint plant CDF and LERF for each unit and description of those scenarios. The licensee pointed out that for Unit 2 a high energy arc fault (HEAF) in an overhead bus duct in the AFW room is an exceptionally dominant contributor to the compliant plant risk (representing about three-quarters of the CDF). The high compliant plant risk in combination with the modification to eliminate this risk (i.e., MOD-1) results in a very large negative change-in-risk value even without consideration of other contributors to the Unit 2 complaint plant risk. In addition to MOD-1, the licensee presented eighteen other non-VFDR risk reduction modifications including several associated with ensuring availability of AFW trains, all of which contribute to the negative change-in-risk presented in LAR, Attachment W. The licensee stated that no assumptions artificially contribute to the large risk reduction credit for modifications. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the large negative change-in-risk is appropriate because of the credits for non-VFDR modifications, specifically to reduce the risk of dominant fire risk contributors.

In PRA RAI 21 (Reference 22), the NRC staff found that LAR, Attachment S, Implementation Item IMP-142 to update the FPRA after modifications and implementation items are completed, did not describe a plan of action in the event RG 1.174 risk acceptance guidelines are exceeded by the updated FPRA. In its revised LAR, Attachment S, Table S-3, Implementation Item IMP-142, (Reference 17), the licensee revised the implementation item to include a plan of action in the event RG 1.174 risk acceptance guidelines are exceeded by the updated FPRA. The NRC staff concludes the licensee's response to the RAI is acceptable because the licensee revised LAR, Attachment S, Table S-3, Implementation Item IMP-142, to include actions to be taken to ensure RG 1.174 risk acceptance guidelines are not exceeded by the updated FPRA.

In PRA RAI 24 (Reference 22), the NRC staff requested that the licensee provide an explanation and justification of its treatment of potential smoke damage in the FPRA. In its response to PRA RAI 24 (Reference 10), the licensee explained that it used guidance from Section T.3.1 of NUREG/CR-6850 and that it only assumed smoke damage to occur from severe smoke exposure. The licensee further explained that components housed in the

same electrical panel as the fire source or in an electrical panel directly connected via an open bus duct were assumed to be damaged by smoke unless specific features would preclude such damage. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that these evaluations are consistent with NUREG/CR-6850.

In PRA RAI 25 (Reference 22), the NRC staff requested that the licensee provide information about the changes to the modifications identified in the LAR, Attachment S, Table S-2, and about revisions that would be made to the FPRA to reflect the changes. In its response to PRA RAI 25 (Reference 12), the licensee identified the deleted modification items, described the new scope of revised modification items, and provided a revised LAR, Attachment S, Table S-2. In its response to PRA RAI 25.01 (Reference 15), the licensee described the FPRA modeling changes made for each revised or deleted modification item and explained that this modeling was part of the integrated analysis provided in its response to PRA RAI 3 (Reference 12). The NRC staff concludes that the licensee's responses to the RAIs are acceptable because the licensee provided the description of revised FPRA modeling which is consistent with the description of the revised plant modifications in the revised LAR, Attachment S, Table S-2.

In the LAR supplement dated August 26, 2015 (Reference 17), the licensee included changes made to the LAR and to the FPRA model after its September 25, 2014, response to PRA RAI 03 (Reference 12), and provided updated fire risk estimates. The NRC staff reviewed the licensee's description of the modeling changes and updated fire risk results, and found that failure modes not previously modeled had been added to the FPRA to account for circuit inadequacies. In PRA RAI S01 (Reference 26), the NRC staff requested that the licensee provide additional information regarding the modeling of inadequate breaker coordination and inadequate circuit protection. In its response to PRA RAI S01 (Reference 19), the licensee provided the requested information along with a final LAR supplement that provided updated fire risk estimates. The final LAR revision reflects the circuit inadequacy modeling and further changes made to the LAR and to the FPRA.

In PRA RAI S01 (Reference 26), the NRC staff requested that the licensee provide an explanation of and a basis for how it modeled inadequate breaker coordination and circuit protection. The NRC staff requested specific information about how the potential for secondary fires and HEAFs was addressed. In its response to PRA RAI S01 (Reference 19), the licensee explained that for breaker fuse coordination, fire damage was assumed by failing all uncoordinated buses, panels, and cables upstream of the fire damaged cable. The licensee also clarified that equipment downstream of the fire damaged cable was assumed to be failed as result of the fire regardless of circuit inadequacies. The licensee explained that, for those scenarios where fire damages 125 VDC control power to 4 kV and/or 13.8 kV switchgear as well as one or more load cables from that same 4 kV/13.8 kV switchgear, secondary fires for cables within a common enclosure and HEAFs were modeled in the FPRA. The licensee explained that secondary fires were modeled 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 (Reference 70), and added to the failures associated with fire scenarios involving the unprotected circuit.

On January 14, 2016, the NRC staff held a public meeting with the licensee to obtain further information about its modeling of the inadequate 125 VDC control power circuits. Based on its response to PRA RAI S01 and this meeting, the NRC staff, in an unnumbered RAI (Reference 27), requested that the licensee provide additional information about how the potential for a secondary fire caused by a cable tray HEAF was modeled. In its response to this RAI (Reference 19), the licensee explained that for loss of direct current (dc) control power combined with a fire-induced fault on cables greater than 4kV that the zone of influence (ZOI) modeled for the HEAF was expanded vertically to 5 feet and horizontally to 3 foot from the cable tray. The licensee also explained that the HEAF was assumed to occur at the initial fault location in the primary fire ZOI where it is most likely to happen. The licensee explained that this modeling was updated and is reflected in the final fire risk estimates (Reference 19). The NRC staff found that the dimensions of the expanded ZOI is consistent with guidance in NUREG/CR-6850, Appendix M, for electrical panels. The NRC staff concludes that the licensee's response to this RAI is acceptable because the licensee demonstrated that the modeling of inadequate breaker coordination and circuit protection uses guidance from NUREG/CR-6850 to the extent possible and reflects the as-built plant.

In PRA RAI S02 (Reference 26), the NRC staff found that modeling of licensing limitations associated opening the turbine-driven auxiliary feedwater (TDAFW) pump unit cross-tie valves were incorporated into the FPRA by making adjustments to a HEP value. The NRC staff requested information about how this modeling was performed and the conditions that required this new modeling. In its response to PRA RAI S02 (Reference 19), the licensee explained that to open the TDAFW pump unit cross-tie valves requires placing the unaffected unit in a TS action condition, and, therefore, less favorable performance shaping factors were applied to the associated operation action HEP for fires in some cases, because procedures for this condition are not part of the critical safety procedures. The licensee also indicated that the procedures will be updated and once the procedures are finalized, the TDAFW cross-tie HEPs will be revised as necessary, and included this action in LAR, Attachment S, Table S-3, Implementation Item IMP-142. The NRC staff concludes the licensee's response to the RAI is acceptable because it demonstrated that the modeling reflects the as-operated plant, and will be updated once the procedures are finalized, which would be required by the proposed license condition.

As a result of its review of the LAR, as supplemented, the NRC staff concludes that the FPRA has sufficient technical adequacy and its quantitative results, considered together with the results of 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 that subject to the actions described in LAR, Attachment S, Table S-3, the FPRA will be acceptable to support post-transition self-approval evaluations.

3.4.2.3 Fire Modeling (FM) in Support of the Development of Fire Risk Evaluations (FRE)

The NRC staff performed detailed reviews of the FM used to support the FRE in order to gain further assurance that the methods and approaches used for the application to transition to NFPA 805 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, 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 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 PBNP FPRA

The licensee used FM 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 PBNP FPRA. The following algebraic fire models and correlations were used for this purpose:

- Flame Height, Method of Heskestad (Reference 103).
- Plume Centerline Temperature, Method of Heskestad (Reference 103).
- Radiant Heat Flux, Point Source Method (Reference 104).
- Ceiling Jet Temperature, Method of Alpert (Reference 105).

The first three algebraic models are described in NUREG-1805, "Fire Dynamics Tools (FDTs): Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program" (Reference 47). Alpert's ceiling jet temperature correlation is described in FIVE, "EPRI Fire Induced Vulnerability Evaluation Methodology," Revision 1 (Reference 106), and serves as the basis for FDTs that are used to estimate sprinkler, smoke detector and heat detector response times as documented in NUREG-1805, Chapters 10, 11, and 12, respectively. V&V of these algebraic models is documented in NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," Volumes 1-7 (Reference 48).

The algebraic FMs and empirical correlations were implemented in a database and workbook referred to as the fire modeling workbook (FMWB). The FMWB also calculates the plume radius according to Heskestad's correlation described in FIVE. The licensee used the plume radius as the horizontal ZOI where it exceeded the ZOI based on heat flux.

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 PBNP FPRA 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 (Reference 47), Chapter 2.
- Method of Beyler, for closed compartments (Reference 47), Chapter 2.
- Method of Foote, Pagni, and Alvares (FPA), for mechanically ventilated compartments (Reference 47), Chapter 2.

These HGL correlations are also described in NUREG-1805, Chapter 2, and implemented in the FMWB.

In LAR (Reference 8), Section 4.5.1.2, the licensee also identified the use of the following empirical correlations.

- Plume Radius, Method of Heskestad (Reference 103).
- Sprinkler Activation Correlation (Reference 48), Chapter 10.
- Smoke Detection Actuation Correlation, Method of Heskestad and Delichatsios (Reference 48), Chapter 11.
- Corner and Wall Heat Release Rate (Reference 107).
- Correlation for Heat Release Rates of Cables (Reference 47), Chapter 7.

- 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 49).

The licensee used the solid flame radiation model described in Chapter 5 of NUREG-1805 to estimate the heat flux from electrical cabinet and transient fires to steel columns in the turbine building, and to determine damaged target sets for transient initiators in the MCR.

The licensee used the ZOI approach 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 PBNP-specific ignition sources that did not adversely affect the operation of credited SSCs, or targets, following a fire. The licensee based its screening on the 98$^{th}$ percentile fire HRR from the NUREG/CR-6850 methodology (References 40, 41, 42).

The Consolidated Model of Fire and Smoke Transport (CFAST), Version 6, was used for

- HGL temperature calculations in fire compartment 552GRP.
- Temperature sensitive equipment HGL study.

Fire Dynamics Simulator (FDS), Version 5, was used for:

- Control Room abandonment calculations.
- Temperature sensitive equipment ZOI study.
- Plume/HGL interaction study.
- Plume calculation in fire zone 158.

V&V of CFAST and FDS is documented in NUREG-1824, Volumes 5 and 7, respectively.

The V&V of all correlations and FMs that were used to support the PBNP FPRA is discussed in detail in SE, Section 3.8.3.2.

3.4.2.3.2 RAIs Pertaining to FM in Support of the PBNP FPRA

By letters dated July 8, 2014 (Reference 22), and November 14, 2014 (Reference 24), the NRC staff requested additional information concerning the FM conducted to support the FREs. By letters dated July 29, 2014 (Reference 10), August 28, 2014 (Reference 11), September 25, 2014 (Reference 12), and December 19, 2014 (Reference 14), the licensee responded to these RAIs.

- In FM RAI 01.b (Reference 22), the NRC staff requested that the licensee identify areas with secondary combustibles that were not considered in the FM analyses, and assess the impact on the risk of fire scenarios that involve secondary combustibles in these areas.

  In its response to FM RAI 01.b (Reference 11), the licensee identified the areas where fires may involve a significant amount of non-cable secondary combustibles, listed the types and quantities of non-cable combustibles in these areas, and explained for each area why FPRA targets will not be affected. The licensee also provided more detail for the two areas that contain more than 1,000 pounds of non-cable combustibles, and assumed full-room burnout in one area (FC 333GRP), and showed that non-cable secondary combustibles need not be considered in the other area (FC 596), because they are distributed over a very large volume (~3,000,000 $ft^3$).

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that there are no areas in the plant where the contribution from non-cable secondary combustibles to the HRR of a fire will affect additional FPRA targets beyond those that are already considered damaged.

- In FM RAI 01.c (Reference 22), the NRC staff requested that the licensee describe how cable trays with covers and fire-resistive wraps were treated in the calculations of fire propagation in cable trays, and how the presence of holes in cable tray covers were referenced.

  In its response to FM RAI 01.c (Reference 11), the licensee stated that cable trays with solid bottom covers were credited to delay ignition of thermoplastic cables by 4 minutes, and that it did not postulate fire growth and propagation for any fully enclosed cable trays in the cable spreading room. The licensee further stated that one hour and three hour rated ERFBSs were credited to prevent damage and ignition of thermoplastic cables, and that cable tray covers and wraps were not credited when located within the ZOI of a high energy arcing fault (HEAF). The licensee also stated that plant walkdowns confirmed that all sections of cable tray covers and wraps, credited in the FPRA analysis to delay ignition or damage to cables, are robust and without holes.

  In FM RAI 01.01 (Reference 24), the NRC staff requested that the licensee explain whether fire growth and propagation was postulated in enclosed cable trays in areas of the plant outside the cable spreading room.

  In its response to FM RAI 01.01 (Reference 14), the licensee stated that fully enclosed cable trays were not credited in any areas of the plant outside the cable spreading room.

  The NRC staff concludes that the licensee's response to FM RAI 01.c is acceptable because the licensee's treatment of cable trays with covers and fire-resistive wraps in the calculations of fire propagation in cable trays is justified

based on the experimental data reported in NUREG/CR-0381 (Reference 53), consistent with the guidance provided in NUREG/CR-6850, and because the covered cable trays in the cable spreading room are robustly enclosed on all sides with heavy gauge steel and provided with ½ in. ceramic fiber blanket insulation.

- In FM RAI 01.d (Reference 22), the NRC staff requested that the licensee confirm that electrical cabinets throughout the plant are either Case 3 (fire limited to a single bundle of unqualified cable) or Case 4 (closed doors and fire involving multiple bundles of unqualified cable) as described in Table E-1 of NUREG/CR-6850, Volumn 2, and explain why cases with higher HRRs were not considered.

  In its response to FM RAI 01.d (Reference 11), the licensee stated that the FM analysis assumes that there are no open cabinets based on plant electrical equipment operation, electrical safety procedures, and personnel expectations. The licensee further stated that FM assumptions regarding the condition of cabinet doors will be included in the monitoring program, and provided an action to do so in LAR, Attachment S, Table S-3, Implementation Item IMP-159.

  The NRC staff concludes that the licensee's response to FM RAI 01.d is acceptable because current plant procedures, requirements, and future updates to the monitoring program ensure that the assumptions in the FM analysis concerning the HRR of electrical cabinets and the status of cabinet doors are consistent with plant conditions.

- In FM RAI 01.e (Reference 22), the NRC staff requested that the licensee describe the criteria 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 tray covers and fire-resistant wraps on HEAF-induced cable tray ignition and subsequent fire propagation.

  In its response to FM RAI 01.e (Reference 11), the licensee stated that it assumed the ZOI of HEAFs in a cabinet to be five feet vertically and three feet horizontally, that it calculated the ZOI of a HEAF at a segmented bus duct transition point based on Supplement 1 to NUREG/CR-6850, and that it assumed the total area of exposed cable trays and combustibles within the ZOI of a HEAF scenario to ignite at time zero. The licensee explained that subsequent flame spread and fire propagation calculations were performed using an approach that is consistent with the guidance in NUREG/CR-6850 and NUREG/CR-7010. The licensee further stated that the assumed HRR of a cabinet following a HEAF is 211 kW for a period of 20 minutes immediately following the HEAF, and that cable tray enclosures and ERFBS within the ZOI of the HEAF were assumed to be physically damaged by the initial explosion and not credited in the analysis.

  The NRC staff concludes that the licensee's response to FM RAI 01.e is acceptable because the licensee's approach to calculate fire propagation in cable

trays following a HEAF is consistent with and generally more conservative than the guidance in NUREG/CR-6850 and NUREG/CR-7010.

- In FM RAI 01.f (Reference 22), regarding the use of algebraic models, the NRC staff requested that the licensee:

  i. Explain how horizontal vents and vents at or near the ceiling of the compartment were treated in the (MQH) HGL calculations.
  ii. Describe how the time to sprinkler actuation and the time to heat and smoke detector activation were calculated, and provide technical justification for applying steady-state models to time-varying conditions.

  In its response to FM RAI 01.f.i (Reference 11), the licensee explained that horizontal vents or vents at or near the ceiling were not included in the MQH HGL calculations for some compartments where these types of vents are present, and assumed an equivalent single vertical wall opening in compartments where ignoring horizontal vents and vents at or near the ceiling resulted in overly conservative HGL temperatures. The licensee further provided results of CFAST and FDS calculations to demonstrate that replacing a horizontal vent, or a vent at or near the ceiling with a single vertical vent leads to conservative MQH HGL temperature calculations.

  The NRC staff concludes that the licensee's response to FM RAI 01.f.i is acceptable because the licensee demonstrated that its approach to calculate HGL temperatures in compartments with a horizontal vent or a vent at or near the ceiling using the MQH method is conservative.

  In its response to FM RAI 01.f.ii (Reference 11), the licensee explained that it used FDT 10 to determine the minimum HRR required to activate the detector within one minute, and that it credited detection to initiate suppression in the scenario if the time to reach the critical HRR in the scenario (e.g., the minimum HRR to cause target damage) was greater than the time to reach the minimum HRR for detector activation and any suppression delay. The licensee further stated that the process for determining sprinkler response times is similar to that for determining detector response times.

  The NRC staff concludes that the licensee's response to FM RAI 01.f.ii is acceptable because the licensee used FDT 10 to determine the minimum steady HRR required for detector activation within one minute and not to determine the detector activation time for a growing fire.

- In FM RAI 01.g (Reference 22), regarding the CFAST analysis in compartment 552 GRP, the NRC staff requested that the licensee discuss whether the potential damage was assessed for targets in the lower gas layer (LGL) due to the combined radiant heat flux from the HGL, heated surfaces and the flame, or provide technical justification for not performing such an assessment.

In its response to FM RAI 01.g (Reference 11), the licensee explained that the only purpose of the CFAST analysis in fire compartment 552 GRP is to determine if a large oil fire involving one of the circulating water pumps is capable of failing all FPRA targets in the compartment via a damaging HGL, and that target failures via direct flame impingement, plume temperatures, radiant heating, and any combination thereof were addressed separately in the detailed FM analysis for the compartment.

The NRC staff concludes that the licensee's response to FM RAI 01.g is acceptable because the potential damage of targets in the lower gas layer (LGL) due to the combined radiant heat flux from the HGL, heated surfaces and the flame were addressed in a separate analysis.

- In FM RAI 01.h (Reference 22), regarding the use of FDS in the MCR abandonment study, the NRC staff requested that the licensee:

  i. Calculate the heat of combustion of cables in the MCR based on the fuel composition specified in the FDS input files, and provide evidence that the soot yield and heat of combustion values that were used in the analysis result in conservative estimates of the soot generation rate.

  ii. Describe the technical basis that was used for choosing the location of fixed and transient ignition sources in the FDS analyses.

  iii. Provide technical justification for assuming that transient fires in the MCR reach peak HRR in 8 minutes.

  iv. Demonstrate that placing the transient combustible inside the horseshoe against a wall or in a corner does not adversely affect control room habitability compared to the baseline transient fire scenarios.

  v. Describe the basis for choosing the locations of the FDS "devices" (temperature, heat flux, and optical density) that were placed in the MCR.

  In its response to FM RAI 01.h.i (Reference 11), the licensee explained that it assumed PE/PVC cabling for the MCR abandonment analysis, that it selected a soot yield value of 0.12 g/g based on the Society of Fire Protection Engineers (SFPE) handbook values for this type of cable, and that it used the same value for transient fires. The licensee further explained that it did not specify the heat of combustion, and demonstrated that the heat of combustion calculated by FDS based on the fuel composition is slightly lower than the SFPE handbook values.

  The NRC staff concludes that the licensee's response to Part i. of the RAI is acceptable because the soot yield and heat of combustion values used in the FDS MCR abandonment calculations are conservative with respect to soot production and abandonment times.

In its response to FM RAI 01.h.ii (Reference 11), the licensee explained that two transient and two electrical cabinet scenario locations were postulated, and that the locations of the fires were selected to bound a fire at any location within the compartment. The licensee further explained that locations of electric cabinet fires were selected so that the fire would spread to two adjacent cabinets, and that locations for the transient fires were selected both inside and outside of the horseshoe at locations in close proximity to the main control boards and operators.

The NRC staff concludes that the licensee's response to Part ii of the RAI is acceptable because the fire locations that were selected resulted in bounding abandonment times.

In its response to FM RAI 01.h.iii (Reference 11), the licensee explained that it took the time to peak HRR of 8 minutes from Supplement 1 of NUREG/CR-6850, assuming trash is in metal containers, and stated that this assumption is based on site administrative procedures which require that combustible trash be placed in metal containers, fitted with metal covers, and that combustible trash too large to fit in metal containers be discarded in a proper receptacle outside of the plant.

The NRC staff concludes that the licensee's response to Part iii of the RAI is acceptable because a time to peak HRR for transient fires in the MCR of 8 minutes is consistent with the combustible controls in the MCR.

In its response to FM RAI 01.h.iv (Reference 11), the licensee provided the results of a sensitivity analysis, which shows that placing transient combustibles in a corner or against a wall does not result in shorter abandonment times.

The NRC staff concludes that the licensee's response to Part iv of the RAI is acceptable because the results of the sensitivity analysis show that placing transient fires in a corner or against a wall does not accelerate control room abandonment.

In its response to FM RAI 01.h.v (Reference 11), the licensee explained that devices were placed throughout the Control Room to: (1) ensure complete coverage of the Control Room, (2) in areas that represent the most likely fire scenario points of origin, (3) in proximity to the expected location of the operators, and (4) in locations where smoke is expected to accumulate.

The NRC staff concludes that the licensee's response to Part v of the RAI is acceptable because the devices were placed throughout the control room in positions to adequately monitor environmental conditions that affect control room habitability.

- In FM RAI 01.i (Reference 22), regarding the multi-compartment analysis (MCA), the NRC staff requested that the licensee:

  i. Describe the criteria that were used to screen multi-compartment scenarios based on the size of the exposing and exposed compartments.

  ii. Explain how the methods described in NUREG-1805, Chapter 2 (MQH and Beyler), were used in the calculations to screen an ignition source based on insufficient HRR to generate a HGL condition in the exposing compartment.

  iii. Explain how the size of the vents in the exposing compartments used in the MQH HGL calculations was determined, and to what extent these vent sizes are representative of conditions in the plant.

  iv. Explain if and how the possibility of damaging hot gases spreading to a third compartment was considered.

  In its response to FM RAI 01.i.i (Reference 11), the licensee explained that it based the qualitative method for screening exposing compartments on their clear inability to generate a HGL due to their size and configuration, and stated that the only fire compartments that were screened in this step without quantitative FM were the turbine buildings, the containment buildings, and the primary auxiliary building central area, areas open to the atmosphere, the circulating water pumphouse, and the north and south service buildings. The licensee further stated it based the qualitative screening method for exposed compartments on their volume being sufficient to preclude the generation of a HGL, and that additional factors were considered such as fire type and size, and configuration of secondary combustibles. The licensee further stated that after these large, open exposed fire compartments were identified, the exposing compartments were assessed to ensure that there are no significantly large fire scenarios that are capable of generating a HGL in both compartments.

  The NRC staff concludes that the licensee's response to Part i of the RAI is acceptable because the licensee's screening method identified very large exposing and exposed compartments in which a HGL clearly cannot develop.

  In its response to FM RAI 01.i.ii (Reference 11), the licensee explained that Beyler's method and the MQH method were used to determine the minimum HRR to create a HGL condition in closed and naturally vented compartments, respectively. The licensee further described the two methods and referred to the response to FM RAI 04.a for a discussion of the use of the two methods within their limits of applicability.

  In FM RAI 01.02 (Reference 24), the NRC staff requested that the licensee describe the criteria that were used in the MCA to select either the method of Beyler or the method of MQH for calculating the minimum HRR required to develop a damaging HGL in each exposing compartment.

In its response to FM RAI 01.02 (Reference 14), the licensee explained that it used Beyler's method in every compartment as the first initial screening, that additional HGL calculations were performed with the MQH method in compartments that did not screen, and that it used the MQH method in the quantitative analysis of the exposed compartments open to multiple adjacent compartments, and for the detailed fire modeling calculations that provided input to the refined analysis of the MCA calculation.

The NRC staff concludes that the licensee's response to FM RAI 01.i.ii is acceptable because the licensee's approach is consistent with the guidance in NUREG/CR-6850, which is to initially perform a scoping analysis, and, if needed, follow-up with more detailed FM.

In its response to FM RAI 01.i.iii (Reference 11), the licensee explained that the ventilation openings assumed in the MQH HGL calculations are representative of the openings in the plant for the respective areas, with the exception of a few areas where smaller than actual opening sizes were used.

The NRC staff concludes that the licensee's response to Part iii of the RAI is acceptable because the licensee assumed vent dimensions in the MQH HGL calculations that are either representative of the actual opening sizes in the plant, or smaller, which lead to conservative HGL temperature estimates.

In its response to FM RAI 01.i.iv (Reference 11), the licensee explained that additional calculations were performed and that as a result of these calculations several scenarios were identified in which the HGL spread beyond the exposed compartment to a third compartment. The licensee further stated that it updated the FPRA to account for the fires that spread to a third compartment and have a frequency of occurrence greater than 1.0E-08/yr.

The NRC staff concludes that the licensee's response to Part iv of the RAI is acceptable because the licensee updated the FPRA to account for risk-significant multi-compartment scenarios in which the HGL spreads from the exposing compartment to more than one exposed compartment.

- In FM RAI 02.a (Reference 22), 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 10), the licensee stated that cables in conduit and raceways have been conservatively analyzed as thermoplastic targets in all fire compartments, (i.e., targets with a critical temperature of 205°C, and a critical heat flux of 6 $kW/m^2$).

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee assumed the most conservative damage thresholds for FPRA cable targets.

- In FM RAI 02.b (Reference 22), the NRC staff requested that the licensee confirm that the guidance in NUREG/CR-6850, Volume 2, Appendix Q, Section Q.2.2, concerning the damage delay time for covered trays was only used for qualified cable.

  In its response to FM RAI 02.b (Reference 10), the licensee stated that cable trays provided with solid bottom covers were credited to delay damage to thermoplastic cables by 4 minutes. The licensee further stated that it assumed a 6-minute delay in cable damage for the fully enclosed trays with ceramic fiber blanket insulation in the cable spreading room.

  In FM RAI 02.01 (Reference 24), the NRC staff requested that the licensee explain whether there are enclosed cable trays, or trays with a bottom cover in areas outside the cable spreading room where it assumed a damage delay greater than 4 minutes.

  In its response to FM RAI 02.01 (Reference 14), the licensee stated that bottom covers were credited in several fire areas to delay damage by 4 minutes, that there are no credited fully-enclosed cable trays in other areas of the plant other than the cable spreading room, and that there are no areas where bottom covers were credited for delaying damage beyond 4 minutes.

  The NRC staff concludes that the licensee's response to FM RAI 02.b is acceptable because the assumed 4-minute damage delay for cable trays with uninsulated bottom covers is consistent with the guidance in NUREG/CR-6850, and the assumed 6-minute damage delay for enclosed cable trays with ceramic fiber insulation is supported by test data included in NUREG/CR-0381.

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, the NRC staff concludes that the licensee's approach for meeting the requirements of NFPA 805, Section 2.4.3.3, is acceptable.

3.4.2.3 Conclusions Regarding Fire PRA Quality

Based on NUREG-0800, Section 19.2, Section III.2.2.4.1, summarizing the NRC staff's review of PRA quality required for an application, the NRC staff concludes that the licensee's PRA satisfies the guidance in RG 1.174, 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, Section 2.4.3.3 of NFPA 805 is satisfied for the request to transition to NFPA 805. The NRC staff based this conclusion on the findings that: (1) the PRA model adequately represents the current, as built, as operated configuration, and is therefore capable of being adapted to model both the post-transition and compliant plant as needed; (2) the PRA models conform sufficiently to the applicable industry PRA standards for internal events and fires at an appropriate 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 after transition to NFPA 805 must use an acceptable PRA approach and acceptable methods and data. The NRC staff concludes that the changes already made to the updated baseline FPRA model to incorporate acceptable methods, as detailed in the licensee's response to PRA RAI 3 (Reference 15), and discussed above, demonstrate that NFPA 805 criteria are satisfied and that the PRA is acceptable for use to support self-approval changes to the FPP program.

Based on the licensee's administrative controls to maintain the PRA models current and assure continued quality, using only qualified staff and contractors (as described in SE, Section 3.8.3), the NRC staff concludes that the PRA maintenance process can assure that the quality of the PRA is sufficient to support self-approval of future RI changes to the FPP under the NFPA 805 license condition subject to completion of the implementation items described in LAR, Attachment S, Table S-3.

### 3.4.3 Fire Risk Evaluation

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, Section C.2.2.4, the licensee used a RI approach to justify acceptable alternatives to compliance 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, Table C-1, "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 do not require a risk evaluation. The licensee identified the VFDRs in LAR, Attachment C, Table C-1, NEI 04-02 Table B-3, "Fire Area Transition," that it does not intend to bring into deterministic compliance under NFPA 805. For these VFDRs, the licensee performed evaluations using the RI approach, in accordance with NFPA 805, Section 4.2.4.2, to address FPP non-compliances and demonstrate that retaining the VFDRs is acceptable.

The VFDRs were characterized by the licensee as separation issues or degraded fire protection systems. The VFDRs characterized as separation issues can generally be categorized into the following three types of plant configurations: (1) inadequate separation resulting in fire-induced damage of process equipment or associated cables required for the identified success path; (2) inadequate separation resulting in fire-induced spurious operation of equipment that may defeat the identified success path; and, (3) inadequate separation resulting in fire-induced failure of process monitoring instrumentation or associated cables required for the identified success path, or combinations of the above configurations.

In its response to PRA RAI 16.d (Reference 12), the license provided a representative list of VFDRs related to plant functionality not modeled in the PRA because they have a negligible

impact on risk. These exclusions include systems and components such as the pressurizer heaters, neutron monitoring, and the boric acid outlet flow control valves because they are not critical to preventing core damage; valves whose spurious opening would create non-critical flow diversion; instrumentation not used as a cue for credited operator actions; and heating ventilation and air conditioning (HVAC) systems whose failures do not impact the success criteria of shutdown systems.

The licensee summarized its change-in-risk evaluations in LAR, Attachment W, Section W.2.1, and in its response to PRA RAI 16 (Reference 12). The change-in-risk for transition (i.e., ΔCDF and ΔLERF) was evaluated by subtracting the risk of a compliant plant configuration from the risk of post-transition plant for each fire area. The post-transition plant model was developed using the current plant configuration with all modifications identified in LAR, Attachment S. Some modifications in LAR, Attachment S, remove VFDRs and other modifications are only included to reduce risk (i.e., risk-reduction modifications). 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.

Exceptions to the VFDR modeling mechanism discussed above are associated with the change-in-risk calculation for MCR abandonment due to loss of habitability for fires within the MCR, and MCR abandonment due to loss of control for fires in three fire areas. In these scenarios, the change-in-risk is also estimated as the post-transition minus the compliant plant risk but a conservative result is achieved by overestimating the post-transition risk and/or by underestimating the compliant plant risk.

In LAR, Attachment W, Section W.2.1, and in its response to PRA RAI 16 (Reference 12), the licensee explained that for MCR abandonment scenarios due to loss of MCR habitability (abandonment when the FM indicates uninhabitable MCR conditions), alternate shutdown is credited in both the compliant and post-transition plant models although quantified using different assumptions in the two cases. In the post-transition plant model the failure of the human actions associated with MCR abandonment are assigned their nominal values yielding CCDP and CLERP values of 0.56 and 0.056, respectively. In the compliant, plant all required human actions after abandonment are assumed to be successful and only equipment failures are included, resulting in CCDP and CLERP values of 0.19 and 0.019 respectively. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that for loss of habitability, the compliant plant risk is underestimated when failure of operator actions are not included, resulting in a conservative change in risk estimate.

The MCR abandonment on loss of control is a proceduralized option for fires in the MCR, cable spreading room (CSR), and 4 kV vital switchgear room. In its response to PRA RAI 16.01.01 (Reference 16), the licensee explained that the change-in-risk associated with MCR abandonment on loss of control assumes that the operators would never abandon the MCR in the post transition plant, but will always abandon the MCR in compliant plant scenarios when abandonment results in lower risk than non-abandonment. The post-transition plant models fire scenarios as in other fire areas (i.e., identifying fire failed equipment and modeling shutting down the plant from the MCR). In the compliant plant, the generic risk from abandoning the MCR on loss of control but failing to successfully shutdown the plant is estimated to result in CCDP and the conditional large early release probability (CLERP) values of 0.19 and 0.019 respectively. The values are the same for loss of habitability and loss of control because the

same procedures and equipment are used as well as the same assumption that all human actions are successful. Abandonment is modeled in the compliant plant by simply replacing all compliant plant scenario risk values that are greater than 0.19/0.019 with those values. The NRC staff finds the licensee's response to the RAI acceptable because for loss of control, the licensee demonstrated that the post-transition plant risk is overestimated by not crediting abandonment for loss of control and the complaint plant risk is underestimated by assuming abandonment is always undertaken when it has the lower risk, and therefore the change-in-risk estimate is conservative.

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, Section 2.2.4.1, and FAQ 08-0054 (Reference 65). 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 with VFDRs meets the risk acceptance criteria described in NFPA 805, Section 2.4.4.1.

3.4.4 Additional Risk Present by Recovery Actions

The NRC staff reviewed LAR, Attachment C, "NEI 04-02 Table B-3, – Fire Area Transition," LAR, Attachment G, "Recovery Actions Transition," and LAR, Attachment W, "Fire PRA Insights," during its evaluation of the additional risk presented by the NFPA 805 RAs. SE, Section 3.2.5, describes the identification and evaluation of RAs.

The licensee used the guidance in RG 1.205, Revision 1, for addressing RAs. Based on consideration of the definition of PCS and RA, as clarified in RG 1.205, Revision 1, and FAQ 07-0030 (Reference 59), the licensee stated in LAR, Attachment G, that it does not have any locations considered to be PCS. Accordingly, as clarified in its response to PRA RAI 20 (Reference 10), any actions credited in the FPRA required outside the MCR were considered RAs per the guidance in RG 1.205 and in accordance with NFPA 805.

The licensee identified the RAs in LAR, Attachment G, Table G-1. Per LAR, Attachment W, Tables W-6 and W-7, the licensee credited RAs in the FPRA in 16 out of 71 fire areas per unit. In its response to PRA RAI 17.a (Reference 10), the licensee clarified that all RAs listed in LAR, Attachment G, are credited in the PRA and none are credited solely to maintain adequate DID.

In its response to PRA RAI 16 (Reference 12), the licensee explained that the additional risk of RAs is calculated by setting recovery events failure probabilities to zero in the post-transition model to obtain the differences in risk for each fire area. This calculation provides the post-transition CDF and LERF assuming RAs never fail. Subtracting the CDF and LERF with successful RAs from the CDF and LERF with the failure probabilities at their nominal values yields the $\Delta$CDF and $\Delta$LERF associated with performing the RAs. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the calculation is consistent with the acceptable methodology in FAQ-07-0030.

In the final revision of LAR, Attachment W, Tables W-6 and W-7 (Reference 19), the licensee explained that the additional risk of RAs for Unit 1 is an increase in CDF of 2.35E-05/yr and an

increase in LERF of 6.76E-07/yr, and for Unit 2 is an increase in CDF of 2.14E-05/yr and an increase in LERF of 4.46E-07/yr. The CDF values presented for Units 1 and 2 are above the RG 1.174 change-in-risk acceptance guidelines of 1E-05/yr, while the LERF values provided for Units 1 and 2 are below the RG 1.174 risk acceptance guideline of 1E-06/yr. Although the increase in CDF values are above the risk acceptance guidelines, the total change-in-CDF for each plant is a negative CDF after risk reduction modifications are credited (as discussed in SE Section 3.4.6). The NRC staff concludes that an additional risk of recovery actions above the risk acceptance guidelines for CDF is acceptable because the CDF change-in-risk measure demonstrates a large risk decrease from the risk-reduction modifications which will improve the safety of the plant.

The licensee reviewed all of the RAs for adverse impact and resolved each action as stated in LAR, Attachment G. None of the RAs listed in LAR, Attachment G, Table G-1, were found to have an adverse impact on the FPRA. All RAs were evaluated against the feasibility criteria provided in NEI 04-02, FAQ 07-0030, Revision 5, and RG 1.205. Additionally, the licensee stated that a confirmatory field verification walk-through of the feasibility for the credited NFPA 805 RAs will be performed and included this action in LAR, Attachment S, Table S-3, Implementation Item IMP-143. 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 the licensee's methods for calculating the additional risk of RAs is acceptable because they are consistent with RG 1.205, Section 2.2.4.1, and FAQ 07-0030. Furthermore, the additional risk of RAs is much smaller than the risk reduction associated with modifications (i.e., the change-in-risk is negative), and, therefore, the NRC staff 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, Table S-2 (Reference 21), the licensee identified its proposed modifications and in its response to PRA RAI 18 (Reference 12), the licensee identified 19 modifications being implemented to reduce plant risk rather than to bring the plant into compliance with the deterministic requirements of NFPA 805. All other plant modifications identified in LAR, Attachment S, Table S-2, are being implemented to bring the plant into compliance with the deterministic requirements of either Chapter 3 or Chapter 4 of NFPA 805. In its response to PRA RAI 19.a (Reference 12), the licensee explained that its FREs credit risk reduction from these non-VFDR risk reduction plant modifications in the post-transition plant but not in the compliant plant and, therefore, the NRC staff concludes that the licensee's application to a RI/PB FPP is a combined change as discussed in Section 1.1 of RG 1.174.

The total CDF and total LERF are estimated by adding the risk assessment results for internal events, internal flooding, internal fire, seismic, high winds, and other external hazard events. Though RG 1.174 does not require total CDF and LERF values for an application when the total

change in CDF and LERF is less than 1.0E-06/yr and 1.0E-07/yr (respectively), the licensee provided an estimate of contributors to the total CDF and LERF in its updated LAR, Attachment W. These values represent final risk estimates provided by the licensee in a revision to LAR, Attachment W, Table W-1 (Reference 19), which also provided the licensee's updated response to PRA RAI 3 (Reference 12), incorporated revisions to the PRA methods into the FPRA model as discussed above. These estimates provided in SE, Table 3.4.6 (below), show that the CDF for both units is below 1E-04/yr and the LERF for both units is below 1E-05/yr.

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

| Hazard Group | Unit 1 | | Unit 2 | |
|---|---|---|---|---|
| | CDF (/year) | LERF (/year) | CDF (/year) | LERF (/year) |
| Internal Events[1] | 5.1E-6 | 3.7E-8 | 5.1E-6 | 3.6E-8 |
| Internal Flood | 3.0E-7 | 2.0E-8 | 3.0E-7 | 2.0E-8 |
| Internal Fire | 5.9E-5 | 9.0E-7 | 6.9E-5 | 1.1E-6 |
| Seismic | 1.0E-5 | 1.0E-6 | 1.0E-5 | 1.0E-6 |
| High Winds | <2E-6 | <8E-8 | <2E-6 | <8E-8 |
| Other | <1E-6 | <1E-7 | <1E-6 | <1E-7 |
| TOTAL | 7.8E-05 | 2.2E-06 | 8.8E-05 | 2.4E-06 |

Notes:
1. In response to PRA RAI 23 (Reference 10), the licensee explained that the internal events CDF and LERF estimates include credit for certain risk reduction modifications.

Final change-in-risk values were provided in LAR, Attachment W, Tables W-6 and W-7 (Reference 19). The final values include the effect of revisions to a number of PRA methods resulting from the NRC staff's RAIs on methods proposed in the LAR. The updated tables provide the ΔCDF and ΔLERF estimates for each fire area that is not deterministically compliant, in accordance with NFPA 805, Section 4.2.3. The reported change-in-risk estimates for the fire areas include the risk-reduction for modifications and the risk increase from retained VFDRs. These results indicate that no fire area in Units 1 and 2 has a change-in-risk that exceeds the risk acceptance guidelines in RG 1.174 of 1E-05/yr ΔCDF and 1E-06/yr ΔLERF. The tables also provide the total change in risk associated with transition as - 9.13E-06/yr and 3.97E-07/yr for ΔCDF and ΔLERF, respectively, for Unit 1, and - 2.86E-04/yr and - 7.08E-08/yr for ΔCDF and ΔLERF respectively for Unit 2. These results indicate that the total transition change-in-risk meets the risk acceptance guidelines in RG 1.174 of 1E-05/yr ΔCDF and 1E-06/yr ΔLERF

The combined change request discussed in RG 1.174 allows the risk-increase and the risk-decrease to be combined and the net change to be compared to the RG 1.174 acceptance guidelines. However, the guidance in Sections 1.1 and 1.2 of RG 1.174 states that any increase and any decrease in the ΔCDF and ΔLERF should be also be reported separately. In the final version of LAR, Attachment W, Tables W-6 and W-7 (Reference 19), and in its response to PRA RAI 18 (Reference 12), the licensee provided the magnitude of the risk decrease associated with just the non-VFDR (risk-reduction) modifications (ΔCDF/ΔLERF of 3.94E-05/1.95E-07 per year for Unit 1 and 3.24E-04/8.69E-07 per year for Unit 2). The difference between the total change-in-risk and risk decrease from the risk reduction modifications is the total risk increase due to unresolved VFDRs (ΔCDF/ΔLERF of 3.03E-

05/5.92E-07 per year for Unit 1 and 3.80E-05/7.98E-07 per year for Unit 2). Accordingly, the total risk decrease is much greater than the total risk increase except in the case of LERF for Unit 1 for which the post-transition plant risk increase of 4.0E-07/yr is less than the acceptance guidelines of 1E-06/yr.

Given that: (1) the total change in CDF is negative for both units, (2) the change in LERF for Unit 2 is negative, (3) the change in LERF for Unit 1 is 3.97E-07/yr, and (4) the change-in-risk for any given fire area does not exceed the RG 1.174 guidelines of 1E-05/yr for CDF and 1E-06/yr for LERF, the NRC staff concludes that the combined change meets RG 1.174 guidelines.

Based on the information provided by the licensee, the NRC staff concludes that the risk associated with the proposed alternatives to compliance with the deterministic criteria of NFPA 805 is acceptable in accordance with NFPA 805, Section 2.4.4.1. Additionally, the NRC staff concludes that the licensee has satisfied RG 1.174, Section 2.4, and NUREG-0800, Section 19.2, regarding acceptable risk.

3.4.7 Uncertainty and Sensitivity Analysis

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 64), 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 19 (Reference 12), the licensee provided the results of this sensitivity study using the integrated analysis provided in its response to PRA RAI 3 (Reference 12), as the baseline. The results indicated that two fire compartments in Unit 1 and one fire compartment in Unit 2 exceed the RG 1.174 guidelines. In the locations for which the RG 1.174 guidelines are exceeded, the licensee defined additional DID factors. The licensee identified that compartment 305 in which RG 1.174 guidelines are slightly exceeded for Unit 1 is provided with automatic halon suppression, wide area detection, and 1-hour cable wrap, all of which is not credited in the FPRA. The licensee identified that compartment 187 GRP in which RG 1.174 guidelines are exceeded for both units has automatic suppression and 3-hour wrap for selected cables. The licensee also explained that for all three fire compartments there are proceduralized operator actions not credited in the FPRA and hot-short probabilities that could be reduced using NRC guidance. Though the integrated analysis was subsequently updated, final fire risk results provided in LAR, Attachment W, Tables W-2 and W-3 (Reference 19), show that the fire risk is still dominated by the fires in same fire compartments identified in the licensee's previous response (Reference 12), and, therefore, the same additional DID factors still apply. The NRC staff concludes the licensee's response to the RAI is acceptable because the licensee demonstrated that the updated LAR, Attachment W, identifies dominant risk results for the same three compartments which exceeded RG 1.174 guidelines in the previous response. The NRC staff further concludes that the substantial DID measures identified, and not credited, for those compartments continue to apply and be adequate, and satisfy the guidance in FAQ 08-0048.

No other key sources of uncertainty requiring a sensitivity analysis were identified by the licensee or by NRC staff.

3.4.8 Conclusion for Section 3.4

Based on the information provided by the licensee in the LAR, as supplemented, regarding the fire risk assessment methods, tools, and assumptions used to support 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 (PCEs,) and Section 4.2.4.2 (FREs), is of sufficient quality to support the application to transition the FPP to NFPA 805. Therefore the PRA approach, methods, tools and data are acceptable in accordance with NFPA 805, Section 2.4.3.3.

- The licensee has completed the changes to the PRA model and replaced certain approaches, data, and methods identified during the LAR review as unacceptable with acceptable approaches, data, and methods as described. Therefore, the NRC staff concludes that the baseline PRA model may be used to support post-transition self-approval of changes because the identified acceptable methods will be used until they are replaced by other acceptable methods.

- The licensee's PRA maintenance process is adequate to support self-approval of future RI changes to the FPP subject to completion of the PRA related Implementation Item IMP-142, as described in LAR, Attachment S, Table S-3.

- 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 to be acceptable. The licensee's process followed the NRC-endorsed guidance in NEI 04-02, Revision 2, and is consistent with the NRC guidance in RG 1.205, Revision 1, which provides an acceptable approach for meeting the requirements of 10 CFR 50.48(c).

- The licensee's application to transition to NFPA 805 is a combined change, as defined by RG 1.205, Revision 1, which includes risk increases identified in the FREs with risk decreases resulting from non-VFDR modifications. The changes in risk (i.e., $\Delta$CDF and $\Delta$LERF) associated with the proposed alternatives to compliance with the deterministic criteria of NFPA 805 (FREs) is acceptable and satisfies the guidance contained in RG 1.205, Revision 1, RG 1.17 4, Sections 2.4, and NUREG-0800, Section 19.2, regarding acceptable risk. By meeting the guidance contained in these approved documents, the NRC staff has concluded that the changes in risk are acceptable and therefore meet the requirements of NFPA 805.

- The additional risk associated with the use of RAs was evaluated and provided in accordance with the guidance in RG 1.205, Revision 1, and NFPA 805, Section 4.2.4. In particular, the NRC staff finds that the additional risk of RAs slightly above the risk acceptance guidelines is acceptable because the primary

change-in-risk measure (i.e., total change-in-risk) is a large risk decrease due to the risk-reduction modifications which will improve plant safety. The NRC staff concludes that the additional risk associated with the NFPA 805 RAs is also acceptable because the change-in-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.

- Implementation Item IMP-142 of LAR, Attachment S, Table S-3, states that the licensee will update the FPRA model after all modifications and procedure changes are complete and as-built and all implementation items affecting the fire PRA results are complete. These results of the FPRA will be compared to the final updated version of the LAR after all RAIs have been responded to and accepted. This comparison will be treated as a change evaluation, (i.e., should the change in CDF or LERF exceed 1E-7/yr. or 1E-8/yr. respectively, then the licensee will submit a LAR).

- The licensee did not utilize any RI or PB alternatives to comply with 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 [EEEE]," 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 nuclear safety performance criteria in Chapter 1;
>
> (2) Selection of cables necessary to achieve the nuclear safety performance criteria in Chapter 1;
>
> (3) Identification of the location of nuclear safety equipment and cables; and
>
> (4) Assessment of the ability to achieve the nuclear safety performance criteria given a fire in each fire area.

This SE section addresses the last topic regarding the ability of each fire area to meet the NSPC of NFPA 805. SE, Section 3.2.1, addresses the first three topics.

NFPA 805, Section 2.4.2.4, "Fire Area Assessment," states 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," LAR, 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.

PBNP is a dual unit PWR with 71 individual fire areas including the yard (comprised of several structures and components that include, plant transformers, duct banks, the 13.8KV switchgear building, switchyard control house, gas turbine building, fuel oil storage tanks, and warehouse #4), and each fire area is composed of one or more fire zones. Based on the information provided by the licensee in the LAR, as supplemented, 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 identifies the fire zones within the fire areas.

SE, Table 3.5-1, identifies 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, "NEI 04-02 Table B-3, Fire Area Transition."

Table 3.5-1 Fire Area and Compliance Strategy Summary

| Fire Area | Area Description | NFPA 805 Compliance Basis |
|---|---|---|
| A01-A | General Plant Area - 8' Elevation and Below | Performance-Based |
| A01-B | Monitor Tank Area | Performance-Based |
| A01-B/46 | CCW Heat Exchanger Boric Acid Tank Area | Performance-Based |
| A01-CN | General Plant Area - PAB 26' Elevation (North) | Performance-Based |
| A01-CS | General Plant Area - PAB 26' Elevation (South) | Performance-Based |
| A01-D | General Plant Area - PAB 44' and 66' | Performance-Based |
| A01-E | General Plant Area - Turbine Building | Performance-Based |
| A01-F | General Plant Area - YARD | Performance-Based |
| A01-G | Unit 1 Façade | Performance-Based |
| A01-H | Unit 2 Façade | Performance-Based |
| A02 | Containment Spray/Safety Injection Pump Room | Performance-Based |
| A03 | 1P2C Charging Pump Room | Performance-Based |
| A04 | 1P2B Charging Pump Room | Performance-Based |
| A05 | 1P2A Charging Pump Room | Performance-Based |
| A06 | 1B32 MCC Area | Performance-Based |
| A07 | Chemical Drain, Laundry Tank and RCP Seal Filter Area | Performance-Based |
| A08 | HVAC Equip. Rm Pipeway 1 Valve Gallery Area | Performance-Based |
| A09 | Exhaust Fan Room | Performance-Based |
| A10 | Radioactive Gas Treatment Area | Performance-Based |
| A11 | Pipe Way 4 - Valve Gallery Area | Performance-Based |
| A12 | 2P2C Charging Pump Room | Performance-Based |
| A13 | 2B2B Charging Pump Room | Performance-Based |
| A14 | 2P2A Charging Pump Room | Performance-Based |
| A15 | 2B32 MCC Area | Performance-Based |
| A16 | D106 - Battery Room | Performance-Based |
| A17 | D04 Electrical Equipment | Performance-Based |
| A18 | D03 Electrical Equipment | Performance-Based |
| A19 | D105 - Battery Room | Performance-Based |
| A20 | Heating Boiler Room | Performance-Based |
| A21 | Heating Boiler Day Tank No. 1 Room | Performance-Based |

| | | |
|---|---|---|
| A22 | Heating Boiler Day Tank No. 2 Room | Performance-Based |
| A23N | Auxiliary Feedwater Pump Room (North) | Performance-Based |
| A23S | Auxiliary Feedwater Pump Room (South) | Performance-Based |
| A24 | 4KV Vital Switchgear Room | Performance-Based |
| A25 | D06 - Battery Room | Performance-Based |
| A26 | D05 - Battery Room | Performance-Based |
| A27 | G01 - Diesel Generator Room | Performance-Based |
| A28 | G02 - Diesel generator Room | Performance-Based |
| A29 | Air Compressor Room | Performance-Based |
| A30 | Cable Spreading Room | Performance-Based |
| A31 | Control Room | Performance-Based |
| A32 | Computer Room | Performance-Based |
| A33 | Control Bldg. HVAC Equip. Room | Performance-Based |
| A34 | Technical Support Center | Performance-Based |
| A35 | Maintenance Building | Performance-Based |
| A36 | Unit 1 Containment Area | Performance-Based |
| A37 | Unit 1 Façade Stairway/Elevator Area | Performance-Based |
| A38 | Circulating Water Service Water Pumphouse | Performance-Based |
| A39 | South Gatehouse | Performance-Based |
| A40 | Fuel Oil Pumphouse | Performance-Based |
| A41 | Flammable Liquids Storage Room | Performance-Based |
| A42 | Lubricating Oil Storage Room | Performance-Based |
| A43 | Blowdown Evaporator Building | Performance-Based |
| A44 | Gas Stripper Building | Performance-Based |
| A45 | Unit 2 Façade Stairway Area | Performance-Based |
| A46 | Unit 2 Containment Area | Performance-Based |
| A47 | Extension Building | Performance-Based |
| A48 | Warehouse #1 | Performance-Based |
| A49 | Well Water Pumphouse | Performance-Based |
| A50 | Warehouse #2 | Performance-Based |
| A51 | Warehouse #3 | Performance-Based |
| A52 | North Service Building | Performance-Based |
| A53 | Sewage Treatment Plant | Performance-Based |
| A54 | D305 - Swing Battery D301 Charger Rooms | Performance-Based |
| A58 | T -175A Fuel Tank Room | Performance-Based |
| A59 | T-175B Fuel Tank Room | Performance-Based |
| A61 | P-206A P207A Fuel Pump Room | Performance-Based |
| A68 | Train B East Duct Bank Manholes | Performance-Based |
| A69 | Manhole Z-068 West of DGB | Performance-Based |
| A70 | Train A West Duct Bank Manholes | Performance-Based |
| A71 | Combined DG Building Train B Areas | Performance-Based |

LAR, Attachment C, provides the results of these analyses on a fire area basis. For each fire area, the licensee documented:

- 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 NFPA 805, Section 3.8.2, (2) automatic water-based fire suppression systems, in accordance with NFPA 805, Section 3.9.1, (3) gaseous fire suppression systems, in accordance with NFPA 805, Section 3.10.1, and (4) passive fire protection features, in accordance with NFPA 805, 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, Table 4-3, "Summary of NFPA 805 Compliance Basis and Required Fire Protection Systems and Features," 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 PBNP treatment of this issue is acceptable because the licensee has 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 of LAR, Attachment C, includes a discussion of how the licensee met the requirement to evaluate the fire suppression effects on the ability to meet the NSPC.

The licensee stated that damage to plant areas and equipment from the accumulation of water discharged from manual and automatic fire protection systems and the discharge of manual suppression water to adjacent compartments is controlled. As described in the LAR, the majority of plant fire areas have drains that are capable of passing the expected flows as a result of system actuation and manual hose application. The licensee stated the fire brigade is trained to discharge water in a judicious manner and instructed to direct hose streams and fire extinguishers in such a way as to limit the amount of overspray beyond the immediate area of the fire. The licensee further stated that consideration is given to the type of fire suppression method used (e.g., fire extinguisher, water, direct, or indirect attack) based on the type of fire, extent, intensity and the need to limit the quantity of water in areas containing energized electrical and safety related equipment and that fire brigade members are trained in protecting safety related equipment from fire and water damage. The licensee concluded that therefore, fire suppression activities are not expected to adversely affect achievement of the NSPC.

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, Section 4.2.3, as supplemented, the licensee identified exemptions from the deterministic requirements for each fire area that were previously approved by the NRC. Each of these exemptions is further detailed in LAR, Attachment K, "Existing Licensing Action Transition." However, the licensee stated in LAR, Section 4.2.3, and indicated in LAR, Attachment C, that no licensing actions will be transitioned into the NFPA 805 FPP as previously approved, since they are no longer required because a FRE has either found that the fire area is compliant with NFPA 805, Section 4.2.4, or demonstrated the installed fire protection features are adequate for the hazard in EEEEs.

Since the fire areas are either compliant with 10 CFR 50.48(c) or the exemptions are no longer necessary, the licensee requested that the exemptions listed in Attachment K be rescinded as part of the LAR process. The rescinded exemptions are documented in LAR, Attachment O, "Orders and Exemptions." See SE, Section 2.5, for further discussion.

The licensee does not have any fire area specific elements of the current FPP for which NRC clarification is needed. LAR, Attachment T, "Clarification of Prior NRC Approvals," contains a clarification to a previous approval for NFPA 805, Chapter 3, Section 3.3.8 (see SE, Section 3.1). The NRC staff evaluation of the clarification request is contained in SE, Section 3.5.2.

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 it followed the guidance in RG 1.205, Regulatory Position 2.3.2, and FAQ 08-0054 (Reference 65). 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 they meet the guidance provided in RG 1.205 and FAQ 08-0054, and the requirements of NFPA 805.

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, as supplemented; or
- Numerous VFDRs were identified as not modeled in the PRA, because the associated failure has a negligible impact on plant risk or does not fail the associated performance goal criteria.

In SSA RAI 01.c (Reference 22), the NRC staff advised the licensee that there were no VFDR resolutions that describe modifications in fire areas A01-B/46, A23N, and A36; however, the fire risk summaries in LAR, Attachment C, for these areas concluded that the applicable risk, DID, and safety margins were satisfied with modifications identified in LAR, Attachment S. The NRC staff requested that the licensee confirm the modifications described in the fire risk summary for the individual fire areas are not associated with VFDRs and identify the specific modifications in LAR, Attachment S, associated with these fire areas. In its response to SSA RAI 01.c (Reference 12), the licensee stated that the proposed cable protection referenced in the fire risk summary for fire areas A01-B/46, A23N, and A36 were not related to VFDR resolutions and were for risk reduction. The licensee further stated (Reference 17), that subsequent to the LAR submission, additional refinements to the FPRA model and risk insights concluded the modifications (MOD-8, MOD-9, MOD-12, MOD-17, and MOD-18) described in the fire risk summary for the subject fire areas were no longer necessary and provided revised pages to LAR, Attachment C,for these fire areas. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided revised pages to the LAR that removed references to the modifications, which the licensee determined are no longer necessary.

In SSA RAI 05 (Reference 22), the NRC staff advised the licensee that numerous VFDRs describe a situation where fire damage can cause overcurrent trip (OCT) concerns that could result in a secondary fire; that the licensee addressed the VFDR condition by qualitative analysis and did not model the condition in the FPRA; and that the licensee's analysis recommended numerous modifications to preserve the overcurrent trip capability. The NRC staff requested that the licensee describe whether all OCT concerns identified in the analysis are resolved by proposed modifications and that the licensee link the specific modifications in LAR, Attachment S, with the associated VFDRs in LAR, Attachment C. The NRC also requested that the licensee provide a discussion explaining how the qualitative risk analyses justifies the presence of secondary fires if the VFDR is not resolved by modification and is not modeled in the FPRA. In its response to SSA RAI 05 (Reference 12), the licensee stated that subsequent to LAR submission, it revisited the OCT/ secondary fires issue. The licensee stated that it updated and supplemented the qualitative analysis by a RI approach and entered the OCT logics into the FPRA model. The licensee further stated that the final quantification demonstrated acceptable results without any of the modifications that had previously been considered. The NRC staff concludes that the licensee's response to the RAI is acceptable

because the licensee included the OCT concern in the FPRA and the quantification determined that the modifications are no longer necessary.

For all fire areas where the licensee used the PB approach to meet the NSPC, the licensee described each VFDR and the associated resolution in LAR, Attachment C. The NRC staff concludes that the licensee's identification and resolution of the VFDRs is acceptable because the licensee performed its analysis in accordance with the criteria in NEI 04-02 as endorsed by RG 1.205.

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.

In SSA RAI 02 (Reference 22), the NRC staff stated that the licensee's analysis indicated that RAs for VFDRs A31-11 and A31-22 are required and requested that the licensee explain why the RAs for VFDR A31-11 and A31-22 were not included in LAR, Attachment G, Table G-1. In its response to SSA RAI 02 (Reference 10), the licensee stated that the VFDRs associated with 125VDC Panels D-21 (A31-11) and D-22 (A31-22) do not correspond directly with RAs, but are represented in the RAs list in LAR, Attachment G, Table G-1. The licensee stated that panels D-21 and D-22 support multiple devices in the NSCA model and on loss of power, most of the supported loads fail in such a fashion so as not to challenge the shutdown strategy credited in the control room (i.e., MCR abandonment). The licensee stated that two loads, however, fail in undesirable states: the MSIVs and "SI-RESET" (a dummy component to represent the ability to block and reset a safety injection signal, whether fire-induced or plant-transient-related). The licensee stated that local actions to isolate and vent instrument air to failed-close the MSIVs are included in LAR, Attachment G, Table G-1 (VFDRs A31-04 and A31-18), as are actions associated with SI-RESET device failures that include the inability to block/ reset a spurious start of the containment spray (CS) pumps and require a local action to trip the CS pumps as included in LAR, Attachment G, Table G-1 (VFDRs A31-05 and A31-19), and the inability to block/ reset a load shed of battery chargers and require a local action to position emergency close switch 43/24212B in 'CLOSE' as included in LAR, Attachment G, Table G-1 (VFDR A31-10). Therefore, the licensee stated that although the VFDRs identifying the loss of 125VDC panels D-21 and D-22 are not directly associated with RAs in the LAR, the undesirable impacts of their loss are addressed by RAs. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee identified RAs in LAR, Attachment G, that address the device failures of concern that are associated with the loss of 125VDC panels as described in VFDRs A31-11 and A31-22.

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 RAs per NFPA 805. The details of the NRC staff review for RAs are described in SE, Section 3.2.5, "Establishing Recovery Actions." The NRC staff's evaluation of the additional risk of RAs credited to meet the risk acceptance guidelines is provided in SE, Section 3.4.4.

3.5.1.7 Plant Fire Barriers and Separations

With the exception of ERFBS, and a fire barrier located internal to Fire Area A06, 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.

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.

3.5.1.8 Electrical Raceway Fire Barrier Systems

The licensee stated that the ERFBS used at PBNP meet the deterministic requirements of NFPA 805, Chapter 3. Each fire area using ERFBS is identified in LAR, Attachment C. In fire areas with PB compliance, the ERFBS were analyzed using the PB approach in accordance with NFPA 805, Section 4.2.4. The licensee indicated that there are no VFDRs associated with installed ERFBS, however, did propose modifications to install ERFBS to resolve VFDRs.

In SSA RAI 03 (Reference 22), the NRC staff requested that the licensee identify VFDRs that credit ERFBS for resolution and to provide the basis for acceptability of the ERFBS in resolving the VFDR. In its response to SSA RAI 03 (Reference 10), and (Reference 12), as well its response to FPE RAI 09 (Reference 12), the licensee stated that VFDRs A01-B-64 and A15-16 are resolved by proposed modifications to protect cable utilizing ERFBS and that these modifications are included in LAR, Attachment S, Table S-2, MOD-20 (In a letter dated August 26, 2015 (Reference 17), the licensee changed modification strategy of MOD-20 to indicate that the cables would e rerouted or protected), and MOD-11, respectively. The licensee also stated the modification design processes (i.e., fire protection and SSD design reviews) will ensure compliance with NFPA 805, Section 4.2.3, for acceptability of resolving each VFDR. The NRC staff's evaluation of the licensee compliance with ERFBS requirements in NFPA 805, Chapter 3, Section 3.11.5, is addressed in SE, Section 3.1. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee identified the VFDRs to be resolved by installing ERFBS and identified the modifications in LAR, Attachment S, Table S-2.

In SSA RAI 04 (Reference 22), the NRC staff requested that the licensee identify the deterministic requirements that are being met for ERFBS installations that resolve VFDRs. In its response to SSA RAI 04 (Reference 12), the licensee stated that:

- MOD-11 is protecting cable ZFD0406A in fire area A15, fire zone 166 with a 1-hour fire barrier to resolve VFDR A15-16. The proposed protection of this cable with a 1-hour fire-rated ERFBS in conjunction with area-wide detection and wet-pipe sprinkler system that is adequate for the hazards in the area satisfies the deterministic separation requirement of NFPA 805, Section 4.2.3.3(c). The fire wrap protection is considered adequate for the fire scenarios in the area as the fire duration beyond an hour is not expected. Additionally, the compartment

contains a wet-pipe sprinkler suppression system, which covers the entire compartment, with the exception of only the MCC area, and protects the entire route of conduit D04-7 through this compartment. There is also area-wide detection and low combustible loading in this area.

- MOD-20 is protecting cables ZF1494A and ZF1494C in fire area A01-B to resolve VFDR A01-B-64. The proposed protection of these cables in fire area A01-B with a 3-hour fire-rated ERFBS satisfies the deterministic separation requirement of NFPA 805 Section 4.2.3.3(a). (In a letter dated August 26, 2015 (Reference 17), the licensee changed modification strategy of MOD-20 to indicate that the cables would be rerouted or protected.).

The NRC staff concludes that the licensee's response to SSA RAI 04 is acceptable because the licensee identified the specific NFPA 805 requirements that will be met by the modifications and has described the fire protection systems that support compliance with NFPA 805, Section 4.2.4.2.

3.5.1.9 Conclusion for Section 3.5.1

For those fire areas that used the PB approach in accordance with NFPA 805, Section 4.2.4, the NRC staff concludes that each fire area has been properly analyzed, and that compliance with the NFPA 805 requirements demonstrated as follows:

- 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. (see SE, Section 3.5.1.5).

- 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. (see SE, Section 3.5.1.6).

- Fire area boundaries (ceilings, walls, and floors), such as fire barriers, fire barrier penetrations, and through penetration fire stops were found to be acceptable. (see SE, Section 3.5.1.7).

- ERFBS credited were documented on a fire area basis, verified to be installed consistent with tested configurations and rated accordingly, and evaluated using a FRE that demonstrated the ability to meet the applicable acceptance criteria for risk, DID, and safety margins. (see SE, Section 3.5.1.8).

Accordingly, the NRC staff concludes that subject to completion of the modifications, each fire area utilizing the PB approach will meet the applicable requirements of NFPA 805, Section 4.2.

3.5.2 Clarification of Prior NRC Approvals

The elements of the pre-transition FPP licensing basis for which specific NRC previous approval needs clarification are included in LAR, Attachment T. The clarification in LAR, Attachment T, applies to NFPA 805, Chapter 3, Section 3.3.8, which states that bulk storage of flammable and combustible liquids shall not be permitted inside structures containing systems, equipment, or components important to nuclear safety and as a minimum, storage and use shall comply with NFPA 30, "Flammable and Combustible Liquids Code."

In a letter dated June 20, 1977 (Reference 92), the licensee summarized the Appendix A to BTP APCSB 9-5.1 guidelines for flammable liquids storage as being that flammable liquids storage should, as a minimum, comply with the requirements of NFPA 30, "Flammable and Combustible Liquids Code." The licensee also stated that the heating boiler day tanks are UL listed each having a capacity of 550 gallons; that the day tanks are more than 50 feet from the safety-related Unit 2 RWSTs; that the day tanks are located in separate 3-hour enclosures on the 52' floor elevation; that each day tank room is diked to contain the total capacity of the day tanks; and that a sprinkler system is provided in each day tank room.

In the subsequent NRC SER dated August 2, 1979 (Reference 28), the NRC stated that the heating boiler room is part of the Unit 2 turbine building and could contain 550 gallons of fuel oil, and that it is located next to the water treatment area and Unit 2 facade. The NRC also stated that an unmitigated fire in this room is not expected to affect SSD. The NRC further stated that fire detectors would be added to the heating boiler room.

In LAR, Attachment T, the licensee stated that the NRC's description of the heating boiler room is incorrect and that it is located on the 26' elevation and does not contain the 550 gallon fuel oil tanks. The licensee further stated that despite the incorrect heating boiler room description identified in the 1979 SER, fire detectors have also been installed in each day tank room, in addition to the heating boiler room, as a result of the NRC SER.

The licensee requested that the NRC formally document as a "prior approval" recognition that the fuel oil storage configuration in each heating boiler day tank room at PBNP satisfies the intent of APCSB 9-5.1, Appendix A guidelines and NFPA 805 requirements regarding the bulk storage of flammable and combustible liquids because:

- The (2) 550 gallon day tanks are physically located in two separate day tank rooms on the 52' floor elevation above the heating boiler room. Each day tank is enclosed in a 3 hour rated enclosure.

- Each day tank room is protected by an automatic sprinkler system and detection system. Portable fire extinguishers are also provided.

- The day tank rooms are diked to contain the total capacity of the heating boiler day tanks. The floor drains in the day tank rooms are not connected to drains from any safety-related area.

- The day tank rooms are more than 50 feet from the safety-related (RWSTs).

The NRC staff agrees with the licensee that the 1979 SER stated that the heating boiler room could contain 550 gallons of fuel oil, whereas the original licensee submittal identified the two 550 gallon day tanks as located in separate fire rated enclosures physically separate from the heating boiler room. The NRC staff concludes that the licensee's clarification in LAR, Attachment T, is acceptable because the clarification corrects the description of the fuel oil day tank locations and configuration as described in the original NRC SER to match the licensee's original submittal and the actual configuration of the plant, and that configuration is in accordance with the requirements of NFPA 805, Section 3.3.8.

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 Table F-1 Non-Power Operational Modes Transition," to evaluate the licensee's treatment of potential fire impacts during non-power operations (NPOs). The licensee used the process described in NEI 04-02, as modified by FAQ 07-0040 (Reference 63), for demonstrating that the NSPC are met for HREs during NPOs.

3.5.3.1 NPO Strategy and Plant Operating States

In LAR, Section 4.3, and LAR, Attachment D, the licensee stated that the process used to demonstrate that the NSPC are met during NPO modes is consistent with the guidance contained in FAQ 07-0040. As described in LAR, Section 4.3.2, and LAR, Attachment D, the licensee has an established procedure that implements risk assessment and risk management for outages. The safety reviews include assessment of the vulnerabilities and areas of concern for key safety functions (KSFs) based on fire protection features. As described in the LAR, the licensee utilizes a numerical status grading system to assign "points" to equipment availability levels. The points are summed and the total "score" for each function (i.e., key safety functions) is assigned a risk condition color (green, yellow, orange, or red) as the plant conditions change from lowest risk (green) to highest risk (red). During periods of elevated risk (i.e., orange and red), including HREs, safety reviews will focus on identifying methods to maintain DID in the KSF either by revising the planned sequence of outage activities or through the use of appropriate contingency plans. The licensee further stated that at all times, fire risk will be minimized through the control of ignition sources, control of combustibles, compensatory actions for fire protection system impairments and housekeeping. The licensee stated that HREs are outage activities, plant configurations, or conditions during shutdown where the plant is more susceptible to an event causing the loss of a KSF. 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.

As described in the LAR, PBNP procedures identify activities which should be scrutinized during pre-outage shutdown safety reviews and the daily safety assessments, if they are scheduled when fuel is in the reactor vessel while the RCS is being operated in the reduced or lowered inventory condition. As stated by the licensee, consideration is given to rescheduling the following activities when the unit is not in reduced or lowered inventory:

a) Safety-related work.

b) Electrical work.

c) Primary system work on the refueling unit.

d) Testing on either unit.

e) Work inside the main control board.

f) Containment openings which would have to be closed within time to boil.

g) Configurations in which a single active failure or personnel error could cause a rapid loss of RCS inventory or impact the operator's ability to monitor or control RCS inventory.

In addition, the licensee stated that time at reduced or lowered inventory is minimized and work scheduled to be performed and that affects the length of time at reduced inventory is also reviewed.

As described in the LAR, the licensee identified equipment and cables necessary to support the KSF success paths. The licensee reviewed the operational modes and functional requirements for the systems and components and 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, the licensee did not use FM 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, 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, the licensee used shutdown safety assessment and fire condition checklists to determine system availability for Modes 4-6. These checklists were used to determine the equipment requirements for each of the associated modes and provide the starting point for identifying the systems to be addressed in the NFPA 805 NPO review. The KSF descriptions in the licensee's outage safety assessment procedure in combination with the equipment, systems, and trains identified in the checklists, the inventory and reactivity flow path diagrams, and the power supply load lists, were utilized in developing a NPO component list.

As described in LAR, Attachment D, the KSFs identified in the licensee's procedure and evaluated in the NPO analysis are core cooling, reactivity control, power availability, and reactor coolant system Inventory. The KSFs of containment and spent fuel pool cooling, were not modeled for this evaluation because the site uses administrative controls to address the containment KSF and the risk associated with loss of spent fuel cooling is sufficiently low due to the long time to boil and the redundancy of make-up water sources to the spent fuel pool.

As described in the licensee's analysis, the licensee selected equipment based on credited paths for meeting each KSF. The licensee evaluated each plant operating state, as described in LAR, Attachment D, and identified the systems and equipment used to satisfy each KSF for the plant operating states. The licensee developed a comprehensive list of equipment to encompass the methods used to satisfy the KSFs. The NPO selected equipment functional requirements were reviewed against the functions previously credited for SSD, if applicable, and cable selection was performed for NPO equipment functions using the same methodology as SSD. The licensee located equipment by fire zone and fire area. LAR, Attachment D, identifies the list of components that support NPO that were not previously selected for SSD (i.e., at power) or FPRA.

3.5.3.3 NPO KSFs and SSCs Used to Achieve Performance

LAR, Attachment D, defines the KSFs as the success paths to achieve and the components required for the success paths. In LAR, Attachment D, the licensee stated that it performed a fire separation analysis (pinch point analysis) and evaluated equipment and cable failures for the impact to KSF success paths. Pinch points were conservatively assigned in areas with required RAs or MCR actions to establish a success path for any KSFs. The analysis also identified target components for which pre-positioning could reduce the risk of a fire induced spurious operation. The licensee stated that it did not use FM to eliminate any pinch points.

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.

LAR, Attachment D, identifies the fire areas that contain pinch points and identifies those specific fire areas that require controls to manage the fire risk by use of the guidance contained in FAQ 07-0040 during outages and especially during HREs. These fire areas include A01-A, A01-B, A01-CS, A02, A06, A07, A08, A11, A15, A23S, A24, A30, A31, A36, and A46. As stated in the LAR, fire areas A23N, A23S, A24, A30, and A31 contain excessive or critical equipment

failure combinations for which feasible RAs may not be able to recover a KSF success path. These fire areas also require stricter controls to manage the fire risk during outages and especially during HREs

In LAR, Attachment S, the licensee identified actions in Implementation Items IMP-137, IMP-140, IMP-141, and IMP-155 that incorporate the results of the NPO analysis in licensee processes and procedures for managing outage risk. The NRC staff concludes that these actions are acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

Based on its review of the information provided in the LAR, as supplemented, the NRC staff concludes that the licensee used acceptable 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 has a process in place to ensure that fire protection DID measures will be implemented to achieve the KSFs during plant outages and that any required actions will be completed as described in LAR, Attachment S, Table S-3, Implementation Items IMP-137, IMP-140, IMP-141, and IMP-155, which will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

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 SSD equipment list and required additional circuit analysis. In the LAR, the licensee stated that it performed cable selection for NPO equipment functions using the same methodology as SSD and located the equipment by fire zone and fire area. The licensee analyzed each fire area and resolved cable and equipment failures using engineering justification, MCR actions, and RAs to achieve a KSF success path. For fire areas containing pinch points, safety reviews consider any equipment which may be out of service and develop appropriate mitigation strategies.

As described by the licensee in LAR, Attachment D, the PBNP procedure for shutdown safety reviews includes assessment of the vulnerabilities and areas of concern for KSFs based on fire protection features. During periods of elevated risk, safety reviews will focus on identifying methods to maintain DID in the KSF either by revising the planned sequence of outage activities or through the use of appropriate contingency plans. During periods of elevated risk or when directed by plant management, the following additional controls are considered:

- Prohibition or limitation of hot work in fire areas during periods of increased vulnerability.
- Verification of operable detection and/or suppression in the vulnerable areas.
- Prohibition or limitation of combustible materials in fire areas during periods of increased vulnerability.
- Plant lineup modifications (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 RAs to mitigate potential losses of KSFs.

- 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.

- Other PBNP specific fire prevention or mitigation strategies identified in the NPO analysis.

The licensee stated that for fire areas containing critical equipment failure combinations for which feasible RAs may not be able to recover a KSF success path, stricter controls to manage the fire risk during HREs are required. This includes but is not limited to prohibition of hot work, prohibition of combustible materials and fire patrols for these areas with limited redundancy.

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; and

- Planned/implemented revisions 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, and subject to completion of Implementation Items IMP-137, IMP-140, IMP-141, and IMP-155, the NRC staff concludes that the licensee provided reasonable assurance that the NSPC will be met during NPO modes and HREs.

3.5.4 Conclusion for Section 3.5

The NRC staff reviewed the licensee's RI/PB FPP, as described in the LAR and its supplements, to evaluate the NSCA results. The licensee used the PB approach in accordance with NFPA 805, Section 4.2.4.

For those fire areas that utilized a PB approach, the NRC staff confirmed the following:

- No exemptions from the existing FPP are being transitioned to meet the requirements of NFPA 805.
- 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, meets NFPA 805, Section 4.2.4.

The NRC staff's review of the licensee's analysis and outage management process during NPO modes concluded that the licensee provided reasonable assurance that the NSPC will be met during NPO modes and HREs, and that the licensee used methods consistent with the guidance provided in RG 1.205 and FAQ 07-0040. The NRC staff's review also concluded that the normal FPP DID actions are credited for addressing the risk impact of those fires which potentially affect one or more trains of equipment that provide a KSF required during NPO modes, but would not be expected to cause the total loss of that KSF. The NRC staff also concludes that the licensee identified those fire areas where stricter controls are necessary to manage fire risk during outages and specifically during HREs and that this overall approach for fire protection during NPO modes is acceptable.

3.6 Radioactive Release Performance Criteria

3.6.1 Method of Review

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 nuclear power plant (NPP) in any plant operational mode.

NFPA 805, Section 1.3.2, "Radioactive Release Goal," states that:

> The radioactive release goal is to provide reasonable assurance that a fire will not result in a radiological release that adversely affects the public, plant personnel, or the environment.

NFPA 805, Section 1.4.2, "Radioactive Release Objective," states that:

> Either of the following objectives shall be met during all operational modes and plant configurations.
>
> (1) Containment integrity is capable of being maintained.
>
> (2) The source term is capable of being limited.

NFPA 805, Section 1.5.2, "Radioactive Release Performance Criteria," states that:

> Radiation release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) shall be as low as reasonably achievable and shall not exceed applicable 10 CFR, Part 20, limits.

The NRC staff has endorsed (with certain exceptions) the methodology given in NEI 04-02 as providing methods acceptable to the NRC staff for establishing a RI/PB FPP consistent with NFPA 805 and 10 CFR 50.48(c) in RG 1.205. Using these methods, the licensee assessed the capability of the current FPP to meet the NFPA 805 performance criteria as contained in NEI 04-02 and FAQ 09-0056 (Reference 66). The results of the licensee's assessment are documented in the LAR.

The NRC reviewed the assessment provided in the LAR, and the licensee's responses to related RAIs (Reference 13), to determine if the existing FPP with its planned modifications would meet the radioactive release performance criteria requirements of a RI/PB FPP, 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.

3.6.2 Scope of Review

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

The licensee's review found 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 follow the guidance in NEI 04-02 and RG 1.205 upon completion of the actions identified in LAR, Attachment S. The licensee identified the radiological areas where the potential for radioactive materials were present during any plant operating mode by reviewing the pre-fire

plans, conducting plant walk downs, and interviewing plant personnel. The licensee identified and eliminated (screened out) from further review, areas with no potential to contain radioactive or contaminated materials. The licensee identified areas with potential for generation of radioactive effluents created by firefighting activities (screened in) for further evaluation. The NRC staff concludes that the scope of the licensee's assessment was adequate because the review included all modes of plant operation and all plant areas.

3.6.3 Identification of Plant Areas Containing Radioactive Materials

The screened in areas included those areas where most of the radioactive materials are present such as in the auxiliary building and containment (i.e., the reactor building). The licensee's review determined these areas have 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 (e.g., floor drains and sumps routed to the radioactive waste system) effluents 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 are adequate because the gaseous effluent is filtered to remove radioactive materials and monitored prior to discharge, and the liquid effluent is collected, processed, and monitored prior to discharge.

In other plant areas where engineered controls are not sufficient for containment of radioactive effluents, the licensee evaluated the potential release of contaminated gaseous and liquid effluents resulting from a fire involving radioactive contents in these areas using a quantitative analysis described in PBNP Calculation No. 99-0045, Revision 1. The calculation results bound the dose consequences for all types of low specific activity containers and credible radioactive sources in warehouse 7, the dry fuel cask manufacturing building, the steam generator storage facility south bay, outside yard areas within the protected area, the Units 1 and 2 containment building facades, and the turbine building. This calculation also bounds any instrument check sources that have been authorized for storage in any location within the owner controlled area.

The bounding case was the yard area where the largest single radioactive source was in a sea land storage container fully loaded with radioactive waste. The licensee performed a dose assessment based on the type of radionuclides that are stored, and the maximum amount of radioactive material that is allowed to be stored and then assumed to be released during a fire. The NRC's evaluation of the licensee's analysis determined that the licensee based its bounding assessment on conservative assumptions and acceptable methods as described in the licensee's offsite dose calculation manual (ODCM). The NRC staff concludes that the results of the analysis demonstrate that the maximum offsite dose from the liquid and gaseous effluents at the exclusion area boundary is less than the 10 CFR 20 dose limits for members of the public and is, therefore, acceptable.

3.6.4 Fire Brigade Training Materials

The licensee reviewed the fire brigade training materials to ensure they are 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 training materials reinforce the use of radiation protection procedures, fire emergency plans, and that the fire attack plans provide for

containment and monitoring of potentially radioactive effluents. Fire emergency plan revisions will be made as described in LAR, Attachment S, to identify potentially contaminated areas, provide instructions for communication with radiation protection, and describe precautions to minimize, contain and safely remove contaminated smoke and water runoff in these potentially contaminated areas. These training material and fire emergency plan revisions will describe the presence and potential use of monitored HVAC and drainage systems, if such systems are deemed operational and capable of supporting manual removal efforts when necessary. The licensee evaluated each training module and lesson plan, and identified and documented those training materials needing improvements.

The licensee also indicated that fire brigade and radiation protection personnel are trained to contain contaminated liquid and gaseous effluents within the RCA to the extent possible (e.g., for gaseous effluents, application of fog-type hose stream to minimize smoke production, consideration of RCA door closure, routing smoke to RCA areas having operable ventilation; for liquid effluents, utilization of absorbent materials, use of portable sump pumps, and directing water to RCA areas having operable drainage if deemed necessary by the Incident Commander). Radiation protection (RP) training materials, such as EPI-02-LP008, "Radiation Protection Emergency Actions Inside of Protected Area," and HPI-02-LP010, "Radiological Alarm Response," and RP Procedures, such as RAM 2.1, "Radioactive Liquid Effluent Releases" and RAM 3.1, "Radioactive Liquid Waste Permits," discuss RP monitoring, sampling, and containing such effluents.

LAR, Attachment S, Table S-3, Implementation Item IMP-130, includes the revision of pre-fire plans and fire brigade training materials to address the radioactive release requirements of NFPA 805. LAR, Attachment S, Implementation Item IMP-131, includes the incorporation of the NFPA 805 radioactive release review into the licensee's configuration control program to ensure that radioactive release goals, objectives and performance criteria will continue to be satisfied even if areas previously screened out become contaminated due to operational plant events. The NRC staff concludes that these actions are acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

The NRC staff reviewed the licensee's evaluation of training materials and concludes that subject to completion of the implementation items, the training materials will be adequate to instruct the licensee's staff to implement the FPP because plant staff will be informed and capable of taking actions to limit the public dose to within the radiological release performance criteria of NFPA 805.

3.6.4 Conclusion for Section 3.6

Based on: (1) the information provided in the LAR, and supplements, (2) the licensee's use of fire pre-plans, (3) the results of the NRC staff's evaluation of the identified engineered controls used to contain potential releases, and (4) the development and implementation of fire brigade response and training procedures, the NRC staff concludes that upon completion of the implementation items, the licensee's RI/PB FPP will provide reasonable assurance that radiation releases to any unrestricted area resulting from the direct effects of fire suppression activities are as low as reasonably achievable and are not likely to exceed the radiological release performance criteria of NFPA 805 and the radiological dose limits in 10 CFR, Part 20,

and that the licensee's FPP will comply with the requirements of NFPA 805, Sections 1.3.2, 1.4.2, and 1.5.2, and that this approach is acceptable.

3.7 NFPA 805 Monitoring Program

For this SE section, the following requirements from NFPA 805, Section 2.6, are applicable to the NRC staff's review of the 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 (Reference 8), Section 4.6, "Monitoring Program," that the licensee developed to monitor availability, reliability, and performance of its 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 concludes is acceptable.

The licensee stated that it will develop an NFPA 805 monitoring program consistent with FAQ 10-0059 (Reference 67). Development of the monitoring program will include a review of existing surveillance, inspection, testing, compensatory measures, and oversight processes for adequacy. The review will examine adequacy of the scope of SSCs within the existing plant programs, performance criteria for availability and reliability and the adequacy of the plant corrective action program. The monitoring program will incorporate phases for scoping,

screening using risk criteria, risk target value determination, and monitoring implementation. The scope of the program will include fire protection systems and features, NSCA equipment, SSCs relied upon to meet radioactive release criteria, and fire protection programmatic elements. The NRC staff concludes that the action to develop the NFPA 805 monitoring program is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and is included in LAR, Attachment S, Table S-3, Implementation Item IMP-139, which would be required by the proposed license conditions.

As described above, NFPA 805, Section 2.6, requires that a monitoring program be established in order to ensure that the availability and reliability of fire protection systems and features are maintained, as well as to assess the overall effectiveness of the FPP in meeting the performance criteria. Monitoring should ensure that the assumptions in the associated engineering analysis remain valid.

Based on the information provided in the LAR, as supplemented, the NRC staff concludes that the licensee's NFPA 805 monitoring program development and implementation process is acceptable and assures that the licensee will implement an effective program for monitoring risk significant fire SSCs because it:

- Establishes the appropriate performance monitoring groups to be monitored;
- Uses an acceptable screening process for determining the SSCs to be included in the performance monitoring groups;
- 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 bring performance back within the required range.

However, since the final values for availability and reliability, as well as the performance criteria for the SSCs being monitored, have not been established for the monitoring program as of the date of this SE, completion of the licensee's NFPA 805, "Monitoring Program," is an implementation item, as described in LAR, Attachment S, Table S-3, Implementation Item IMP-139, and as discussed above.

The NRC staff concludes that the 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 (except IMP-142 and IMP-150 since they are associated with modifications), as described in LAR, Attachment S, Table S-3, within 180 days after NRC approval unless that falls within a scheduled outage window, in which case implementation items will be completed within 60 days after startup from the scheduled outage, which is prior to completion of the modifications to achieve full compliance with 10 CFR 50.48(c) (which is by the startup of the second refueling outage (for each unit) after the issuance of the SE).

3.7.1 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, Sections 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 implement the monitoring program as part of the FPP transition to NFPA 805, 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 conditions.

3.8 Program Documentation, Configuration Control, and Quality Assurance

For this SE section, 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 (Reference 8), as supplemented, in regard to the appropriate content, configuration control, and quality of the documentation used to support the PBNP FPP transition to NFPA 805.

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

> The analyses performed to demonstrate compliance with this standard shall be documented for each nuclear power plant. The intent of the documentation is that the assumptions be clearly defined and that the results be easily understood, that results be clearly and consistently described, and that sufficient detail be provided to allow future review of the entire analyses. Documentation shall be maintained for the life of the plant and be organized carefully so that it can be checked for adequacy and accuracy either by an independent reviewer or by the AHJ.

NFPA 805, Section 2.7.1.2, "Fire Protection Program Design Basis Document," states that:

> A fire protection program design basis document shall be established based on those documents, analyses, engineering evaluations, calculations, and so forth that define the fire protection design basis for the plant. As a minimum, this document shall include fire hazards identification and nuclear safety capability assessment, on a fire area basis, for all fire areas that could affect the nuclear safety or radioactive release performance criteria defined in Chapter 1.

NFPA 805, Section 2.7.1.3, "Supporting Documentation," states that:

> Detailed information used to develop and support the principal document shall be referenced as separate documents if not included in the principal document.

NFPA 805, Section 2.7.2.1, "Design Basis Document," states that:

> The design basis document shall be maintained up-to-date as a controlled document. Changes affecting the design, operation, or maintenance of the plant shall be reviewed to determine if these changes impact the fire protection program documentation.

NFPA 805, Section 2.7.2.2, "Supporting Documentation," states that:

> Detailed supporting information shall be retrievable records. Records shall be revised as needed to maintain the principal documentation up-to-date.

NFPA 805, Section 2.7.3.1, "Review," states that:

> Each analysis, calculation, or evaluation performed shall be independently reviewed.

NFPA 805, Section 2.7.3.2, "Verification and Validations" states that:

> Each calculational model or numerical method used shall be verified and validated through comparison to test results or comparison to other acceptable models.

NFPA 805, Section 2.7.3.3, "Limitations of Use," states that:

> Acceptable engineering methods and numerical models shall only be used for applications to the extent these methods have been subject to verification and validation. These engineering methods shall only be applied within the scope, limitations, and assumptions prescribed for that method.

NFPA 805, Section 2.7.3.4, "Qualification of Users," states that:

> Cognizant personnel who use and apply engineering analysis and numerical models (e.g., fire modeling techniques) shall be competent in that field and experienced in the application of these methods as they relate to nuclear power plants, nuclear power plant fire protection, and power plant operations.

NFPA 805, Section 2.7.3.5, "Uncertainty Analysis," states that:

> An uncertainty analysis shall be performed to provide reasonable assurance that the performance criteria have been met.

3.8.1 Documentation

The NRC staff reviewed LAR, Section 4.7.1, "Compliance with Documentation Requirements in Section 2.7.1 of NFPA 805," to evaluate the PBNP FPP design basis document and supporting documentation.

The PBNP FPP design basis is a compilation of multiple documents (i.e., fire safety analyses, calculations, engineering evaluations, NSCAs, etc.), databases, and drawings which are identified in LAR Figure 4-9, "NFPA 805 Planned Post-Transition Documents and Relationships." The licensee stated that the analyses conducted to support the NFPA 805 transition were performed in accordance with PBNP processes which meet or exceed the requirements for documentation outlined in NFPA 805, Section 2.7.1.

Specifically, the design analysis and calculation procedures 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. The process includes provisions for appropriate design and engineering review and approval. In addition, the approved analyses are considered controlled documents, and are accessible via PBNP'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.

The LAR stated that the documentation associated with the FPP will be maintained for the life of the plant and organized in such a way to facilitate review for accuracy and adequacy by independent reviewers, including the NRC staff.

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 Section 2.7.2 and 2.2.9 of NFPA 805," in order to evaluate the PBNP configuration control process for the new NFPA 805 FPP.

To support the many other technical, engineering and licensing programs at PBNP, the licensee has existing configuration control processes and procedures for establishing, revising, or utilizing program documentation. Accordingly, the licensee is integrating the new FPP design basis and supporting documentation into these existing configuration control processes and procedures. These processes and procedures require that all plant changes be reviewed for potential impact on the various PBNP licensing programs, including the FPP.

The LAR stated that the configuration control process includes provisions for appropriate design, engineering reviews and approvals, and that approved analyses are considered controlled documents available through the PBNP document control system. The LAR also stated that analyses based on the PRA program, which includes the FRE, are issued as formal analyses subject to these same configuration control processes, and are additionally subjected to the PRA peer review process specified in the ASME/ANS PRA standard (Reference 36).

Configuration control of the existing FPP during the transition period is maintained by the change evaluation process, as defined in existing configuration management and configuration control procedures. LAR, Attachment S, Table S-3, includes Implementation Item IMP-135 to revise or develop technical documents and administrative procedures as needed for implementation of NFPA 805. 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 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 in SE, Section 3.4.

Based on the description of the PBNP configuration control process, which indicates that the new FPP design basis and supporting documentation will be controlled and that plant changes will be reviewed for impact on the FPP, the NRC staff concludes that subject to completion of the implementation items, the requirements of NFPA 805, Sections 2.7.2.1 and 2.7.2.2, will be met.

### 3.8.3 Quality

The NRC staff reviewed LAR, Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," to evaluate the quality of the engineering analyses used to support transition of the FPP to NFPA 805 based on the requirements outlined above. The individual sections of this SE provide the NRC staff's evaluation of the application of the NFPA 805 quality requirements to the licensee's FPP, as appropriate.

#### 3.8.3.1 Review

NFPA 805, Section 2.7.3.1, requires that each analysis, calculation, or evaluation performed be independently reviewed. The licensee stated that its procedures require independent review of analyses, calculations, and evaluations, including those performed in support of compliance with 10 CFR 50.48(c). The licensee further 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 the 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 provided a description of the process for performing independent reviews of analyses, calculations, and evaluations for review.

#### 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 V&V, 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 48), 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, Attachment J, the licensee identified the use of several empirical correlations that are not addressed in NUREG-1824. 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 PBNP," in SE, Attachment A, and Table 3.8-2, "V&V Basis for Other Fire Models and Related Calculations Used at PBNP," in SE, Attachment B, identify these empirical correlations and algebraic models, respectively, as well as the NRC staff evaluation of 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 48, 102, 103, 109, 110, 114, and 115). SE, Tables 3.8-1 and 3.8-2, summarize 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 FRE used empirical correlations that provide bounding solutions for the ZOI and used conservative input parameters that produced conservative results for the FM analysis. The empirical correlations and models were used to develop a detailed methodology to determine the ZOI which is documented in the fire modeling workbook (FMWB). See SE, Section 3.4.2.3, for further discussion of the licensee's FM methods.

3.8.3.2.2 Discussion of RAIs

By letters dated July 8, 2014 (Reference 22), and November 14, 2014 (Reference 24), the NRC staff requested additional information concerning the FM conducted to support the FREs. By letters dated July 29, 2014 (Reference 10), August 28, 2014 (Reference 11), September 25,

2014 (Reference 12), and December 19, 2014 (Reference 14), the licensee responded to these RAIs.

- In FM RAI 03.a (Reference 22), the NRC staff requested that the licensee provide technical details to demonstrate that the temperature to smoke density correlation has been applied within the validated range, or justify the application of the correlation outside the validated range reported in the V&V basis documents.

  In its response to FM RAI 03.a (Reference 10), the licensee stated that the smoke detection actuation correlation developed by Heskestad and Delichatsios is based on the ceiling jet temperature predicted by Alpert's ceiling jet correlation, and that it applied the latter within the validated range for the applicable normalized parameter (ratio of ceiling jet radial distance to ceiling height) reported in NUREG-1824. The licensee further explained that the fuels and corresponding smoke properties in the areas at PBNP where it applied the smoke detection actuation correlation, are within the range of the materials that were tested to develop the temperature to smoke density correlation.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that it applied the smoke detection actuation correlation developed by Heskestad and Delichatsios within the validated range and provided documentation in the applicable V&V basis documents.

- In FM RAI 03.b (Reference 22), the NRC staff requested that the licensee provide the V&V basis for any FM tool or method that is not discussed in LAR, Attachment J.

  In its response to FM RAI 03.b (Reference 10), the licensee stated that the solid flame radiation model (method of Shokri and Beyler) is the only FM tool or method used in support of the LAR and not discussed in LAR, Attachment J. The licensee further stated that it used the model to calculate the radiative heat flux from a fire in the MCR and structural steel analyses, and that V&V basis is discussed in a revision of LAR, Attachment J.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee identified the single fire model that is not mentioned in the LAR and added a discussion of its V&V basis to LAR, Attachment J.

3.8.3.2.3 Post-Transition

The licensee 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 are identified in LAR, Attachment S, Table S-3, Implementation Items IMP-135 and IMP-155, and the NRC staff concludes that these actions are acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

3.8.3.2.4 Conclusion for Section 3.8.3.2

Based on the licensee's description of the PBNP process for V&V of calculational models and numerical methods and its 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 has identified actions that will incorporate the provisions of NFPA 805 in the FPP and those actions would be required by the proposed license conditions.

The NRC staff concludes that the licensee's FM approach 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 are consistent with either NUREG-1824, or other authoritative publications, peer reviewed journal articles, or national laboratory research reports.

3.8.3.3 Limitations of Use

NFPA 805, Section 2.7.3.3, requires that acceptable engineering methods and numerical models be used for applications only to the extent that these methods have been subject to V&V and that they are applied within the scope, limitations, and assumptions prescribed for that method. The LAR stated that the engineering methods and numerical models used in support of the transition to NFPA 805 were subject to the limitations of use outlined in NFPA 805, Section 2.7.3.3, and that the engineering methods and numerical models used post-transition will be subject to these same limitations of use.

3.8.3.3.1 General

The NRC staff assessed the acceptability of each empirical correlation and other fire model in terms of the limits of its use. Table 3.8-1 in SE, Attachment A, and Table 3.8-2, in Attachment B, summarize the fire models used, how the licensee applied the models in the PBNP FRE, the V&V basis for each, and the NRC staff evaluation for each.

3.8.3.3.2 Discussion of RAIs

By letters dated July 8, 2014 (Reference 22), and November 14, 2014 (Reference 24), the NRC staff requested additional information concerning the FM conducted to support the FREs. By letters dated July 29, 2014 (Reference 10), August 28, 2014 (Reference 11), September 25, 2014 (Reference 12), and December 19, 2014 (Reference 14), the licensee responded to these RAIs.

- In FM RAI 04.a (Reference 22), the NRC staff requested that the licensee explain how the limits of applicability of algebraic models were determined for each fire area and zone where they were applied.

  In its response to FM RAI 04.a (Reference 11), the licensee stated that the limitations and assumptions associated with the algebraic models are documented in NUREG-1805 and NUREG-1824, and that in most cases, the subject correlations have been applied within the limits of applicability reported in

these documents. In addition, the licensee further identified all cases where the algebraic models have been applied outside of the defined limits, and provided a detailed discussion to justify their use.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee provided the basis for the limits of applicability of the algebraic models, and justified the use of the models in cases where they were applied outside these limits.

- In FM RAI 04.b (Reference 22), the NRC staff requested that the licensee identify uses, if any, of CFAST outside the limits of applicability of the model and for those cases explain how the use of CFAST was justified.

  In its response to FM RAI 04.b (Reference 11), the licensee explained that the normalized parameters summarized in NUREG-1934 were calculated for each of the CFAST analyses. The licensee further explained that, in cases where it applied the model outside the validated range, either the model input parameters were conservatively modified and brought within the validated range, or it justified the use of the model based on a qualitative assessment or a quantitative sensitivity analysis.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee identified the applications of CFAST outside its limits of applicability and followed the guidance in NUREG-1934 (Reference 52), to justify the use of CFAST in those cases.

- In FM RAI 04.c (Reference 22), the NRC staff requested that the licensee identify uses, if any, of FDS outside the limits of applicability of the model and for those cases explain how the use of FDS was justified.

  In its response to FM RAI 04.c (Reference 11), the licensee explained that the normalized parameters summarized in NUREG-1934 were calculated for each of the FDS analyses. The licensee further explained that, in cases where it applied the model outside the validated range, either the model input parameters were conservatively modified and brought within the validated range or it justified the use of the model based on a qualitative assessment or a quantitative sensitivity analysis.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee identified the applications of FDS outside its limits of applicability and followed the guidance in NUREG-1934 to justify the use of FDS in those cases.

3.8.3.3.3 Post-Transition

The licensee 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 limitations of use. Revision of the applicable post-transition processes and

procedures to include NFPA 805 requirements for limitations of use are identified as implementation items in LAR, Attachment S, Table S-3, Implementation Item IMP-135. 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.

3.8.3.3.4 Conclusion for Section 3.8.3.3

Based on the licensee's statements that the fire models used to support development of the FRE were used within their limitations, and the description of the PBNP process for placing limitations on the use of engineering methods and numerical models, the NRC staff concludes that the licensee's approach to meeting the requirements of NFPA 805, Section 2.7.3.3, is acceptable because the models are consistent with approved uses in NRC guidance or other authoritative publications and the licensee identified actions that will incorporate the provisions of NFPA 805 in the FPP and those actions would be required by the proposed license conditions.

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) shall be competent in that field and experienced in the application of these methods as they relate to NPPs fire protection, and power plant operations. The licensee's procedures require that cognizant personnel who use and apply engineering analyses and numerical models be competent in the field of application and experienced in the application of the methods, including those personnel performing analyses in support of compliance with 10 CFR 50.48(c).

3.8.3.4.1 General

Specifically, these requirements are being addressed through the implementation of an engineering qualification process at PBNP. 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). The licensee has developed qualification or training requirements for personnel performing engineering analyses and numerical methods. The licensee included this action in LAR, Attachment S, Table S-3, Implementation Item IMP-135. The NRC staff concludes that this action is acceptable because the action will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

3.8.3.4.2 Discussion of RAIs

By letters dated July 8, 2014 (Reference 22), and November 14, 2014 (Reference 24), the NRC staff requested additional information concerning the FM conducted to support the FREs. By letters dated July 29, 2014 (Reference 10), August 28, 2014 (Reference 11), September 25, 2014 (Reference 12), and December 19, 2014 (Reference 14), the licensee responded to these RAIs.

- In FM RAI 05.a (Reference 22), the NRC staff requested that the licensee describe its requirements to qualify personnel for performing FM calculations in the NFPA 805 transition.

  In its response to FM RAI 05.a (Reference 10), the licensee stated that qualification requirements for the contractor personnel that use, apply, and approve FM include required reading of FM project instructions, relevant industry methodology and guidance documents, and applicable FM software user's guide documents; training or mentoring in fire growth analysis, ZOI calculations, and FM tools; and demonstration of comprehension and proficiency in FM. The licensee also stated that qualifications will be updated during implementation to include the additional knowledge requirements associated with NFPA 805.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the personnel performing FM are appropriately qualified.

- In FM RAI 05.b (Reference 22), the NRC staff requested that the licensee describe the process for ensuring that the FM personnel have those qualifications, not only before the transition but also during and following the transition.

  In its response to FM RAI 05.b (Reference 10), the licensee stated that contract personnel performed FM to support the LAR and FPRA development using their company's procedures and quality assurance programs, which require that project personnel assigned to each task have the proper experience and training to perform the work as determined by their company processes. The licensee further stated that during transition, it will continue to employ the services of qualified vendors to meet the requirements of NFPA 805, Section 2.7.3, and that appropriate qualification guides will be developed under LAR, Attachment S, Table S-3, Implementation Item IMP-135, to qualify FM personnel post-transition.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its process and procedures ensure that the personnel performing the FM are appropriately qualified and because the licensee included an action to qualify FM personnel post-transition which will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

- In FM RAI 05.c (Reference 22), the NRC staff requested that the licensee explain how proper communication between the FM and FPRA personnel is ensured.

  In its response to FM RAI 05.c (Reference 10), the licensee explained that during the development of the FPRA, fire modelers maintained frequent communication with the PRA engineers through project team meetings, cutset reviews, and schedule updates. The licensee further stated that LAR, Attachment S, Table S-3, Implementation Item IMP-135 will provide position-specific training to ensure

> that the PBNP personnel and contractors will continue the vital communication process.
>
> The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated appropriate interactions between FM staff and PRA staff to ensure that it adequately performed FM, and because the licensee included an action in LAR, Attachment S, Table S-3, to ensure that the PBNP personnel and contractors will continue the communication process, which will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

The NRC staff concludes that competent and experienced personnel developed the PBNP FREs, including the supporting FM calculations and 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

LAR, Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805," states, in part, that:

> Post-transition, for personnel performing fire modeling or Fire PRA development and evaluation, NextEra 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.

The post-transition qualification training program will be implemented to include NFPA 805 requirements for qualification of users as described in LAR, Attachment S, Table S-3, Implementation Item IMP-135. The NRC staff concludes that this action is acceptable because the action will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license conditions.

3.8.3.4.4 Conclusion for Section 3.8.3.4

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, Section 2.7.3.5, 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 it performed an uncertainty analysis 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 36), includes requirements to address uncertainty. Accordingly, the licensee addressed uncertainty as a part of the development of the PBNP FRE. The NRC staff's evaluation of the licensee's treatment of these uncertainties is discussed in SE, Section 3.4.7.

According to NUREG-1855, Volume 1, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making," (Reference 50), there are three types of uncertainty associated with FM calculations:

(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 Analysis Guide (NPP FIRE MAG)" (Reference 52).

(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 July 8, 2014 (Reference 22), and November 14, 2014 (Reference 24), the NRC staff requested additional information concerning the FM conducted to support the FREs. By letters dated July 29, 2014 (Reference 10), August 28, 2014 (Reference 11), September 25, 2014 (Reference 12), and December 19, 2014 (Reference 14), the licensee responded to these RAIs.

- In FM RAI 06.a (Reference 22), the NRC staff requested that the licensee describe how the uncertainty associated with the FM input parameters was accounted for in the analyses.

In its response to FM RAI 06.a (Reference 10), the licensee explained that conservative model input parameters were used in the FM calculations to provide a safety margin that bounds the uncertainty. The licensee gave the following examples of conservative modeling assumptions that provide safety margin:

- The majority of fire scenarios involving electrical cabinets utilize the 98th percentile HRR to determine the severity factor.
- The fire elevation in most cases is at the top of the cabinet or pump body.
- The radiant fraction utilized is 0.4, while the convective fraction utilized is maintained at 0.7.
- For transient fire impacts, a large bounding transient zone assumes all targets within its ZOI are affected by a fire and time to damage is calculated based on the closest target.
- For HGL calculations, no equipment or structural steel is credited as a heat sink.
- In most cases cable trays are assumed to be filled to capacity.
- As the fire propagates to secondary combustibles, the fire is modeled as one single fire.
- Target damage is assumed to occur when the exposure environment meets or exceeds the damage threshold.
- The fire elevation for transient fires is 2 feet.
- Oil fires are analyzed as both unconfined and confined spills with 20 minute duration.
- HEAF scenarios are assumed to be at peak fire intensity for 20 minutes from time zero.
- For many scenarios, fire brigade intervention is not credited prior to 85 minutes.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that it adequately accounted for the uncertainty associated with the model input parameters by the safety margin produced through the use of conservative model input parameter values.

- In FM RAI 06.b (Reference 22), the NRC staff requested that the licensee explain how uncertainties due to ignoring compartment contents in the HGL calculations were accounted for, or to show that ignoring compartment contents leads to conservative HGL temperatures.

In its response to FM RAI 06.b (Reference 10), the licensee explained that there were several conservatisms in the FM that compensated for omitting the compartment contents from the HGL calculations, and gave the following examples of conservatisms specifically related to compartment volume and heat transfer:

- Including equipment and cable trays in HGL calculations provides a large heat sink in the compartment, which would result in lower HGL temperatures.
- No heat transfer through fire doors or dampers was considered in the HGL temperature calculations, and all exterior boundaries of the fire compartment were assumed to consist of concrete.
- Many obstructions are not completely solid and do not reduce the compartment volume as much as their physical dimensions indicate.
- The volume of some fire compartments was reduced in the FM analysis to meet the validation range for compartment aspect ratio.

In addition, the licensee stated that many of the conservatisms discussed in the response to FM RAI 06.a help alleviate this uncertainty as well.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that uncertainties due to ignoring compartment contents in the HGL calculations were appropriately compensated for which lead to conservative HGL temperatures.

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 IMP-135. 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.

3.8.3.5.4 Conclusion for Section 3.8.3.5

Based on the licensee's description of the PBNP 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 subject to completion of the implementation items, the engineering analyses required to support the PBNP RI/PB FPP will

meet each of the requirements of NFPA 805, Section 2.7.3, which include conducting independent reviews, performing V&V, limiting the application of acceptable methods and models to within prescribed boundaries, ensuring that personnel applying acceptable methods and models are qualified, and performing uncertainty analyses.

3.8.4 Fire Protection Quality Assurance (QA) Program

GDC 1 of Appendix A to 10 CFR Part 50 requires that:

> 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.

The LAR stated that the existing fire protection QA program will be maintained and that the licensee has and will continue to perform work in accordance with the quality requirements of NFPA 805, Section 2.7.3. 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 IMP-135. 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 conditions.

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 subject to completion of the implementation item described in LAR, Attachment S, Table S-3, related to the QA program, the licensee's approach for meeting the requirements specified in NFPA 805, Section 2.7, is acceptable.

## 4.0 FIRE PROTECTION LICENSE CONDITION

The licensee proposed a FPP license conditions 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 NRC staff concludes that 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 PBNP, Units 1 and 2, and is, therefore, acceptable.

The following license condition is included in the revised license for the PBNP Units 1 and 2, and will replace Operating License No. DPR-24 and DPR-27, Condition 4.F:

F. NextEra Energy Point Beach shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the license amendment request dated June 26, 2013, and supplements dated September 16, 2013, July 29, 2014, August 28, 2014, September 25, 2014, November 14, 2014, December 19, 2014, January 16, 2015, May 12, 2015, August 26, 2015, February 22, 2016, April 7, 2016 (two letters), and May 3, 2016, and as approved in the SE dated September 8, 2016. 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 license condition, and the criteria listed below are satisfied.

1. 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.

   a. 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.

   b. Prior NRC review and approval is not required for individual changes that result in a risk increase less than $1X10^{-7}$/yr for CDF and less than $1X10^{-8}$/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.

2. Other Changes that May Be Made Without Prior NRC Approval

   a. 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.)

   b. 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 SER dated September 8, 2016 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.

3. Transition License Conditions

   a. Before achieving full compliance with 10 CFR 50.48(c), as specified by 3.b and 3.c 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.b above.

   b. The licensee shall implement the modifications to its facility, as described in Attachment S, Table S-2, "Plant Modifications Committed," of NextEra Energy Point Beach letter NRC-2016-0021, to complete the transition to full compliance with 10 CFR 50.48(c) no later than prior to startup from the second refueling outage (for each unit) after receipt of the license amendment. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

   c. The licensee shall implement the items listed in Attachment S, Table S-3, "Implementation Items," of NextEra Energy Point Beach letter NRC-2016-0021, with the exception of the items noted below, within 12 months after NRC approval unless that falls within a scheduled outage window; then in that case, completion will occur 60 days after startup from that scheduled outage.

      i. Implementation item IMP-120 is an exception as the industry guidance is under review by the NRC and the final resolution will occur 12 months after the guidance is available unless that falls within a scheduled outage window; then in that case, completion will occur 60 days after startup from that scheduled outage.

      ii. Implementation items IMP-142 and IMP-150 are exceptions because they are associated with completion of committed modifications identified in LAR, Attachment S, Table S-2 and will not be completed until 3 months following the last refueling outage identified in item 3.b above.

## 5.0 SUMMARY

The NRC staff reviewed the licensee's application, as supplemented by various letters, to transition to a RI/PB FPP in accordance with the requirements established by NFPA 805. The NRC staff concludes that, subject to implementation of items in LAR, Attachment S, as supplemented, 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 under 10 CFR 50.48(c) must be in accordance with the 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) must be achieved. Before the licensee is able to fully implement the transition to a 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 Wisconsin official was notified on August 9, 2016, of the proposed issuance of the amendments. The state official had no comments.

## 7.0 ENVIRONMENTAL CONSIDERATION

These amendments change a requirement with respect to the installation or use of a facility component 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 effluent that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously published a proposed finding that these amendments involve no significant hazards consideration and there has been no public comment on such finding (79 FR 38580). Accordingly, these 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 these 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 APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants (ADAMS Accession No. ML070660461)," (ADAMS Accession No. ML070660461).

2 U.S. Nuclear Regulatory Commission, Appendix A to Branch Technical Position 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).

6 U.S. Nuclear Regulatory Commission, "Rulemaking Plan, Reactor Fire Protection Risk-Informed, Performance-Based Rulemaking," SECY-00-0009, January 2000 (ADAMS Accession No. ML003671923).

7 Nuclear Energy Institute, "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)," NEI 04-02, Revision 2, Washington, DC, April 2008 (ADAMS Accession No. ML081130188).

8 Meyer, Larry, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 & 2, Dockets 50-266 & 50-301, Renewed License Nos. DPR-24 & DPR-27, LAR 271 Transition to 10CFR50.48(c), NFPA 805, Performance Based Std. for Fire Protection for Light Water Reactor Electric Generating Plants," June 26, 2013 (ADAMS Accession No. ML13182A353).

9 Meyer, Larry, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, License Amendment Request 271 Supplement 1, Transition to 10CFR50.48(c) - NFPA 805," September 16, 2013 (ADAMS Accession No. ML13259A273).

10 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Response (60 Day) to Request for Additional Information, License Amendment Request Associated with NFPA 805," July 29, 2014 (ADAMS Accession No. ML14210A645).

11 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Response (90 Day) to Request for Additional Information, License Amendment Request Associated with NFPA 805," August 28, 2014 (ADAMS Accession No. ML14241A267).

12 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Response (120 Day) to Request for

Additional Information and Revision to 60 Day Response, License Amendment Request 271 Associated with NFPA 805," September 25, 2014 (ADAMS Accession No. ML14269A447).

13 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Response to Request for Additional Information, License Amendment Request 271 Associated with NFPA 805," November 14, 2014 (ADAMS Accession No. ML14321A451).

14 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Response to Request for Additional Information, (Fire Protection Engineering/Fire Modeling), LAR 271 Associated with NFPA 805," December 19, 2014 (ADAMS Accession No. ML14353A048).

15 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Response to Request for Additional Information (Probabilistic Risk Assessment), License Amendment Request 271 Associated with NFPA 805," January 16, 2015 (ADAMS Accession No. ML15015A281).

16 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Response to Request for Additional Information (Main Control Room Abandonment), License Amendment Request 271 Associated with NFPA 805," May 12, 2015 (ADAMS Accession No. ML15132A402).

17 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Supplement 2 to License Amendment Request 271 Associated with NFPA 805," August 26, 2015 (ADAMS Accession No. ML15238A858).

18 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Response to Request for Additional Information Regarding Point Beach Nuclear Plant NFPA 805 License Amendment Request 271," February 22, 2016 (ADAMS Accession No. ML16053A336).

19 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Response to Request For Additional Information, License Amendment Request 271 Associated with NFPA 805," April 7, 2016 (ADAMS Accession No. ML16098A262).

20 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Supplement 4 to License Amendment Request 271 Associated with NFPA 805," April 7, 2016 (ADAMS Accession No. ML16098A132).

21 McCartney, Eric, NextEra Energy Point Beach, letter to U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant, Units 1 and 2, Dockets 50-266 and 50-301, Renewed License Nos. DPR-24 and DPR-27, Point Beach Nuclear Power Plant, License

Amendment Request 271 Associated with NFPA 805, Updated Attachment S and Clean License Pages," May 3, 2016 (ADAMS Accession No. ML16124A735).

22 Beltz, Terry, U.S. Nuclear Regulatory Commission, letter to Millen, Michael, NextEra Energy, "Point Beach Nuclear Plant Unit Nos. 1 and 2 - Final Revised Requests for Additional Information Re: License Amendment Request Associated with NFPA 805 (TAC Nos. MF2372 and MF2373)," July 8, 2014 (ADAMS Accession No. ML14189A365).

23 Beltz, Terry, U.S. Nuclear Regulatory Commission, letter to Millen, Michael, NextEra Energy, "Point Beach Nuclear Plant Unit Nos. 1 and 2 - Requests for Additional Information (Radiation Release) re: LAR to Adopt NFPA 805 (TAC Nos. MF2372 and MF2373)," October 20, 2014 (ADAMS Accession No. ML14295A013).

24 Beltz, Terry, U.S. Nuclear Regulatory Commission, letter to Millen, Michael, NextEra Energy, "Point Beach Nuclear Plant, Units 1 and 2 - Follow-up Requests for Additional Information (AFPB) re: NFPA 805 License Amendment Request Review (TAC Nos. MF2372 and MF2373)," November 14, 2014 (ADAMS Accession No. ML14325A541).

25 Beltz, Terry, U.S. Nuclear Regulatory Commission, letter to Millen, Michael, NextEra Energy, "RE: Point Beach Nuclear Plant Unit Nos. 1 and 2 - Follow-up Requests for Additional Information (AFPB) re: NFPA 805 License Amendment Request Review (TAC Nos. MF2372 and MF2373)," November 19, 2014 (ADAMS Accession No. ML14325A540).

26 Chawla, Mahesh, U.S. Nuclear Regulatory Commission, E-Mail to Mrozinsky, Richard, NextEra Energy, "Request for Additional Information, Point Beach Nuclear Plant, Units 1 and 2, NFPA 805 LAR, MF2372 and MF2373," October 9, 2015 (ADAMS Accession No. ML15348A262).

27 Chawla, Mahesh, U.S. Nuclear Regulatory Commission, E-Mail to Mrozinsky, Richard, NextEra Energy, "Request for Additional Information, Point Beach Nuclear Plant, Units 1 and 2, NFPA 805 LAR, MF2372 and MF2373," January 20, 2016 (ADAMS Accession No. ML16022A004).

28 Schwencer, A., U.S. Nuclear Regulatory Commission, letter to Burstein, Sol, Wisconsin Electric Power Company, "Issuance of Amendments 39 and 44 to Facility Operating License Nos DPR-24 and DPR-27 for the Point Beach Nuclear Plant, Units 1 and 2, Includes Safety Evaluation Report, Docket Nos. 50-266 and 50-301," August 2, 1979 (ADAMS Accession No. ML021860006).

29 Clark, R.A., U.S. Nuclear Regulatory Commission, letter to Burnstein, S., Wisconsin Electric Power Company, "Supplemental Safety Evaluation, Fire Protection Modifications Identified as Incomplete," October 21, 1980 (ADAMS Legacy Library Accession No. 8011060071).

30 Clark, R.A., U.S. Nuclear Regulatory Commission, letter to Burnstein, S., Wisconsin Electric Power Company, "Fire Protection Safety Evaluation Supplement for Proposed Modifications," January 22, 1981 (ADAMS Legacy Library Accession No. 8102200338).

31 U.S. Nuclear Regulatory Commission, "Safety Evaluation Supporting Utility Proposal, Design of Switchgear Room, per Sections III.G & III.L of Appendix R to 10CFR50," July 27, 1988 (ADAMS Legacy Library Accession No. 8808080143).

32 Gundrum, Linda L., U.S. Nuclear Regulatory Commission, letter to Grigg, Richard R., Wisconsin Electric Power Company, "Point Beach Nuclear Plant, Unit Nos. 1 and 2 - Issuance of Amendments RE: Fire Protection Requirements, TAC Nos. M95354 and M95355, Amendment No. 170 to DPR-24, Amendment No. 174 to DPR-27, Docket Nos. 50-266 and 50-301," January 8, 1997 (ADAMS Accession No. ML021970391).

33 Nuclear Energy Institute, "Guidance for Post Fire Safe Shutdown Circuit Analysis," NEI 00-01, Revision 2, Washington, DC, NEI 00-01, Revision 2, May 2009 (ADAMS Accession No. ML091770265).

34 U.S. Nuclear Regulatory Commission, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Regulatory Guide 1.174, Revision 2, May 2011 (ADAMS Accession No. ML100910006).

35 U.S. Nuclear Regulatory Commission, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk Informed Activities," Regulatory Guide 1.200, Revision 2, March 2009 (ADAMS Accession No. ML090410014).

36 American Society of Mechanical Engineers (ASME) and American Nuclear Society (ANS), "Addenda to ASME/ANS RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," ASME/ANS RA-Sa-2009, February 2, 2009.

37 U.S. Nuclear Regulatory Commission, "Fire Protection for Nuclear Power Plants," Regulatory Guide 1.189, Revision 2, October 2009 (ADAMS Accession No. ML092580550).

38 U.S. Nuclear Regulatory Commission, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition, Chapter 9.5.1.2, Risk-Informed, Performance-Based Fire Protection Program," NUREG-0800, Revision 0, December 2009 (ADAMS Accession No. ML092590527).

39 U.S. Nuclear Regulatory Commission, "Standard Review Plan for the Review of Safety Analysis Reports for NPP: LWR Edition Chapter 19.1, Determining the Technical Adequacy of Probabilistic Risk Assessment for Risk-Informed License Amendment Requests after Initial Fuel Load, Revision 3," NUREG-0800, September 2012 (ADAMS Accession No. ML12193A107).

40 U.S. Nuclear Regulatory Commission, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition, Chapter 19.2, Review of Risk Information Used to Support Permanent Plant-Specific Changes to the Licensing Basis: General Guidance," NUREG-0800, Revision 0, June 2007 (ADAMS Accession No. ML071700658).

41 U.S. Nuclear Regulatory Commission, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, Volume 1: Summary and Overview," NUREG/CR-6850 , September 2005 (ADAMS Accession No. ML052580075).

42 U.S. Nuclear Regulatory Commission, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, Volume 2: Detailed Methodology," NUREG/CR-6850, September 2005 (ADAMS Accession No. ML052580118).

43 U.S. Nuclear Regulatory Commission, "Fire Probabilistic Risk Assessment Methods Enhancements," NUREG/CR-6850, Supplement 1, September 2010 (ADAMS Accession No. ML103090242).

44 Correia, R. P., memorandum to Joseph G. Giitter, U.S. Nuclear Regulatory Commission, "Interim Technical Guidance on Fire-Induced Circuit Failure Mode Likelihood Analysis," June 14, 2013 (ADAMS Accession No. ML13165A194).

45 U.S. Nuclear Regulatory Commission, "Cable Response to Live Fire (CAROL-FIRE)," NUREG/CR-6931, Volumes 1, 2, and 3, April 2008 (ADAMS Accession Nos. ML081190230, ML081190248, and ML081190261).

46 U.S. Nuclear Regulatory Commission, "Direct Current Electrical Shorting in Response to

Exposure Fire (DESIREE-Fire): Test Results," NUREG/CR-7100, April 2012 (ADAMS Accession No. ML121600316).

47 U.S. Nuclear Regulatory Commission, "Fire Dynamics Tools (FDTS): Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program," NUREG-1805, December 2004 (ADAMS Accession No. ML043290075).

48 U.S. Nuclear Regulatory Commission, NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," May 2007. Volume 1: Main Report, Volume 2: Experimental Uncertainty, Volume 3: Fire Dynamics Tools (FDTs), Volume 4: Fire-Induced Vulnerability Evaluation (FIVE-Rev. 1), Volume 5: Consolidated Fire Growth and Smoke Transport Model (CFAST), Volume 6: MAGIC, and Volume 7: Fire Dynamics Simulator (ADAMS Accession Nos. ML071650546, ML071730305, ML071730493, ML071730499, ML071730527, ML071730504, ML071730543, respectively).

49 U.S. Nuclear Regulatory Commission, "Cable Heat Release, Ignition, and Spread in Tray Installations during Fire (CHRISTI FIRE), Phase 1: Horizontal Trays," NUREG/CR-7010, Volume 1, July 2012 (ADAMS Accession No. ML12213A056).

50 U.S. Nuclear Regulatory Commission, NUREG-1855, Volume 1, NUREG-1855, Vol. 1, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making," March 2009 (ADAMS Accession No. ML090970525).

51 U.S. Nuclear Regulatory Commission, "EPRI/NRC-RES Fire Human Reliability Analysis Guidelines," NUREG-1921, July 2012 (ADAMS Accession No. ML12216A104).

52 U.S. Nuclear Regulatory Commission, "Nuclear Power Plant Fire Modeling Analysis Guidelines (NPP FIRE MAG)," NUREG-1934, November 2012 (ADAMS Accession No. ML12314A165).

53 U.S. Nuclear Regulatory Commission, "A Preliminary Report of Fire Protection Research Program Fire Barriers and Fire Retardant Coatings," NUREG/CR-0381, September, 1978.

54 U.S. Nuclear Regulatory Commission, Generic Letter 2006-03, "Potentially Nonconforming HEMYC and MT Fire Barrier Configurations," April 10, 2006 (ADAMS Accession No. ML053620142).

55 National Fire Protection Association Standard 101 (NFPA 101), "Life Safety Code," Quincy, Massachusetts.

56 National Fire Protection Association, "Standard for Installation of Stationary Pumps for Fire Protection," Standard 20, (NFPA 20), Quincy, Massachusetts.

57 National Fire Protection Association, "Flammable and Combustible Liquids Code," Standard 30 (NFPA 30), Quincy, Massachusetts.

58 Klein, Alexander R., U.S. Nuclear Regulatory Commission, memorandum to file, "Close-out of National Fire Protection Association Standard 805 Frequently Asked Question 06-0022 on Electrical Cable Flame Propagation Tests," May 5, 2009 (ADAMS Accession No. ML091240278).

59 Klein, Alexander R., U.S. Nuclear Regulatory Commission, memorandum to file, "Close-out of National Fire Protection Association Frequently Asked Question 07-0030 on Establishing Recovery Actions," February 4, 2011 (ADAMS Accession No. ML110070485).

60 Klein, Alexander R., U.S. Nuclear Regulatory Commission, memorandum to file, "Close-out of National Fire Protection Association Frequently Asked Question 07-0038 on Lessons

Learned on Multiple Spurious Operations," February 3, 2011 (ADAMS Accession No. ML110140242).

61 Nuclear Energy Institute, "Guidance for Post Fire Safe Shutdown Circuit Analysis," NEI 00-01, Revision 1, Washington, DC, January 2005 (ADAMS Accession No. ML050310295).

62 Klein, Alexander R., U.S. Nuclear Regulatory Commission, memorandum to file, "Close-out of National Fire Protection Association Standard 805 Frequently Asked Question 07-0039 Incorporation of Pilot Plant Lessons Learned- Table B-2," January 15, 2010 (ADAMS Accession No. ML091320068).

63 Klein, Alexander R., U.S. Nuclear Regulatory Commission, memorandum to file, "Close-out of National Fire Protection Association 805 Frequently Asked Question 07-0040 on Non-Power Operations Clarifications," August 11, 2008 (ADAMS Accession No. ML082200528).

64 Klein, Alexander R., U.S. Nuclear Regulatory Commission, memorandum to file, "Closure of National Fire Protection Association 805 Frequently Asked Question 08-0048 Revised Fire Ignition Frequencies," September 1, 2009 (ADAMS Accession No. ML092190457).

65 Klein, Alexander R., U.S. Nuclear Regulatory Commission, memorandum to file, "Close-out of National Fire Protection Association Frequently Asked 08-0054 on Demonstrating Compliance with Chapter 4 of National Fire Protection Association 805," March 10, 2015 (ADAMS Accession No. ML15016A280).

66 Klein, Alexander R., U.S. Nuclear Regulatory Commission, memorandum to file, "Close out of National Fire Protection Association 805 Frequently Asked Question 09-0056 on Radioactive Release Transition," January 14, 2011 (ADAMS Accession No. ML102920405).

67 Klein, Alexander R., U.S. Nuclear Regulatory Commission, memorandum to file, "Close-out of National Fire Protection Association Standard 805 Frequently Asked Question 10-0059: National Fire Protection 805 Monitoring Program," March 19, 2012 (ADAMS Accession No. ML120750108).

68 Klein, Alexander R., U.S. Nuclear Regulatory Commission, memorandum to file, "Close-out of National Fire Protection Association Standard 805 Frequently Asked Question 12-0062 on Updated Final Safety Analysis Report (UFSAR) Content," September 5, 2012 (ADAMS Accession No. ML121980557).

69 Hamzehee, Hossein, G., U.S. Nuclear Regulatory Commission, memo to APLA Files, "Close-out of Fire Probabilistic Risk Assessment Frequently Asked Question 13-0004 On Clarifications Regarding Treatment of Sensitive Electronics," December 3, 2013 (ADAMS Accession No. ML13322A085).

70 Hamzehee, Hossein, G., U.S. Nuclear Regulatory Commission, Memo to File, "Close-out of Fire Probabilistic Risk Assessment Frequently Asked Question 13-0005 on Cable Fires Special Cases: Self-Ignited and Caused by Welding and Cutting," December 3, 2013 (ADAMS Accession No. ML13319B181).

71 Hamzehee, Hossein, G., U.S. Nuclear Regulatory Commission, Memorandum to APLA Files, "Close-out of Fire Probabilistic Risk Assessment Frequently Asked Question 13-0006 on Modeling Junction Box Scenarios in a Fire PRA," December 12, 2013 (ADAMS Accession No. ML13331B213).

72 Marion, Alexander, Nuclear Energy Institute, letter dated June 17, 2003, to John Hannon, U.S. Nuclear Regulatory Commission, transmitting Revision 0 of NEI 02-03, "Guidance for Performing a Regulatory Review of Proposed Changes to the Approved Fire Protection Program," June 2003 (ADAMS Accession No. ML031780500).

73 Schwencer, A., U.S. Nuclear Regulatory Commission, letter to Burnstein, S., Wisconsin Electric Power Company, "Open Items and Resolution of Incomplete Items for Fire Protection Program Safety Evaluation Report," March 5, 1980 (ADAMS Legacy Library Accession No. 8003280029).

74 Clark, R.A., U.S. Nuclear Regulatory Commission, letter to Burnstein, S., Wisconsin Electric Power Company, "Evaluation of Utility Request for Exemption from 10CFR50, Appendix R, Section III.H," May 4, 1981 (ADAMS Accession No. ML021860003).

75 Clark, R.A., U.S. Nuclear Regulatory Commission letter to Fay, C.W., Wisconsin Electric Power Company, "NUREG-0737, Item II.E.1.1, Auxiliary Feedwater System Evaluation," April 21, 1982 (ADAMS Accession No. ML030710086).

76 Institute of Electrical and Electronics Engineers, "IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations," IEEE 383, New York, New York.

77 Underwriters Laboratories, "Test for Cable Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air," Standard 910 (UL 910), Chicago, Illinois.

78 Underwriters Laboratories, "Reference Standard for Electrical Wires, Cables, and Flexible Cords," Standard 1581 (UL 1581), Chicago, Illinois.

79 National Fire Protection Association, "Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces," Standard 262 (NFPA 262), Quincy, Massachusetts.

80 Electric Power Research Institute Technical Report TR-1006756, "Fire Protection Equipment Surveillance Optimization and Maintenance Guide for Fire Protection Systems and Features," Final Report, Palo Alto, CA, Final Report July 2003.

81 National Fire Protection Association, "Standard for Gaseous Hydrogen Systems at Consumer Sites," Standard 50A (NFPA 50A), Quincy, Massachusetts.

82 National Fire Protection Association, "Standard on Industrial Fire Brigades," Standard 600 (NFPA 600), Quincy, Massachusetts.

83 National Fire Protection Association, "Portable Fire Extinguishers," Standard 10 (NFPA 10), Quincy, Massachusetts.

84 National Fire Protection Association, "National Fire Alarm and Signaling Code," Standard 72 (NFPA 72), Quincy, Massachusetts.

85 National Fire Protection Association, "Standard for the Installation of Sprinkler Systems," Standard 13 (NFPA 13), Quincy, Massachusetts.

86 National Fire Protection Association, "Standard for Fire Doors and Other Opening Protectives," Standard 80, (NFPA 80), Quincy, Massachusetts.

87 National Fire Protection Association, "Standard for the Installation of Air-Conditioning and Ventilating Systems," Standard 90A (NFPA 90A), Quincy, Massachusetts.

88 Weinkam, Edward, J. Nuclear Management Company, LLC, letter to U.S. Nuclear Regulatory Commission, "Response to Generic Letter 2006-03: Potentially Nonconforming Hemyc and MT Fire Barrier Configurations," June 8, 2006 (ADAMS Accession No. ML061600209).

89 National Fire Protection Association, "Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source," Standard 253 (NFPA 253),

Quincy, Massachusetts.

90 U.S. Nuclear Regulatory Commission, "Combustibility of Epoxy Floor Coatings at Commercial Nuclear Power Plants," IN 2007-26, August 13, 2007 (ADAMS Accession No. ML071920090).

91 American Society for Testing and Materials, "Standard Test Method for Surface Burning Characteristics of Building Materials," Standard E-84 (ASTM E-84), West Conshohocken, PA.

92 Burnstein, Sol, Wisconsin Electric Power Company, letter to Case, Edson, G., U.S. Nuclear Regulatory Commission, "Point Beach Nuclear Plant Units 1 and 2, Dockets 50-266 and 50-301, Fire Protection Provisions," June 20, 1977 (ADAMS Accession No. ML12194A295).

93 National Fire Protection Association, "National Electric Code," Standard 70 (NFPA 70), Quincy, Massachusetts.

94 National Fire Protection Association Standard 805, 2010 Edition, (NFPA 805 - 2010), "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," Quincy, Massachusetts.

95 National Fire Protection Association, "Standard for Gaseous Hydrogen Systems and Consumer Sites," Standard 567 (NFPA 567), Quincy, Massachusetts.

96 National Fire Protection Association, "Standard for the Installation of Standpipe and Hose Systems," Standard 14 (NFPA 14), Quincy, Massachusetts.

97 U.S. Nuclear Regulatory Commission, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition, Chapter 9.5.1.1, Fire Protection Program," NUREG-0800, Revision 0, February 2009 (ADAMS Accession No. ML090510170).

98 Nuclear Energy Institute, "Process for Performing Internal Events PRA Peer Reviews Using the ASME/ANS PRA Standard," NEI 05-04, Revision 2, Washington, DC, November 2008.

99 U.S. Nuclear Regulatory Commission, "Internal Events Probabilistic Risk Assessment Record of Review for Point Beach SE Section 3.4," June 8, 2016 (ADAMS Accession No. ML16159A400).

100 Nuclear Energy Institute, "Fire Probabilistic Risk Assessment (FPRA) Peer Review Process Guidelines," NEI 07-12, Revision 0, Washington, DC, November 2008.

101 U.S. Nuclear Regulatory Commission, "Fire Probabilistic Risk Assessment Record of Review for Point Beach SE Section 3.4," June 8, 2016 (ADAMS Accession No. ML16159A402).

102 Correia, Richard, P., U.S. Nuclear Regulatory Commission, memo to Giitter, Joseph, G., U.S. Nuclear Regulatory Commission, "Supplemental Interim Technical Guidance on Fire-Induced Circuit Failure Mode Likelihood Analysis," February 12, 2014 (ADAMS Accession No. ML14017A084).

103 Heskestad, G., Fire Plumes, Flame Height, and Air Entrainment, Chapter 2-1, *The SFPE Handbook of Fire Protection Engineering*, 4th ed. Quincy, Massachusetts: National Fire Protection Association, 2008.

104 Beyler, C., Fire Hazard Calculations for Large, Open Hydrocarbon Fires, Chapter 3-10, *The SFPE Handbook of Fire Protection Engineering*, 4th ed. Quincy, Massachusetts: National Fire Protection Association, 2008.

105 Alpert, R., Chapter 2-2, Ceiling Jet Flows, *The SFPE Handbook of Fire Protection*

*Engineering*, 4th ed. Quincy, Massachusetts: National Fire Protection Association, 2008.

106 EPRI 1002981, "Fire Modeling Guide for Nuclear Power Plant Applications," Electric Power Research Institute, Palo Alto, California, August 2002.

107 U.S. Nuclear Regulatory Commission, "Reactor Oversight Process Inspection Manual, Chapter 0609, Appendix F, Fire Protection Significance Determination Program," February, 2005.

108 Walton W., and Thomas, P., Estimating Temperatures in Compartment Fires, Chapter 3-6, *The SFPE Handbook of Fire Protection Engineering*, 4th ed. Quincy, Massachusetts: National Fire Protection Association, 2008.

109 E., Evans, D., Nelson, H. Budnick, "Simplified Fire Growth Calculations," in *NFPA Fire Protection Handbook, 19th Edition*. Quincy, Massachusetts: National Fire Protection Association, 2003, ch. 3-9.

110 R., Meacham, B., Schifiliti, R. Custer, "Design of Detection Systems," in *The SFPE Handbook of Fire Protection Engineering*. Quincy, Massachusetts: National Fire Protection Association, 2008, ch. 4-1.

111 McDermott, R., McGrattan, K., Hostikka, S., Floyd, J., "Fire Dynamics Simulator (Version 5) Technical Reference Guide Volume 2: Verification," National Institute of Standards and Technology, Gaithersburg, MD, NIST Special Publication 1018-5, 2010.

112 McGrattan, K., Hostikka, S., Floyd, J., McDermott, R., "Fire Dynamics Simulator (Version 5) Technical Reference Guide, Volume 3: Validation," National Institute of Standards and Technology, Gaithersburg, MD, 1018-5, 2010.

113 R., Jones, W., Remeke, P. Peacock, "CFAST – Consolidated Model of Fire Growth and Smoke Transport (Version 6) Software Development and Model Evaluation Guide," National Institutes of Standards and Technology, Gaithersburg, MD, NIST Special Publication 1086, 2008.

114 Babrauskas, V., Chapter 3-1, *The SFPE Handbook of Fire Protection Engineering*, 4th ed. Quincy, Massachusetts: National Fire Protection Association, 2008.

115 Lee, B., "Heat Release Rate Characteristics of Some Combustible Fuel Sources in Nuclear Power Plants," NBSIR 85-3196, U.S. Department of Commerce, National Bureau of Standards (NBS), Washington, DC July, 1985.

116 National Fire Protection Association, "Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians," Standard 1582 (NFPA 1582), Quincy, Massachusetts.

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Attachments:
A. Table 3.8-1 – V&V Basis for Fire Modeling Correlations Used at PBNP
B. Table 3.8-2 – V&V Basis for Other Fire Models and Related Calculations Used at PBNP
C. Abbreviations and Acronyms

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

| Correlation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Flame Height (Method of Heskestad) | The Flame Height Correlation was implemented in the FMWB. The licensee used the correlation to determine the vertical extension of the flame region as part of the ZOI calculations. | NUREG-1805, Chapter 3, 2004 (Reference 47)<br><br>NUREG-1824, Volume 3, 2007 (Reference 48)<br><br>SFPE Handbook, 4th Edition, Chapter 2-1, Heskestad, 2008 (Reference 103) | • The licensee provided verification of the FMWB on basis of comparison with NUREG-1805.<br>• The correlation is validated in NUREG-1824 and the SFPE Handbook.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based on its review and evaluation, the NRC staff concludes that the use of this correlation is acceptable. |
| Plume Centerline Temperature (Method of Heskestad) | The Plume Centerline Temperature correlation was implemented in the FMWB. The licensee used the correlation to determine vertical separation distance, based on temperature, to a target in order to determine the vertical extent of the ZOI. | NUREG-1805, Chapter 9, 2004 (Reference 47)<br><br>NUREG-1824, Volume 3, 2007 (Reference 48)<br><br>SFPE Handbook, 4th Edition, Chapter 2-1, Heskestad, 2008 (Reference 103) | • The licensee provided verification of the FMWB on basis of comparison with NUREG-1805.<br>• The correlation is validated in NUREG-1824 and the SFPE Handbook.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>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 PBNP

| Correlation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Radiant Heat Flux (Point Source Method) | The Radiant Heat Flux (Point Source Method) correlation was implemented in the FMWB. The licensee used the correlation to determine the horizontal separation distance, based on heat flux, to a target in order to determine the horizontal extent of the ZOI. | NUREG-1805, Chapter 5, 2004 (Reference 47)<br><br>NUREG-1824, Volume 3, 2007 (Reference 48)<br><br>SFPE Handbook, 4th Edition, Chapter 3-10, Beyler, C., 2008 (Reference 104) | • The licensee provided verification of the FMWB on basis of comparison with NUREG-1805.<br>• The correlation is validated in NUREG-1824 and the SFPE Handbook.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based on its review and evaluation, the NRC staff concludes that the use of this correlation is acceptable. |
| Plume Radius (Method of Heskestad) | The Plume Radius (Method of Heskestad) correlation was implemented in the FMWB. The licensee used the correlation to calculate the horizontal radius, based on temperature of the plume at a given height. | FIVE, Rev.1, (Reference 106)<br><br>NUREG-1824, Volume 3, 2007 (Reference 48)<br><br>SFPE Handbook, 4th Edition, Chapter 2-1 (Reference 103) | • The licensee stated that it did not use the plume radius as the sole basis for any target failures.<br>• The licensee provided verification of the FMWB on the basis of a comparison withFIVE, Rev.1.<br>• The correlation is validated in the SFPE Handbook.<br>• The plume radius correlation is derived from Heskestad's plume centerline temperature correlation, for which V&V is documented in NUREG-1824. The plume radius correlation is subject to the same validated ranges.<br>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 PBNP

| Correlation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Hot Gas Layer (Method of McCaffrey, Quintiere, and Harkleroad) | The HGL (Method of McCaffrey, Quintiere, and Harkleroad) correlation was implemented in the FMWB. The licensee used the correlation to calculate the HGL temperature for a room with natural ventilation. | NUREG-1805, Chapter 3, 2004 (Reference 47)<br><br>NUREG-1824, Volume 3, 2007 (Reference 48)<br><br>SFPE Handbook, 4th Edition, Chapter 3-6, Walton W. and Thomas, P., 2008 (Reference 108) | • The licensee provided verification of the FMWB on basis of comparison with NUREG-1805.<br>• The correlation is validated in NUREG-1824 and the SFPE Handbook.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based on its review and evaluation, the NRC staff concludes that the use of this correlation is acceptable. |
| Hot Gas Layer (Method of Beyler) | The HGL (Method of Beyler) correlation was implemented in the FMWB. The licensee used the correlation to calculate the HGL temperature for a room with no ventilation. | NUREG-1805, Chapter 3, 2004 (Reference 47)<br><br>NUREG-1824, Volume 3, 2007 (Reference 48)<br><br>SFPE Handbook, 4th Edition, Chapter 3-6, Walton W. and Thomas, P., 2008 (Reference 108) | • The licensee provided verification of the FMWB on basis of comparison with NUREG-1805.<br>• The correlation is validated in NUREG-1824 and the SFPE Handbook.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>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 PBNP

| Correlation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Hot Gas Layer (Method of Foote, Pagni, and Alvares [FPA]) | The HGL (Method of Foote, Pagni, and Alvares) correlation was implemented in the FMWB. The licensee used the correlation to calculate the HGL temperature for a room with forced ventilation. | NUREG-1805, Chapter 3, 2004 (Reference 47)<br><br>NUREG-1824, Volume 4, 2007 (Reference 48)<br><br>FIVE, Rev.1, (Reference 106)<br><br>SFPE Handbook, 4th Edition, Chapter 3-6, Walton W. and Thomas, P., 2008 (Reference 108) | • The licensee provided verification of the FMWB on basis of comparison with FIVE, Rev.1.<br>• The correlation is validated in NUREG-1824 and the SFPE Handbook.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>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 PBNP

| Correlation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Ceiling Jet Temperature (Method of Alpert) | The Ceiling Jet Temperature (Method of Alpert) correlation was implemented in the FMWB. The licensee used the correlation to calculate horizontal separation distance, based on temperature at the ceiling of a room, to a target in order to determine the horizontal extent of the ZOI. | NUREG-1824, Volume 3, 2007 (Reference 48)<br><br>SFPE Handbook, 4th Edition, Chapter 2-2, Alpert, R., 2008, (Reference 105) | • The licensee provided verification of the FMWB on basis of comparison with NUREG-1805.<br>• The correlation is validated in NUREG-1824 and the SFPE Handbook.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based on its review and evaluation, the NRC staff concludes that the use of this correlation is acceptable. |
| Sprinkler Activation Correlation | Sprinkler Activation Correlation was implemented in the FMWB. The licensee used the correlation to estimate sprinkler actuation time based on ceiling jet temperature, velocity, and thermal response of sprinkler. | NUREG-1805, Chapter 10, 2004 (Reference 47)<br><br>NFPA Handbook, 19th Edition, Chapter 3-9, Budnick, E., Evans, D., and Nelson, H., 2003 (Reference 109) | • The licensee provided verification of the FMWB on basis of comparison with NUREG-1805.<br>• The correlation is validated in the NFPA Handbook.<br>• The licensee stated that in most cases, the correlation has been applied within the validated range. The licensee provided justification for cases where it used the correlation outside the validated range.<br>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 PBNP

| Correlation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Smoke Detection Actuation Correlation (Method of Heskestad and Delichatsios) | The Smoke Detector Actuation correlation (Method of Heskestad and Delichatsios) was implemented in the FMWB. The licensee used the correlation to estimate smoke detector time based on ceiling jet temperature, velocity, and thermal response of detector. The licensee used the method of Heskestad and Delichatsios to calculate the activation time. | NUREG-1805, Chapter 11, 2004 (Reference 47)<br><br>NUREG-1824, Volume 3, 2007 (Reference 48)<br><br>SFPE Handbook, 4th Edition, Chapter 2-2, Alpert, R., 2008, (Reference 105)<br><br>SFPE Handbook, 4th Edition, Chapter 4-1, Custer R., Meacham B., and Schifiliti, R., 2008 (Reference 110) | • The licensee provided verification of the FMWB on basis of comparison with NUREG-1805.<br>• The correlation is validated in the SFPE Handbook.<br>• The licensee stated that in most cases, the correlation has been applied within the validated range. The licensee provided justification for cases where it used the correlation outside the validated range.<br>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 PBNP

| Correlation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Solid Flame Radiation Model | The licensee used this model to estimate the heat flux from electrical cabinet and transient fires to steel columns in the turbine building, and to determine damaged target sets for transient initiators in the MCR. | NUREG-1805, Chapter 5, 2004 (Reference 47)<br><br>SFPE Handbook, 4th Edition, Chapter 3-10, Beyler, C., 2008 (Reference 104) | • The correlation is validated in the SFPE Handbook.<br>• The licensee stated that the correlation has been applied within the validated range.<br>Based on its review and evaluation, the NRC staff concludes that the use of this correlation is acceptable. |
| Corner and Wall HRR | The licensee used this method to determine a HRR adjustment factor for fires that are proximate to a wall or corner. | U.S. NRC, "Inspection Manual, Chapter 0609, Appendix F, Fire Protection Significance Determination Program," February, 2005. (Reference 107) | • The method is validated in authoritative publications.<br>• The licensee stated that in most cases, the method has been applied within the validated range and provided justification for cases where it used outside the validated range.<br>Based its review and evaluation, the NRC staff concludes that the use of this method is acceptable. |

Attachment B: Table 3.8-2, V&V Basis for Other Fire Models and Related Calculations Used at PBNP

| Calculation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Fire Dynamics Simulator (Version 5) Control Room Abandonment Calculation | The licensee used Fire Dynamics Simulator (Version 5) to calculate abandonment time for the PBNP MCR. | NUREG-1824, Volume 7, 2007 (Reference 48)<br><br>NIST Special Publication 1018-5, Volume 2: Verification (Reference 111)<br><br>NIST Special Publication 1018-5, Volume 3: Validation (Reference 112) | • The modeling technique is validated in NUREG-1824 and NIST Special Publication 1018.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based on its review and evaluation, the NRC staff concludes that the use of FDS for the MCR abandonment time calculations is acceptable. |
| Temperature Sensitive Equipment ZOI Study | The licensee used FDS (Version 5) to calculate the radiant heat flux ZOI at which temperature sensitive equipment will reach damage thresholds. | NUREG-1824, Volume 7, 2007 (Reference 48)<br><br>NIST Special Publication 1018-5, Volume 2: Verification (Reference 111)<br><br>NIST Special Publication 1018-5, Volume 3: Validation (Reference 112) | • The modeling technique is validated in NUREG-1824 and NIST Special Publication 1018.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based on its review and evaluation, the NRC staff concludes that the use of FDS is acceptable. |

Attachment B: Table 3.8-2, V&V Basis for Other Fire Models and Related Calculations Used at PBNP

| Calculation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Plume/Hot Gas Layer Interaction Study | The licensee used FDS (Version 5) to locate the point where HGL and plume interact and establish limits for plume temperature application. | NUREG-1824, Volume 7, 2007 (Reference 48)<br><br>NIST Special Publication 1018-5, Volume 2: Verification (Reference 111)<br><br>NIST Special Publication 1018-5, Volume 3: Validation (Reference 112) | • The modeling technique is validated in NUREG-1824 and NIST Special Publication 1018.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based on its review and evaluation, the NRC staff concludes that the use of FDS is acceptable |
| Hot Gas Layer Calculations using Consolidated Model of Fire and Smoke Transport (Version 6) | The licensee used CFAST (Version 6) in the MCA to calculate the upper and lower gas layer temperatures and the layer height in connected compartments. | NUREG-1824, Volume 5, 2007 (Reference 48)<br><br>NIST Special Publication 1086, 2008 (Reference 113) | • The modeling technique is validated in NUREG-1824 and NIST Special Publication 1086.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based on its review and evaluation, the NRC staff concludes that the use of CFAST is acceptable. |

Attachment B: Table 3.8-2, V&V Basis for Other Fire Models and Related Calculations Used at PBNP

| Calculation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Temperature Sensitive Equipment Hot Gas Layer Study | The licensee used CFAST (Version 6) to calculate the upper and lower gas layer temperatures for various compartments, and the layer height, for use in assessment of damage to temperature sensitive equipment. | NUREG-1824, Volume 5, 2007 (Reference 48)<br><br>NIST Special Publication 1086, 2008 (Reference 113) | • The modeling technique is validated in NUREG-1824 and NIST Special Publication 1086.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based on its review and evaluation, the NRC staff concludes that the use of CFAST is acceptable. |
| Correlation for Heat Release Rates of Cables (Method of Lee) | The licensee used the Method of Lee to correlate bench scale data to heat release rates from cable tray fires. | SFPE Handbook, 4th Edition, Chapter 3-1, Babrauskas, 2008 (Reference 114)<br><br>NBSIR 85-3195, Lee, 1985 (Reference 115) | • The modeling technique is documented in the SFPE Handbook and NIST 85-3195.<br>• The licensee stated that the correlation has been applied within the range of its applicability.<br>Based on its review and evaluation, the NRC staff concludes that the use of this correlation is acceptable. |
| Correlation for Flame Spread over Horizontal Cable Trays (FLASH-CAT) | The licensee used the FLASH-CAT method to calculate the growth and spread of a fire within a vertical stack of horizontal cable trays. | NUREG/CR-7010, Section 9, 2010 (Reference 49) | • The modeling technique is validated in NUREG/CR-7010.<br>• The licensee stated that the correlation has been applied within the range of its applicability.<br>Based on its review and evaluation, 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 PBNP

| Calculation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Fire Dynamics Simulator (Version 5) Hot Gas Layer Calculations | The licensee used Fire Dynamics Simulator (Version 5) to calculate abandonment time for the MCR. | NUREG-1824, Volume 7, 2007 (Reference 48)<br><br>NIST Special Publication 1018-5, Volume 2: Verification (Reference 111)<br><br>NIST Special Publication 1018-5, Volume 3: Validation (Reference 112) | • The modeling technique is validated in NUREG-1824 and NIST Special Publication 1018.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based its review and evaluation, the NRC staff concludes that the use of FDS is acceptable. |
| Fire Dynamics Simulator (Version 5) Plume Temperature Calculations | The licensee used Fire Dynamics Simulator (Version 5) to calculate abandonment time for the MCR. | NUREG-1824, Volume 7, 2007 (Reference 48)<br><br>NIST Special Publication 1018-5, Volume 2: Verification (Reference 111)<br><br>NIST Special Publication 1018-5, Volume 3: Validation (Reference 112) | • The modeling technique is validated in NUREG-1824 and NIST Special Publication 1018.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based its review and evaluation, the NRC staff concludes that the use of FDS is acceptable. |

Attachment B: Table 3.8-2, V&V Basis for Other Fire Models and Related Calculations Used at PBNP

| Calculation | Application at PBNP | V&V Basis | NRC Staff Evaluation of Acceptability |
|---|---|---|---|
| Fire Dynamics Simulator (Version 5) Smoke Concentration Calculations | The licensee used Fire Dynamics Simulator (Version 5) to calculate abandonment time for the MCR. | NUREG-1824, Volume 7, 2007 (Reference 48)<br><br>NIST Special Publication 1018-5, Volume 2: Verification (Reference 111)<br><br>NIST Special Publication 1018-5, Volume 3: Validation (Reference 112) | • The modeling technique is validated in NUREG-1824 and NIST Special Publication 1018.<br>• 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 it used the correlation outside the validated range reported in NUREG-1824.<br>Based its review and evaluation, the NRC staff concludes that the use of FDS is acceptable. |

## Attachment C: Abbreviations and Acronyms

| | |
|---|---|
| ADAMS | Agencywide Documents Access and Management System |
| AHJ | authority having jurisdiction |
| Amp | amperes |
| ANS | American Nuclear Society |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| BTP | Branch Technical Position |
| BWR | boiling-water reactor |
| BWRVIP | Boiling Water Reactor Vessels and Internals Project |
| CC | Capability Categories |
| CCDP | conditional core damage probability |
| CDF | core damage frequency |
| CFAST | consolidated model of fire and smoke transport |
| CFR | Code of Federal Regulations |
| CHRISTIFIRE | Cable Heat Release, Ignition, and Spread in Tray Installations During Fire |
| CPT | control power transformer |
| DC | direct current |
| DESIREE-Fire | Direct Current Electrical Shorting in Response to Exposure Fire |
| DID-RA | defense-in-depth recovery action |
| DID | defense-in-depth |
| EEEE | existing engineering equivalency evaluation |
| EMT | electrical metallic tubing |
| EPRI | Electric Power Research Institute |
| ERFBS | electrical raceway fire barrier system |
| F&O | facts and observations |
| FAQ | frequently asked question |
| FDS | fire dynamics simulator |
| FDT | fire dynamics tool |
| FM | fire modeling |
| FMWB | fire modeling workbook |
| FPE | fire protection engineering |
| FPP | fire protection program |
| FPRA | fire probabilistic risk assessment |
| FR | Federal Register |
| FRE | fire risk evaluation |
| FSAR | final safety analysis report |
| FSS | fire scenario selection |
| GDC | general design criteria |
| GFMT | generic fire modeling treatments |
| GL | generic letter |
| HEAF | high energy arcing fault |
| HEP | human error probability |
| HFE | human failure events |
| HGL | hot gas layer |
| HRA | human reliability analysis |
| HRE | high(er) risk evolution |

| | |
|---|---|
| HRR | heat release rate |
| HVAC | heating, ventilation, and air conditioning |
| IA | instrumental air |
| IEEE | Institute of Electrical and Electronics Engineers |
| IEPRA | internal events PRA |
| IN | Information Notice |
| IT&M | inspection, testing, and maintenance |
| KSF | key safety function |
| kV | kilovolt |
| kW | kilowatt |
| LAR | license amendment request |
| LB | licensing basis |
| LERF | large early release frequency |
| LOH | loss of habitability |
| MCA | multi-compartment analysis |
| MCB | main control board |
| MCC | motor control centers |
| MCR | main control room |
| min | minute(s) |
| MQH | McCaffrey, Quintiere and Harkleroad |
| MSDS | Material Safety Data Sheet |
| MSO | multiple spurious operation |
| NEC | National Electric Code |
| NEI | Nuclear Energy Institute |
| NFPA | National Fire Protection Association |
| NIST | National Institute of Standards and Technology |
| No. | number |
| NPO | non-power operation |
| NPP | nuclear power plant |
| NRC | U.S. Nuclear Regulatory Commission |
| NRR | Office of Nuclear Reactor Regulation |
| NSCA | nuclear safety capability assessment |
| NSPC | nuclear safety performance criteria |
| OCT | overcurrent trip |
| PAU | physical analysis unit |
| PB | performance-based |
| PBNP | point beach nuclear plant |
| PCE | plant change evaluation |
| PCS | primary control station |
| PORV | power-operated relief valve |
| RP | radiation protection |
| PRA | probabilistic risk assessment |
| PSA | probabilistic safety assessment |
| PWR | pressurized-water reactor |
| PWROG | Pressurized Water Reactors Owner's Group |
| QA | quality assurance |
| RA | recovery action |
| RAI | request for additional information |

| | |
|---|---|
| RCA | radiologically controlled area |
| RCP | reactor coolant pump |
| RCS | reactor coolant system |
| RES | Office of Nuclear Regulatory Research |
| RG | Regulatory Guide |
| RHR | residual heat removal |
| RI | risk-informed |
| RI/PB | risk-informed, performance-based |
| SE | safety evaluation |
| SER | safety evaluation report |
| SFP | spent fuel pool |
| SFPE | Society of Fire Protection Engineers |
| SOKC | state of knowledge correlation |
| SR | supporting requirement |
| SSA | safe shutdown analysis |
| SSC | structures, systems, and components |
| SSD | safe shutdown |
| SWS | service water system |
| TR | technical report |
| TS | Technical Specification |
| UFSAR | updated final safety analysis report |
| UL | Underwriters Laboratories, Inc. |
| V | Volt |
| V&V | verification and validation (verified and validated) |
| VFDR | variance from deterministic requirements |
| yr | year |
| ZOI | zone of influence |

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,

***/RA/***

Mahesh L. Chawla, Project Manager
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-266 and 50-301

Enclosures:
1. Amendment No.256 to DPR-24
2. Amendment No. 260 to DPR-27
3. Safety Evaluation

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