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

December 6, 2016

Mr. Steven D. Capps
Vice President
McGuire Nuclear Station
Duke Energy Carolinas, LLC
12700 Hagers Ferry Road
Huntersville, NC 28078

SUBJECT: MCGUIRE NUCLEAR STATION, UNITS 1 AND 2 – ISSUANCE OF AMENDMENTS REGARDING NATIONAL FIRE PROTECTION ASSOCIATION STANDARD (NFPA) 805 (CAC NOS. MF2934 AND MF2935)

Dear Mr. Capps:

By letter dated September 26, 2013, as supplemented by letters dated January 8, 2014; October 13, 2014; November 12, 2014; December 12, 2014; January 26, 2015; February 27, 2015; March 13, 2015; July 15, 2015; August 20, 2015; September 9, 2015; October 1, 2015; January 14, 2016; April 26, 2016; September 29, 2016; and November 21, 2016, Duke Energy Carolinas, LLC (the licensee) submitted a license amendment request to transition the McGuire Nuclear Station (MNS), Units 1 and 2, to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.48(c), "National Fire Protection Association Standard NFPA 805."

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 291 to Renewed Facility Operating License No. NPF-9 and Amendment No. 270 to Renewed Facility Operating License No. NPF-17 for MNS, Units 1 and 2, respectively. The amendments authorize the transition of the fire protection program to a risk-informed, performance-based program based on National Fire Protection Association (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 fire protection license condition in the MNS, Units 1 and 2, Renewed Facility Operating Licenses are revised to reflect the use of NFPA 805.

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

Sincerely,

Bob Martin

Bob Martin, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370

Enclosures:
1. Amendment No. 291 to NPF-9
2. Amendment No. 270 to NPF-17
3. Safety Evaluation

cc w/enclosures: Distribution via Listserv

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

DUKE ENERGY CAROLINAS, LLC

DOCKET NO. 50-369

MCGUIRE NUCLEAR STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 291
Renewed License No. NPF-9

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

   A. The application for amendment to the McGuire Nuclear Station, Unit 1 (the facility), Renewed Facility Operating License No. NPF-9, filed by Duke Energy Carolinas, LLC (the licensee), dated September 26, 2013, as supplemented by letters dated January 8, 2014; October 13, 2014; November 12, 2014; December 12, 2014; January 26, 2015; February 27, 2015; March 13, 2015; July 15, 2015; August 20, 2015; September 9, 2015; October 1, 2015; January 14, 2016; April 26, 2016; September 29, 2016; and November 21, 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 as 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 set forth in 10 CFR Chapter I;

   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 as indicated in the attachment to this license amendment. Paragraph 2.C(4) of Renewed Facility Operating License No. NPF-9 is hereby amended to read as follows:

(4) Fire Protection Program

Duke Energy Carolinas, LLC shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the licensee amendment request dated September 26, 2013, as supplemented by letters dated January 8, 2014; October 13, 2014; November 12, 2014; December 12, 2014; January 26, 2015; February 27, 2015; March 13, 2015; July 15, 2015; August 20, 2015; September 9, 2015; October 1, 2015; January 14, 2016; April 26, 2016; September 29, 2016; and November 21, 2016, and as approved in the safety evaluation dated December 6, 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 a license condition, and the criteria listed below are satisfied.

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

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

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

2) Prior NRC review and approval is not required for individual changes that result in a risk increase less than 1×10^{-7}/year (yr) for CDF and less than 1×10^{-8}/yr for LERF. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety

margins. The change may be implemented following completion of the plant change evaluation.

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

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

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

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

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

This License Condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

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

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

December 6, 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.

c. Transition License Conditions

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

2) The licensee shall implement the items as listed in Attachment S, Table S-3, "Implementation Items," of Duke Energy letter dated November 21, 2016, within 180 days or 365 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then, implementation will occur within 60 days after startup from that scheduled refueling outage. Implementation Item 19 is associated with thermoplastic cable analysis and will be completed by June 30, 2017. Implementation Item 20, associated with the pressure boundary breach analysis, will be completed by December 31, 2017.

3. This license amendment is effective as of its date of issuance and shall be implemented as stated in paragraph 2.C.(4) above.

FOR THE NUCLEAR REGULATORY COMMISSION

Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to Renewed Facility
Operating License No. NPF-9

Date of Issuance: December 6, 2016

ATTACHMENT TO LICENSE AMENDMENT NO. 291

MCGUIRE NUCLEAR PLANT, UNIT 1

RENEWED FACILITY OPERATING LICENSE NO. NPF-9

DOCKET NO. 50-369

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

Remove	Insert
NPF-9, page 4	NPF-9, page 4
NPF-9, page 4A	NPF-9, page 4A
	NPF-9, page 4B
	NPF-9, page 4C

(4) Fire Protection Program

Duke Energy Carolinas, LLC shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the licensee amendment request dated September 26, 2013, as supplemented by letters dated January 8, 2014; October 13, 2014; November 12, 2014; December 12, 2014; January 26, 2015; February 27, 2015; March 13, 2015; July 15, 2015; August 20, 2015; September 9, 2015; October 1, 2015; January 14, 2016; April 26, 2016; September 29, 2016; and November 21, 2016, and as approved in the safety evaluation dated December 6, 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 a license condition, and the criteria listed below are satisfied.

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

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

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

2) Prior NRC review and approval is not required for individual changes that result in a risk increase less than 1×10^{-7}/year (yr) for CDF and less than 1×10^{-8}/yr for LERF. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

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

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

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

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

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

This License Condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

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

Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC safety evaluation report dated December 6, 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.

c. Transition License Conditions

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

2) The licensee shall implement the items as listed in Attachment S, Table S-3, "Implementation Items," of Duke Energy letter dated November 21, 2016, within 180 days or 365 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then, implementation will occur within 60 days after startup from that scheduled refueling outage. Implementation Item 19 is associated with thermoplastic cable analysis and will be completed by June 30, 2017. Implementation Item 20, associated with the pressure boundary breach analysis, will be completed by December 31, 2017.

(5) Additional Conditions

The Additional Conditions contained in Appendix B, as revised through Amendment No. 269, are hereby incorporated into this renewed operating license. Duke Energy Carolinas, LLC shall operate the facility in accordance with the Additional Conditions.

(6) Antitrust Conditions

The licensee shall comply with the antitrust conditions delineated in Appendix C of this renewed operating license.

(7) Mitigation Strategy License Condition

Develop and maintain strategies for addressing large fires and explosions and that include the following key areas:

A) Fire fighting response strategy with the following elements:
   1 Pre-defined coordinated fire response strategy and guidance
   2. Assessment of mutual aid fire fighting assets
   3. Designated staging areas for equipment and materials
   4. Command and control
   5. Training of response personnel

B) Operations to mitigate fuel damage considering the following:
   1. Protection and use of personnel assets
   2. Communications
   3. Minimizing fire spread

4. Procedures for implementing integrated fire response strategy
5. Identification of readily-available pre-staged equipment
6. Training on integrated fire response strategy
7. Spent fuel pool mitigation measures

C) Actions to minimize release to include consideration of:
1. Water spray scrubbing
2. Dose to onsite responders

D. Physical Protection

Duke Energy Carolinas, LLC 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 contains safeguards information protected under 10 CFR 73.21, is entitled: "Duke Energy Physical Security Plan" submitted by letter dated September 8, 2004, and supplemented on September 30, 2004; October 15, 2004; October 21, 2004; and October 27, 2004.

Duke Energy Carolinas, LLC shall fully implement and maintain in effect all provisions of the Commission-approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The Duke Energy Carolinas, LLC CSP was approved by License Amendment No. 264, as supplemented by a change approved by License Amendment No. 279.

E. Deleted by Amendment No. 233.

UNITED STATES
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DUKE ENERGY CAROLINAS, LLC

DOCKET NO. 50-370

MCGUIRE NUCLEAR STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 270
Renewed License No. NPF-17

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

   A. The application for amendment to the McGuire Nuclear Station, Unit 2 (the facility), Renewed Facility Operating License No. NPF-17, filed by Duke Energy Carolinas, LLC (the licensee), dated September 26, 2013, as supplemented by letters dated January 8, 2014; October 13, 2014; November 12, 2014; December 12, 2014; January 26, 2015; February 27, 2015; March 13, 2015; July 15, 2015; August 20, 2015; September 9, 2015; October 1, 2015; January 14, 2016; April 26, 2016; September 29, 2016; and November 21, 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 as 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 set forth in 10 CFR Chapter I;

   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 as indicated in the attachment to this license amendment. Paragraph 2.C.(4) of Renewed Facility Operating License No. NPF-17 is hereby amended to read as follows:

(4) Fire Protection Program

Duke Energy Carolinas, LLC shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the licensee amendment request dated September 26, 2013, as supplemented by letters dated January 8, 2014; October 13, 2014; November 12, 2014; December 12, 2014; January 26, 2015; February 27, 2015; March 13, 2015; July 15, 2015; August 20, 2015; September 9, 2015; October 1, 2015; January 14, 2016; April 26, 2016; September 29, 2016; and November 21, 2016, and as approved in the safety evaluation dated December 6, 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 a license condition, and the criteria listed below are satisfied.

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

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

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

2) Prior NRC review and approval is not required for individual changes that result in a risk increase less than 1×10^{-7}/year (yr) for CDF and less than 1×10^{-8}/yr for LERF. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety

margins. The change may be implemented following completion of the plant change evaluation.

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

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

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

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

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

This License Condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

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

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

December 6, 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.

c. Transition License Conditions

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

2) The licensee shall implement the items as listed in Attachment S, Table S-3, "Implementation Items," of Duke Energy letter dated November 21, 2016, within 180 days or 365 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then, implementation will occur within 60 days after startup from that scheduled refueling outage. Implementation Item 19 is associated with thermoplastic cable analysis and will be completed by June 30, 2017. Implementation Item 20, associated with the pressure boundary breach analysis, will be completed by December 31, 2017.

3. This license amendment is effective as of its date of issuance and shall be implemented as stated in paragraph 2.C.(4) above.

FOR THE NUCLEAR REGULATORY COMMISSION

Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to Renewed Facility
Operating License No. NPF-17

Date of Issuance: December 6, 2016

ATTACHMENT TO LICENSE AMENDMENT NO. 270

MCGUIRE NUCLEAR PLANT, UNIT 2

RENEWED FACILITY OPERATING LICENSE NO. NPF-17

DOCKET NO. 50-370

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

Remove	Insert
NPF-17, page 4	NPF-17, page 4 NPF-17, page 4A NPF-17, page 4B NPF-17, page 4C

(4) Fire Protection Program

Duke Energy Carolinas, LLC shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the licensee amendment request dated September 26, 2013, as supplemented by letters dated January 8, 2014; October 13, 2014; November 12, 2014; December 12, 2014; January 26, 2015; February 27, 2015; March 13, 2015; July 15, 2015; August 20, 2015; September 9, 2015; October 1, 2015; January 14, 2016; April 26, 2016; September 29, 2016; and November 21, 2016, and as approved in the safety evaluation dated December 6, 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 a license condition, and the criteria listed below are satisfied.

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

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

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

2) Prior NRC review and approval is not required for individual changes that result in a risk increase less than 1×10^{-7}/year (yr) for CDF and less than 1×10^{-8}/yr for LERF. The proposed change must also be consistent with the defense-in-depth philosophy and must maintain sufficient safety margins. The change may be implemented following completion of the plant change evaluation.

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

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

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

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

This License Condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

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

Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC safety evaluation report dated December 6, 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.

c. Transition License Conditions

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

2) The licensee shall implement the items as listed in Attachment S, Table S-3, "Implementation Items," of Duke Energy letter dated November 21, 2016, within 180 days or 365 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then, implementation will occur within 60 days after startup from that scheduled refueling outage. Implementation Item 19 is associated with thermoplastic cable analysis and will be completed by June 30, 2017. Implementation Item 20, associated with the pressure boundary breach analysis, will be completed by December 31, 2017.

(5) Protection of the Environment

Before engaging in additional construction or operational activities, which may result in a significant adverse environmental impact that was not evaluated or that is significantly greater than that evaluated in the Final Environmental Statement dated April 1976, the licensee shall provide written notification to the Office of Nuclear Reactor Regulation.

(6) Additional Conditions

The Additional Conditions contained in Appendix B, as revised through Amendment No. 249, are hereby incorporated into this renewed operating license. Duke Energy Carolinas, LLC shall operate the facility in accordance with the Additional Conditions.

(7) Antitrust Conditions

The licensee shall comply with the antitrust conditions delineated in Appendix C of this renewed operating license.

(8) Mitigation Strategy License Condition

Develop and maintain strategies for addressing large fires and explosions and that include the following key areas:

A) Fire fighting response strategy with the following elements:
   1. Pre-defined coordinated fire response strategy and guidance
   2. Assessment of mutual aid fire fighting assets
   3. Designated staging areas for equipment and materials
   4. Command and control
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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. 291 TO RENEWED FACILITY OPERATING LICENSE NO. NPF-9

AND AMENDMENT NO. 270 TO RENEWED FACILITY OPERATING LICENSE NO. NPF-17

DUKE ENERGY CAROLINAS, LLC

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-369 AND 50-370

1.0 INTRODUCTION

1.1 Background

The U.S. Nuclear Regulatory Commission (NRC) 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 to 10 CFR Part 50, "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) of 10 CFR states that the fire protection plan must describe the specific features necessary to implement the program described in paragraph (a)(1), including administrative controls and personnel requirements; 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.

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

> On March 26, 1998, the NRC staff sent to the Commission SECY-98-058, "Development of a Risk-Informed, Performance-Based Regulation for Fire Protection at Nuclear Power Plants" (Reference 5), in which it proposed to work with the NFPA and the industry to develop a risk-informed, performance-based [RI/PB] consensus standard for NPP fire protection. This consensus standard could be endorsed in a future rulemaking as an alternative set of fire protection requirements to the existing regulations in 10 CFR 50.48. In SECY-00-0009, "Rulemaking Plan, Reactor Fire Protection Risk-Informed, Performance-Based Rulemaking," dated January 13, 2000 (Reference 6), the NRC staff requested and received Commission approval to proceed with rulemaking to permit operating reactor licensees to adopt an NFPA standard as an alternative to existing fire protection requirements. On February 9, 2001, the NFPA Standards Council approved the 2001 edition of NFPA 805, "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 performance criteria 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 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 an RI/PB FPP. RG 1.205 endorses the guidance of NEI 04-02, Revision 2, subject to certain exceptions, as providing methods acceptable to the staff for adopting an FPP consistent with the 2001 Edition of NFPA 805 and 10 CFR 50.48(c).

Accordingly, Duke Energy Carolinas, LLC (Duke Energy, the licensee) requested license amendments to allow the licensee to maintain the McGuire Nuclear Station, Units 1 and 2 (MNS), FPP in accordance with 10 CFR 50.48(c) and change the renewed facility operating licenses (RFOLs) and technical specifications (TSs) accordingly.

1.2 Requested Licensing Action

By letter dated September 26, 2013 (Reference 8), as supplemented by letters dated January 8, 2014 (Reference 9); October 13, 2014 (Reference 10); November 12, 2014 (Reference 11); December 12, 2014 (Reference 12); January 26, 2015 (Reference 13); February 27, 2015 (Reference 14); March 13, 2015 (Reference 15); July 15, 2015 (Reference 16); August 20, 2015 (Reference 17); September 9, 2015 (Reference 18); October 1, 2015 (Reference 19); January 14, 2016 (Reference 20); April 26, 2016 (Reference 21); September 29, 2016 (Reference 22); and November 21, 2016 (Reference 23), the licensee submitted an application for a license amendment to transition the MNS FPP 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 August 28, 2014 (Reference 24); October 27, 2014

(Reference 25); May 8, 2015 (Reference 26); June 18, 2015 (Reference 27); August 18, 2015 (Reference 28); July 12, 2016 (Reference 29); and November 4, 2016 (Reference 30).

The licensee requested an amendment to the MNS RFOLs to establish and maintain an RI/PB FPP in accordance with the requirements of 10 CFR 50.48(c). Specifically, the licensee requested to transition from the existing deterministic fire protection licensing basis established in accordance with the Updated Final Safety Analysis Report (UFSAR) for MNS and as approved in the safety evaluation report (SER), March 1978 (Reference 31); SER Supplement 2, March 1979 (Reference 32); SER Supplement 5, April 1981 (Reference 33); SER Supplement 6, March 1983 (Reference 34); and the SE dated May 15, 1989 (Reference 35), to an RI/PB FPP in accordance with 10 CFR 50.48(c), which 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 MNS is referred to as RI/PB throughout this SE.

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

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

1. The licensee's application has identified any orders and license conditions that must be revised or superseded, and contains any necessary revisions to the plant's technical specifications 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 NPFA 805 (including all required evaluations and analyses), and the NRC staff has approved the licensee's modified fire protection plan, which reflects the decision to comply with NFPA 805, as required by 10 CFR 50.48(a); and

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

The licensee proposed a new fire protection license condition reflecting the new RI/PB FPP licensing basis. SE Sections 2.4.2 and 4.0 discuss in detail the license condition, and SE Section 2.4.3 discusses the staff's conclusion that no changes to the MNS TSs are required to support the NFPA 805 transition process.

The licensee's supplements dated January 8, 2014; October 13, 2014; November 12, 2014; December 12, 2014; January 26, 2015; February 27, 2015; March 13, 2015; July 15, 2015; August 20, 2015; September 9, 2015; October 1, 2015; January 14, 2016; April 26, 2016; September 29, 2016; and November 21, 2016, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change

the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on February 19, 2014 (79 FR 9492).

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 an RI/PB FPP based on the provisions of NFPA 805 (Reference 3). Paragraph 50.48(c)(3)(i) of 10 CFR states, in part, 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, 69 FR 33536, 33548 (June 16, 2004), which 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 part, 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," may do so by submitting an LAR in accordance with 10 CFR 50.48(c)(2)(vii). This regulation further provides that:

> The Director of the Office of Nuclear Reactor Regulation, or a designee of the Director, may approve the application if the Director or designee determines that the performance-based approach;
>
> (A) Satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release;
>
> (B) Maintains safety margins; and
>
> (C) Maintains fire protection defense-in-depth [DID] (fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown [SSD] capability).

Alternatively, licensees may choose to use RI or PB alternatives to comply with NFPA 805 by submitting an LAR in accordance with 10 CFR 50.48(c)(4). This regulation further provides that:

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

In addition to the conditions outlined by the rule that require licensees to submit an LAR for NRC review and approval in order to adopt an RI/PB FPP, a licensee may also submit additional elements of its FPP for which it wishes to receive specific NRC review and approval, as set forth in Regulatory Position C.2.2.1 of RG 1.205, Revision 1 (Reference 4). Inclusion of these elements in the NFPA 805 LAR is meant to alleviate uncertainty in portions of the current FPP licensing bases as a result of the lack of specific NRC approval of these elements. RGs are not substitutes for regulations, and compliance with them is not required. Methods and solutions that differ from those set forth in RGs will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission.

Accordingly, any submittal addressing these additional FPP elements needs to include sufficient detail to allow the NRC staff to assess whether the licensee's treatment of these elements meets 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:

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

- GDC 5, "Sharing of structures, systems, and components," to 10 CFR Part 50, Appendix A: Structures, systems, and components important to safety shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

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

- 10 CFR 50.48(c) incorporates NFPA 805 (2001 Edition) (Reference 3) by reference, with certain exceptions, modifications and supplementation. This regulation establishes the requirements for using an RI/PB FPP in conformance with NFPA 805 as 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 (RPs) in Section C of RG 1.205, Revision 1, include clarification of the guidance provided in NEI 04-02, as well as NRC exceptions to the guidance. RG 1.205 sets forth RPs, 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 RPs in RG 1.205 govern. This RG also indicates that Chapter 3 of NEI 00-01, "Guidance for Post-Fire Safe Shutdown Circuit Analysis," Revision 2, issued May 2009, when used in conjunction with NFPA 805 and the RG, provides one acceptable approach to circuit analysis for a plant implementing an FPP under 10 CFR 50.48(c).

- The 2001 edition of NFPA 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants" (Reference 3), which specifies the minimum fire protection requirements for existing light water NPPs during all phases of plant operations, including shutdown, degraded conditions, and decommissioning. NFPA 805 was developed to provide a comprehensive RI/PB standard for fire protection. The NFPA 805 Technical Committee on Nuclear Facilities is composed of nuclear plant licensees, the NRC, insurers, equipment manufacturers, and subject matter experts. The standard was developed in accordance with NFPA processes, and consisted of a number of technical meetings and reviews of draft documents by committee and industry

representatives. The scope of NFPA 805 includes goals related to nuclear safety, radioactive release, life safety, and plant damage/business interruption. The standard addresses fire protection requirements for nuclear plants during all plant operating modes and conditions, including shutdown and decommissioning, which had not been explicitly addressed by previous requirements and guidelines. NFPA 805 became effective on February 9, 2001.

- NEI 04-02 "Guidance for Implementing a Risk-Informed, Performance-Based Fire Protection Program Under 10 CFR 50.48(c)" (Reference 7), which provides guidance for implementing the requirements of 10 CFR 50.48(c), and represents methods for implementing in whole or in part an RI/PB FPP. This implementing guidance for NFPA 805 has two primary purposes: (1) provide direction and clarification for adopting NFPA 805 as an acceptable approach to fire protection, consistent with 10 CFR 50.48(c); and (2) provide additional supplemental technical guidance and methods for using NFPA 805 and its appendices to demonstrate compliance with fire protection requirements. Although there is a significant amount of detail in NFPA 805 and its appendices, clarification and additional guidance for select issues help ensure consistency and effective utilization of the standard. The NEI 04-02 guidance focuses attention on the RI/PB 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 36), 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. RG 1.205 indicates that Chapter 3 of NEI 00-01, Revision 2, when used in conjunction with NFPA 805 and RG 1.205, provides one acceptable approach to circuit analysis for a plant implementing an FPP under 10 CFR 50.48(c).

- 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 37), which provides the NRC staff's recommendations for using risk information in support of licensee-initiated licensing basis changes to a NPP that require such review and approval. The guidance provided does not preclude other approaches for requesting licensing basis changes. Rather, RG 1.174 is intended to improve consistency in regulatory decisions in areas in which the results of risk analyses are used to help justify regulatory action. As such, the RG provides general guidance concerning one approach that the NRC has determined to be acceptable for analyzing issues associated with proposed changes to a plant's licensing basis

and for assessing the impact of such proposed changes on the risk associated with plant design and operation.

- RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Revision 2, issued March 2009 (Reference 38), 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 (ASME)/American Nuclear Society (ANS) RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications" (Reference 39), which provides guidance for PRAs used to support RI decisions for commercial light water reactor NPPs and prescribes a method for applying these requirements for specific applications. The Standard gives guidance for a Level 1 PRA of internal and external hazards for all plant operating modes. In addition, the Standard provides guidance for a limited Level 2 PRA sufficient to evaluate large early release frequency (LERF). The only hazards explicitly excluded from the scope are accidents resulting from purposeful human-induced security threats (e.g., sabotage). The Standard applies to PRAs used to support applications of RI 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 40), 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 41), which

provides the NRC staff with guidance for evaluating LARs that seek to implement an RI/PB FPP in accordance with 10 CFR 50.48(c).

- NUREG-0800, Section 19.1, "Determining the Technical Adequacy of Probabilistic Risk Assessment for Risk-Informed License Amendment Requests After Initial Fuel Load," Revision 3, issued September 2012 (Reference 42), provides the NRC staff with guidance for evaluating the technical adequacy of a licensee's PRA results when used to request RI changes to the licensing basis.

- NUREG-0800, Section 19.2, "Review of Risk Information Used to Support Permanent Plant-Specific Changes to the Licensing Basis: General Guidance," Revision 0, issued June 2007 (Reference 43), provides the NRC staff with guidance for evaluating the risk information used by a licensee to support permanent RI changes to the licensing basis.

- NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," Volumes 1 (Reference 44) and 2 (Reference 45), and Supplement 1 (Reference 46), which presents a compendium of methods, data and tools to perform a 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 Fire PRA methodology. Both RES and EPRI have provided specialists in fire risk analysis, fire modeling (FM), electrical engineering, human reliability analysis, 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 Fire PRA. 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 Fire PRA.

- 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 "Fire Dynamics Tools" (FDTs), to assist regional fire protection inspectors in performing fire hazard analysis. The FDTs are intended to assist fire protection inspectors in performing RI evaluations of credible fires that may cause critical damage to essential safe-shutdown equipment, as required by the reactor oversight process defined in the NRC's inspection manual.

- NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," Volumes 1 through 7 (Reference 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 the EPRI and the National Institute of Standards and Technology (NIST). The selected models are:

  1. FDTs developed by NRC (Volume 3);

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

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

  4. The zone model MAGIC developed by 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 decision making. To meet the objective of the NUREG, it is necessary to understand the role that PRA results play in the context of the decision process. To define this context, NUREG-1855, Volume 1, provides an overview of the RI decision making 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 human reliability analysis (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 fire PRA. 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.

- Generic Letter (GL) 2006-03. "Potentially Nonconforming Hemyc and MT Fire Barrier Configurations" (Reference 53), 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 54), 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 55), 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.

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
06-0019	"Definition of 'Power Block' and 'Plant'" • This FAQ provides guidance on the definitions of "power block" and "plant" as found in NFPA 805.	(Reference 56)	3.1.2
06-0022	"Electrical Cable Flame Propagation Tests" • This FAQ provides a list of acceptable electrical cable flame propagation tests.	(Reference 57)	3.1.1.1
07-0030	"Establishing Recovery Actions (RAs)" • This FAQ provides an acceptable process for determining the RAs for NFPA 805, Chapter 4, compliance. The process includes: ▪ Differentiation between RAs and activities in the main control room or at primary control station(s). ▪ Determination of which RAs are required by the NFPA 805 FPP. ▪ Evaluate the additional risk presented by the use of RAs. ▪ Evaluate the feasibility of the identified RAs. ▪ Evaluate the reliability of the identified RAs.	(Reference 58)	3.2.5 3.4.4
07-0038	"Lessons Learned on MSOs" • This FAQ reflects an acceptable process for the treatment of MSOs during transition to NFPA 805: ▪ Step 1 – Identify potential MSO combinations of concern. ▪ Step 2 – Expert panel assesses plant-specific vulnerabilities and reviews MSOs of concern. ▪ Step 3 – Update the fire PRA and Nuclear Safety Capability Assessment (NSCA) to include MSOs of concern. ▪ Step 4 – Evaluate for NFPA 805 compliance. ▪ Step 5 – Document the results.	(Reference 59)	3.2.4 3.2.6 3.4.2.2
07-0039	"Incorporation of Pilot Plant Lessons Learned – Table B-2" • This FAQ provides additional detail for the comparison of the licensee's safe shutdown strategy to the endorsed industry guidance, NEI 00-01 "Guidance for Post-Fire Safe Shutdown Circuit Analysis," Revision 1 (Reference 60). In short, the process has the licensees: ▪ Assemble industry and plant-specific documentation; ▪ Determine which sections of the guidance are applicable; ▪ Compare the existing safe shutdown methodology to the applicable guidance; and ▪ Document any discrepancies.	(Reference 61)	3.2.1

FAQ #	FAQ Title and Summary	Reference	SE Section
07-0040	"Non-Power Operations (NPO) Clarifications" • This FAQ clarifies an acceptable NFPA 805 NPO program. The process includes: ▪ Selecting NPO equipment and cabling. ▪ Evaluation of NPO Higher Risk Evolutions (HRE). ▪ Analyzing NPO key safety functions (KSFs). ▪ Identifying plant areas to protect or "pinch points" during NPO HREs and actions to be taken if KSFs are lost.	(Reference 62)	3.5.3 3.5.3.1 3.5.3.2 3.5.3.3 3.5.3.4 3.5.4
08-0048	"Revised Fire Ignition Frequencies" • This FAQ provides an acceptable method for using updated fire ignition frequencies in the licensee's fire probabilistic risk assessment (FPRA). The method involves the use of sensitivity studies when the updated fire ignition frequencies are used.	(Reference 63)	3.4.7
08-0052	"Transient Fires - Growth Rates and Control Room Non-Suppression" • This FAQ clarifies and updates the treatment of transient fires in terms of both manual suppression and time-dependent fire growth modeling.	(Reference 64)	3.4.2.3.2
08-0054	"Compliance with Chapter 4 of NFPA 805" • This FAQ provides an acceptable process to demonstrate Chapter 4 compliance for transition: ▪ Step 1 – Assemble documentation. ▪ Step 2 – Document Fulfillment of NSPC. ▪ Step 3 – Variance from Deterministic Requirement (VFDR) Identification, Characterization, and Resolution Considerations. ▪ Step 4 – PB Evaluations. ▪ Step 5 – Final VFDR Evaluation. ▪ Step 6 – Document Required Fire Protection Systems and Features.	(Reference 65)	3.4.3 3.4.4 3.5.1.4
10-0059	"Monitoring Program" • This FAQ provides clarification regarding the implementation of an NFPA 805 monitoring program for transition. It includes: ▪ Monitoring program analysis units; ▪ Screening of low safety significant structures, systems, and components; ▪ Action level thresholds; and ▪ The use of existing monitoring programs.	(Reference 66)	3.1.1 3.7
12-0062	"UFSAR Content" • This FAQ provides the necessary level of detail for the transition of the fire protection sections within the UFSAR.	(Reference 67)	2.4.4

FAQ #	FAQ Title and Summary	Reference	SE Section
13-0004	"Clarifications on Treatment of Sensitive Electronics" • This FAQ provides supplemental guidance for application of the damage criteria provided in Sections 8.5.1.2 and H.2 of NUREG/CR-6850 for solid-state components.	(Reference 68)	3.4.2.2 3.4.2.3.2
13-0006	"Modeling Junction Box Scenarios in a Fire PRA" • This FAQ provides a definition for junction boxes that allow the characterization and quantification of junction box fire scenarios in plant physical access units (PAUs) requiring detailed FPRA/FM analysis and also describes a process for quantifying the risk associated with junction box fire scenarios in such plant locations.	(Reference 69)	3.4.2.2
14-0008	"Main Control Board (MCB) Treatment" • This FAQ clarifies the MCB definition and gives guidance on application of the frequencies in Appendix L to NUREG/CR-6850.	(Reference 70)	3.4.2.2
14-0009	"Treatment of Well Sealed MCC Electrical Panels Greater Than 440V" • This FAQ provides clarification for the treatment of fire propagation from well-sealed MCC electrical cabinets with voltage levels at 440V or greater.	(Reference 71)	3.4.2.2

2.4 Orders, License Conditions, and Technical Specifications

Paragraph 50.48(c)(3)(i) of 10 CFR states 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 MNS that complies with 10 CFR 50.48(c). Based on the information provided by the licensee, the NRC staff finds the licensee's conclusions regarding the revisions or superseding of orders acceptable.

The licensee also performed a specific review of the license amendment that incorporated the mitigation strategies required by Section B.5.b of Commission Order EA-02-026 (and 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

MNS. The licensee's review of this regulation and the related license amendment demonstrated that changes to the FPP during transition to NFPA 805 will not affect the measures required by Section B.5.b of Commission Order EA-02-026. 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," as supplemented, regarding changes the licensee seeks to make to the MNS FPP fire protection license condition in order to adopt NFPA 805, as required by 10 CFR 50.48(c)(3).

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

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

The revised license condition also defines the limitations imposed on the licensee during the transition phase of plant operations when the physical plant configuration does not fully match the configuration represented in the fire risk analysis. The limitations on self-approval are required because NFPA 805 requires that the risk analyses be based on the as-built, as-operated and maintained plant, and reflect the operating experience at the plant. Until the proposed implementation items 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 associated implementation schedule that must be accomplished at MNS to complete transition to NFPA 805 and comply with 10 CFR 50.48(c). These 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 MNS FPP license condition.

2.4.3 Technical Specifications

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 MNS TSs that are being revised or superseded during the NFPA 805 transition process. According to the LAR,

the licensee conducted a review of the MNS TSs to determine which, if any, TS sections will be impacted by the transition to an RI/PB FPP based on 10 CFR 50.48(c). In LAR Attachment N, the licensee indicated that there are no TSs that need to be revised, deleted, or added as a result of the transition to NFPA 805.

The NRC staff found that the licensee had previously requested, and obtained NRC approval for removal of the fire protection requirements from the MNS TSs in Amendment 98 (Unit 1) and Amendment 80 (Unit 2) (Reference 72). In addition, the NRC staff reviewed the licensee's TSs and determined that the TSs do not include the requirement that written procedures be established, implemented, and maintained for the FPP. As a result, the NRC staff concludes that no changes to the MNS TSs are required to support the NFPA 805 transition process.

2.4.4 Updated Final Safety Analysis Report

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 UFSAR will be revised and the format and content will be consistent with NEI 04-02 and FAQ 12-0062. The licensee included this action in LAR Attachment S, Table S-3, Implementation Item 2. The NRC staff concludes that this action is acceptable because it would be required by the proposed license condition.

Since the licensee has developed an implementation item to 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

MNS was licensed to operate on June 12, 1981, for Unit 1, and on March 3, 1983, for Unit 2, the MNS FPP is based on compliance with 10 CFR 50.48(a) and the MNS fire protection license condition.

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. MNS was licensed to operate after January 1, 1979, and, therefore, licensing actions associated with 10 CFR 50, Appendix R, were not issued as exemptions to the regulation. Therefore, the NRC staff concludes that no exemptions need to be rescinded.

2.6 Self-Approval Process for Fire Protection Program 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 that:

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

2.6.1 Post-Implementation Plant Change Evaluation Process

The NRC staff reviewed LAR Section 4.7.2, "Compliance with Configuration Control Requirements in Section 2.7.2 and 2.2.9 of NFPA 805," for compliance with the NFPA 805 plant change evaluation 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 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 73), 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 is 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 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 (Δ) CDF (change in CDF) and Δ 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 impact 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 MNS 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 10. The NRC staff concludes that the action is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

The licensee stated that several document types such as NSCA supporting information, non-power mode NSCA treatment, etc., generally require new control procedures and processes 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 update of system level design basis documents to reflect the NFPA 805 role that the system components now play will be completed as part of LAR implementation. This action is included in LAR Attachment S, Table S-3, Implementation Item 9. The NRC staff concludes that the action is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

The licensee stated that 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 is an initial screening for process users to determine if there is a potential to impact the FPP as

defined under NFPA 805 through a series of screening questions/checklists contained in one or more procedures depending upon the configuration control process being used. The licensee further stated that reviews that identify potential FPP impacts will be sent to qualified individuals (e.g., Fire Protection, Safe Shutdown, Fire PRA) 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 would be used to determine if the proposed change could be implemented "as-is" or whether prior NRC approval of the proposed change is required.

The licensee stated that this process follows the requirements in NFPA 805 and the guidance outlined in RG 1.174 (Reference 37). 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 MNS 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 Δ risk calculations, uses risk assessment methods acceptable to the NRC, uses appropriate risk acceptance criteria in determining acceptability, involves the use of a Fire PRA 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 Fire PRA 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 (Reference 7), as well as RG 1.205, Revision 1 (Reference 4). The NRC staff concludes that the proposed PCE process at MNS, which includes defining the change, a preliminary risk screening, a risk evaluation, and an acceptability determination, as described in Section 2.6.1, is acceptable because it addresses the required Δ risk calculations, uses risk assessment methods acceptable to the NRC, uses appropriate risk acceptance criteria in determining acceptability, involves the use of a Fire PRA 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 completing the implementation items listed in SE Section 2.7.2 (i.e., during full implementation of the transition to NFPA 805), the proposed license condition provides 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. In addition, the proposed license condition requires that fire protection DID and safety margins are maintained during the transition process. The "Transition License Conditions" in the proposed NFPA 805 license condition 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 RI 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 since 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 the NFPA 805 guidelines. In particular, this means that the evaluations must meet the requirements of NFPA 805, Section 2.4, "Engineering Analyses," and NFPA 805, Section 2.7, "Program Documentation, Configuration Control, and Quality." Specifically, the effectiveness of the fire protection features under review must be evaluated and found acceptable in relation to their ability to detect, control, suppress, and extinguish a fire and provide passive protection to achieve the performance criteria and not exceed the damage threshold for the plant being analyzed. The associated evaluations must also meet the documentation content (as outlined by NFPA 805, Section 2.7.1, "Content") and quality requirements (as outlined by NFPA 805, Section 2.7.3, "Quality") of the standard in order to be considered adequate. 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. SE Section 3.4.2, "Quality of the Fire Probabilistic Risk Assessment,"

discusses the technical adequacy of the Fire PRA, 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 condition, 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 MNS 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 FREs conducted to determine the change in risk associated with proposed plant changes.

2.7 Modifications and Implementation Items

Regulatory Position C.3.1 of RG 1.205, Revision 1 (Reference 4), 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 found 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 November 21, 2016 (Reference 23).

2.7.1 Modifications

The NRC staff reviewed LAR Attachment S, "Plant Modifications and Items to be Completed During Implementation," which described the plant modifications necessary to implement the NFPA 805 licensing basis, as proposed. These modifications were identified in the LAR as necessary to bring MNS into compliance with either the deterministic or PB requirements of NFPA 805. LAR Attachment S, Table S-2 provided a description of each of the proposed plant modifications, presented the problem statement explaining why the modification was needed, and identified whether compensatory actions were required to be in place pending completion/implementation of the modification. In a letter dated April 26, 2016 (Reference 21), the licensee indicated that it had completed all its proposed modifications and revised Attachment S to move them from Table S-2, to Table S-1.

The NRC staff's review confirmed that the modifications identified in LAR Table S-2 were the same as those identified elsewhere in the LAR as the modifications being credited in the proposed NFPA 805 licensing basis.

As depicted in LAR Attachment S, Table S-1, the licensee has completed all its modifications as part of the NFPA 805 transition. LAR Attachment S, Table S-1 provides a detailed listing of the

plant modifications that the licensee has completed in order for MNS to be fully in accordance with NFPA 805 and implement many of the attributes upon which this SE is based, and thereby meet the requirements of 10 CFR 50.48(c).

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

Each implementation item will be completed prior to the deadline for implementation of the RI/PB FPP based on NFPA 805, as specified in the license condition and the letter transmitting the license amendment (i.e., implementation period), that states that the implementation items listed in LAR Attachment S, Table S-3, will be completed within 180 days or 365 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then, implementation will occur within 60 days after startup from that scheduled refueling outage. In its letter dated November 21, 2016 (Reference 23), the licensee stated that implementation items 1, 5, 6, 8, 10, 14, and 16 will be completed within 180 days after issuance of the license amendment, and that implementation items 2, 3, 4, 7, 9, 13, and 15 will be completed within 365 days after issuance of the license amendment. The licensee further stated that implementation items 11, 12, 17, and 18 have been completed. Implementation Item 19, associated with thermoplastic cable analysis will be completed by June 30, 2017, and implementation Item 20, associated with the pressure boundary breach analysis, will be completed by December 31, 2017.

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 item, would be tracked and resolved appropriately under the licensee's corrective action program and could be subject to appropriate NRC enforcement action as they would be required by the proposed license conditions.

2.7.3 Schedule

LAR Section 5.5, as supplemented, provides the overall schedule for completing the NFPA 805 transition at MNS. The licensee stated that it will complete the implementation of the new NFPA 805 FPP to include procedure changes, process updates, and training to affected plant personnel within 180 days or 365 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then, implementation will occur within 60 days after startup from that scheduled refueling outage. Specifically, the licensee stated that implementation items 1, 5, 6, 8, 10, 14, and 16 will be completed within 180 days after issuance of the license amendment, and that implementation items 2, 3, 4, 7, 9, 13, and 15 will be

completed within 365 days after issuance of the license amendment. The licensee further stated that Implementation Item 19, associated with thermoplastic cable analysis will be completed by June 30, 2017, and that implementation Item 20 associated with the pressure boundary breach analysis will be completed by December 31, 2017.

In its letter dated November 21, 2016 (Reference 23), the licensee provided its justification for requesting 365 days to complete implementation items 2, 3, 4, 7, 9, 13, and 15. The licensee stated that completion of these particular implementation items requires the final SE from the NRC and that the resources necessary to complete these items are also required for a number of other activities scheduled for 2017 and that vendor or augmented staff resources are not viable options. Based on the information provided by the licensee, the NRC staff concludes that the completion schedules proposed by the licensee for the implementation items are acceptable.

3.0 TECHNICAL EVALUATION

The following sections evaluate the technical aspects of the LAR to transition the FPP at MNS 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, Standard Review Plan, Section 9.5.1.2, "Risk-Informed, Performance-Based Fire Protection" (Reference 41), 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 an RI/PB FPP based on NFPA 805.

- Section 3.8 provides the results of the NRC staff review of the licensee's program documentation, configuration control and quality assurance.

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

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

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

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

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

- 10 CFR 50.48(c)(2)(vii) – *Performance-based methods.* While Section 3.1 of NFPA 805 prohibits the use of PB methods to demonstrate compliance with the NFPA 805, Chapter 3 requirements, 10 CFR 50.48(c)(2)(vii) specifically permits that the FPP elements and minimum design requirements of NFPA 805, Chapter 3 may be subject to the PB methods permitted elsewhere in the standard, provided a license amendment is granted and the approach satisfies the performance goals, performance objectives, and performance criteria specified in NFPA 805 related to nuclear safety and radiological release, maintains safety margins, and maintains fire protection DID.

Furthermore, Section 3.1 of NFPA 805 specifically allows the use of alternatives to the NFPA 805, Chapter 3 fundamental FPP requirements that have been previously approved by

the NRC (which is the AHJ, as denoted in NFPA 805 and RG 1.205), and are contained in the currently approved FPP for the facility.

3.1.1 Compliance with NFPA 805, Chapter 3 Requirements

The licensee used the systematic approach described in NEI 04-02, Revision 2 (Reference 7), as endorsed by the NRC in RG 1.205, Revision 1 (Reference 4), to assess the proposed MNS 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 MNS 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, and others are provided with multiple compliance statements to fully document compliance with the element.

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

1. The existing FPP element complies directly with the requirement: noted in LAR Attachment A, "NEI 04-02 Table B-1, Transition of Fundamental Fire Protection Program and Design Elements," (Reference 19), as "Comply." (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 existing engineering equivalency evaluation (EEEEs) whose bases remain valid and are of sufficient quality: noted in LAR Attachment A as "Complies via Use of EEEE." (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 with 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.)

The NRC staff has determined that, taken together, these methods compose an acceptable approach for documenting compliance with the NFPA 805, Chapter 3 requirements, because the licensee followed the compliance strategies identified in the endorsed NEI 04-02 guidance document. The process defined in the endorsed guidance provides an organized structure to document each attribute in NFPA 805, Chapter 3, allowing the licensee to provide significant

detail in how the program meets the requirements. In addition to the basic strategy of "Comply," which itself makes the attribute both auditable and inspectable, additional strategies have been provided allowing for amplification of information, when necessary, regarding how or why the attribute is acceptable.

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

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

In LAR Section 4.2.3, "Licensing Action Transition," the licensee stated that the existing licensing actions used to demonstrate compliance have been evaluated to ensure that their bases remain valid. The results of these licensing action evaluations are provided in LAR Attachment K (Reference 19).

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

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

- 3.4.1(c)
- 3.3.5.3

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. In Fire Protection Engineering (FPE) RAI 01 (Reference 24), the NRC staff requested that the licensee provide a description of how the requirements of this section of NFPA 805, specifically regarding sufficient training and knowledge of nuclear safety systems for the brigade leader and at least two brigade members, would be met. In its response to FPE RAI 01 (Reference 12), the licensee stated that, as described in fleet

procedures, the brigade leader and at least two brigade members of the on-shift fire brigade shall have sufficient training and knowledge of nuclear safety systems to understand the effects of fire and fire suppressants on nuclear safety performance, which is consistent with NFPA 805, Chapter 3, Section 3.4.1(c). The licensee stated the procedures provide an equivalent knowledge of the plant systems for a pressurized water reactor that represent the minimum plant knowledge for a non-licensed operator fire brigade member or leader to understand the effects of fire and fire suppressants on the NSPC. The licensee stated that these systems include:

- Reactor Coolant System;
- Steam Generator System;
- Auxiliary Feed System;
- Charging and Volume Control System;
- Residual Heat Removal System;
- Safety Injection System;
- Containment Spray System;
- Component Cooling Water System;
- Emergency Service Water System;
- Electrical System Overview - AC & DC; and
- Emergency Core Cooling Systems.

The NRC staff concludes that the licensee's response to FPE RAI 01 and the statement of compliance regarding this element are acceptable, because the licensee demonstrated that its procedures require that the fire brigade leader and at least two fire brigade members have the minimum plant knowledge for a non-licensed operator, which includes knowledge of the plant systems identified above, and are trained to understand the effects of fire and fire suppressants on the NSPC; and because the licensee demonstrated that it meets the requirement of NFPA 805, Section 3.4.1(c).

NFPA 805, Section 3.3.5.3, requires that electric cable construction comply with a flame propagation test acceptable to the AHJ. The licensee stated that electrical cable complies with Institute of Electrical and Electronics Engineers (IEEE) Standard 383, "Qualifying Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations" (Reference 74), which is identified as acceptable by the NRC staff in FAQ 06-0022 (Reference 57). In FPE RAI 09 (Reference 24), the NRC staff identified that the LAR only described armored cables in conjunction with a discussion of an outer jacket, but the licensee's analysis includes unjacketed armored cables, which are associated with rapid and significant flame spread. The NRC staff requested that the licensee provide more information regarding the extent of use and location of unjacketed armored cables, the qualification of unjacketed armored cables, and if unqualified, the impact on the FPRA. In its response to FPE RAI 09 (Reference 11), the licensee stated that:

- Approximately 90% of the unjacketed armored cable is installed in the Unit 1 and Unit 2 reactor buildings (i.e., containment). The remainder is distributed throughout MNS in the auxiliary building (cable rooms, battery room, ETA and ETB switchgear and penetration rooms, etc.), Unit 1 and 2 turbine buildings, and service building.

- The term "qualified" is interpreted to mean "cable that meets or exceeds the performance requirements specified in IEEE 383-1974." Because a portion of the cables installed at MNS pre-date IEEE 383, not all cable was procured to this standard. Power, control, and instrumentation cables procured since 1981 are required to meet IEEE 383.
- Jacketed and unjacketed armored cables were tested for flame propagation in 2007 in accordance with IEEE 1202 (Reference 75), and test results indicated that there is essentially no difference in flame propagation between jacketed and unjacketed armored cable. Many armored cable types used at the licensee's nuclear stations have undergone standardized testing to determine the flame spread characteristics and these tests were performed in accordance with IEEE 383 and IEEE 1202 test standards, and the results confirmed that the armored cable types are IEEE 383 or IEEE 1202 qualified.
- The unjacketed armored cables used at MNS have either been purchased to meet the IEEE standards, have been shown to meet the requirements of IEEE 383 or IEEE 1202 through testing, or are considered equivalent to IEEE 383 or IEEE 1202 qualified cables by comparison.

On the basis of the information provided above, the licensee stated that there is no impact on the FPRA analysis. The licensee revised LAR Attachment A, Section 3.3.5.3, to indicate that electrical cable complies with IEEE 383 or equivalent flame propagation testing as outlined in FAQ 06-0022. The NRC staff concludes that the licensee's response to FPE RAI 09 and the statement of compliance are acceptable because the licensee demonstrated that electrical cable installed at MNS complies with IEEE 383 or equivalent flame propagation testing that is acceptable to the NRC staff as described in FAQ 06-0022.

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

- 3.2.2.4
- 3.2.3 (1)
- 3.2.3 (3)
- 3.3.1.2 (1)
- 3.3.3
- 3.3.5.1
- 3.4.2.1

NFPA 805, Section 3.2.2.4, requires that the policy document identify the appropriate AHJ. The compliance basis in LAR Attachment A, Section 3.2.2.4, identifies the NRC as the AHJ however, the licensee's primary FPP policy document needs to be updated to include the statement that the NRC is the AHJ for fire protection changes requiring approval. This action is included in LAR Attachment S, Table S-3, Implementation Item 3. The NRC staff concludes that the action is acceptable because it will incorporate the provisions of NFPA 805, Chapter 3 in the FPP, and would be required by the proposed license condition.

NFPA 805, Section 3.2.3(1), requires that procedures be established for the inspection, testing, and maintenance of fire protection systems and features credited by the FPP. The licensee stated it complies with this requirement, but requested NRC approval to use the methodology of EPRI Report TR1006756, "Fire Protection Equipment Surveillance Optimization, and Maintenance Guide" (Reference 76). The licensee identified an action to update appropriate FPP document(s) regarding implementation of the EPRI methods, and included the action in

LAR Attachment S, Table S-3, Implementation Item 4. The NRC staff concludes that the action is acceptable because it will incorporate the provisions of NFPA 805, Chapter 3 in the FPP, and would be required by the proposed license condition. See SE Section 3.1.1.5.

NFPA 805, Section 3.2.3(3), requires procedures be established for the review of the FPP for related performance and trends. LAR Attachment A, Section 3.2.3(3) indicates that the monitoring program required by NFPA 805 will include a process that monitors and trends the fire protection systems and features based on specific goals established to measure availability and reliability. The licensee stated that the monitoring program required by NFPA 805, Section 2.6, will be implemented as part of the FPP transition to NFPA 805, in accordance with FAQ 10-0059, "Monitoring Program," (Reference 66), and will include a process that reviews the FPP performance and trends in performance. This action is included in LAR Attachment S, Table S-3, Implementation Item 5. The NRC staff concludes that the action is acceptable because it will incorporate the provisions of NFPA 805, Chapter 3 in the FPP, and would be required by the proposed license condition.

NFPA 805, Section 3.3.1.2(1), requires that wood used within the power block be listed pressure-impregnated or coated with a listed fire-retardant application. LAR Attachment A, Section 3.3.1.2(1), identified an action to revise station procedures/directives to comply with NFPA 805, Section 3.3.1.2(1). This action is included in LAR Attachment S, Table S-3, Implementation Item 6. The NRC staff concludes that the action is acceptable because it will incorporate the provisions of NFPA 805, Chapter 3, in the FPP, and would be required by the proposed license condition.

NFPA 805, Section 3.3.3, requires that interior wall or ceiling finish classification be in accordance with NFPA 101, "Life Safety Code" (Reference 54), requirements for Class A materials, and interior floor finishes shall be in accordance with NFPA 101 requirements for Class I interior floor finishes. The licensee stated that interior wall and structural components, thermal insulation materials, radiation shielding materials, and sound proofing materials are non-combustible. The licensee further stated that interior finishes have a flame spread rating of 25 or less and a smoke and fuel contribution of 50 or less in its use configuration. The licensee further stated that coatings used on interior floors, walls, and ceilings in "power block" buildings are required to meet NFPA 805, Section 3.3.3. LAR Attachment A, Section 3.3.3, identified an action to update station documentation to indicate the requirements for interior floor finishes. This action is included in LAR Attachment S, Table S-3, Implementation Item 18. The NRC staff concludes that the action is acceptable because it will incorporate the provisions of NFPA 805, Chapter 3, in the FPP, and would be required by the proposed license condition. In its letter dated November 21, 2016 (Reference 23), the licensee submitted a revised LAR Attachment S that indicated implementation item 18 has been completed.

NFPA 805, Section 3.3.5.1, requires that wiring above suspended ceiling be kept to a minimum, and that where installed, electrical wiring be listed for plenum use, routed in armored cable, routed in metallic conduit, or routed in cable trays with solid metal top and bottom covers. LAR Attachment A, Section 3.3.5.1, identified an action to update appropriate station documentation to include the requirements for installation of cable above suspended ceilings. This action is included in LAR Attachment S, Table S-3, Implementation Item 7. The NRC staff concludes that the action is acceptable because it will incorporate the provisions of NFPA 805, Chapter 3 in the FPP, and would be required by the proposed license condition.

NFPA 805, Section 3.4.2.1, requires that pre-fire plans detail the fire area configuration and fire hazards to be encountered in the fire area, along with any nuclear safety components and fire protection systems and features that are present. LAR Attachment A, identified an action to review and update the fire strategies to include any changes to equipment important to nuclear safety and other updates pertinent to the NFPA 805 Transition. This action is included in LAR Attachment S, Table S-3, Implementation Item 8. The NRC staff concludes that the action is acceptable because it will incorporate the provisions of NFPA 805, Chapter 3 in the FPP, and would be required by the proposed license condition.

Based on the licensee's statement of compliance and the associated implementation items as described in LAR Attachments A and S for the individual attributes described above, as well as the statements that these items will be completed prior to implementation, the NRC staff concludes that the licensee's statements of compliance are acceptable subject to completion of the implementation items.

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.

3.1.1.3 Compliance Strategy -- Complies with Use of EEEEs

For several NFPA 805, Chapter 3 requirements, the licensee demonstrated compliance with the fundamental FPP element through the use of EEEEs. The NRC staff reviewed the licensee's statement of continued validity for the EEEEs, 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.

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

- 3.3.7.2

NFPA 805, Section 3.3.7.2, requires that outdoor high-pressure flammable gas storage containers be located so that the long axis is not pointed at buildings. In FPE RAI 10 (Reference 24), the NRC staff identified that the EEEE referenced for this element contained no conclusion regarding the acceptability of the container configuration. In its response to FPE RAI 10 (Reference 12), the licensee stated that the referenced calculation and the compliance basis statement were incorrect, and revised LAR Attachment A to indicate that the bulk hydrogen storage cylinders are orientated with the long axis perpendicular to the plant, and that its evaluation found this configuration to be acceptable. Based on the statements of compliance and summary of the evaluation conclusions provided by the licensee, the NRC staff concludes

the licensee's statements of compliance are acceptable because the performance of an EEEE to evaluate acceptability brings this configuration into compliance with NFPA 805.

3.1.1.4 Compliance Strategy -- Complies With 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) Supplements 2 and 6 dated March 1979 and April 1981 (Reference 32) and (Reference 33), to the original SER;

(2) SE dated May 15, 1989 (Reference 35);

(3) NRC memorandum dated January 8, 1981 (Reference 77); and

(4) NRC letter dated January 13, 2003 (Reference 78).

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

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

- 3.11.5

NFPA 805, Section 3.11.5, requires that electrical raceway fire barrier systems (ERFBS) required by NFPA 805, Chapter 4, be capable of resisting the fire effects of the hazards in the area and shall be tested in accordance with and shall meet the acceptance criteria of GL 86-10, Supplement 1, "Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used to Separate Safe Shutdown Trains Within the Same Fire Area" (Reference 79). For NFPA 805, Section 3.11.5, the licensee stated that it does not use any ERFBS, such as Thermo-Lag, 3M Interam, Hemyc, MT, or Darmatt systems for NFPA 805, Chapter 4, compliance. However, in LAR Attachment C, Table B-3, Hemyc is cited by engineering evaluations as adequate for the hazard in fire areas 2A (Unit 1 turbine driven CA pump room), and 3A (Unit 2 turbine driven CA pump room) and is cited in variances from deterministic requirements (VFDRs) for these fire areas. In FPE RAI 02 (Reference 24), the NRC staff requested that the licensee provide clarification on the use of Hemyc. In its response to FPE RAI 02 (Reference 10), the licensee stated that Hemyc is not required as part of the NFPA 805 analysis and that the associated VFDRs and engineering evaluations are specifically analyzed without any credit for Hemyc. As stated in the resolution to the VFDRs, risk, DID, and safety margin are satisfied without further action. The licensee stated that no modifications are proposed for any of the Hemyc installations. The licensee further stated that the inclusion of the engineering evaluation crediting Hemyc was an oversight and that the Hemyc engineering

evaluation should not have been identified in LAR Attachment C, Table C-1 and identified as required for transition. The licensee revised LAR Attachment C, Table C-1 (Reference 12), and the reference to the engineering evaluation crediting Hemyc in LAR Attachment C, Table C-1, Fire Areas 2A and 3A was deleted. The NRC staff concludes that the licensee's response to FPE RAI 02 is acceptable because the licensee does not credit Hemyc in its evaluations. See SE Section 3.1.3.1 for additional information.

3.1.1.5 Compliance Strategy -- Submit for NRC Approval

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

- 3.2.3(1), which concerns establishing procedures for PB inspection, testing, and maintenance for fire protection systems and features credited by the FPP. The licensee requested NRC staff approval to use PB methods to establish inspection, testing, and maintenance frequencies for fire protection systems and features required by NFPA 805. See SE Section 3.1.4.1 for the NRC staff's evaluation of this request.

- 3.3.5.1, which concerns the requirement that electrical wiring above suspended ceilings be listed for plenum use, routed in armored cable, routed in metallic conduit or routed in cable trays with solid metal top and bottom covers. The licensee requested NRC staff approval to use a PB method to demonstrate an equivalent level of fire protection for the existence of wiring above suspended ceilings, thereby meeting the requirements of NFPA 805. See SE Section 3.1.4.2 for the NRC staff's evaluation of this request.

- 3.3.5.2, which concerns the use of metal tray and metal conduits used for electrical raceways. The licensee requested NRC staff approval to use a PB method to justify its use of PVC conduit, thereby meeting the requirements of NFPA 805. See SE Section 3.1.4.3 for the NRC staff's evaluation of this request.

- 3.3.12(1), which concerns the reactor coolant pump oil collection system requirements from pressurized and non-pressurized leakage sites. The licensee requested NRC staff approval to use a PB method to justify an equivalent level of fire protection for the inability to collect and contain oil misting from normal motor operation, thereby meeting the requirements of NFPA 805. See SE Section 3.1.4.4 for the NRC staff's evaluation of this request.

- 3.5.3, which concerns the fire pumps required to be designed and installed in accordance with NFPA 20, "Standard for the Installation of Stationary Pumps for Fire Protection," (Reference 55). The licensee requested NRC staff approval to use a PB method to justify the use of its fire pump controllers, thereby meeting

the requirements of NFPA 805. See SE Section 3.1.4.5 for the NRC staff's evaluation of this request.

- 3.5.16, which concerns the dedication of fire protection water supply for fire protection use only. The licensee requested NRC staff approval for the use of a PB method to justify its use of fire protection system water for plant evolutions other than fire protection, thereby meeting the requirements of NFPA 805. See SE Section 3.1.4.6 for the NRC staff's evaluation of this request.

- 3.3.4, which concerns the use of insulation materials that meet the flame spread rating criteria but do not meet the NFPA 805, Section 3.3.4 definition of noncombustible or limited combustible regarding heat value content. The licensee requested NRC staff approval for the use of a PB method to justify its use of certain types of insulation materials, thereby meeting the requirements of NFPA 805. See SE Section 3.1.4.7 for the NRC staff's evaluation 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 -- 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, the combination of compliance strategies is acceptable, and holistic compliance with the fundamental FPP element is assured because the licensee demonstrated that the compliance strategy meets the requirements of NFPA 805.

3.1.1.7 Chapter 3 Sections Not Reviewed

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

- Sections that do not contain any technical requirements (e.g., NFPA 805, Sections 3.4.5 and 3.11).

- Sections that are not applicable to MNS because of the following:

  — The licensee stated that MNS does not have systems of this type installed (e.g., Section 3.9.1(4) - NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray 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 fire brigade

standards used since they depend on the type of brigade specified in the FPP at the site).

3.1.1.8 Compliance with Chapter 3 Requirements Conclusion

As discussed above, the NRC staff evaluated the results of the licensee's assessment of the proposed MNS 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 MNS'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 MNS 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 MNS 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 could affect plant operation for power generation; equipment important to safety; and equipment that could affect the ability to maintain the NSCA in the event of a fire. In FPE RAI 03 (Reference 24), the NRC staff requested the licensee provide the basis for not including radioactive waste structures in Table I-1 "Power Block Definition." In its response to

FPE RAI 03 (Reference 11), the licensee provided the definition of power block, which was consistent with FAQ 06-0019 (Reference 56) demonstrating that the power block was limited to those areas required to meet the NSPC. The licensee determined that the radioactive waste structures were not required to meet the NSPC, and therefore, were not considered as part of the power block. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee appropriately evaluated the structures and equipment at MNS, and adequately documented a list of those structures that fall under the definition of "power block" in NFPA 805.

3.1.3 Plant Specific Treatments or Technologies

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

GL 2006-03 requested that licensees evaluate their facilities to confirm compliance with existing applicable regulatory requirements in light of the results of NRC testing that determined that both Hemyc™ and MT™ fire barriers failed to provide the protective function intended for compliance with existing regulations, for the configurations tested using the NRC's thermal acceptance criteria. In a letter dated June 7, 2006 (Reference 80), the licensee stated that Hemyc fire barrier material was used as a 1-hour rated ERFBS and was credited for separation of safe shutdown cables in a single fire area, but that MT fire barrier material was not used. In LAR Attachment A, Table B-1, Section 3.11.5, the licensee indicated that it does not utilize any ERFBSs such as Thermo-Lag, 3M Interam, Hemyc™, MT™, or Darmatt for Chapter 4 compliance. In its response to FPE RAI 02 (Reference 10), the licensee stated that Hemyc™ is not required as part of the NFPA 805 analysis and that the associated VFDRs and engineering evaluations are specifically analyzed without any credit for Hemyc (see SE Section 3.1.1.4). The NRC staff considers the generic issue (GL 2006-03 – (Reference 53)) related to the use of these ERFBS at MNS closed because the licensee does not credit Hemyc in its evaluations and indicated that risk, DID, and safety margin are satisfied for the associated VFDRs without further action.

3.1.3.2 Fire Resistive Cables – Meggitt Cable

In LAR Attachment A, Element 3.11.5, and LAR Attachment K, Licensing Action 01, the licensee described a fire resistive silicon dioxide insulated cable manufactured by Meggitt Safety Systems credited with providing cable separation for redundant trains of systems necessary to achieve and maintain hot shutdown conditions, in lieu of installing a 3-hour fire barrier to protect a SSD function. The installation of the Meggitt Cable was previously approved by the NRC and the evaluation of the licensing action is included in SE Section 3.5.1.3.

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 the use of PB methods permitted elsewhere in the standard as a means of demonstrating compliance with the prescriptive NFPA 805, Chapter 3, fundamental FPP elements and minimum design requirements. Paragraph 50.48(c)(2)(vii) of 10 CFR requires that an acceptable PB approach accomplish the following:

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

(B) Maintains safety margins; and

(C) Maintains fire protection DID (fire prevention, fire detection, fire suppression, mitigation, and post-fire 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 [boiling-water reactor] such that fuel clad damage as a result of a fire is prevented.
>
> (c) *Decay Heat Removal.* Decay heat removal shall be capable of removing sufficient heat from the reactor core or spent fuel such that fuel is maintained in a safe and stable condition.
>
> (d) *Vital Auxiliaries.* Vital auxiliaries shall be capable of providing the necessary auxiliary support equipment and systems to assure that the systems required under (a), (b), (c), and (e) are capable of performing their required nuclear safety function.
>
> (e) *Process Monitoring.* Process monitoring shall be capable of providing the necessary indication to assure the criteria addressed in (a) through (d) have been achieved and are being maintained.

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

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

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

3.1.4.1 NFPA 805, Section 3.2.3(1) – Inspection, Testing, and Maintenance 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 inspection, testing and maintenance for fire protection

systems and features credited in the FPP. The licensee requested approval to use PB methods to establish inspection, testing, and maintenance frequencies for fire protection systems and features required by NFPA 805, in accordance with EPRI Technical Report TR-1006756, "Fire Protection Surveillance Optimization, and Maintenance Guide for Fire Protection Systems and Features." EPRI TR-1006756 provides guidance for licensees to follow in order to optimize their fire protection surveillance and testing practices and frequencies for fire protection SSCs based upon performance.

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

- NFPA 805, Section 2.6, "Monitoring Program," requires that a monitoring program be established to ensure availability and reliability of the fire protection systems and features credited by the FPP. Performance monitoring will be conducted in conjunction with the monitoring program required by NFPA 805, Section 2.6, and it will ensure site-specific operating experience is considered in the monitoring process.

- This scope and frequency of the inspection, testing, and maintenance activities for fire protection systems and features required in the FPP have been established based on the previously approved TSs or licensee controlled documents, and appropriate NFPA codes and standards. This request does not involve the use of EPRI TR-1006756 to establish the scope of those activities, as that is determined by the required system review identified in LAR Attachment C, Table C-2, "NFPA 805 Required Fire Protection Systems and Features."

- Reliability and frequency goals will be established to ensure the assumptions in the NFPA 805 engineering analysis remain valid. The failure criterion will be established based on the required fire protection systems and features credited functions and will ensure those functions are maintained. Data collection and analysis will follow the EPRI Technical Report TR-1006756 document guidance. 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 stated that use of PB test frequencies established in accordance with the methods in EPRI TR-1006756, combined with the NFPA 805, Section 2.6, will ensure that the availability and reliability of the fire protection systems and features are maintained to the levels assumed in the NFPA 805 engineering analysis. The licensee stated 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 and that fire protection systems and features may be credited as part of that evaluation. The licensee further stated that use of PB test frequencies established per the EPRI Technical Report TR-1006756 methods combined with NFPA 805, Section 2.6, will ensure that the availability and reliability of the fire protection systems and features are maintained to the levels assumed in the NFPA 805 engineering analysis, which includes those assumptions credited to meet the radioactive release performance criteria. The licensee concluded therefore, there is no adverse impact to radioactive release performance criteria.

The licensee stated that the use of PB test frequencies established per EPRI TR-1006756 methods combined with NFPA 805, Section 2.6, Monitoring Program, will ensure that the availability and reliability of the fire protection systems and features are maintained to the levels assumed in the NFPA 805 engineering analysis, which includes those assumptions credited in the FRE 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 and standards 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 the EPRI Technical Report TR-1006756 methods. The licensee stated the use of PB test frequencies established per EPRI Technical Report TR-1006756 methods combined with the monitoring program required by NFPA 805, Section 2.6, 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 on echelons 2 and 3 for 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 safe shutdown capability).

3.1.4.2 NFPA 805, Section 3.3.5.1 – Electrical Wiring above Suspended Ceiling

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 3.3.5.1 requirement for wiring above suspended ceilings. Specifically, the licensee requested approval of a PB method to justify the use of limited quantities of wiring/cabling above suspended ceilings. The licensee stated that the cables in question are video/communication/data cables, which have been field routed above suspended ceilings and these cables may not be plenum rated.

The licensee stated that the areas at MNS that have suspended ceilings installed inside the NFPA 805 defined power block are the:

- Control Room and Work Control Center (WCC);
- Technical Support Center (TSC); and
- Service Building offices and corridors.

The licensee stated that these areas are not risk significant with the exception of the Control Room. The licensee stated that the MNS cable construction standard for power, control, and

instrumentation cables is IEEE 383 (or equivalent) in steel jackets (armored) and, therefore, power, control, and instrumentation cables meet the requirements of this section. The licensee stated that the cables in question are video/communication/data cables, which have been field routed above suspended ceilings and that these cables may not be plenum rated. The licensee further stated that video/communication/data cables are low voltage and these low voltage cables are not generally susceptible to shorts, which would result in a fire.

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

- Low voltage is not susceptible to shorts causing a fire;
- Power, control, and instrumentation cables used for plant operation are protected (armored) per this code section;
- Eliminating cables with the potential shorts eliminates ignition sources and, therefore, the jacketing of cable is not relevant;
- There is no equipment important to nuclear safety in the vicinity of these cables; and
- There are limited or no ignition sources above these ceilings and the lack of continuity of combustibles make it unlikely a significant fire could develop.

The licensee stated that the location of wiring above suspended ceilings does not affect nuclear safety. The licensee also stated that other wiring, while it may not be in armored cable, in metallic conduit, or plenum rated, is low voltage cable and not susceptible to shorts that would result in a fire and, therefore, there is no impact on the NSPC.

In FPE RAI 04 (Reference 24), the NRC staff requested that the license describe the proximity of these unqualified cables to nuclear safety capability components or cabling and address the likelihood and significance of adjacent fires. The NRC staff also requested that the licensee describe what mechanisms are in place to prevent this from happening in future installations. In its response to FPE RAI 04 (Reference 10), the licensee stated that the Control Room is the only location in the power block that has cables above suspended ceilings that are located near nuclear safety capability equipment (components or cables) and that a minimum amount of cables exist above the Control Room ceiling. The licensee also stated that all electrical cables used for power, control, and instrumentation is armored cable or routed in metallic conduit. The licensee further stated that cables used for power, control, and instrumentation meet the requirements of NFPA 805, Section 3.3.5.1 and the use of low voltage communication, video, and data cables is minimized. The licensee stated the closest point these unqualified cables are to any nuclear safety capability equipment is approximately 2 feet, but the majority of the cabling is located more than 7 feet from any nuclear safety capability equipment. The licensee further stated that the impact of a fire involving these small cables on a target 2 feet away is highly unlikely and that in the unlikely event a fire were to occur, the Control Room is continuously occupied and provided with a smoke detection system compliant with NFPA 72, and a fire would be detected and extinguished in the incipient stages before a significant fire could develop. The licensee stated that LAR Attachment S, Table S-3, Implementation Item 7

addresses controls to prevent future non-compliance. The NRC staff concludes that the licensee's response to FPE RAI 04 is acceptable because of the proximity of the data cables to nuclear safety capability components, the licensee's qualitative assessment of the low risk of fire occurring in this area, and the inclusion of future controls to prevent reoccurrence in LAR Attachment S, Table S-3, Implementation Item 7, which will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

The licensee stated that the location of cables above suspended ceilings has no impact on the radiological release performance criteria. The licensee also stated that the radiological release 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 and, therefore, the cables do not change the results of the radiological release evaluation performed that concluded that potentially contaminated water is contained and smoke is monitored. The licensee also stated that the cables do not add additional radiological materials to the areas or challenge systems boundaries.

The licensee stated that power, control, and instrumentation cables meet the requirements of this section of NFPA 805, and that other wiring, while it may not be in armored cable, in metallic conduit, or plenum rated, is low voltage cable not susceptible to shorts that would result in a fire. The licensee also stated that these areas with video/communication/data cables have been analyzed in their current configuration and that the amount of non-rated and non-enclosed wiring above the ceilings in the power block is minor and does not present a significant fire hazard, and therefore, the safety margin inherent in the analysis for the fire event has been preserved.

The licensee stated that the three echelons of DID are 1) to prevent fires from occurring; 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 prior introduction of non-listed video/communications/data cables routed above suspended ceilings does not impact fire protection DID and that echelon 1 is maintained by the cable installation procedures documenting the requirements of NFPA 805, Section 3.3.5.1. The licensee also stated that the introduction of cables above suspended ceilings does not affect echelons 2 or 3 and that the video/communications/data cables routed above suspended ceilings does not directly result in compromising automatic fire suppression systems, manual fire suppression functions, or post-fire safe shutdown capability.

Based on its review of the LAR, as supplemented, and subject to completion of Implementation Item 7 in LAR Attachment S, Table S-3, 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 safe shutdown capability).

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

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 3.3.5.2 requirement for use of metal trays or conduits for electrical raceways. Specifically, the licensee requested approval of a PB method to justify the use of Polyvinyl Chloride (PVC) conduit embedded in building walls, floors, or foundations and in outdoor buried locations with or without concrete encasement.

The licensee stated that the use of PVC conduit is permitted by MNS when embedded in building walls, floors or foundations and in outdoor buried locations with or without concrete encasement. The licensee also stated that where embedded, buried, or encased, the PVC conduit is within a non-combustible enclosure, which provides protection from mechanical damage and from damage resulting from either an exposure fire or from a fire within the conduit impacting other targets.

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

- The PVC conduit, while a combustible material, is not subject to flame/heat impingement from an external source, which would result in structural failure, contribution to fire load, and damage to the circuits contained within where the conduit is embedded in concrete or compacted sand/soil; and

- Failure of circuits within the conduit resulting in a fire would not result in damage to external targets.

The licensee stated that the use of PVC conduit in embedded, buried, or encased locations does not affect nuclear safety as the material in which conduits are run within an embedded location is not subject to the failure mechanisms potentially resultant in circuit damage or resultant damage to external targets and, therefore, there is no impact on the NSPC.

The licensee stated that the use of PVC conduits in embedded, buried, or encased, installations has no impact on the radiological release performance criteria. The licensee also stated that the radiological release review was performed based on the potential location of radiological concerns and is not dependent on the type or location of conduit. The licensee further stated that PVC conduits do not change the results of the radiological release evaluation that concluded that potentially contaminated water is contained and smoke is monitored, and therefore, the PVC conduits do not add additional radiological materials to the area or challenge system boundaries.

The licensee stated that PVC conduit material is embedded/buried/encased in a non-combustible configuration, and, therefore, 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 use of PVC conduits in embedded/buried/encased, does not impact fire protection DID and that the PVC conduits do not directly result in compromising automatic or manual fire suppression functions. The NRC staff concludes that DID is maintained because the use of PVC conduit that is embedded/buried/encased does not contribute to combustible loading or the severity of fire, does not impact automatic or manual fire suppression capabilities, does not contribute to potential fire damage to the circuits contained within or present an exposure hazard to other external circuits, and does 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), 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 safe shutdown capability).

3.1.4.4 NFPA 805, Section 3.3.12(1) – RCP Oil Collection System

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 3.3.12(1), requirement that the oil collection system for each reactor coolant pump (RCP) be capable of collecting lubricating oil from all potential pressurized and non-pressurized leakage sites in each RCP oil system. The licensee requested approval for the potential of oil misting from the RCPs due to normal motor oil consumption not captured by the oil collection system designed for pressurized and non-pressurized leakage and spillage.

The licensee stated that the MNS RCP oil collection system is designed and was reviewed in accordance with 10 CFR 50 Appendix R, Section III.O, to collect leakage from pressurized and non-pressurized leakage sites in the RCP oil system. The licensee stated this may not include collection of oil mist as result of pump/motor operation and oil misting is not leakage due to equipment failure, but an inherent occurrence in the operation of large rotating equipment as it is normal for large motors to lose some oil through seals and the oil to potentially become 'atomized' in the ventilation system. The licensee also stated that this atomized oil mist can then collect on surfaces in the vicinity of the RCP as the pump design is not completely sealed to permit airflow for cooling and that the oil mist resulting from normal operation will not adversely impact the ability of a plant to achieve and maintain safe shutdown even if ignition occurred.

The licensee stated that it does not have a history of significant oil loss from the RCPs as a result of oil misting or oil leakage that is not contained by the properly designed and installed oil leakage collection system.

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

- The oil collection system is designed to collect leakage from pressurized and non-pressurized leakage sites in the RCP oil system;

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

- Oil misted from normal operation does not significantly reduce the oil inventory. The oil historically released as misting does not account for an appreciable HRR or accumulation near potential ignition sources or non-insulated reactor coolant piping; and

- The RCPs use a synthetic oil of a high flash point over 400 degrees Fahrenheit (°F).

The licensee further stated that the RCPs are not required to achieve or maintain fire safe shutdown, and, therefore, there is no impact on the NSPC. The licensee also stated that the potential for oil mist from the RCPs has no impact on the radiological release performance criteria and that the radiological release review was performed based on the potential location of radiological concerns, which encompasses the reactor building in which the RCPs are located.

The licensee stated the oil mist resulting from normal operation will not adversely impact the ability of a plant to achieve and maintain fire safe shutdown even if ignition occurred, and, therefore, 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 oil historically released as misting does not account for an appreciable heat release rate or accumulation near potential ignition sources or non-insulated reactor coolant piping. The licensee stated that the potential for mist from the RCPs does not directly result in compromising automatic fire suppression functions, manual fire suppression functions, or post-fire safe shutdown capability. Based on the information provided by the licensee, the NRC staff concludes that DID is maintained because the oil released as misting does not result in compromising fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability.

Based on the above, 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 3.3.12(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 safe shutdown capability).

3.1.4.5 NFPA 805, Section 3.5.3 – Fire Pump Conformance to NFPA 20

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 3.5.3 requirement that fire pumps be designed and installed in accordance with NFPA 20 (Reference 55).

Specifically, the licensee requested approval because fire pumps A and B can be stopped from the control room.

The licensee stated it has three electric motor-driven fire pumps, that each pump is sized for 100 percent of the required fire water system demand, and that each pump is provided with independent power and control capability. The licensee also stated that it has procedural controls over manipulating switches, especially in the control room, and that switches may only be operated by well trained, knowledgeable operators. The licensee further stated that operators are trained and procedure driven to investigate all fire alarm or suppression system flow indications received in the control room and procedurally driven not to turn off any fire pump until indication has been investigated. The licensee further stated that alarms received in the control room have a corresponding procedure that dictates the operator's response that include precautions on fire pump operation.

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

- A redundant fire pump with 100 percent fire water supply capability.
- Strict procedural controls over control of the fire pump.
- Operation by trained personnel only.

The licensee stated that the ability to remotely stop the fire pump does not affect nuclear safety, as there are strict administrative controls placed over the control of the fire pump. The licensee stated that a deliberate operations decision would be required to remotely stop an operating fire pump, and that redundant fire pump C would automatically start in the event that fire pumps A and/or B were inadvertently stopped. The licensee also stated that these measures ensure that there is no impact on the ability of the fire water distribution system to perform its function, and, therefore, there is no impact on nuclear safety.

The licensee stated the ability to remotely stop fire pumps A and B has no impact on the radiological release performance criteria. The licensee stated that the radiological release review was performed based on the potential location of radiological concerns and is not dependent on the fire protection water system, and the radioactive release evaluation does not credit the fire water system. The licensee also stated that the operation of the fire protection water system does not change the results of the radiological release evaluation performed that concluded that potentially contaminated water is contained and smoke is monitored. The licensee further stated that the fire protection water system does not add additional radiological materials to the areas or challenge systems boundaries.

The licensee stated that the methods, input parameters, and acceptance criteria used in this analysis were reviewed against those used for NFPA 805, Chapter 3, acceptance, and that the methods, input parameters, and acceptance criteria used to determine the adequacy of the fire water system were not altered. The licensee also stated that the fire protection water system has redundant capability to supply the demands of the fire water system, and that the ability to remotely stop fire pumps A and/or B will not impact the ability of the fire protection water system to perform its design objectives, and therefore, the safety margin inherent in the analysis of the fire even has been preserved.

The licensee stated that the three echelons of DID are 1) to prevent fires from starting; 2) to rapidly detect, control, and extinguish fires that do occur thereby limiting damage; and 3) to provide 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 ability to remotely stop fire pumps A and B does not impact fire protection DID. The licensee stated that a redundant fire pump will start in the event that one is stopped and that each fire pump is sized for 100 percent capacity of the fire water demands. The licensee stated that this (the ability to remotely stop fire pumps A and B) does not result in compromising automatic fire suppression functions, manual fire suppression functions, or post-fire safe shutdown capability and that since both the automatic and manual fire suppression functions are maintained, DID is maintained. Based on the information provided by the licensee, the NRC staff concludes that DID is maintained because the ability to remotely stop fire pumps A and B does not result in compromising fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability.

Based on its review of the information submitted by the licensee, and in accordance with 10 CFR 50.48(c)(2)(vii), the NRC staff concludes that the proposed PB method is an acceptable alternative to the corresponding NFPA 805, Section 3.5.3 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 safe shutdown capability).

3.1.4.6 NFPA 805, Section 3.5.16 – Dedicated Fire Water Supply

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 3.5.16 requirement that the fire protection water supply system be dedicated for fire protection use only. The licensee stated that the three cases by design where fire protection system water is used for other than fire protection purposes are:

- Back-up to the condenser circulating water pump seal/bearings (total demand 200 gpm).
- Back-up to the low level intake (LLI) pump seal/bearings (total demand 30 gpm for all pumps).
- Intake screen backwash (RS) (demand 1,100 gpm).

The licensee stated that the use of the fire protection water for these non-fire protection system water demands would have no adverse impact on the ability of the fire protection system to provide the required flow and pressure.

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

- The back-up to the condenser circulating water pump seal/bearings demand is a total demand of 200 gpm for all condenser circulating water pumps. This is an

automatic alignment when both normal condenser circulating water bearing cooling pumps are lost. Normally there is one bearing cooling pump in service and one standby. There are three sequential 2,500 gpm at 145 psi fire pumps, which will provide the maximum single fire suppression water demand and an additional 500 gpm hose stream plus 200 gpm for back-up condenser circulating water pump demands.

- The back-up to the LLI pump seal/bearings demand is a total of 30 gpm for all three LLI pumps. This is manual alignment only by operations. This demand is within the available water supply per Exception No. 2 (of NFPA 805, Section 3.5.16). The largest suppression system demand is 1,900 gpm. The fire pumps are each rated for 2,500 gpm.

- The Intake RS demand is 1,100 gpm. This is manual alignment only by operations.

The licensee stated the use of fire protection water for non-fire protection plant uses is either within the capabilities of the existing fire water system or requires a deliberate operations decision to use the fire protection water system and these measures ensure that there is no impact on the ability of the automatic suppression systems to perform their functions. The licensee stated that the ability to isolate the non-fire protection flows ensures there is no impact on manual fire suppression efforts, and therefore, there is no impact on the NSPC.

In FPE RAI 05 (Reference 24), the NRC staff requested that the licensee describe the administrative controls in place for the evolutions that initiate and control non-dedicated fire water use and how these evolutions are approved, conducted, and controlled. In its response to FPE RAI 05 (Reference 10), the licensee stated that alignments occur as follows:

- Alignment to the condenser circulating water pump seal/bearings is performed automatically. Back-up to the condenser circulating water pump seal/bearings demand is approximately 200 gpm, which is well within the capacity of the largest suppression system and hose stream flowing.

- Alignment for back-up cooling to the LLI pump bearings and seal is performed by implementation of procedure and that explicit approval for the use of backup is not identified. In order for this alignment to occur, there must be a failure of other plant equipment and then implementation of a station procedure. The LLI pump seal/bearings demand is approximately 30 gpm, which is well within the fire protection system capacity of the largest suppression system and hose stream flowing.

- Alignment and approval for use of the RS is performed by implementation of a procedure. It is noted that using the fire protection system is a backup if the RS pump is not available. The procedure states that the main fire pump must not be in use as part of the procedure initial conditions. In addition, the fire pump in use for backwash is declared inoperable, thereby identifying to the control room fire pump/water system operation.

In its response to FPE RAI 05, the licensee also stated that the three fire pumps are each rated for 2,500 gpm at approximately 142 psi and each fire pump is required to provide 2,500 gpm at 125 psi based on testing every 18 months. The licensee also stated that the most demanding suppression system is 2,583 gpm at 72 psi (Unit 2 Turbine Building Mezzanine Area 2 (South)). The licensee further stated that the fire pump curves associated with the recent fire pump test demonstrate that approximately 4,500 gpm is available at a pressure of 72 psi.

In its response to FPE RAI 05, the licensee also stated that a revision to LAR Attachments A and L (Reference 12), identified that the largest suppression system demand is 2,583 gpm. The licensee further stated that simultaneous operation of the back-up to the condenser circulating water pump seal/bearings and the back-up to the LLI pump seal/bearings would not adversely affect the ability of the fire protection system to supply the largest suppression system demand and hose stream demands. The licensee further stated that if the intake screen backwash was being performed, then the backwash activity can be secured as needed to ensure proper fire protection water is available.

The NRC staff concludes that the licensee's response to FPE RAI 05 is acceptable because the licensee demonstrated that the capacity for each of these alternative uses are well within the fire protection system capacity, the intake screen backwash is monitored by the control room and can be discontinued in the event of a fire, and simultaneous operation is either within the system capability or controllable from the control room.

The licensee stated that use of fire protection water for non-fire protection plant uses is either within the capabilities of the existing fire water system or requires a deliberate operations decision to use the fire protection water system and these measures ensure that there is no impact on the ability of the automatic suppression systems to perform their functions. The licensee also stated that the ability to isolate the non-fire protection flows ensures there is no impact on manual fire suppression efforts, and therefore, there is no impact on the NSPC.

The licensee stated that the use of fire protection water for plant uses other than fire protection has no impact on the radiological release performance criteria. The licensee also stated that the radiological release review was performed based on the potential location of radiological concerns and is not dependent on the fire protection water system and the radioactive release evaluation does not credit the fire water system. The licensee further stated the use of fire protection water does not change the results of the radiological release evaluation performed that concluded that potentially contaminated water is contained and smoke is monitored and that the fire protection water system does not add additional radiological materials to the areas or challenge systems boundaries.

The licensee stated that the methods, input parameters, and acceptance criteria used in this analysis were reviewed against those used for NFPA 805, Chapter 3, acceptance and that the methods, input parameters, and acceptance criteria used to calculate flow requirements for the automatic and manual suppression systems were not altered, and therefore, the safety margin inherent in the analysis for the fire event has been preserved.

The licensee stated that the three echelons of DID are 1) to prevent fires from starting; 2) to rapidly detect, control, and extinguish fires that do occur thereby limiting damage; and 3) to provide 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 the fire water system for non-fire protection uses does not impact fire protection DID. The licensee also stated that the fire pumps have the excess capacity to supply the demands of the fire protection system in addition to the non-fire protection uses, or the demands are manually aligned by operations and can be secured if necessary in a fire event. The licensee stated that this (the use of the fire water system for non-fire protection uses) does not result in compromising automatic fire suppression functions, manual fire suppression functions, or post-fire safe shutdown capability and that since both the automatic and manual fire suppression functions are maintained, DID is maintained. Based on the information provided by the licensee, the NRC staff concludes that DID is maintained because the use of the fire water system for non-fire protection uses does not result in compromising fire prevention, fire detection, fire suppression, mitigation, and post-fire safe shutdown capability.

Based on the above, 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 safe shutdown capability).

3.1.4.7 NFPA 805, Section 3.3.4 – Insulation Materials

In a letter dated July 12, 2016 (Reference 29), the NRC staff requested that the licensee confirm whether certain insulation materials used at MNS meet the NFPA 805 code definition of limited combustible. In a letter dated September 29, 2016 (Reference 22), the licensee responded to the request and stated that insulation which does not meet the definition of noncombustible or limited combustible has been identified as being installed at MNS for industrial personnel safety and on various system piping to prevent sweating. The licensee further stated that the identified insulation is potentially an intervening combustible and that walkdowns have been performed to evaluate whether the identified insulation has the potential to become an intervening combustible for any fixed or transient ignition sources. The licensee further stated that for those locations where the insulation is determined to be an intervening combustible, a PRA risk evaluation has been performed to determine the potential impact on plant fire risk and that based on its evaluation of the locations throughout the plant that contain combustible insulation, several locations were identified where an additional transient scenario could be postulated that would have impacts that are not currently addressed in the FPRA. The licensee further stated that there are locations where additional impact from the combustible insulation could increase the fire risk impact from existing fixed ignition source scenarios and that these scenarios were analyzed for impact on CDF and in some of these locations the potential for an increase in CDF could not be shown to be negligible. The licensee stated that these locations are as follows:

Auxiliary Building Common area elevation 716', Column Line FF-55/EE-55
Auxiliary Building Common area elevation 716', Column Line FF-58/EE-58
Auxiliary Building Common area elevation 716', Column Line FF-56
Auxiliary Building Common area elevation 716', Column Line GG-57
Auxiliary Building Common area elevation 716', Column Line FF-55

The licensee stated that a work order has been completed to remove the combustible insulation for the specific locations and that the impact of the combustible insulation at all remaining locations has shown to be less than 1.0E-08/yr for CDF and less than 1.0E-09/yr for LERF, at each location.

In its letter dated September 29, 2016 (Reference 22), the licensee included a revised LAR Attachment A for NFPA 805, Section 3.3.4, "Insulation Materials," where it revised its compliance stated from Complies to "Submit for NRC Approval," and also included new LAR Attachment L, Approval Request 7. The NRC staff concludes that the licensee's response to the request is acceptable because the licensee identified insulation materials that require specific NRC staff approval in accordance with 10 CFR 50.48(c)(3)(vii), because the licensee completed a risk evaluation and removed insulation materials that do not meet the applicable risk guidelines, and because the licensee revised its LAR to request approval of the insulation materials. The NRC staff's review of the licensee's request is provided below.

In LAR Attachment L, Approval Request 7, the licensee requested approval of a PB method to use AP Armaflex and Trymer 2000 thermal insulation materials that meet the flame spread rating criteria but do not meet the NFPA 805, Section 3.3.4 definition of noncombustible or limited combustible regarding heat value content.

The licensee stated that NFPA 805 Section 1.6.36 has re-defined earlier definitions of noncombustible material to the now current definition of limited combustible material:

> Limited Combustible. Material that, in the form in which it is used, has a potential heat value not exceeding 3500 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 in several areas of the plant, exposed thermal insulation materials are installed for industrial personnel safety and on miscellaneous system piping to prevent sweating and that these materials met the Branch Technical Position (BTP) APCSB 9.5-1 (Reference 1), requirements for limited combustibles by complying with the flame spread rating of 25 or less as measured using the test method of American Society for Testing and Materials Standard E-84, "Standard Test Method for Surface Burning Characteristics of Building Materials" (ASTM E-84) (Reference 81), but do not meet the current heat value content requirement based on the definition of a limited combustible due to the heat value exceeding 3,500 Btu/lb. The licensee further stated that typical thermal insulation materials were noted as having heat contribution values of approximately 9,000 to 11,000 Btu/lb, which, while higher than the definition, is not considered to contribute appreciably to the spread of fire, nor represent a secondary combustible beyond those currently analyzed in the FPRA.

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

> The forms in which the thermal insulation are installed and the conditions anticipated meet the intent of the revised limited combustible material definition

because the materials have a flame spread rating of 25 or less and will not support continued progressive combustion. Specifically, the thermal insulation materials have flame spread ratings of 25 per ASTM E-84. Although the thermal insulation materials exceed the NFPA 805 heat value of 3,500 Btu/lb, AP Armaflex and Trymer 2000 will not contribute significantly to fire due to flame spread ratings per ASTM E-84.

The forms in which the thermal insulation materials are installed and the conditions anticipated do not impact nuclear safety. The applications of exposed thermal insulation materials do not compromise post-fire safe shutdown capability as previously designed, reviewed and considered. Adequate defense-in-depth measures are in place as described above to ensure that essential safety functions are maintained and capable of being performed.

The identified insulation installations were evaluated against the fire scenarios supporting the Fire PRA. As a result of this evaluation, instances were identified where an additional transient scenario could be postulated that would have impacts, including the combustible insulation, that are not currently addressed in the FPRA. Additionally, instances were identified where additional impact from the combustible insulation could increase the fire risk impact from existing fixed ignition source scenarios. For these locations, either the combustible insulation was removed, or the scenarios were analyzed for the impact of the combustible insulation on both CDF and LERF. In all locations where the insulation has not been removed, the impact on CDF was shown to be less than 1.0E-08/yr and the impact on LERF was shown to be less than 1.0E-09/yr. Duke Fleet Procedures which govern the Engineering Change Process are in place to review future installation impacts to the fire protection program and fire PRA, resulting in updates to the applicable analyses and calculations as required.

The licensee stated that a number of plant locations were identified where insulation material is used for low point obstruction or head-bump protection (industrial safety) and anti-sweat applications, and that industrial safety applications include a minimal amount of material affixed to pipes, conduits, and structural components. The licensee further stated that anti-sweat applications were identified primarily on piping associated with low temperature cooling water, heating, ventilation and air conditioning systems supporting Power Block components and structures located in the following areas:

Service Building Basement EL. 739' [Elevation 739 ft.]
Service Building EL. 787' (Rm 413) ventilation equipment room
Turbine Building Unit 1 EL. 739'
Aux. Building Common Area EL. 716'
Aux. Building Common Area EL. 750'
Aux. Building Common Area EL. 767'
VC/YC Chiller Room EL. 767'
Electrical Penetration Rooms EL. 750'
Switchgear Ventilation Rooms EL. 750'
Unit 1 CA Pump Rooms (TD, MD, and RN Strainers)
Unit 2 CA Pump Rooms (TD, MD, and RN Strainers)

The licensee stated that containment was not walked down, since the fire scenarios in containment fail all targets within a given area, and the targets are not based on a specific ZOI for the ignition source. The licensee further stated that the frequency of all ignition sources in an area were combined and assumed to impact all cables in that area and that as such, the addition of an intervening combustible has no impact on the FPRA. The licensee further stated that it was explicitly recognized that there is combustible insulation in the ice condenser rooms; however, this insulation is contained within the chiller units and would likely not impact targets outside the chiller itself. The licensee further stated that the FPRA treatment of containment described above adequately accounts for this insulation.

The licensee stated that all of the identified locations were evaluated against the fire scenarios supporting the FPRA and that instances were identified where an additional transient scenario could be postulated that would have impacts, including the combustible insulation, that are not currently addressed in the FPRA. The licensee further stated that instances were identified where additional impact from the combustible insulation could increase the fire risk impact from existing fixed ignition source scenarios, and that for these locations, either the combustible insulation was removed, or the scenarios were analyzed for the impact of the combustible insulation on both CDF and LERF. The licensee further stated that in all locations where the insulation has not been removed, the impact on CDF was shown to be less than 1.0E-08/yr and the impact on LERF was shown to be less than 1.0E-09/yr. The licensee further stated that the applications of exposed thermal insulation material were not of a quantity that would impact the fire scenarios or ZOIs and target failures developed in support of the fire and PRA analysis, and do not compromise automatic fire suppression functions, manual fire suppression functions, or post-fire safe shutdown capability as previously designed, reviewed and considered. The licensee further stated that Duke Fleet Procedures which govern the Engineering Change Process are in place to review future installation impacts to the FPP and FPRA, resulting in updates to the applicable analyses and calculations as required.

The licensee stated that the use of thermal insulation material other than noncombustible and more than limited combustible does not affect nuclear safety and that the applications of exposed thermal insulation materials do not compromise post-fire safe shutdown capability as previously designed, reviewed and considered. The licensee further stated that essential safety functions are maintained and capable of being performed.

The licensee stated that the forms in which the thermal insulation materials are installed and the conditions anticipated meet the intent of the revised limited combustible material definition because the materials have a flame spread rating of 25 or less and will not support continued progressive combustion. The licensee further stated that the selection and application of thermal insulation material is controlled per its piping and equipment thermal insulation specification. The licensee further stated that the FPRA development requires the inclusion of the effect of intervening or secondary combustibles to be documented and included in the analysis where determined to have fire effects as part of the PB approach. The licensee further stated that Duke Fleet Procedures which govern the Engineering Change Process are in place to review future installation impacts to the FPP and FPRA, resulting in updates to the applicable analyses and calculations as required.

The licensee stated that plant walkdowns and personnel interviews concluded that there were no large concentrations of thermal insulation in the plant. The licensee stated that it walked

down the Service Building 739' and 786' (ventilation equipment room) elevations, the Turbine Building 739' elevation, the Auxiliary Building 716', 750', and 767' elevations (including the electrical penetration rooms), and the motor driven and turbine driven CA pump rooms, and that during the walkdowns, locations were documented where combustible insulation is within the 98th percentile fire ZOI for class A combustible materials. The licensee further stated that the 75th percentile fire was an option for scenarios located in Class A combustible control areas and that if the insulation was identified as being within the ZOI of a fire, it was assumed to become an intervening combustible capable of impacting targets above it, provided that the target was within 10' of the insulation vertically. The licensee further stated that in the horizontal direction, targets were evaluated for impacts if they were within approximately 3' of the combustible insulation and that targets within 3' horizontally were not automatically assumed to fail. The licensee further stated that it was assumed that if the combustible insulation is configured such that it is a vertical run with a height that is greater than the extent of the ZOI of the initial fire, the insulation will ignite and the fire will travel vertically indefinitely. The licensee further stated that in all locations where the insulation has not been removed, the impact on CDF was shown to be less than 1.0E-08/yr and the impact on LERF was shown to be less than 1.0E-09/yr and that there is no impact on the NSPC.

The licensee stated that the use of insulation material other than noncombustible and more than limited combustible has no impact on the radiological release performance criteria and that the radiological release review was performed based on the manual fire suppression activities in areas containing or potentially containing radioactive materials and is not dependent on the type of thermal insulation material. The licensee further stated that the insulation material, regardless of heat contribution value, does not change the radiological release evaluation performed that concluded that potentially contaminated water is contained and smoke is monitored. The licensee further stated that the insulation materials do not add additional radiological materials to the area or challenge systems boundaries.

The licensee stated that the forms in which the thermal insulation are installed and the conditions anticipated meet the intent of the revised limited combustible material definition because the materials have a flame spread rating of 25 or less and will not support continued progressive combustion. The licensee further stated that the insulation material, and specifically the increase in heat contribution, does not compromise automatic fire suppression functions, manual fire suppression functions, or post-fire safe shutdown capability as previously designed, reviewed and considered.

The licensee stated that the insulation materials in the current configurations are considered as intervening combustibles and are evaluated by the FPRA, which showed that safety margin is not affected. The licensee further stated that the selection and application of thermal insulation material is controlled per its piping and equipment thermal insulation specification and that Duke Fleet Procedures which govern the Engineering Change Process are in place to review future installation impacts to the FPP and FPRA, resulting in updates to the applicable analyses and calculations as required. The licensee further stated that the precautions and limitations on the use of these materials do not impact the fire safety analysis of the fire event and that the inherent safety margin and conservatisms in these analysis methods remain unchanged.

The licensee stated that the three echelons of defense-in-depth are: 1) to prevent fires from starting (combustible/hot work controls), 2) to rapidly detect, control, and extinguish fires that do

occur thereby limiting damage (fire detection systems, automatic fire suppression, manual fire suppression, pre-fire plans), and 3) to provide an adequate level of fire protection for systems and structures so that a fire will not prevent essential safety functions from being performed (fire barriers, fire rated cable, success path remains free of fire damage, recovery actions).

The licensee stated that the use of insulation material which is noncombustible or more than limited combustible does not affect Echelons 1, 2, and 3 and that the insulation material, and specifically the increase in heat contribution, does not introduce new ignition sources, does not exceed the design bases of installed fire protection systems, does not compromise manual fire suppression functions, and does not adversely impact fire protection systems and features or post-fire safe shutdown capability as previously designed, reviewed and considered.

In regard to Echelon 1, the licensee stated that the thermal insulation does not introduce new ignition sources and presents a negligible hazard in terms of secondary or intervening combustibles. The licensee further stated that the forms in which the thermal insulation are installed and the conditions anticipated meet the intent of the revised limited combustible material definition because the materials have a flame spread rating of 25 or less and will not support continued progressive combustion. The licensee further stated that the thermal insulation materials have fuel contribution and flame spread ratings of 25 per ASTM E-84, respectively, and that although the thermal insulation materials exceed the NFPA 805 heat value of 3,500 Btu/lb, AP Armaflex and Trymer 2000 will not contribute significantly to fire due to limited flame spread per ASTM E-84.

In regard to Echelon 2, the licensee stated that the applications of exposed thermal insulation materials installed for industrial personnel safety and on miscellaneous system piping do not result in increased combustible loading which would challenge the design bases of the installed fire protection systems. The licensee further stated that the presence of the thermal insulation and associated procedural controls do not impact the ability of the automatic suppression and detection systems to perform credited functions and that portable fire extinguishers and hose stations are available for manual firefighting activities by the site fire brigade, and if a fire was to occur, damage would be limited.

In regard to Echelon 3, the licensee stated that the applications of exposed thermal insulation materials installed for industrial personnel safety and on miscellaneous system piping do not adversely impact the installed fire protection systems and features, and essential safety functions are maintained and capable of being performed. The licensee stated that the insulation material does not compromise post-fire safe shutdown capability as previously designed, reviewed and considered and that the forms in which the thermal insulation are installed and the conditions anticipated meet the intent of the revised limited combustible material definition because the materials have a flame spread rating of 25 or less and will not support continued progressive combustion. The licensee further stated that the identified installations were evaluated against the fire scenarios supporting the FPRA and that instances were identified where an additional transient scenario could be postulated that would have impacts, including the combustible insulation, that are not currently addressed in the FPRA. The licensee further stated that instances were identified where additional impact from the combustible insulation could increase the fire risk impact from existing fixed ignition source scenarios, and that for these locations, either the combustible insulation was removed, or the scenarios were analyzed for the impact of the combustible insulation on both CDF and LERF.

The licensee further stated that in all locations where the insulation has not been removed, the impact on CDF was shown to be less than 1.0E-08/yr, and the impact on LERF was shown to be less than 1.0E-09/yr. The licensee stated that Duke Fleet Procedures which govern the Engineering Change Process are in place to review future installation impacts to the FPP and FPRA, resulting in updates to the applicable analyses and calculations as required. The licensee further stated that the presence of the thermal insulation does not compromise automatic/manual fire protection functions, or post-fire safe shutdown capability and will not prevent essential safety functions from being performed.

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 3.3.4, 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 safe shutdown capability).

3.2 Nuclear Safety Capability Assessment Methods

NFPA 805 (Reference 3), is an RI/PB standard that allows engineering analyses to be used to show that FPP features and systems provide sufficient capability to meet the requirements of 10 CFR 50.48(c).

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

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

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

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

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

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

> In the event of a fire during any operational mode and plant configuration, the plant shall be as follows:

(1) *Reactivity Control.* Capable of rapidly achieving and maintaining subcritical conditions.

(2) *Fuel Cooling.* Capable of achieving and maintaining decay heat removal and inventory control functions.

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

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

Fire protection features shall be capable of providing reasonable assurance that, in the event of a fire, the plant is not placed in an unrecoverable condition. To demonstrate this, the following performance criteria shall be met.

(a) *Reactivity Control.* Reactivity control shall be capable of inserting negative reactivity to achieve and maintain subcritical conditions. Negative reactivity inserting shall occur rapidly enough such that fuel design limits are not exceeded.

(b) *Inventory and Pressure Control.* With fuel in the reactor vessel, head on and tensioned, inventory and pressure control shall be capable of controlling coolant level such that subcooling is maintained for a PWR [pressurized water reactor] and shall be capable of maintaining or rapidly restoring reactor water level above top of active fuel for a BWR [boiling water reactor] such that fuel clad damage as a result of a fire is prevented.

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

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

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

3.2.1 Compliance with NFPA 805 Nuclear Safety Capability Assessment Methods

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

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

(1) Selection of systems and equipment and their interrelationships necessary to achieve the nuclear safety performance criteria in Chapter 1.

(2) Selection of cables necessary to achieve the nuclear safety performance criteria in Chapter 1.

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

(4) Assessment of the ability to achieve the nuclear safety performance criteria given a fire in each fire area.

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

Regulatory Guide (RG) 1.205, Revision 1 (Reference 4), endorses NEI 04-02, Revision 2 (Reference 7), and Chapter 3 of NEI 00-01, Revision 2 (Reference 36), 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 safe shutdown. It provides detailed guidance for:

- Selecting systems and components required to meet the NSPC;
- Selecting the cables necessary to achieve the NSPC;
- Identifying the location of nuclear safety equipment and cables; and
- Appropriately conservative assumptions to be used in the performance of the NSCA.

The licensee developed the LAR based on the three guidance documents cited above. Although RG 1.205, Revision 1, endorses NEI 00-01, Revision 2, the licensee's review was performed to the guidance in NEI 00-01, Revision 1 (Reference 60). In addition, the licensee stated that a review of NEI 00-01, Revision 2, Chapter 3, was conducted to identify the substantive changes from NEI 00-01, Revision 1, that are applicable to an NFPA 805 FPP. Based on the information provided in the licensee's submittal, the NRC staff concludes that the licensee used a systematic process to evaluate the post-fire 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 61) provides one acceptable method for documenting the comparison of the SSA against the requirements of NFPA 805. 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 and conducting a gap analysis between the process described in Chapter 3 of NEI 00-01, Revision 1, and the process described in NEI 00-01, Revision 2. The licensee documented the results of its review in LAR Attachment B, "NEI 04-02 Table B-2, Nuclear Safety Capability Assessment – Methodology Review," in accordance with NEI 04-02, Revision 2.

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

- The SSA directly aligns with the attribute: noted in LAR Attachment B, Table B-2 as "Aligns."

- The SSA aligns with the intent of the attribute: noted in LAR Attachment B, Table B-2 as "Aligns with Intent."

Some attributes may not be applicable to the SSA (i.e., the attribute may be applicable only to BWRs or PWRs), and the licensee noted these in LAR Attachment B, Table B-2 as "Not Applicable."

As described in LAR Section 4.2.1.1 and discussed above, the licensee performed the review of the SSA using the guidance of NEI 00-01, Revision 1, and then performed a gap analysis between NEI 00-01, Revision 1 and NEI 00-01, Revision 2, to identify substantive changes that are applicable to the NFPA 805 FPP. Based on its review, the licensee identified the following gaps:

- NEI 00-01 Section 3.2.1.2 - Post fire manual operation of rising stem valves in the fire area of concern: NEI 00-01, Revision 2 added additional guidance for evaluating for the post-fire coefficient of friction for rising stem valves.

  In SSA RAI 05 (Reference 24), the NRC staff requested that the licensee provide more detail with regard to which RAs required operation of rising stem valves in the fire area of concern. The NRC staff determined that the RA feasibility analysis did not include any specific assumptions, criteria, or reference to the NEI 00-01 Revision 2 attribute. In its response to SSA RAI 05 (Reference 11), the licensee stated that motor operated valves 1/2CA161C and 1/2CA162C, the alternate auxiliary feedwater suction source, have been identified as rising stem valves. The licensee also stated that these valves would require opening prior to 18 hours after the initiating fire to provide an alternate suction water source for the turbine driven auxiliary feedwater pump during standby shutdown system operation. The licensee further stated that modifications will be performed to eliminate the reliance on these rising stem valves by installing bypass valves and included this modification in LAR Attachment S, Table S-2, Modification 4

(Reference 12). In its letter dated April 26, 2016 (Reference 21), the licensee indicated that it completed this modification and moved it from LAR Attachment S, Table S-2, to LAR Attachment S, Table S-1. The NRC staff concludes that the licensee's response to SSA RAI 05 is acceptable because the licensee demonstrated that it completed a modification to eliminate the need to operate the valves if damaged by fire.

- NEI 00-01 Section 3.5.2.1- Analysis of open circuits on high voltage (e.g., 4.16 kV) ammeter current transformers: NEI 00-01, Revision 2 added additional guidance on the methods to address an open circuit of a high voltage ammeter current transformer (CT). LAR Attachment B, Table B-2, Section 3.5.2.1, stated that the licensee considered this additional guidance in its evaluations.

- NEI 00-01 Section 3.5.2.4 - Analysis of control power for switchgear with respect to breaker coordination: NEI 00-01, Revision 2 added additional guidance to ensure breaker coordination. This guidance included examples for breakers that have internal breaker tripping devices that do not require control power and breakers that require control power for tripping. The latter requires an evaluation to ensure the availability of control power. LAR Attachment B, Table B-2, Section 3.5.2.4 stated that the licensee performed circuit analysis that evaluated this condition.

The licensee stated that the results of the NEI 00-01, Revision 2 evaluation are incorporated in LAR Attachment B and that the applicable findings were incorporated in the NSCA model.

The NRC staff has determined that, taken together, these methods compose an acceptable approach for documenting compliance with the NFPA 805, Section 2.4.2, "Nuclear Safety Capability Assessment," requirements, because the licensee demonstrated consistency with the alignment strategies identified in NEI 04-02. 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, the NRC staff concludes that the licensee's statements of alignment are acceptable.

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

- 3.2.1.2

In SSA RAI 06 (Reference 24), the NRC staff indicated that the licensee's analysis regarding fire damage to mechanical components stated that instrument sensing lines were evaluated as if the fluid boundary remains intact. The NRC staff requested that the licensee provide justification for this assumption regarding heat sensitive piping materials, including tubing with brazed or soldered joints. In its response to SSA RAI 06 (Reference 10), the licensee stated that the NSCA instruments do not use soldered or brazed connections. The licensee stated that process lines, including instrument air lines, use stainless steel tubing and/or copper tubing. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the instrument tubing required for NSCA does not use heat sensitive materials.

3.2.1.2 Attribute Alignment – Aligns with Intent

For certain of the NEI 00-01, Chapter 3, attributes, the licensee determined that the SSA aligns with the intent of the attribute, and provided additional clarification when describing its means of alignment. The attributes identified in LAR Attachment B, Table B-2 as having this condition are as follows:

- 3.1.C
- 3.1.1.9
- 3.2.1.1
- 3.2.2.4
- 3.3.3.2
- 3.5.2.1
- 3.4.1.7
- 3.1.1.3
- 3.1.1.11
- 3.2.1.6
- 3.3.1.2
- 3.3.3.3
- 3.5.2.3 A/B
- 3.4.2.3
- 3.1.1.4
- 3.1.2.4
- 3.2.2.1
- 3.3.1.3
- 3.5.1.1
- 3.4.1.4
- 3.1.1.7
- 3.1.2.5
- 3.2.2.2
- 3.3.1.6
- 3.5.1.3
- 3.4.1.5
- 3.4.2.4
- 3.1.3.4
- 3.2.2.3
- 3.3.1.7
- 3.5.1.5(B)
- 3.4.1.6

In SSA RAI 01 (Reference 24), the NRC staff found that for some attributes in LAR Attachment B, Table B-2, it was not clear why the licensee's description in the alignment basis does not align with the guidance, and requested that the licensee provide clarification on the "aligns with intent" category for these attributes. In its response to SSA RAI 01 (Reference 11), the licensee stated that the alignment basis for the following NEI 00-01 elements should be changed to "Aligns":

- 3.1.1.11 Multiple units
- 3.2.1.6 Spurious components
- 3.3.1.3 Isolation Devices
- 3.3.1.6 Auto Initiation Logic
- 3.3.1.7 Circuit Coordination
- 3.5.1.3 Duration of Circuit Failures
- 3.5.2.1 Circuit Failures Due to an Open Circuit
- 3.4.1.4 Manual Actions

For the two attributes, 3.1C (Spurious operations), and 3.1.1.7 (Off-site Power), the licensee provided further justification for categorizing these attributes as "Aligns with Intent." For both of these attributes, the licensee provided additional information, which demonstrated that the methods meet the intent of the NEI 00-01, Revision 2, because the methods achieve the intended objective of NEI 00-01 to evaluate spurious equipment operations and the availability

of offsite power. The NRC staff concludes that the licensee's response to SSA RAI 01 is acceptable because the licensee revised several alignment statements to accurately reflect how the SSA aligns with NEI 00-01, and because the licensee provided additional justification for the two attributes and confirmed that those two elements of the SSA do in fact align with the intent of NEI 00-01, which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2.

Attribute 3.1C is associated with spurious operations of safe shutdown systems and safe shutdown path development. The guidance in NEI 00-01 Revision 2 Section C.3, clarifies the criterion for the determination of a high/low pressure interface valve as a valve whose spurious opening could result in a loss of reactor coolant system (RCS) inventory and, due to the lower pressure rating on the downstream piping, an interfacing loss-of-coolant accident (LOCA) outside of primary containment (i.e., pipe rupture in the low pressure piping). In accordance with the guidance, these high/low pressure interface valves are subject to more stringent circuit analysis. In LAR Attachment B, the licensee stated that the high/low pressure interfaces consist solely of interface with the residual heat removal (RHR) system in accordance with its SE Report NUREG 0422 Supplement 6 (Reference 34). In its response to SSA RAI 01, the licensee stated that it aligns with the guidance of considering spurious operations, but aligns with the intent for high/low pressure interface. The licensee stated that it analyzed high/low pressure interfaces resulting in a LOCA outside containment.

In SSA RAI 02 (Reference 24), the NRC staff requested additional information regarding the licensee's statement that the RHR system is the only high/low pressure interface to be evaluated, including justification for not evaluating other RCS valves (e.g., high point vents and letdown valves) as high/low pressure interfaces. In its response to SSA RAI 02 (Reference 10), the licensee stated that high/low pressure interfaces are limited to meeting the latest guidance in NEI 00-01, Revision 2, which defines high/low pressure. The licensee stated that NEI 00-01 Revision 1, states that high/low pressure interfaces result in a LOCA and RG 1.189, Revision 2 (Reference 40), Section 5.3.2.c, endorses NEI 00-01, Revision 2, which expands the high/low pressure interface definition to a LOCA outside containment. The licensee stated that it analyzed high/low pressure interfaces resulting in a LOCA outside containment and found that the RHR suction isolation valves are the only ones that meet the definition. The licensee further stated that its analysis identified that another potential high/low pressure interface is the RHR discharge lines to the RCS, but these were eliminated because they are normally open and there are two check valves in each line upstream of these valves that would have to fail to pressurize the low pressure piping. The licensee further stated that the letdown and excess letdown valves spurious opening are protected by relief valves to adequately relieve pressure to the pressurizer relief tank. The licensee further stated that although these are not within the definition of high/low pressure interfaces, the MSO analysis considered spurious operation of the valves in the letdown and excess letdown lines. The licensee further stated that a RCP thermal barrier failure in conjunction with a fire does not need to be considered because it is an independent event. NFPA 805, Section 2.3 indicates that an assumption provided to perform a deterministic analysis of ensuring the NSPC are met is that independent failures (i.e. failures that are not a consequence of fire damage) of systems, equipment, instrumentation, controls or power supplies relied upon to achieve the NSPC do not occur before, during or following the fire. Based on the information provided by the licensee, the NRC staff finds that the licensee's position is consistent with NFPA 805, Section 2.3. The NRC staff concludes that the licensee's response to SSA RAI 02 is acceptable because the licensee demonstrated that its analysis is

consistent with the requirements of NFPA 805 and with the guidance provided in NEI 00-01 Revision 2.

Attribute 3.1.1.3 is associated with the availability of pressurizer heaters for safe shutdown. The licensee stated that the SSA does not rely on pressurizer heaters for fire areas where the safe and stable strategy does not use the Standby Shutdown Facility (SSF). The licensee also stated that for areas that require the use of the SSF, one sub-bank of pressurizer heaters are available for reactor coolant system (RCS) pressure control to aid the system operation within prescribed pressure/temperature limits to minimize void formation within the reactor vessel and to maintain the steam bubble in the pressurizer. The licensee further stated that due to the high desirability of pressurizer heaters to assist in pressure control, the pressurizer heaters are analyzed as required in the SSA. The licensee further stated that steam release rates and auxiliary feedwater flow rates are controlled to prevent formation of a bubble in the reactor head for all fire scenarios. The NRC staff concludes that the methods described by the licensee are acceptable because they align with the intent of the NEI 00-01 guidance, which is to ensure that the post-fire safe shutdown analysis addresses the requirements of NFPA 805, Section 2.4.2, and because the licensee evaluated the availability of pressurizer heaters where credited to support the capability to achieve and maintain the fuel in a safe and stable condition as required by NFPA 805, Section 1.3.1.

Attribute 3.1.1.4 is associated with use of alternative shutdown capability. The licensee stated that it utilizes a dedicated SSF for fires in areas where both trains of equipment relied on to meet the NSPC may be damaged or the control room may have to be evacuated. Based upon the information provided by the licensee in the LAR, the NRC staff finds that portions of the SSF design meet the definition of alternative shutdown capability (meaning that portions of the circuits form part of the control/power scheme under normal conditions but are transferred/isolated to be independent of the fire area of concern when placed in alternate shutdown mode) and portions of the SSF design meet the definition of dedicated shutdown (the equipment may only be started/controlled/powered from the SSF so are always independent of the fire area of concern). The licensee stated that transfer of control to the SSF isolates redundant systems and equipment from the effects of a fire. The licensee also stated that the intent of the guidance is that dedicated cables and equipment relied on for alternative shutdown are independent of the fire area of concern. The licensee further stated that following transfer of control to the SSF, the dedicated equipment relied on to meet the nuclear performance goals via the SSF meets the intent of the guidance. Based on the information provided by the licensee, the NRC staff found that upon transfer of plant control to the SSF, all required nuclear safety functions have been provided and the systems and equipment are capable of meeting the NSPC. The NRC staff concludes that the methods described by the licensee are acceptable because they align with the intent of NEI 00-01, which is to ensure that the post-fire safe shutdown analysis addresses the requirements of NFPA 805, Section 2.4.2, and because the licensee demonstrated the capability to achieve and maintained the fuel in a safe and stable condition as required by NFPA 805, Section 1.3.1.

Attribute 3.1.1.7 is associated with the ability to use offsite power for SSD. NEI 00-01 states that for the case of redundant shutdown, offsite power may be credited if demonstrated to be free of fire damage. The licensee stated that it does not rely on offsite power for redundant SSD and emergency diesel generators are relied upon for electrical power. The licensee further stated that offsite power has not been analyzed or demonstrated to be free of fire damage for

redundant shutdown and the cascading power supply analysis determines fire impact to power sources relied upon and is utilized in the analysis of fire areas for SSD. The licensee further stated that this analysis ensures power is available to operate applicable SSD equipment. The licensee further stated that power supply/cable failures are analyzed for effects of loss with and without offsite power and that for alternate shutdown, a dedicated diesel generator is provided independent of emergency diesel generator systems that can supply the necessary electrical power for Hot Standby. The licensee further stated that it does not rely on offsite power, and therefore, it is not required to demonstrate that it is free of fire damage and meets the intent of the guidance. In SSA RAI 01 (Reference 24), the NRC staff requested that the licensee provide additional justification regarding the part of the attribute that does not align with NEI 00-01. In its response to SSA RAI 01 (Reference 11), the licensee stated that it does not credit offsite power in the SSA and does not demonstrate it to be free of fire damage and that SSD success paths were analyzed as shown on the functional logic diagrams with and without offsite power. The licensee also stated that it aligns with the intent of considering offsite power during the analysis, but does not credit it. The NRC staff concludes that the licensee's response to SSA RAI 01 is acceptable because the methods described by the licensee align with the intent of NEI 00-01, which is to ensure that the post-fire safe shutdown analysis addresses the requirements of NFPA 805, Section 2.4.2, and because the licensee's analysis considers the effects of meeting the NSPC with and without offsite power.

Attributes 3.1.1.9 and 3.4.1.5 are associated with the criteria for a post-fire 72-hour coping period. The licensee stated that NFPA 805 does not have any explicit requirements to achieve cold shutdown within 72 hours, and therefore, the NFPA 805 criteria for NSPC have been applied to ensure the fuel is maintained safe and stable. The licensee stated that the previous hot and cold shutdown references for equipment were retained in the SSD database. For these attributes, the NRC staff concludes that the licensee's SSA aligns with the intent of NEI 00-01, which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2.

Attribute 3.1.2.4 is associated with decay heat removal to achieve cold shutdown. The licensee stated that NFPA 805 does not have any explicit requirements to achieve cold shutdown and, therefore, the NFPA 805 criteria for the NSPC have been applied to ensure the fuel is maintained in a safe and stable condition. For this attribute, the NRC staff concludes that the licensee's SSA aligns with the intent of NEI 00-01, which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2.

Attribute 3.1.2.5 is associated with the availability of process monitoring for SSD. The licensee stated that to achieve and maintain safe and stable conditions via the control room, sufficient instrumentation channels remain available to provide all of the necessary monitoring requirements. The licensee also stated that to achieve and maintain safe and stable conditions via the SSF, dedicated channels of instrumentation are available to provide all of the necessary monitoring requirements. The licensee further stated that the SSF does not require source range instrumentation since the standby make up pump can only take suction from the borated spent fuel pool. The licensee further stated that the T_{hot} and T_{cold} requirements may be met with core exit thermocouples and main steam pressure indication for either normal or alternate shutdown trains. The licensee further stated that some monitoring parameters may not be available in the control room for A train switchgear HVAC room fires and that for these areas, SSF instrumentation is available to provide the necessary monitoring. For this attribute, the

NRC staff concludes that the licensee's SSA aligns with the intent of NEI 00-01, which is to ensure that the post-fire safe shutdown analysis addresses the requirements of NFPA 805, Section 2.4.2.

Attribute 3.1.3.4 is associated with assigning shutdown paths to each combination of systems for safe shutdown. The licensee stated that logic diagrams were utilized to show success paths for the various nuclear safety performance functions and success paths were designated for each system and NSPC. The licensee stated it did not assign a "path designation" to each combination of systems or equipment. The licensee further stated that the logic diagrams provided numerous combinations of success paths that could be used to achieve the nuclear safety performance goals and then relied upon one combination of success paths for each fire area. For this attribute, the NRC staff concludes that the licensee's SSA aligns with the intent of NEI 00-01, which is to ensure that the post-fire safe shutdown analysis addresses the requirements of NFPA 805, Section 2.4.2. The NRC staff also concludes that the licensee used logic diagrams to achieve the objective of identifying safe shutdown paths, which is consistent with the guidance of NEI 00-01.

Attribute 3.2.1.1 is associated with primary and secondary component selection, categorization, and documentation. NEI 00-01 provides guidance that SSD equipment be categorized as 1) primary components, or 2) secondary components. The licensee stated that the two category approach was used, that "primary" components were identified and added to the safe shutdown equipment list (SSEL), and that "secondary" components, referred to as subcomponents, were grouped together with the primary components. The licensee stated that although some subcomponents were not individually identified (for example: relays, fuses, hand switches), the cables, which connected to the subcomponents were identified and assigned to the primary component. The licensee stated that in some instances, components were not captured by the cable selection process but were captured within the cascading interlocks analysis as pseudo-components and the effects of fire on these pseudo components were evaluated where appropriate. For this attribute, the NRC staff concludes that the licensee's SSA aligns with the intent of NEI 00-01, which is to ensure that the post-fire safe shutdown analysis addresses the requirements of NFPA 805, Section 2.4.2.

Attributes 3.2.2.1 and 3.2.2.2 are associated with the identification of the system flow path for each shutdown path, including equipment that may spuriously operate and affect system operation. The licensee described the method used to identify the system flow path for each shutdown path, stating that piping and instrument drawings were marked up and used to determine flow and diversion paths, which were then translated into success path logic diagrams. The licensee further stated that in its method, these logic diagrams were then used to identify potential SSD equipment list components; however, these piping and instrument drawings were not maintained as part of the SSA. The licensee indicated that NSCA logic diagrams were marked up and annotated to designate specific flow paths for each system. For these attributes, the NRC staff compared the method used by the licensee with the method recommended in the NEI guidance and concludes that the methods described by the licensee align with the intent of NEI 00-01, which is to ensure that the post-fire safe shutdown analysis addresses the requirements of NFPA 805, Section 2.4.2.

Attributes 3.2.2.3 and 3.2.2.4 are associated with developing a list of SSD equipment and assigning the corresponding system and SSD path(s) designation to each. The licensee

described the method used to develop the nuclear safety equipment list. The licensee stated that piping and instrument drawings and electrical one-lines were marked up to determine flow and diversion paths for nuclear safety performance functions and to identify potential SSD equipment list components including components that could spuriously operate and affect the desired system function of relied upon equipment. The licensee stated that any additional success paths identified were defined on logic diagrams; however, the technique of designating a set number of safe shutdown paths was not used. For these attributes, the NRC staff compared the method used by the licensee with the method recommended in the NEI guidance and concludes that the methods described by the licensee align with the intent of NEI 00-01, which is to ensure that the post-fire SSA addresses the requirements of NFPA 805, Section 2.4.2.

Attributes 3.3.1.2, 3.3.3.2, and 3.3.3.3 are associated with cables affecting multiple components, interlocked circuits, and spurious operation. The licensee described the method used to evaluate multiple components, interlocked circuits and spurious operation. The licensee stated that for control logic circuits where multiple components receive signals from common control logic, the control logic was analyzed as a primary component and a pseudo component was created for the logic with cables selected accordingly. The licensee stated that this same methodology was used for similar circuit scenarios such as common power supplies. The licensee stated that whereas this approach does not assign the cable to each individual component, the effect on each component due to fire damage was evaluated. For these attributes, the NRC staff compared the method used by the licensee with the method recommended in the NEI guidance and concludes that the methods described by the licensee align with the intent of NEI 00-01, which is to ensure that the post-fire safe shutdown analysis addresses the requirements of NFPA 805, Section 2.4.2.

Attributes 3.5.1.1, 3.5.1.5, and 3.5.2.3 are associated with circuit failure types, impact, and cable failure modes. The licensee described the circuit failure types, impact and cable failure modes used in its analysis and stated that all combinations of circuit failures except inter-cable hot shorts are considered and evaluated to determine if spurious component actuation can occur. The licensee stated that inter-cable hot shorts were not considered due to the use of armored cable, because the armor jacketing of the cables prevents conductors from one cable shorting to conductors of another cable. The licensee also stated that cables, which meet separation requirements are not postulated to fail; therefore, performing circuit analysis was not required. For these attributes, the NRC staff compared the method used by the licensee with the method recommended in the NEI guidance and concludes that the methods described by the licensee align with the intent of NEI 00-01, which is to ensure that the post-fire safe shutdown analysis addresses the requirements of NFPA 805, Section 2.4.2.

In a letter dated November 4, 2016 (Reference 30), the NRC staff identified an issue regarding the licensee's proposed action in LAR Attachment S, Table S-3, Implementation Item 20 to perform additional Information Notice (IN) 92-18, "Potential for Loss of Remote Shutdown Capability During a Control Room Fire" (Reference 82), analysis to determine whether hot shorts in subject MOV control circuits could result in damage to the MOV pressure boundary. The NRC staff requested that the licensee provide additional information regarding implementation item 20 including extent of condition and justification for the proposed action, and also requested that the licensees revise the LAR if necessary. In its letter dated November 21, 2016 (Reference 23), the licensee responded to the NRC staff's request and

indicated that it had revised LAR Attachment B to clarify that the evaluation of MOV pressure boundary integrity associated with implementation item 20 is a required analysis. The licensee also stated that NEI 00-01, Section 3.5.2.3, states that the analysis must demonstrate the MOV thrust failure does not damage the MOV pressure boundary, and revised LAR Attachment B accordingly. The licensee also included a list of the valves that are to be included in the scope of the analysis. The NRC staff concludes that the licensee's response is acceptable because the licensee identified the analysis as required, made appropriate revisions to the LAR, and included an action in LAR Attachment S, Table S-3, implementation item 20 to complete the pressure boundary breach analysis which will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

Attribute 3.4.2.3 is associated with determining SSD equipment impacts. The licensee described the method used for determining SSD equipment impacts in its analysis and stated that the fire area analysis methodology selected a success path based on cables/components in a fire area being analyzed and that for this path, multiple fire induced failures and multiple spurious actuations were analyzed. The licensee stated that all postulated SSD cable and component failures for the assured path were identified and a resolution provided at the cable or component level. The licensee also stated that although the analysis reveals all SSEL component conflicts in a given fire area, the least impacted train is selected as a credited train and only its assurance is analyzed. For this attribute, the NRC staff compared the method used by the licensee with the method recommended in the NEI guidance and concludes that the methods described by the licensee align with the intent of NEI 00-01, which is to ensure that fire impacts on equipment that can affect safe shutdown are identified and ensure that the post-fire safe shutdown analysis addresses the requirements of NFPA 805, Section 2.4.2.

Attributes 3.4.2.4, 3.4.1.6, and 3.4.1.7 are associated with developing a compliance strategy or resolution to mitigate the effects due to fire damage to each required component or cable. The licensee described the methods used to develop a compliance strategy/resolution to mitigate the effects due to fire damage to each required component or cable and stated that success paths were analyzed and potential impacts identified, and these potential impacts were resolved by specifying one or more of the options listed in NEI 00-01 such that the least impacted success path could be identified. The licensee also stated that VFDRs were identified and mitigating strategies to address the VFDRs in a PB FRE were developed and documented and that credit for transitioning EEEEs and licensing actions was taken wherever possible and a recovery action specified as a last resort. For these attributes, the NRC staff compared the method used by the licensee with the method recommended in the NEI guidance and concludes that the methods described by the licensee align with the intent of NEI 00-01, which is to ensure that the post-fire safe shutdown analysis addresses the requirements of NFPA 805, Section 2.4.2.

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, and by conducting a gap analysis between NEI 00-01, Revision 1, and NEI 00-01, Revision 2. The

licensee documented the results of the review and the gap analysis 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 83), since NFPA 805 only requires the licensee to maintain the fuel in a safe and stable condition rather than achieve and maintain cold shutdown in 72 hours. In LAR Section 4.2.1.2 the licensee stated that the NFPA 805 licensing basis is to maintain safe and stable conditions in Hot Standby (Mode 3) and stops prior to the point of manually initiating a cooldown. The licensee also stated that long-term safe and stable conditions can be maintained with natural circulation and steam generator steaming with assured adequate feedwater.

In LAR Section 4.2.1.2, the licensee stated that safe and stable conditions at hot standby may continue long term with the following:

- Fuel Oil
  - The SSF diesel generator (DG) fuel tank needs replenishing approximately every 72 hours. Fuel oil may also be obtained from offsite vendors.
  - For A or B train - The safety-related DGs need replenishing approximately every 5 days per design basis accident. Alternatively, the fire affected train's respective DG fuel can be pumped to the non-fire affected train DG providing approximately 10 days of fuel. Fuel oil may also be obtained from offsite sources.
- Feedwater
  - Approximately 18 hours of condensate grade water is available for A train, B train, or SSF success path.
  - For SSF, additional feedwater can be taken from the condenser cooling water embedded piping for approximately 3 days' supply. This can be

gravity replenished via Lake Norman or manual actions can replenish the water in this piping if required.

- For A or B train, although Lake Norman is expected to be available, the assured source is the standby nuclear service water pond via nuclear service water.

- Reactor coolant inventory
  - For SSF train - The spent fuel pool will provide available inventory via the standby makeup pump for at least 72 hours. Spent fuel pool makeup can be provided from the refueling water storage tank as well as several other sources to extend the available supply.
  - For A or B train - Charging flow to the RCP seals will provide a steady state supply of inventory. The assured source is the refueling water storage tank (approximately 383,146 gal.) and then realignment to containment sump.

The licensee stated that the following long-term actions can be instituted, as needed:

- The site emergency organization can be established.
- More resources can be made available.
- Additional materials can be made available from both within and outside the corporation.
- Damage repairs can be completed as desired/needed resulting in additional success paths being made available.
- Offsite power is expected to be restored.

Based on a review of the licensee's analysis as described in the LAR, as supplemented, the NRC staff concludes that the licensee has provided reasonable assurance that the fuel can be maintained in a safe and stable condition, post-fire, for an extended period of time.

3.2.3 Applicability of Feed and Bleed

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

> In demonstrating compliance with the performance criteria of Sections 1.5.1(b) and (c), a high-pressure charging/injection pump coupled with the pressurizer power-operated relief valves (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 MNS meets the feed and bleed requirements. In LAR Table 5-3, the licensee stated that feed and bleed is not utilized as the sole fire protected SSD methodology. 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 confirmed that all fire areas either met the deterministic requirements of NFPA 805, Section 4.2.3, or the PB evaluation performed in accordance with NFPA 805, Section 4.2.4, demonstrated that the integrated assessment of risk, DID, and safety margins for the fire area was acceptable.

Therefore, 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 Table 5-3 and LAR Attachment C, the staff concludes that the licensee meets the requirements of 10 CFR 50.48(c)(2)(iii) because feed and bleed is not utilized as the sole fire-protected safe shutdown method.

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 and LAR Attachment F, the licensee's process for identification and evaluation of MSOs was conducted using the guidance of NEI 04-02 and RG 1.205, as supplemented by FAQ 07-0038 (Reference 59) and included the following five steps:

1. Identify potential MSOs of concern;

2. Conduct an expert panel to assess plant-specific vulnerabilities;

3. Update the fire probabilistic risk assessment (FPRA) model and NSCA to include the MSOs of concern;

4. Evaluating for NFPA 805 compliance; and

5. Documenting results.

For Step 1 in LAR Attachment F, the licensee stated that the preparation phase included developing a list of scenarios to consider during the onsite review meeting. The licensee also stated that a draft copy of results of an industry survey on fire-induced MSOs was obtained from the pressurized-water reactor owners group (PWROG) and that this listing, although in rough draft form, provided a comprehensive set of scenarios for discussion.

For Step 2, the licensee stated that the expert panel consisted of representatives from MNS fire protection and post-fire SSD, MNS Operations, PRA, and members of the Strategic Alliance for NFPA 805 transition team. The licensee also stated that a training session for the panel members was conducted prior to starting the actual assessment and the results of the expert panel were documented. The licensee further stated that key to the expert panel process is the diverse review of SSD and that this diverse review is performed by an expert panel comprised of experienced personnel in the major aspects of plant operation and post-fire SSD.

In SSA RAI 03 (Reference 24), the NRC staff found that some of the documents used by the expert panel were identified as drafts and requested that the licensee describe what reconciliation was done to ensure completeness of the analysis with the final documents, and also to describe the reference to the term "strategic alliance" used in the context of the expert panel. In its response to SSA RAI 03.a (Reference 11), and PRA RAI 21 (Reference 10), the licensee stated that the MSO expert panel calculation was updated to provide a comparison and reconciliation of the original MSO input reference list to the MSO lists in Revision 2 and Revision 3 of NEI 00-01 (Reference 84). The licensee stated that its review of the NEI 00-01, Revision 3, MSO list was completed, and a response to each new item was included in the revised MSO calculation. The licensee added that no additional MSOs were required to be added to the FPRA as a result of this review. In its response to SSA RAI 03.b (Reference 10), the licensee stated the strategic alliance was a group of contractors with expertise in safe shutdown analysis, fire protection, and electrical systems and circuits. The licensee also described the MSO expert panel and indicated that its MSO calculation contains a brief biography for every member of the expert panel, its own staff, and the strategic alliance personnel. Based on the information provided by the licensee, the NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that its documents were subjected to follow-up reviews, that's its own staff, its expert panel, and strategic alliance personnel were appropriately qualified, and because the licensee's process and results follow the guidance in NEI 04-02, as supplemented by FAQ 07-0038, and are consistent with the guidance in RG 1.205.

For Step 3, the licensee stated that the NSCA and FPRA were updated to reflect the treatment of applicable MSO scenarios, which included the identification of equipment, identification of cables, and the routing of cables by plant locations and that the results are contained in plant documents.

For step 4 the licensee stated that the MSO combination components of concern were also evaluated as part of the NSCA. The licensee also stated that for cases where the pre-transition MSO combination components did not meet the deterministic compliance, the MSO combination components were added to the scope of the FREs.

For step 5 the licensee stated that the results are documented in the MSO expert panel report, the NSCA, the FPRA, and the FREs.

The NRC staff reviewed the licensee's expert panel process for identifying circuits susceptible to MSOs as described above and concludes that the licensee adopted a systematic and comprehensive process for identifying MSOs to be analyzed using available industry guidance. The NRC staff also concludes that the process used provides reasonable assurance that the FREs appropriately identify and include risk significant MSO combinations and, therefore, 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 an RA as:

> Activities to achieve the nuclear safety performance criteria that take place outside the main control room or outside the primary control station(s) for the equipment being operated, including the replacement or modification of components.

NFPA 805, Section 4.2.3.1, states 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.

In LAR Attachment G the licensee stated that evaluation of RAs was performed in accordance with the guidance provided in NEI 04-02, FAQ 07-0030 (Reference 58), and RG 1.205 and that the following methodology was used to evaluate RAs required for compliance with NFPA 805:

- Step 1: Define the primary control station(s) (PCSs) and determine which pre-transition operator manual action (OMAs) are taken at PCSs. (Activities that occur in the Main Control Room (MCR) are not considered pre-transition OMAs). Activities that take place at PCS or in the MCR are not RAs, by definition;

- Step 2: Determine the population of RAs that are required to resolve VFDRs (to meet the risk acceptance criteria or maintain a sufficient level of DID);

- Step 3: Evaluate the additional risk presented by the use of RAs required to demonstrate the availability of a success path;

- Step 4: Evaluate the feasibility of the RAs; and

- Step 5: Evaluate the reliability of the RAs.

In LAR Attachment G the licensee stated that based on the definition provided in RG 1.205 and the additional guidance provided in FAQ 07-0030, the following locations outside the MCR are considered PCSs for alternate shutdown:

- The SSF, which is external to the plant and houses control stations, SSF Diesel Generator, SSF Battery supplies, ventilation, and electrical equipment.

- Unit 1 turbine driven auxiliary feedwater pump room, which is enclosed within a fire area and also houses the turbine driven auxiliary feedwater steam generator controls and suction sources.

- Unit 2 turbine driven auxiliary feedwater pump room, which is enclosed within a fire area and also houses the turbine driven auxiliary feedwater steam generator controls and suction sources.

The licensee stated there are PCS transfer actions occurring in Unit 1 and/or Unit 2 A train and B train switchgear rooms and that these transfer actions occur at the respective panels, motor control centers (MCCs), switchgear, and bunker plugs.

In LAR Attachment G, the licensee stated that there are three categories of actions in its post-fire procedures, of which the first two are RAs required for NFPA 805 compliance and as described below:

- RAs required for risk. These are actions the FPRA credited to reduce the risk numbers.

- RAs required for DID. These actions are credited as a result of the DID evaluations performed as part of the FREs.

The licensee stated that the first two categories of RAs are evaluated for feasibility against the criteria in NFPA 805, Section B.5.2(e); NEI 04-02; and FAQ-07-0030.

The licensee stated that the third category, while associated with VFDRs, are additional actions that screened out due to no or very low risk. The licensee stated that these actions are not considered RAs for NFPA 805, therefore, feasibility is not evaluated against the criteria in NFPA 805, Section B.5.2(e); NEI 04-02; and FAQ-07-0030.

In SSA RAI 04 (Reference 24), the NRC staff requested that the licensee provide a more detailed description of the RAs that screened out due to no or very low risk. Specifically, the licensee was requested to identify how these RAs were originally identified, what nuclear safety performance goals the RAs are associated with, and if the RAs are currently listed in LAR Attachment G. In its response to SSA RAI 04 (Reference 11), the licensee stated that these are not a category of RAs but a category of "actions." The licensee further stated that LAR Attachment G, Step 2, indicates that the population of RAs is those that are required to resolve VFDRs. The licensee stated that the population of VFDRs is from the deterministic analysis for each fire area and that no VFDRs were written against pre-existing operator manual actions (OMAs) by themselves, but there had to be a fire effect on the component. The licensee further stated that some component fire impacts that resulted in a VFDR were found to have pre-existing OMAs that could be used to address the VFDR resolution. The licensee further stated that each VFDR was then evaluated using the PB approach, and required RAs were identified where necessary to satisfy risk or DID. The licensee stated that the FRE process, using the FPRA, determined that some of these had no or very low contribution to risk and were not required to be carried forward as RAs for risk or DID. The licensee further stated that if VFDRs in LAR Attachment C contained recommended operator actions for the deterministic analysis, but did not result in required RAs, then the recommended action was not required to be implemented and not reflected in LAR Attachment G. The NRC staff concludes the licensee's response to SSA RAI 04 is acceptable because the licensee explained that these actions are not RAs necessary to meet the requirements of NFPA 805.

Regulatory Position C.2.4 in RG 1.205 (Reference 4), states that there are two cases where operator actions taken outside the main control room may be considered as taking place at a primary control station. These two cases involve dedicated shutdown or alternative shutdown controls, which have been reviewed and approved by the NRC.

On July 27, 2015, the licensee informed the NRC staff that one of the fire areas (Fire Area 25) that credits the SSF as the success path to meet the NSPC had not been previously reviewed and approved by the NRC in the deterministic licensing basis. In SSA RAI 08 (Reference 28), the NRC staff stated that utilization of the Alternative/Dedicated Shutdown strategy in a fire area that had not been previously approved by the NRC staff is a modification to the previously approved strategy and requested the following information:

a) A detailed description of the modification to the dedicated or alternative shutdown strategy sufficient for the NRC staff to verify that the strategy meets the attributes provided in RG 1.205 Section C.2.4 (electrical independence, command and control, instrumentation, actions necessary to enable (if required), etc.);

b) Sufficient design information to provide assurance that connections/interconnections with safety-related plant systems will not cause a reduction in the capability, redundancy, diversity, or design margin for those systems;

c) Verification that the use of the SSF for the fire area in question will not invalidate any of the previously approved attributes of the alternative/dedicated shutdown strategy (electrical independence, command and control, instrumentation, actions necessary to enable, etc.); and

d) Verification that upon successful startup and enabling of the SSF, the credited success path is physically and electrically independent of the fire area resulting in the SSF strategy meeting the deterministic requirements of NFPA 805, Section 4.2.3.

In its response to SSA RAI 08a (Reference 18), the licensee stated that Fire Area 25 originally credited shutdown from the Main Control Room for a fire event in the area; however, the credited method for shutdown for a fire event in the fire area was revised to credit the Standby Shutdown System (SSS), or transfer of control to the SSF, shortly after issuance of NUREG-0422, Supplement No. 6, which approved the 10 CFR 50 Appendix R, III.G, Safe Shutdown Capability, and that the NRC was notified of this update. The licensee further stated that Fire Area 25 meets all the criteria (electrical independence, command and control, instrumentation, actions necessary to enable) for a (10 CFR 50, Appendix R) III.G.3, Alternate Shutdown Fire Area. The licensee further stated that the activation of the SSS, or transfer of control to the SSF, is initiated by entry into the plant procedure for loss of plant control due to fire; and, therefore, SSS/SSF activation as a result of a fire event in Fire Area 25 is consistent with the other SSS credited fire areas previously reviewed and approved by the NRC.

In its response to SSA RAI 08b (Reference 18), the licensee stated that the SSS design interfaces with predominantly A Train components and a small number of B Train components related to the SSS scheme. The licensee stated that the SSS design scheme is the same for all fire areas, which credit the transfer of control to the SSF and nothing is introduced as new in the Fire Area 25 assignment. The licensee stated there are no issues in Fire Area 25, which would prevent the transfer of control to the SSF and achieving the NSPC.

In its response to SSA RAI 08c (Reference 18), the licensee stated that SSS activation as a result of a fire event in Fire Area 25 is identical to SSS activation for any other fire area that the SSS is the assured train, and thus, independence, command and control, instrumentation, and activation actions are the same, which precludes the possibility of a conflict.

In its response to SSA RAI 08d (Reference 18), the licensee stated that the performance criteria for successful SSF operation as a result of a fire event in Fire Area 25 is the same as all other SSS credited Fire Areas. The licensee stated that all associated SSS components had cabling and location of the cabling (routing) identified. The licensee stated that a deterministic analysis was performed for all fire areas and the least impacted success path for Fire Area 25 was determined to be SSS. The licensee stated that any impacts to the SSS success path due to a fire in the fire area were identified as VFDRs and processed in a FRE. The licensee stated that the NFPA 805 LAR Attachment C (B-3 table) itemizes Fire Area 25 VFDRs and the risk assessment.

The NRC staff concludes that the licensee's response to SSA RAI 08 and the use of the SSF/SSS as a primary control station for Fire Area 25 is acceptable because the licensee previously informed the NRC of the change, the fire area was evaluated in accordance with the

same methodology for alternative shutdown that was applied to other alternative shutdown fire areas at the McGuire Nuclear Station and approved by the NRC, the use of the SSF and SSS for Fire Area 25 does not invalidate other previously approved attributes, and is included in the licensee's procedures for fire areas requiring use of the SSF.

In LAR Attachment G, the licensee stated that the set of RAs that are necessary to demonstrate the availability of a success path for the NSPC in Table G-1 were evaluated for additional risk using the process described in NEI 04-02, FAQ 07-0030, and RG 1.205 and compared against the guidelines of RG 1.174 and RG 1.205. RAs were evaluated against the feasibility criteria provided in the NEI 04-02, FAQ 07-0030, and RG 1.205.

OMAs meeting the definition of an RA are required to comply with the NFPA 805 requirements outlined above. Some of these OMAs may not be required to demonstrate the "availability of a success path," in accordance with NFPA 805, Section 4.2.3.1, but may still be required to be retained in the RI/PB FPP because of DID considerations described in NFPA 805, Section 1.2. Accordingly, the licensee defined a DID-RA as an action that is not needed to meet the NSPC, but has been retained to provide DID. In each instance, the licensee determined whether a transitioning OMA was an RA, a DID-RA, or not necessary for the post-transition RI/PB FPP.

The licensee stated that all credited RAs, as listed in LAR Attachment G including DID-RAs, 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 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; and

- Drills - Periodic drills, which simulate the conditions to the extent practical (e.g., communications between the control room and field actions, the use of SCBAs if credited, appropriate use of operator aids) should be performed.

LAR Attachment G, Table G-1, "Recovery Actions and Activities Occurring at the Primary Control Stations," describes each RA associated with the resolution of a VFDR from the fire area assessments as documented in LAR Attachment C, "Fire Area Transition."

Actions resulting from the feasibility evaluation are included in LAR Attachment S, Table S-3, Implementation Item 14, and include:

- Corrective action to add hard hat lights in control room and operation's kitchen.

- Add 60 minutes time to throttle turbine driven auxiliary feedwater valves to "Time Critical" program.

- Add 60 minutes time to trip NC (reactor coolant) Pumps (for FA-13(1 and 2)) to "Time Critical" program.

The NRC staff concludes that the actions above are acceptable because they will incorporate the provisions of NFPA 805 in the FPP and because they would be required by the proposed license condition.

Based on the above, 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 is acceptable based on conformance with the endorsed guidance contained in NEI 04-02, subject to completion of LAR Attachment S, Table S-3, Implementation Item 14.

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. The NRC staff concludes that the declared safe and stable condition proposed is acceptable and that the licensee's process is adequate to appropriately identify and locate the systems, equipment, and cables, required to provide reasonable assurance of achieving and maintaining the fuel in a safe and stable condition, as well as to meet the NFPA 805 NSPC.

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 was 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 concludes that the approach the licensee uses for assessing the potential for MSO combinations is acceptable because it was performed in accordance with the guidance contained in RG 1.205, NEI 04-02, and FAQ 07-0038.

The NRC staff concludes that, based on the information provided in the LAR, as supplemented, 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 an RI/PB FPP is consistent with the NRC endorsed guidance contained in NEI 04-02 and RG 1.205 regarding the identification of RAs. Subject to completion of Implementation Item 14 as described in LAR Attachment S, Table S-3, the NRC staff concludes that there is reasonable assurance that the regulatory requirements of 10 CFR 50.48(c) and NFPA 805 for NSCA methods are met.

3.3 Fire Modeling

NFPA 805 (Reference 3), allows both FM and FREs as PB alternatives to the deterministic approach outlined in the standard. These two PB approaches are described in NFPA 805, Sections 4.2.4.1 and 4.2.4.2, respectively. Although FM and FREs are presented as two different approaches for PB compliance, the FRE approach generally involves some degree of FM to support engineering analyses and fire scenario development. NFPA 805, Section 1.6.18, defines a fire model as a "mathematical prediction of fire growth, environmental conditions, and potential effects on structures, systems, or components 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 at MNS, 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 at MNS, to determine whether the FM used to support transition to NFPA 805 is acceptable.

In LAR Section 4.5.2, the licensee indicated that the FM approach (NFPA 805, Section 4.2, 1) was not used for the MNS 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 MNS 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, 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:

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

The NRC staff reviewed LAR Section 4.2.4, "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, "NEI 04-02 Table B-3 – Fire Area Transition," as well as the associated supplemental information, in order to determine whether the principles of defense-in-depth (DID) were maintained in regard to the planned transition to NFPA 805 at MNS.

The licensee developed a methodology for evaluating each of the three DID elements in NFPA 805, Section 1.2, referred to as echelons 1, 2, and 3, respectively. In its response to PRA RAI 05 (Reference 10), the licensee provided a table where, for each of the three echelons, several examples of fire protection features that addressed that echelon were identified, along with a discussion of the considerations used to assess those features. The qualitative assessment determined whether changes were needed to assure that each echelon had been satisfactory achieved or whether reliance on features in other echelons was needed and should be developed to maintain an adequate balance between the three echelons. Many of the identified fire protection features are required in order to demonstrate compliance with the fundamental FPP and design elements of NFPA 805, Chapter 3 (e.g., combustible control program, hot work control program, etc.). However, the capabilities for some of the fire protection features for DID were evaluated and improved as needed based on the results of the PB analyses conducted during the NFPA 805 transition (e.g., transient free areas, detection system, suppression system, ERFBS, use of fire rated cable, use of RAs, etc.).

As described in the LAR and in response to PRA RAI 05 (Reference 10), this method for addressing DID was implemented in the FREs performed on each PB fire area. The licensee stated that the FREs evaluated VFDRs using an integrated assessment of risk, DID, and safety margins. The licensee evaluated the VFDRs and fire area risk and scenario consequences to identify general DID imbalances. In the LAR, the licensee identified DID features to ensure an adequate balance between the DID echelons is maintained for the fire area. DID features identified in this evaluation included RAs and various plant systems such as suppression and detection systems.

Based on review of the LAR, the response to PRA RAI 05, and the FREs reviewed, the NRC staff concludes that the licensee systematically and comprehensively evaluated fire hazards, area configuration, detection and suppression features, and administrative controls in each fire area. The NRC staff concludes that the systematic evaluation ensures that an adequate balance between the DID echelons has been achieved 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 (Reference 7), 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 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 PB fire area. The results of the licensee's safety margin assessment by fire area are provided in the LAR Attachment C, Table B-3.

LAR Section 4.5.1.2 states that the FPRA applies methodologies consistent with the guidance in NUREG/CR-6850 (Reference 44), and, according to LAR Attachment H, NRC-approved frequently asked questions (FAQs). LAR Attachment J explains that FM, including verification and validation, performed in support of the FPRA utilized accepted codes and standards including NUREG/CR-6850, NUREG-1805 (Reference 47), NUREG-1824 (Reference 48), etc. In response to PRA RAI 05 (Reference 10), the licensee added that the methodology used to evaluate safety margins in the FREs included the following evaluations and determinations:

- Fire Modeling: FM performed to support the FPRA utilized codes and standards acceptable to the NRC, and the bases for these codes and standards were not altered in support of the FRE. The results of the FM used in support of the FRE (i.e., as part of the FPRA) were documented as part of the qualitative safety margin review performed consistent with guidance in NEI 04-02, Section 5.3.5.3.

- PRA Logic Model: The PRA logic model was reviewed in accordance with the ASME/ANS RA-Sa-2009 PRA standard (Reference 39) and RG 1.200, Revision 2 (Reference 38).

- Plant System Performance: The safety margin inherent in the analyses for the plant design basis events was preserved in the analysis for fire events. Performance parameters originally established to support nuclear performance criteria in the plant accident analyses were not modified in support of the FRE.

The NRC staff concludes that the safety margin criteria described in the LAR and in the licensee's response to PRA RAI 05 are consistent with the criteria as described in RG 1.174 (Reference 37), and in NEI 04-02, Section 5.3.5.3 and are, therefore, acceptable. The NRC staff also concludes that the licensee used appropriate codes and standards (or NRC guidance) and met the safety analyses acceptance criteria in the licensing basis (e.g., FSAR and supporting analyses). Based on the NRC staff's review of the LAR, the response to PRA RAI 05, and a review of the FREs, the NRC staff concludes that the licensee's approach provided sufficient margin to account for analysis and data uncertainty and adequately addressed the issue of safety margins in the implementation of the FREs.

3.4.2 Quality of the Fire Probabilistic Risk Assessment

The objective of the PRA quality review was to determine whether the plant-specific PRA used to evaluate the proposed LAR was 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, "Fire PRA Development and Assessment," LAR Section 4.7, "Program Documentation, Configuration Control, and Quality Assurance," LAR Attachment C, "NEI 04-02 Table B-3 – Fire Area Transition," LAR Attachment U, "Internal Events PRA Quality," LAR Attachment V, "Fire PRA Quality," and LAR Attachment W, "Fire PRA Insights," as well as the associated supplemental information.

The licensee developed its initial internal events PRA prior to 2002 when the consensus American Society of Mechanical Engineers (ASME) PRA standard ASME RA-S-2002, "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications" (Reference 85), was first issued. The licensee continued to maintain and improve the PRA as RG 1.200, and supporting industry standards have evolved. The licensee developed its FPRA model for both Level 1 (core damage) and partial Level 2 (large early release) PRA during at-power conditions. For the development of the FPRA, the licensee modified its internal events PRA (IEPRA) model to capture the effects of fire.

In LAR Section 4.8.2, the licensee stated that no significant plant changes (beyond those identified and scheduled to be implemented as part of the transition to a FPP based on NFPA 805) are outstanding with respect to their inclusion in the FPRA model.

3.4.2.1 Internal Events PRA (IE PRA) Model

The licensee evaluated the technical adequacy of those portions of its IEPRA model that were used to support development of the FPRA model using a full scope peer review by the Westinghouse Owner's Group (WOG) performed in October 2000 consistent with the NEI 00-02 (Reference 86), industry PRA peer review process. Subsequent gap assessments were performed in 2008 and 2013 to determine the scope of work required to ensure that the PRA met RG 1.200, Revision 1 (Reference 87) and RG 1.200, Revision 2 (Reference 38). In addition, focused-scope peer reviews were performed in December 2012 (LERF model) and in September 2011(internal flooding model). Both of these focused-scope peer reviews were performed against the supporting requirements in the ASME/ANS-Ra-S-2009 PRA standard and RG 1.200, Revision 2. The Revision 3 IEPRA model serves as the basis of the FPRA used in performing PRA evaluations for the LAR.

For each supporting requirement (SR), there are three 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 scope/level of detail, plant specificity, and realism. For many SRs the CCs are combined (e.g., the requirement for meeting CC-I may be combined with CC-II, or the requirement is the same across all CCs so that the SR is simply met or not met. For each SR, the PRA reviewer from the peer review team designates the highest CC met or indicates that the SR is met or not met.

LAR Attachment U, Table U-1 provided the licensee's resolutions to all Level A (important and necessary to address before the next regular PRA update) and Level B (important and necessary to address, but resolution may be deferred until the next PRA update) facts and observations (F&Os) from the 2000 WOG peer review that were not superseded by the subsequent internal flooding and LERF focused-scope peer reviews. In addition, LAR Attachment U, Table U-1 provided the results of the licensee's 2008 and 2013 self-assessments for SRs that 1) were assessed to not meet the equivalent of CC-II or CC-III in the 2000 WOG peer review, 2) were not assessed in the 2000 WOG peer review, or 3) were assessed to meet CC-II or met but had related findings. LAR Attachment U, Table U-2 provided the licensee's resolutions to the four F&Os characterized as findings and the licensee's assessment of the 13 SRs assessed as CC-I or not met by the focused-scope peer review of the LERF model. LAR Attachment U, Table U-3 provides this same information for the findings and CC-I and not met SRs from the focused-scope peer review of the internal flooding model. In general, an F&O/self-assessment issue 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/self-assessment issue by either providing a description of how the F&O/self-assessment issue was resolved or by providing an assessment of the impact of resolution of the F&O/self-assessment issue on the FPRA and the results for the NFPA 805 application. The NRC staff evaluated each F&O/self-assessment issue and the licensee's resolution in LAR Attachment U to determine whether the F&O/self-assessment issue had any significant impact for the application. The NRC staff requested additional information to assess the adequacy of some of the F&O/self-assessment issue resolutions for the review. The NRC staff's review and conclusion for the licensee's resolution of each F&O/self-assessment issue is summarized in SE Attachment D.

In PRA RAI 02.f (Reference 24) concerning the resolution to the self-assessment for SR IE-C14, the NRC staff found that the licensee resolved the F&O as having a small and non-significant impact, and requested that the licensee define what is meant by small and non-significant impact. In its response to the RAI (Reference 12), the licensee explained that following the issuance of the F&O, the MNS emergency operating procedures were revised to resolve the F&O. The procedures now direct the operators, in interfacing system loss of coolant accident (ISLOCA) scenarios, to reduce the differential pressure across the two motor-operated valves (MOVs) that were originally credited in the PRA to close under differential pressure conditions that are beyond the demonstrated ability of the MOVs to close. In its response to PRA RAI 03.b.01 (Reference 17), the licensee stated that it updated the PRA model to credit this additional operator action and included this change in the integrated analysis reported in its response to PRA RAI 03.a.01 (Reference 17) and in the revised LAR Attachment W (Reference 20). The NRC staff concludes that the licensee's response to the

RAI is acceptable because the licensee updated the PRA model to include the operator action required to ensure operation of the two credited MOVs and the licensee incorporated this change in the integrated analysis and updated risk results.

In PRA RAI 02.i (Reference 24), concerning the resolution to F&O QU-2, the NRC staff requested that the licensee clarify if the unavailability of the nuclear service water (RN) pump for each unit is accounted for in the modeling of the cross-tie to the opposite unit. In its response to the RAI (Reference 12), the licensee stated that accounting for the unavailability of the opposite unit RN pump results in a small increase in fire risk. The licensee further stated in its response to PRA RAI 03.b.01 (Reference 17) that it updated the PRA model to account for the unavailability of the opposite unit RN pump and that this change is included in the integrated analysis reported in its response to PRA RAI 03.a.01 (Reference 17), and updated LAR Attachment W (Reference 20). The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee updated the PRA model to account for the unavailability of the opposite unit RN pump and the licensee incorporated this change in the integrated analysis and updated risk results.

Based on information provided by the licensee and the above evaluations, the NRC staff concludes that the MNS IEPRA is adequate and can be used to support the FPRA. To reach this conclusion, the NRC staff reviewed all F&Os provided by the peer reviewers, and self-assessment issues, and determined that the resolution of every F&O/self-assessment issue supports the determination that the quantitative results are adequate or have no significant impact on the FPRA. Therefore, the NRC staff concludes that the licensee has demonstrated that the IEPRA meets the guidance in RG 1.200, Revision 2; was reviewed against the applicable SRs in ASME/ANS-RA-Sa-2009, and is technically adequate to support the FREs and other risk calculations required for the NFPA 805 application.

3.4.2.2 Fire PRA Model

The licensee evaluated the technical adequacy of the MNS FPRA model for this application by conducting a full-scope peer review of the model using the NEI 07-12 process (Reference 88), and the combined PRA standard, ASME/ANS RA-Sa-2009 (Reference 39), as clarified by RG 1.200, Revision 2 (Reference 38). The full scope peer review of the FPRA was performed in September 2009.

LAR Attachment V, Table V-1 provides the licensee's resolutions to all 21 finding-level F&Os from the 2009 peer review. This table also provides the licensee's resolution to one additional issue identified by the peer review that was not classified as an F&O by the peer review. LAR Attachment V, Table V-2 identifies all 12 SRs that were determined by the peer review to be met only at CC-I and provides an evaluation of those SRs.

Per LAR Attachment V, no changes have been made to the FPRA since the peer reviews that would constitute an upgrade as defined in ASME/ANS RA-Sa-2009.

The NRC staff reviewed the licensee's resolutions to all of the F&Os to determine the technical adequacy of the FPRA for the NFPA 805 application. The NRC staff requested additional information to assess the adequacy of some of the resolutions for the review. The NRC staff's review and conclusion for the licensee's resolution of each of the F&Os is summarized in the

NRC's Record of Review in SE Attachment D. A summary of major issues identified during the NRC staff's review of the F&Os and methods used in the FPRA is provided below along with the associated resolution.

In PRA RAI 01.b (Reference 24), concerning the resolution to F&O FSS-C5-02, the NRC staff requested that the licensee identify the functions associated with non-armored cable used at MNS and to provide the basis for concluding that fire damage to these cables would not impact the FPRA results. In its response to the RAI (Reference 12), the licensee reviewed the cables that were credited in the FPRA and determined that there were some non-armored cables involving credited control power. In its response to PRA RAI 03.b.01 (Reference 17), the licensee stated that it updated the FPRA to use appropriate circuit failure probabilities from NUREG/CR-7150 (Reference 89), for these non-armored cables in the integrated analysis reported in its response to PRA RAI 03.a.01 (Reference 17), and updated LAR Attachment W (Reference 20). The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee updated the PRA model to utilize NRC accepted methods and incorporated this change in the integrated analysis and updated risk results.

In PRA RAI 01.c (Reference 24), concerning the resolution to F&O HRA-E1-01, the NRC staff requested that the licensee provide justification for the use of the multiplier methodology for developing human error probabilities (HEPs) and joint HEPs (JHEPs), or revise the human reliability analysis (HRA) to utilize HEP/JHEP values developed using NRC accepted methods such as NUREG-1921 (Reference 51). In its response to the RAI (Reference 12), the licensee updated the HEPs/JHEPs utilizing the screening or detailed HRA methodologies found in NUREG-1921 as necessary. If the HEPs/JHEPs were determined to be conservative relative to the NUREG-1921 guidance, the licensee stated that these conservative HEPs/JHEPs would also yield a conservative Δ risk result. The licensee justified the use of JHEPs less than 1E-05 based on several factors from NUREG-1792 (Reference 90), including large time windows between actions, the actions having different cues, the lack of intervening successes between actions, and the presence of intervening successes between actions. In its response to PRA RAI 03.b.01 (Reference 17), the licensee stated that the updated HEPs/JHEPs were incorporated in the FPRA model and in the integrated analysis reported in its response to PRA RAI 03.b.01 (Reference 17), and updated LAR Attachment W (Reference 20). The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee revised the HRA as necessary, to utilize NRC accepted methods and incorporated the changes in the integrated analysis and updated risk results, or the licensee determined that the HRA yielded conservative risk results. In addition, the licensee's application of certain JHEPs less than 1E-05 is acceptable to the NRC because the licensee used the guidance in NUREG-1792 to demonstrate independence of the operator actions associated with these JHEPs.

In PRA RAI 06 (Reference 24), the NRC staff requested that the licensee explain how state-of-knowledge correlations (SOKCs) were taken into account in the FPRA quantification since the FPRA results reported in the LAR appeared to be point estimates instead of mean values and, therefore, did not include parametric uncertainty. In its response to the RAI (Reference 12), the licensee indicated that it performed a parametric uncertainty analysis to account for SOKCs for circuit failure likelihood, hot short duration, severity factors, and non-suppression probabilities.

The results of this uncertainty analysis were provided in the integrated analysis reported in the licensee's response to PRA RAI 03.a.01 (Reference 17). The exception was that the mean ΔLERF for Unit 2 was reported to be 19 percent higher than the point estimate. The licensee clarified that propagation of uncertainty, including SOKCs, will be evaluated post-transition by comparing the mean CDF and LERF results to the point estimate CDF and LERF results as the FPRA is revised and included this action in LAR Attachment S, Table S-3, Implementation Item 12. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee accounted for the SOKCs in the FPRA, evaluated them in the integrated analysis, and the mean results were determined to meet the RG 1.174 risk guidelines for small changes, and the licensee included an action to evaluate them after transition to NFPA 805, which would be required by the proposed license condition. In its letter dated November 21, 2016 (Reference 23), the licensee submitted a revised LAR Attachment S that indicated implementation item 12 has been completed.

LAR Attachment G describes three categories of operator manual actions (OMAs): (1) recovery actions (RAs) to reduce risk, (2) RAs required for DID, and (3) actions associated with VFDRs but that were screened out due to no or very low risk and are not considered RAs. In PRA RAI 07 (Reference 24), the NRC staff requested that the licensee justify the treatment in the FPRA model of this third category of OMAs. In its response to the RAI (Reference 10) and (Reference 12), the licensee clarified that it did not model these OMAs in the FPRA, but they were evaluated for potential adverse risk impact. An example of an "adverse risk" would be a preemptive operator action that would remove potentially non-fire affected equipment from service that would otherwise be available during a fire scenario. The licensee further stated that none of the OMAs in this category were determined to present an adverse risk. The NRC staff concludes that the licensee's treatment of this third category of OMAs is acceptable because they were screened out due to very low risk impact and determined to not present an adverse risk, therefore, their exclusion from the FPRA does not represent a significant non-conservative assumption.

In PRA RAI 10 (Reference 24) the NRC staff requested that the licensee provide an assessment of their method for assigning conditional probabilities of spurious operations for control circuits relative to the guidance in NUREG/CR-7150, Volume 2. In its response to the RAI (Reference 12), the licensee stated 1) the applicable conditional hot short probabilities applied in the Fire PRA model were either updated to those in NUREG/CR-7150 or the Fire PRA model probabilities were confirmed to bound those in NUREG/CR-7150, 2) the probabilities of spurious operation duration applied in the Fire PRA model were updated to those in NUREG/CR-7150, and 3) it updated the FPRA to apply the uncertainty values for circuit failure probabilities and spurious operation duration from NUREG/CR-7150. In its response to PRA RAI 03.b.01 (Reference 17), the licensee stated that it incorporated the updated values for hot short probabilities and spurious operation duration in the integrated analysis reported in its response to PRA RAI 03.a.01 (Reference 17), and updated LAR Attachment W (Reference 20). The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee used NRC accepted methods in the development of control circuit hot short probabilities, spurious operation duration, and associated uncertainty values, and incorporated this change in the integrated analysis and updated risk results.

In PRA RAIs 12 and 12.01 (Reference 24) and (Reference 27), the NRC staff requested that the licensee explain how it modeled the two main control room (MCR) abandonment on loss

of habitability scenarios (one for MCB fires and one for non-MCB fires), including how the analysis of these scenarios accounted for the range of potential fire-induced failures and associated probabilities for successfully shutting down the plant using the alternate shutdown procedure. In its response to the RAIs (Reference 11), (Reference 14), (Reference 16), and (Reference 17), the licensee explained that the transfer of control to the SSF according to plant procedures is the only success path available and the only success path credited in the PRA upon MCR abandonment. All other functions are modeled as failed by the fire or unavailable because of transfer to the SSF. The licensee further explained that it applied the entire fire ignition frequency for all MCB and non-MCB ignition sources in the MCR (fire area 24) to the respective abandonment scenarios. The licensee clarified that the two abandonment scenarios were chosen to maximize the CDF and LERF estimates in the post-transition PRA model by assuming the worst case fire-induced failures and spurious operations that can occur prior to transfer of control to the SSF. The worst case post-transition PRA model yields a conservative change-in-risk estimate because compliant case CDF and LERF values were developed by removing VFDRs from the post-transition model. The NRC staff finds the modeling of the two scenarios acceptable because 1) they model the as-operated plant and 2) maximize the risk increase associated with the retained VFDRs by beginning with the maximum risk scenarios in the post-transition plant.

In PRA RAIs 13, 13.01, and 13.02 (Reference 24) and (Reference 27), the NRC staff requested that the licensee clarify if MCR abandonment on loss-of-control is credited in the FPRA and, if so, to describe and justify this modeling. In its response to these RAIs (Reference 13), (Reference 16), and (Reference 17), the licensee stated that a number of fire areas are designated Appendix R, III.G.3 areas and that fires in these areas will not affect the habitability of the MCR. The SSF is the assured NSCA success path for these areas and plant procedures exist and are trained upon to decide when to electronically isolate the SSF and then shutdown the plant using the equipment at the SSF. VFDRs are only assessed against the assured NSCA success path (i.e., the SSF). The licensee clarified that the damage caused by fires in the Appendix R, III.G.3 areas is assessed for each ignition location and, if an alternative successful shutdown path exists such that transfer to the SSF is unnecessary, the PRA models shutting down from the MCR. The licensee further clarified that for fires that damage all success paths within the fire area (e.g., full area burnout), the PRA models the implementation of the plant procedures that electronically isolate the SSF and shutdown the plant from the SSF. Therefore, the licensee stated that the FPRA does credit transfer of control to the SSF for certain loss-of-control scenarios, which are then modeled similar to non-abandonment scenarios although the licensee added that the MCR would never be "abandoned" in these scenarios (i.e., the MCR remains habitable).

In its responses to PRA RAIs 12 and 13 (Reference 11) and (Reference 13), the licensee explained that the HRA for the loss-of-control scenarios is based on the loss of function scenario having the most limiting timing available (i.e., loss of RCP seal cooling) accounting for both cognition and recovery, including transferring to the SSF. In these same RAI responses, the licensee stated that failure to successfully transfer control to the SSF is included in the model.

The NRC staff finds the licensee's modeling of transfer of control to the SSF due to loss-of-control in the MCR acceptable because:

1) The modeling reflects the as-built, as-operated plant in plant procedures and associated operator training, including abandonment of the MCR due to loss-of-control if needed, and how the operators make the decision to transfer to the SSF;

2) The HRA for the loss-of-control scenarios modeled in the FPRA are based on cues for the loss-of-control scenario having the most limiting timing for cognition and recovery; and

3) Loss-of-control is specifically modeled in the PRA fault trees, including both random failures, fire-induced equipment failures, and operator failures (e.g., failure to transfer control to the SSF).

In PRA RAI 16 (Reference 24), the NRC staff requested that the licensee describe the treatment of sensitive electronics, and provide justification for this treatment if different than the guidance in FAQ 13-0004 (Reference 68). FAQ 13-0004 provides guidance for various sensitive electronics configurations, on the application of the NUREG/CR-6850 criteria that sensitive electronics should be failed if the temperature of the electronics exceeds 65 °C (centigrade) or the electronics are exposed to a heat flux greater than 3 kW/m^2. In its response to the RAI (Reference 12), the licensee changed the evaluation applied to one physical configuration to be consistent with the FAQ and justified a simplified evaluation applied to a second physical configuration.

- Sensitive electronic components mounted on the outside surface of the cabinet or which are mounted inside the cabinet and penetrate the cabinet surface. The licensee explained that it updated the FPRA model to include additional fire scenarios assuming failure of these sensitive electronics that are in the direct line of sight of the ignition source using the NUREG/CR-6850 radiant heat flux damage criteria for sensitive electronics of 3 kW/m2.

- Sensitive electronic components located inside cabinets having louvers. The licensee explained that if the highest temperature in the hot gas layer (HGL) developed during a fire reaches 80 °C before the fire is extinguished all sensitive electronics within the HGL are assumed failed. Although 80 °C is greater than the 65 °C sensitive electronic damage criteria, the 80 °C is the highest temperature of the upper gas layer (i.e., near the ceiling) and not at the location of the sensitive electronics, which are generally located in cabinets well below the upper layer and, therefore, below the highest HGL temperature. The licensee further explained that even if the cabinet is immersed in relatively high temperatures within the HGL, the thermal protection provided by the cabinet, even considering the louvers, provides additional time before the interior of the cabinet reaches the sensitive electronics damage temperature.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee updated the FPRA model using the radiant heat flux damage criteria contained in NUREG/CR-6850, and because the assumption that the 80 °C HGL temperature will be reached before the sensitive electronics reaches 65 °C, which is consistent with heat transfer characteristics and with the physical configurations described.

In its response to PRA RAI 03.b.01 (Reference 17), the licensee confirmed that it included the updated analysis of sensitive electronics in the integrated analysis reported in its response to PRA RAI 03.a.01 (Reference 17), and updated LAR Attachment W (Reference 20). The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's evaluations are consistent with FAQ 13-0004.

In PRA RAI 17 (Reference 24), the NRC staff requested that the licensee provide justification for the use of reduced heat release rates (HRRs) for transient fires, and to identify the fire areas where it credited the reduced HRRs. In its response to the RAI (Reference 11), and (Reference 14), the licensee stated that the only transient HRRs used to develop zones of influence were 317 kW and 142 kW, and identified 18 fire areas where it originally credited the reduced HRR of 142 kW in the FPRA. Regarding these 18 fire areas, the licensee reviewed the location-specific attributes of each in accordance with the guidance in the NRC letter to NEI dated June 21, 2012 (Reference 91). The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee re-analyzed the compartments using the larger HRR, justified the use of the lower HRR, or implemented additional administrative controls as applicable, which is in accordance with the guidance provided in the June 21, 2012 letter.

For fire areas 1, 4, 13 (Room 648), 14, 21, and 25 the licensee revised the FPRA to use an HRR of 317 kW for modeling transient fires. In its response to PRA RAI 03.b.01 (Reference 17), the licensee confirmed that it used this revised PRA in the integrated analysis reported in in its response to PRA RAI 03.a.01 (Reference 17), and updated LAR Attachment W (Reference 20). The NRC staff concludes that this is acceptable because the licensee used the revised HRR in its integrated analysis included in its response to PRA RAI 03.a.01.

For the remaining fire areas (fire areas 2, 2A, 3, 3A, 13 [Room 701], 17A, 18A, 19, 20, 9-11, 10-12, 15-17, and 16-18), the licensee explained that either 1) additional administrative controls will be applied on the amount, type, duration, and monitoring of transient combustible materials brought into the area, or 2) additional administrative controls are not needed based on location-specific attributes that limit the amount of combustible materials brought into the area. The licensee described the additional administrative controls as a "tiered approach" in which separation distances and fire load limits are imposed on combustible materials, and implementation of compensatory measures when combustible materials are not maintained at defined distances from one another or from plant equipment that is susceptible to fire damage. The location-specific attributes are the limited combustible materials needed for maintenance activities associated with the type of equipment in the area or simply size and geometry constraints of the area.

The licensee performed a review of past violations of the combustible control procedure in the above identified fire areas, concluding that most of the identified violations were either administrative (e.g., missing documentation) or occurred during an outage. The licensee concluded that violations of the combustible control procedure are expected to decline with the implementation of a transient combustible improvement action plan to increase the awareness of plant operators concerning transient combustibles. The licensee did not identify any violations of the combustible control procedure for those areas identified above where location-specific attributes limit the amount of combustibles.

The NRC staff concludes that the licensee's evaluation of additional administrative controls, location-specific attributes, and review of plant records related to violations of the MNS combustible control procedure is consistent with the guidance in the NRC letter to NEI dated June 21, 2012, justifying a reduced HRR and is, therefore, acceptable.

In PRA RAI 18 (Reference 24), the NRC staff requested that the licensee describe the configuration of the main control board (MCB) and provide justification for its treatment in the FPRA relative to the guidance in FAQ 14-0008 (Reference 70). In its response to the RAI (Reference 10), the licensee explained that the MNS MCB configuration is consistent with the conditions in FAQ 14-0008 for treating the rear side of the MCB as an integral part of the MCB. The licensee also explained that the MCB treatment is consistent with the FAQ 14-0008 methodology with the exception that it does not fully address the front-to-back considerations for application of the NUREG/CR-6850 Appendix L methodology. The licensee updated the FPRA model to address the front-to-back considerations in accordance with FAQ 14-0008. In its response to PRA RAI 03.b.01 (Reference 17), the licensee confirmed that it included these updates in the integrated analysis reported in its response to PRA RAI 03.b.01 (Reference 17), and updated LAR Attachment W (Reference 20). The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee updated the PRA model to treat the MCB in accordance with FAQ 14-0008 and incorporated this change into the integrated analysis and updated risk results.

In PRA RAI 19 (Reference 24), the NRC staff requested that the licensee justify:

A) The assumption that fires within some Bin 15 cabinets above 440V would not propagate outside the cabinet.
B) The apparent application of a 0.20 severity factor used to limit the damage assumed for fires in some well-sealed cabinets.
C) Inclusion of well-sealed cabinets less than 440V in the Bin 15 count.

In its response to the RAI (Reference 12), the licensee indicated that it revised the FPRA to propagate fires outside of all motor control centers (MCCs) containing circuits having greater than 440V in accordance with FAQ 14-0009 (Reference 71). Consistent with the guidance in NUREG/CR-6850 that indicates fires caused by (non-HEAF) arcing faults in well-sealed cabinets that house circuit voltages of 440V or greater could compromise panel integrity (therefore, allowing a fire to propagate), the licensee stated that, "[l]oad center and switchgear fires are modeled as propagating outside of the electrical cabinet, even if the cabinet has no observed openings." The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee updated the PRA model to treat the electrical cabinet fires in accordance with FAQ 14-0009 and NUREG/CR-6850 and incorporated this change into the integrated analysis and updated risk results.

Regarding the application of a 0.2 severity factor to MCC fire scenarios, the licensee stated in its responses to PRA RAIs 19 and 19.b.01 (Reference 12) and (Reference 16) that it updated the FPRA to remove the severity factor and to apply internal hot short spurious operation probabilities using the guidance in NUREG/CR-7150.

Regarding the counting of well-sealed, robustly-secured electrical cabinets having circuits less than 440V, the licensee stated in its response to PRA RAI 03.b.01 (Reference 17) that it updated the FPRA to remove cabinets meeting this definition.

The licensee included the updated analysis of electrical cabinets in the integrated analysis reported in its response to PRA RAI 03.a.01 (Reference 17), and updated LAR Attachment W (Reference 20). The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee updated the PRA model to utilize NRC accepted guidance and incorporated the model changes in the integrated analysis and updated risk results.

In PRA RAI 20 (Reference 24), the NRC staff requested that the licensee justify the multi-compartment analysis (MCA) wherein a severity factor of 0.2 was applied to all MCA scenarios and the barrier failure probability did not account for multiple barrier types. In its response to the RAI (Reference 12), the licensee updated the MCA to utilize compartment-specific fire ignition frequencies in the HGL analysis, rather than applying a generic factor, and to utilize a fire barrier failure probability equal to the sum of the barrier failure probabilities for each type of barrier present. The licensee also stated that all MCA scenarios were screened and so the change did not impact the risk results reported in the LAR. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee updated the PRA model to utilize NRC accepted guidance.

In PRA RAI 21 (Reference 24), the NRC staff indicated that the list of generic MSOs evaluated for consideration in the FPRA is not consistent with the generic list in NEI 00-01, Rev. 2 (Reference 36), and requested that the licensee provide an assessment of those MSOs in NEI 00-01 that were not considered in the LAR. In its response to the RAI (Reference 10), the licensee explained that it reviewed the generic MSO list in NEI 00-01, Rev. 2, and evaluated each MSO not previously considered for applicability to MNS. The licensee also stated that this evaluation did not result in any new MSOs being modeled in the FPRA. However, the licensee stated in its response to PRA RAI 03.b.01 (Reference 17) that another MSO expert panel will be held following transition to NFPA 805 to confirm the impacts of the new generic MSOs in NEI 00-01, Rev. 2 and included that action in LAR Attachment S, Table S-3, Implementation Item 19. 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 response to the RAI is acceptable because the licensee evaluated the generic MSO list in NEI 00-01, Rev. 2 in accordance with the RG 1.205, Section 3.3, and FAQ 07-0038 (Reference 59).

In PRA RAI 22 (Reference 24), the NRC staff requested justification for not modeling junction boxes in the FPRA in accordance with the guidance in FAQ 13-0006 (Reference 69). In its response to the RAI (Reference 12), the licensee stated that the extensive use of armored cables minimized the need to splice cables and there are no enclosures at MNS that meet the definition of a junction box as defined in FAQ 13-0006. However, in its RAI response, the licensee evaluated spliced cables and splice boxes as potential junction boxes and determined that these would have an insignificant impact on fire risk. The licensee also evaluated small terminal boxes as potential junction boxes and concluded that these also are not expected to have a significant impact on fire risk. The NRC staff concludes the licensee's response to the RAI is acceptable because the licensee evaluated enclosures that might be

considered junction boxes and determined to be an insignificant contributor to fire risk at MNS.

In PRA RAI 23 (Reference 24), the NRC staff requested justification for apportioning the fire ignition frequency for cable fires caused by welding and cutting (CFWC) based on the number of raceways in each compartment rather than cable loading per NUREG/CR-6850. In its response to the RAI (Reference 14), the licensee explained that the number of raceways is a reasonable surrogate for apportioning CFWC fire frequency because fire compartments with the highest number of cable trays are also likely to have the highest quantity of cables or cable loading. The licensee further stated that fire compartments with the highest number of cable trays are also likely to have the highest number of cables (and the highest combustible loading due to cable mass). The NRC staff finds the licensee's response to the RAI acceptable because the licensee apportioned CFCW frequency by number of raceways, which is a reasonable alternative to cable loading because both criteria are based on physical characteristics related to the relative distribution of cables.

In PRA RAI 09 (Reference 24), the NRC staff requested that the licensee identify and justify any FPRA methods that deviate from the guidance in NUREG/CR-6850 or other guidance acceptable to the NRC. In its response to the RAI (Reference 12), the licensee stated that the MNS FPRA does not employ any deviations from the NRC-accepted guidance. The NRC staff, therefore, considers this issue resolved.

As a result of its review of the LAR, as supplemented, the NRC staff concludes that the MNS FPRA is technically adequate and its quantitative results, considered together with the sensitivity studies, can be used to demonstrate that the change in risk due to the transition to NFPA 805 meets the acceptance guidelines in RG 1.174 and is, therefore, acceptable. Accordingly, the NRC staff concludes that the licensee demonstrated that the FPRA meets the guidance in RG 1.200, Revision 2, and that, after the changes described in LAR Attachment S, Table S-3 are complete, the FPRA will be acceptable to support the FREs and other risk calculations required for the post-transition PCE process.

3.4.2.3 Fire Modeling in Support of the Development of Fire Risk Evaluations

The NRC staff performed detailed reviews of the FM used to support the FREs to gain further assurance that the methods and approaches used for the application to transition to NFPA 805 (Reference 3), were technically adequate. NFPA 805 has the following requirements that pertain to FM used in support of the development of the FREs:

NFPA 805, Section 2.4.3.3: "On Acceptability"

> The PSA approach, methods, and data shall be acceptable to the AHJ.

NFPA 805, Section 2.7.3.2, "Verification and Validation":

> 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":

> 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":

> 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":

> 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 review of the acceptability of the FM (first requirement). The results of the NRC staff 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 FRE

The licensee determined the zone of influence (ZOI) around fixed and transient ignition sources based on tables in the Generic Fire Modeling Treatments (GFMTs) approach. The tables in the GFMTs approach provide the horizontal and vertical dimensions of the ZOI for various ignition sources (transient fuel packages, small liquid fuel fires, open cabinets and cable trays) and different types of targets (i.e., thermoplastic and thermoset cables as defined in NUREG/CR-6850, Volume 2 (Reference 45); and Class A combustibles). The GFMTs approach also includes a set of tables that are used to determine if and when the hot gas layer (HGL) temperature exceeds the damage threshold of specified targets depending on fire size, room volume, and ventilation conditions. The GFMTs approach was used as a basis for the scoping or screening evaluation in support of the MNS FPRA.

The ZOI tables in the GFMTs approach were obtained by using a collection of algebraic models and empirical correlations. The following algebraic fire models and empirical correlations/equations were used for this purpose.

- Heskestad Flame Height Correlation (Reference 47), Chapter 3
- Heskestad Plume Temperature Correlation (Reference 47), Chapter 9
- Modak Point Source Radiation Model (Reference 47), Chapter 5

The Heskestad Plume Temperature Correlation (Reference 44) is not listed in LAR Attachment J; however, LAR Attachment J, Table J-2, lists the plume centerline temperature

correlation developed by Yokoi (Reference 92), which is similar to the Heskestad plume temperature correlation.

These algebraic models are described in NUREG-1805, "Fire Dynamics Tools (FDT^s): Quantitative Fire Hazard Analysis Methods for the US Nuclear Regulatory Commission Fire Protection Inspection Program" (Reference 47). Validation and Verification (V&V) of these algebraic models is documented in NUREG-1824, "Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications," Volume 3 (Reference 48). The V&V of the fire models that were used to support the MNS Fire PRA is discussed in SE Section 3.8.3.2.

The following empirical correlation/models that are not addressed in NUREG-1824 were used in the development of the sections of the GFMTs document that were applied at MNS.

- Mudan and Croce flame radiation model (Reference 92)
- Plume heat flux correlation by Wakamatsu et al. (Reference 93)
- Yokoi plume centerline temperature correlation (Reference 94) and (Reference 95)
- Hydrocarbon spill fire size correlation (Reference 96)
- Flame extension correlation (Reference 97)
- Delichatsios line source flame height model (Reference 98)
- Corner flame height correlation (Reference 97)
- Kawagoe natural vent flow equation (Reference 99)
- Yuan and Cox line fire flame height and plume temperature correlations (Reference 100)
- Lee cable fire model (Reference 101)
- Babrauskas method to determine ventilation-limited fire size (Reference 102)

The licensee's ZOI approach was used as a screening tool to distinguish between fire scenarios that required further evaluation and those that did not require further evaluation. Qualified personnel performed a plant walk-down to identify ignition sources and surrounding targets or SSCs in compartments and assess whether these targets and SSCs were within the ZOI of the ignition source. Based on the fire hazards present, these generalized ZOIs were used to screen from further consideration those MNS-specific ignition sources that did not adversely affect the operation of credited SSCs, or targets, following a fire. The licensee's screening was based on the 98th percentile fire HRR from the NUREG/CR-6850 methodology.

The Consolidated Model of Fire and Smoke Transport (CFAST) zone fire model, Version 6.1.1, was used to generate the HGL tables in the GFMTs approach. The FPRA used these calculations 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. CFAST was also used for the Main Control Room (MCR) abandonment time calculations. The V&V of CFAST is documented in NUREG-1824, Volume 5 (Reference 48).

The V&V of all empirical correlations and fire models that were used to support the MNS FPRA is discussed in detail in SE Section 3.8.3.2.

3.4.2.3.2 RAIs Pertaining to Fire Modeling in Support of the MNS Fire PRA

By letters dated August 28, 2014 (Reference 24), and May 8, 2015 (Reference 26), NRC staff requested additional information concerning the FM conducted to support the FPRA. By letters dated October 13, 2014 (Reference 10), November 12, 2014 (Reference 11), December 12, 2014 (Reference 12), January 26, 2015 (Reference 13), February 27, 2015 (Reference 14), and August 20, 2015 (Reference 17), the licensee responded to these RAIs.

- In FM RAI 01.a (Reference 24), the NRC staff requested that the licensee provide technical justification for ignoring the separation between the MCR area and the interstitial space above provided by the acoustical tile ceiling in the CFAST MCR abandonment calculations.

  In its response to FM RAI 01.a (Reference 12), licensee explained that it performed a sensitivity analysis as part of the updated MCR abandonment calculations to evaluate the effect of the false ceilings in the adjacent equipment areas on both the calculated abandonment times and the total probability of control room abandonment. The licensee further stated that the sensitivity analysis compared abandonment times between a two-room baseline and a four-room sensitivity configuration, and that the latter introduces a maximum non-conservative bias in the probability of control room abandonment of 4.86%.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee updated the MCR abandonment calculations to address the effect of the false ceilings in the adjacent equipment areas on both the calculated abandonment times and the total probability of control room abandonment, and demonstrated that the probability of control room abandonment for the baseline configuration is conservatively biased.

- In FM RAI 01.b (Reference 24), the NRC staff requested that the licensee provide a technical justification for the assumption that the fire brigade will arrive 15 minutes after a fire event based on historic drill records or demonstrate that this assumption is conservative.

  In its response to FM RAI 01.b (Reference 10), the licensee explained that the FPRA incorporates the most adverse results from the MCR abandonment time analysis regardless of if and when doors are opened. The licensee further stated

that the average drill time from initial fire alarm to fire brigade arrival at the scene for all plant locations is approximately 18 minutes, but that the fire brigade dress-out area is very close to the MCR, and provided several reasons why drill response times are expected to be greater than the response times during actual fire events.

The NRC staff concludes that the licensee's response to the RAI is acceptable because historical response time data from fire drills indicate that the 15 minute assumption is conservative given the short distance between the fire brigade dress-out area and the MCR.

- In FM RAI 01.c (Reference 24), the NRC staff requested that the licensee provide technical justification for the assumption in the MCR abandonment time calculations that fire spreads to adjacent cabinets in 15 minutes, instead of 10 minutes as recommended in Appendix S of NUREG/CR-6850, for the case when cables in an adjacent electrical cabinet are in direct contact with the separating wall.

  In its response to FM RAI 01.c (Reference 12), the licensee explained that the MCR abandonment times for propagating panel fires were re-calculated assuming fire spread to adjacent panels in 10 minutes.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee revised the assumption to be consistent with NRC-endorsed guidance.

- In FM RAI 01.d (Reference 24), the NRC staff requested that the licensee describe and provide technical justification for any deviations taken from the guidance in FAQ 08-0052 (Reference 64), in the MCR abandonment calculations, including to transient fire growth rates.

  In its response to FM RAI 01.d (Reference 12), the licensee stated that the MCR abandonment calculations for transient fire scenarios were revised based on the assumption that the peak HRR is reached in 8 minutes and that the fuel properties are representative of poorly ventilated burning conditions. The licensee further stated that a sensitivity analysis in the updated MCR abandonment calculations shows that this assumption results in a higher probability of control room abandonment than the assumption of a growth time of two minutes to peak HRR and fuel properties that correspond to well-ventilated conditions for all scenarios except the severe transient fire scenario.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee revised the assumed transient fire growth rate and fuel properties so that they are consistent with the guidance in the FAQ and maximize the calculated probability of control room abandonment.

- In FM RAI 01.e (Reference 24), the NRC staff requested that the licensee explain how the fuel heat of combustion and soot yield values used in the CFAST MCR

abandonment calculations were derived, and confirm that these values result in conservative estimates of the soot generation rate.

In its response to FM RAI 01.e (Reference 12), the licensee stated that the fuel properties values were obtained from the SFPE Handbook of Fire Protection Engineering and were selected to maximize the production of soot. The licensee further stated that it assumed a poorly ventilated burning regime because a sensitivity analysis showed that this results in the shortest control room abandonment times.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee assumed property values that are representative of the fuels involved in the postulated MCR fire scenarios and that result in conservative abandonment time estimates.

- In FM RAI 01.f (Reference 24), the NRC staff requested that the licensee explain if and when the door between the main control board (MCB) and the MCR area was assumed to be opened in any of the scenarios that were modeled in the MCR abandonment calculations.

  In its response to FM RAI 01.f (Reference 12), the licensee stated that both doors between the MCBs and the MCR area were assumed to be opened when an MCR area boundary door is opened.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the probability of control room abandonment used in the FPRA is based on the bounding assumption regarding the door status.

- In FM RAI 01.g (Reference 24), the NRC staff requested that the licensee explain why, based on the MCR abandonment time sensitivity analysis, variations in the initial ambient temperature do not appear to affect the abandonment times for the MCB fire scenarios.

  In its response to FM RAI 01.g (Reference 12), the licensee stated that the updated MCR abandonment calculations show that the control room abandonment time is only sensitive to the initial ambient temperature for scenarios in which the HGL temperature is the criterion for abandonment. The licensee further explained that, for the scenario showing the greatest sensitivity to the initial ambient temperature, the minimum initial temperature that results in shorter abandonment times exceeds the maximum normal MCR operating temperature of 24 °C (75 °F).

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the abandonment time is only adversely affected by an increased initial ambient temperature if that temperature exceeds the maximum normal MCR operating temperature.

- In FM RAI 01.h (Reference 24), the NRC requested that the licensee explain how the GFMTs modification to the critical heat flux for targets immersed in a thermal plume was used in the ZOI and HGL timing determinations.

  In its response to FM RAI 01.h (Reference 10), the licensee explained that it implemented the modified critical heat flux using either a two- or three-point treatment in the FPRA. The licensee further stated that it used the two-point treatment in most areas of the plant and that in this approach, the ZOI tables in the GFMTs approach are applied without any adjustments for HGL temperatures of 80 °C or less. The licensee further stated that full room burnout is assumed when the HGL temperature is higher than 80 °C, and that the three-point method was used in the remaining areas. The licensee further stated that in the three-point method the ZOI tables for thermoplastic cable targets are used to determine the ZOI for thermoset targets when the HGL temperature is between 80 °C and 220 °C and that full room burnout is assumed when the HGL temperature exceeds 220 °C.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's approach conservatively accounts for the effect of an elevated surrounding gas temperature on the damage of targets exposed to radiant heat.

- In FM RAI 01.j (Reference 24), the NRC staff requested that the licensee re-evaluate the effect of horizontal flame spread and vertical fire propagation in cable trays and the resulting increased HRR on the ZOI and HGL temperature timing determination for fires that involve cables, and provide a summary of the impact of the re-evaluation on the risk and Δ risk.

  In its response to FM RAI 01.j (Reference 13), the licensee stated that it extended the vertical ZOI to the ceiling to account for fire propagation, and that the horizontal ZOI encompasses the 35° angle as discussed in NUREG/CR-6850. The licensee further referred to tests conducted by EPRI and NEI to justify ignoring flame spread over armored cable with a PVC jacket beyond the 35° cone.

  Based on its review of the additional information provided, the NRC staff determined that the results of the referenced EPRI/NEI tests do not apply to cable trays that are located directly above the ignition source, and that the licensee did not account for the effect of the HRR contribution from the cables on the horizontal ZOI and HGL timing.

  In FM RAI 01.j.01 (Reference 26), the NRC staff requested that the licensee re-quantify the impact of fire propagation in cable trays and the HRR contribution from the cables on target damage and plant risk in light of the fact that the response to FM RAI 02.b indicated that 24% of the total cable population in the plant is thermoplastic.

In its response to FM RAI 01.j.01 (Reference 17), the licensee explained that it performed an analysis in which it compared the HRR margin to a HRR that includes the contribution from all impacted cable trays, and that it added full room burnout scenarios to the PRA RAI 03 re-quantification where this margin was found to not be adequate. The licensee further stated that accounting for additional target damage due to horizontal flame propagation in thermoplastic cable trays results in a risk increase of approximately 1.74E-06/year CDF and 3.02E-07/year LERF for Unit 1, and approximately 1.39E-06/year CDF and 2.65E-07/year LERF for Unit 2.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee conservatively accounted for the effect on plant risk of fire propagation in thermoplastic cable trays.

- In FM RAI 01.k (Reference 24), the NRC staff requested that the licensee explain how location effects were accounted for in the application of the GFMTs approach to determine the ZOI and HGL timing for wall and corner fires.

  In its response to FM RAI 01.k (Reference 13), the licensee stated that walkdowns did not identify any fixed ignition sources in a corner, but found some inverters in the battery room that are located against a wall. The licensee further explained that these inverters are equipped with top-mounted deflector shields, and that wall effects were, therefore, not considered in the determination of the ZOI for fixed ignition sources. The licensee further stated that location effects were considered in the determination of the ZOI for transient fires within 2 ft. of a wall or corner by doubling or quadrupling the HRR, respectively. Finally, the licensee also explained that wall and corner effects were not applied to the HGL screening analysis because the overall heat input to the room is not increased by placement near a wall or corner.

  The NRC staff concludes that the licensee's response to the first part of the RAI is acceptable because the deflector shields will interfere with the flame, disturb the plume and result in a lower plume temperature at a given height. The NRC staff also concludes that the licensee's response to the third part of the RAI is acceptable because location effects on the HGL temperature are relatively small, and the licensee used a significantly lower HGL temperature limit than the target damage threshold.

  Because the second part of the response raised a question about the placement of the ignition source in transient fire scenarios, consequently, in FM RAI 01.k.01 (Reference 26), the NRC staff requested that the licensee explain how it ensures that critical targets or pinch-points located close to a wall or corner were identified and considered in the transient fire target damage analysis.

  In its response to FM RAI 01.k.01 (Reference 17), the licensee explained that it performed an evaluation of fire scenarios based on placing transients at corners and that it incorporated the results of this evaluation into the FPRA. The licensee further stated that it performed a FM analysis to support the simplified treatment

of wall configurations by assuming that they are equivalent to an open configuration.

The NRC staff concludes that the licensee's response to FM RAI 01.k.01 is acceptable because the licensee properly accounted for location effects for fires involving a transient ignition source in the vicinity of a wall or in a corner.

- In FM RAI 01.l (Reference 24), the NRC staff requested that the licensee describe the criteria that were used to determine whether a cable tray in the vicinity of an electrical cabinet will ignite following a high energy arcing fault (HEAF) event, 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.l (Reference 12), the licensee stated that the ZOI for a HEAF includes the first non-empty adjoining cubicle; targets within 5' vertical distance of the top of the panel; and targets within 3' horizontal distance from the front and back of the panel, below the top of the panel and 1' horizontal distance above the top of the panel. The licensee further explained that the bin 15 HRR is assumed without any fire growth delay. The licensee further explained that target trays are assumed to ignite up to the ceiling, unless there is a significant distance between trays such that the fire would not propagate to the next tray.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's approach is consistent with the guidance in Appendix M of NUREG/CR-6850.

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

  In its response to FM RAI 02.a (Reference 14), the licensee stated that thermoset damage thresholds were used in the FPRA for armored and non-armored cables.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the sensitivity analysis performed by the licensee in response to FM RAI 02.b and subsequently revised in response to FM RAI 02.b.01 indicates that that accounting for the presence of the non-negligible amount of thermoplastic cable does not significantly affect plant risk.

- In FM RAI 02.b (Reference 24), the NRC staff requested that the licensee confirm that cable targets that are characterized as thermoset are not only IEEE 383 qualified, but are actually assigned thermoset damage thresholds as defined in NUREG/CR-6850.

In its response to FM RAI 02.b (Reference 14), the licensee stated that the higher damage thresholds associated with thermoset cables were used based on the assumption that the cables at MNS are predominately constructed with EPR or XLPE (thermoset) insulation, a galvanized steel interlocking armor, and a thin flame retardant polyvinylchloride (PVC) exterior jacket. The licensee further stated that a subsequent review of cable information showed that there is a higher percentage of thermoplastic insulation in the plant than initially considered, that approximately 15% of the roughly 12,000 FPRA-related cables are thermoplastic cables, and that these thermoplastic FPRA-related cables are relatively evenly distributed throughout the plant with only six fire areas being appreciably above the overall average. The licensee further identified five conservatisms in the present analysis that may partly offset the impact of the presence of thermoplastic cables on the FPRA, and explained that, to quantify this impact, it performed a sensitivity analysis and determined that a more thorough evaluation of the thermoplastic cable insulation impact does not result in a risk increase greater than 1 E-06/year for CDF or 1 E-07/year for LERF.

The NRC staff performed a detailed review of the sensitivity analysis and determined that it relies on the assumption that fires will not propagate in horizontal stacks of cable trays. This assumption appears to be inconsistent with the licensee's response to FM RAI 02.b, which states that approximately 15% of the FPRA-related cables and 24% of the total cable population in the plant are thermoplastic. Consequently, in FM RAI 02.b.01 (Reference 26), the NRC staff requested that the licensee revise the sensitivity analysis described in its response to FM RAI 02.b taking ignition of fire propagation in stacks of horizontal cable trays into account.

In its response to FM RAI 02.b.01 (Reference 17), the licensee revised the sensitivity analysis and provided the results.

The NRC staff concludes that the licensee's response to the follow-up RAI is acceptable because the licensee demonstrated in the updated sensitivity analysis that accounting for the presence of the non-negligible amount of thermoplastic cable does not significantly affect plant risk.

- In FM RAI 02.c (Reference 24), the NRC staff requested that the licensee provide justification for concluding that the armored cable that has a PVC exterior jacket can be treated as thermoset material.

  In its response to FM RAI 02.c (Reference 10) and (Reference 12), the licensee stated that the HRR contribution from the small amount of flame-retardant, self-extinguishing jacket material that might collect on the top surface of a fixed ignition surface is considered negligible in comparison with the peak HRR of the ignition source and is, therefore, considered insignificant with respect to the postulated target damage.

  In FM 02.c.01 (Reference 26), the NRC staff requested that the licensee provide a quantitative assessment to justify the licensee's conjecture that the HRR

contribution from the jacket material is negligible and its impact on the postulated target damage is insignificant.

In its response to FM RAI 02.c.01 (Reference 17), the licensee stated that the updated sensitivity analysis submitted in support of the response to FM RAI 02.b.01 provides a quantitative assessment of the HRR contribution from fire propagation in cable trays, and that this quantitative assessment does not take any credit for the percentage of combustible material that is inside the armor.

The NRC staff concludes that the licensee's response to the follow-up RAI is acceptable because the licensee used the method in NUREG/CR-7010 to model fire propagation in cable trays and ignored the presence of the armor.

- In FM RAI 02.d (Reference 24), the NRC staff requested that the license describe how cable tray covers, conduits and wraps affect the damage thresholds that were used in the fire modeling analyses.

  In its response to FM RAI 02.d (Reference 10), the licensee stated that it did not take any FPRA credit for cable tray covers, conduits or wraps.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's approach is more conservative than the recommendations in NUREG/CR-6850.

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

  In its response to FM RAI 02.e (Reference 11), the licensee stated that the same damage thresholds were assumed as for the cables connecting to the component.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee's approach is consistent with the guidance in Appendix H of NUREG/CR-6850.

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

  In its response to FM RAI 02.f (Reference 11), the licensee stated that the damage criteria used for temperature-sensitive electronic equipment inside of electrical cabinets were the same as those for thermoset cables, which is consistent with the guidance in FAQ 13-0004 (Reference 68). The licensee further stated that the limitations in FAQ 13-0004 regarding sensitive electronics mounted on the surface of cabinets and the presence of louvers or vents are addressed in its response to PRA RAI 16.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee followed the guidance in FAQ 13-0004 for sensitive electronics in an enclosure and used the damage thresholds for exposed sensitive electronics recommended in NUREG/CR-6850.

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 MNS 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.

3.4.2.4 Conclusions Regarding Fire PRA Quality

Based on NUREG-0800, Section 19.2 (Reference 43), Section III.2.2.4.1, summarizing the NRC staff's review of PRA quality required for an LAR, the NRC staff concludes that the licensee's revised PRA satisfies the guidance in RG 1.174, Section 2.3, and RG 1.205, Section 4.3 regarding the technical adequacy of the PRA used to support risk assessment for transition to NFPA 805.

The NRC staff concludes that the PRA approach, methods and data are acceptable, and therefore, that NFPA 805, Section 2.4.3.3 is satisfied for the request to transition to NFPA 805. The NRC staff based this conclusion on the findings that: (1) the PRA model meets the criteria in that it adequately represents the current, as built, as operated configuration, and is, therefore, capable of being adapted to model both the post-transition and compliant plant as needed; (2) the PRA models conform to the applicable industry PRA standards for internal events and fires, considering the acceptable resolution of the peer review and NRC staff review findings; and (3) the FM used to support the development of the MNS FPRA has been confirmed as appropriate and acceptable.

The FPRA used to support RI self-approval of changes to the FPP must use an acceptable PRA approach and acceptable methods and data. The NRC staff concludes that subject to completion of implementation item 19, the changes already made to the updated baseline FPRA model to incorporate acceptable methods, as detailed in the licensee's response to PRA RAI 03.b.01 (Reference 17), and discussed above, demonstrate that NFPA 805 criteria are satisfied and the PRA is acceptable for use to support self-approval changes to the FPP program.

In PRA RAI 08 (Reference 24) and PRA RAI 24 (Reference 27), the NRC staff requested that the licensee address concerns with LAR Attachment S, Table S-3, Implementation Item 12. In its response to PRA RAI 24 (Reference 16), the licensee revised the implementation item to indicate that following installation of the risk-related modifications and the as-built installation details, additional refinements surrounding the modifications and procedural implementations items will be incorporated into the FPRA model and internal events model, as required. The licensee also revised the implementation item to include verification that the revised FPRA risk results do not exceed the RG 1.174 risk guidelines and to take one or more of the following actions if RG 1.174 guidelines are exceeded: (1) implementing additional modifications, (2) refining the analytical estimates, or (3) requesting that exceeding the guidelines be deemed

acceptable in a new LAR. The revised implementation item is included in LAR Attachment S, Table S-3 (Reference 22). The NRC staff finds this acceptable because the implementation item provides confidence that the transition change-in-risk estimates will meet the risk acceptance guidelines in RG 1.174 and because it would be included in the proposed license condition. In its letter dated November 21, 2016 (Reference 23), the licensee submitted a revised LAR Attachment S that indicated implementation item 12 has been completed.

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

3.4.3 Fire Risk Evaluations

For those fire areas for which the licensee used 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, "Risk Evaluations," 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 MNS's FREs: LAR Section 4.5.2, "Performance-Based Approaches," LAR Attachment C, "NEI 04-02 Table B-3 – Fire Area Transition," and LAR Attachment W, "Fire PRA Insights," as well as associated supplemental information.

Plant configurations that did not meet the deterministic requirements of NFPA 805, Section 4.2.3.1 were considered VFDRs. VFDRs that will be brought into deterministic compliance through plant modifications do not require risk evaluation. In LAR Attachment C, Table B-3, "Fire Area Transition," the licensee identified the VFDRs 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 to demonstrate that the VFDRs are acceptable.

All of the VFDRs identified by the licensee were categorized as separation issues. The VFDRs related to separation 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; or (3) inadequate separation resulting in fire-induced failure of process monitoring instrumentation or associated cables required for the identified success path.

For MCR abandonment areas, the licensee explained in its response to PRA RAI 13.01.i (Reference 16) that the SSF is credited as the assured NSCA success path and that, therefore, VFDRs were identified based on inadequate separation of SSD functions at or controlled from the SSF. As discussed in SE Section 3.5.1.5, the NRC staff concludes that the licensee's method for identifying VFDRs associated with the SSF was acceptable.

In LAR Attachment W, Section W.2.1, the licensee described how it determined the change in risk associated with VFDRs in the FREs. For this calculation, the licensee used the FPRA to develop a logic model representing the post-transition plant configuration. The licensee further explained that some risk reduction modifications (i.e., non-VFDR modification) that do not resolve a VFDR but instead reduce risk are included in the post-transition PRA model.

The licensee explained that it created the compliant plant case by manipulating the post-transition plant PRA model to remove the VFDRs, and described this as "toggling off" or excluding specific PRA basic events to remove the fire-induced failure associated with the VFDR. The licensee explained it obtained the change-in-risk associated with each fire area by calculating the difference between the CDF and LERF of a compliant plant configuration and the post-transition plant configuration. The licensee indicated that it obtained the total change-in-risk by summing the change-in-risk for each fire area and comparing the total for each unit to the RG 1.174 acceptance guidelines. The non-VFDR modifications were not toggled off and, therefore, the risk-reduction modifications were credited in both the post-transition and compliant plant cases.

In PRA RAIs 12.01 and 13.01 (Reference 27), the NRC staff requested that the licensee clarify how it modeled MCR abandonment scenarios, due to either loss of habitability or loss of control. In its response to PRA RAIs 12.01 and 13.01 (Reference 16) and (Reference 17), the licensee explained that, other than removing the fire-induced failures associated with the VFDRs associated with the SSF functions for the compliant case, there is no modeling difference between the variant and compliant plant cases. The licensee further clarified that all of the fire areas where the SSF is the credited as the assured NSCA success path have 1) been previously reviewed and approved by the NRC under Appendix R Section III.G.3, to credit the SSF as the SSD capability or, in the case of fire area 25, determined by the licensee that the capability to achieve and maintain hot standby conditions utilizing the SSF is assured, and 2) determined by the licensee to meet all of the provisions in RG 1.205, Section 2.4b, upon completion of transfer of command and control to the SSF. The NRC staff concludes that this is acceptable because an appropriately designed SSF can be the single assured NSCA success path for fire areas designated as 10 CFR Part 50, Appendix R, Section III.G.3, areas consistent with the NFPA 805, Section 4.2.3.2, description of a success path located in a separate fire area.

In LAR Attachment W, Section W.2.1 the licensee explained that not all VFDRs are quantified in the change in risk calculation because it did not model the function of concern for the VFDR FPRA. The specific VFDRs not modeled are identified in LAR Attachment C. The licensee's justification for not modeling the function of concern for certain VFDRs includes 1) the function is not required within the mission time of the PRA and so has minimal risk contribution, 2) the PRA models other plant features that minimize the risk benefit of the particular function of concern, 3) not including certain SSD equipment identified in the fire SSA in the FPRA based on the results of implementing the NUREG/CR-6850 procedure for selecting FPRA components, and 4) similarly, certain RAs were not modeled because the function being recovered is not modeled. The licensee explained that, while few instrument and control (I&C) SSCs were directly modeled in the FPRA, some I&C SSCs were modeled indirectly via the HRA performed for RAs credited to recover the associated function. Other I&C SSCs were modeled by using an "actuation" basic event modeled in the PRA as a surrogate for the I&C SSCs.

LAR Attachment W, Tables W-6 and W-7, as supplemented (Reference 20), identify the risk reduction realized from the non-VFDR related modification to the Liquid Waste Recycle System (WL) line. The risk reduction from this modification is credited in the LAR to offset the increase in LERF due to the retained VFDRs as permitted by the combined change request section in RG 1.174. In PRA RAI 15 (Reference 24), the NRC staff requested that the licensee justify the basis for the risk reduction. In its response to the RAI (Reference 10), the licensee explained that the risk reduction for this modification is the difference in risk from quantifying the FPRA model with and without WL line isolation failure. The licensee further explained that 100 percent reliability of the modification to prevent WL line isolation failure is assumed because the modification involves installation of a passive device whose failure to reduce flow is considered to be negligibly small. Based on the WL line modification being a passive device, the NRC staff concludes that the risk reduction credited for this modification is reasonable.

In PRA RAI 14 (Reference 24), the NRC staff requested additional information about other methods used by the licensee to determine the change in risk, including for MCR abandonment areas. In its response to the RAI (Reference 12), the licensee clarified that for low risk fire areas, it used the baseline risk for the fire area as the change in risk for the fire area. The NRC staff finds these methods for determining the change in risk acceptable because they are consistent with the methods described in FAQ 08-0054 (Reference 65), for use of bounding approaches and for creating the compliant plant condition by excluding basic events associated with the VFDR from the PRA.

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. 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 (Reference 20), demonstrate that the difference between the risk associated with implementation of the deterministic requirements and that of the VFDRs, after crediting the risk offset for the WL line modification, meets the risk acceptance criteria described in NFPA 805, Section 2.4.4.1.

3.4.4 Additional Risk Presented by Recovery Actions

The NRC staff reviewed LAR Attachment C, "NEI 04-02 Table B-3 – Fire Area Transition," LAR Attachment G, "Recovery Actions Transition," and LAR Attachment W, "Fire PRA Insights," as well as the associated supplemental information, 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.

LAR Attachment G, Table G-1 provides the RAs that were credited in the FPRA for risk reduction as well as for DID. All RAs were identified as a result of a VFDR separation issue, including pre-existing OMAs, and were evaluated for acceptability through the FRE process. Operator actions performed at the SSF following MCR abandonment because of loss of habitability are identified in LAR Attachment G, Table G-1, but are not considered RAs because the SSF is a primary control station (PCS).

In PRA RAI 13 (Reference 24), the NRC staff requested that the licensee justify the basis for crediting the operator actions identified in fire areas 01, 02, 03, 04, 13, 14, 19, 20, 21, 24, and 25 as PCS actions rather than RAs given the statement in LAR Attachment V, Section V.2.7 that, "control room abandonment is only considered for cases where the Control Room environment (temperature and smoke) reaches the criteria specified in NUREG/CR-6850." In its response to the RAI (Reference 13), the licensee explained that while the SSF is the assured NSCA success path for each of these fire areas, not all fires lead to transfer to and shutdown from the SSF, and the MCR need not, and would not, be abandoned because loss of MCR habitability will not occur in these scenarios. The licensee also explained in its responses to this RAI and PRA RAIs 12.01 and 13.01 (Reference 16) and (Reference 17) that there are no VFDRs for fire impacts to the other shutdown trains (i.e., Trains A and B) located in these fire areas and that operator actions taken away from the MCR to address these fire impacts are, therefore, not considered RAs because they are not taken due to a fire induced failure. In its response to PRA RAI 03.02.c (Reference 17), the licensee further explained that RAs resulting from VFDRs identified against the SSF success path are identified in LAR Attachment G if the action is modeled in the PRA. The NRC staff concludes that this is acceptable because the PRA models how the plant will be operated and the NRC staff has previously determined that the SSF can be the single assured NSCA success path for fire areas designated as 10 CFR Part 50, Appendix R, Section III.G.3, areas.

LAR Attachment W, Section W.2.2, as supplemented (Reference 20), explains that the additional risk of RAs is bounded by the Δ risk due to VFDRs. This treatment is demonstrated in LAR Tables W-6 and W-7, as supplemented. In these tables, for each fire area where RAs are credited, the additional risk of RAs is presented as the same as the change-in-risk for each fire area. Per FAQ 08-0054, the change-in-risk can be used to bound the additional risk of RAs, although this approach cannot be used if risk reduction from non-VFDR related modifications is credited in the post-transition plant and not in the compliant plant PRA models. The changes in risk values presented in LAR Attachment W, Tables W-6 and W-7 do not reflect risk reduction from non-VFDR modifications because non-VFDR modification are credited in both the compliant and post-transition plant models. Therefore, the NRC staff concludes that the additional risk of RAs are properly bounded by the change-in-risk values presented in LAR Attachment W, Tables W-6 and W-7, as supplemented.

In order to determine the total additional risk of RAs in the LAR, the NRC staff summed the additional risk of RAs reported for all fire areas presented by the licensee in the LAR, as supplemented (Reference 17), and determined the total additional risk of RAs for Unit 1 to be 3.30E-06 per year for CDF and 6.82E-07 per year for LERF, and for Unit 2 to be 4.28E-06 per year for CDF and 8.73E-07 per year for LERF. The NRC staff finds these results acceptable because they are less than the Region II risk guidelines depicted in Figure 4 and Figure 5 of RG 1.174.

Per LAR Attachment G, the licensee reviewed all of the RAs for adverse impact and resolved each action as stated in LAR Attachment G. The licensee did not find any of the RAs listed in LAR Attachment G, Table G-1 to have an adverse impact on the FPRA. All RAs listed in LAR Attachment G were evaluated against the feasibility criteria provided in NEI 04-02, FAQ 07-0030 (Reference 58), and RG 1.205. Additionally, as a result of the feasibility evaluation, the licensee identified actions that will be performed and documented as part of the

NFPA 805 RI/PB FPP implementation and included these actions in LAR Attachment S, Table S-3, Implementation Item 14. The NRC staff concludes that these actions are acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

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

3.4.5 Risk-Informed/Performance-Based Alternatives to Compliance

The licensee did not use any risk-informed or performance-based alternatives to compliance with NFPA 805.

3.4.6 Cumulative Risk and Combined Changes

In LAR Attachment S, Table S-2, the licensee identified two plant modifications being implemented to reduce plant risk rather than bring the plant into compliance with the deterministic requirements of NFPA 805. In its letter dated April 26, 2016 (Reference 21), the licensee indicated that it completed these modifications and moved them from LAR Attachment S, Table S-2, to LAR Attachment S, Table S-1. LAR Attachment W, Section W.2.1 explains that non-VFDR plant modifications are credited in both the compliant and post-transition plant PRA models used to calculate the fire area change-in-risk values presented in LAR Attachment W, Tables W-6 and W-7. However, the risk reduction for each fire area realized from one of these modifications (i.e., in the Liquid Waste Recycle System), affected LERF from many fire areas and was determined in a separate calculation presented in the last column of LAR Attachment W, Tables W-6 and W-7 for Units 1 and 2, respectively. In its response to PRA RAI 15 (Reference 10), the licensee explained that the risk offset credit for this modification is the difference in risk from quantifying the FPRA model with and without WL line isolation failure. The risk reduction from this modification is credited in the LAR to offset the increase in LERF due to VFDRs. Therefore, the NRC staff concludes that the licensee's LAR to transition to an RI/PB FPP is a combined change request per RG 1.174, Revision 2 (Reference 37), Section 1.1.

The total CDF and total LERF are estimated for each unit by adding the risk assessment results for internal (including flooding), fire, and external (seismic and tornado) hazard events. As presented in LAR Attachment W, Table W-5, as supplemented (Reference 20), SE Table 3.4.6 provides the total and hazard-specific CDF and LERF results for both Unit 1 and Unit 2. The estimated total CDF and LERF for both units are within the RG 1.174 acceptance guidelines for Region II changes of 1E-04 per year and 1E-05 per year, respectively. This conclusion would not change even if the seismic CDF is estimated at 2.0E-05/year using the preliminary results for the "IPEEE weighted average" model from the NRC staff's safety/risk assessment for Generic Issue 199, "Safety/Risk Assessment Results for Generic Issue 199, Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants" (Reference 103). The "weakest link model" seismic CDF of 3.1E-05/year from this same report results in a total CDF for Unit 2 of 1.04E-04/year. However, the NRC staff

concludes that it is likely that the total CDF for Unit 2 is less than 1.0E-04/year because the "weakest link model" determines the seismic CDF for the spectral frequency resulting in the worst-case damage to SSCs.

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

Hazard Group	Unit 1		Unit 2	
	CDF (/year)	LERF (/year)	CDF (/year)	LERF (/year)
Internal Events	1.08E-05	2.08E-06	1.08E-05	2.08E-06
Internal Flooding	8.65E-06	2.05E-07	8.65E-06	2.05E-07
Seismic	8.82E-06	Not Available	8.82E-06	Not Available
Tornado	1.78E-06	2.03E-07	1.78E-06	2.03E-07
Fire	3.81E-05	4.36E-06	5.16E-05	4.76E-06
TOTAL	6.82E-05	6.85E-06	8.17E-05	7.25E-06

In PRA RAI 03 (Reference 24), the NRC staff requested that the licensee provide the results of an aggregate analysis that assesses the integrated impact on the fire risk of replacing methods in the FPRA with methods acceptable to the NRC. In its response to PRA RAI 03.a.01 (Reference 17), the licensee identified a number of changes to PRA methods, as discussed above, that were incorporated into the FPRA model and provided revised estimates of the total fire CDF and LERF for each unit. These revised risk estimates are included in the risk results reported in SE Table 3.4.6.

In LAR Attachment W, Tables W-6 and W-7, as supplemented (Reference 20), the licensee provided the ΔCDF results and ΔLERF results for each fire area at each MNS unit and the total ΔCDF results and ΔLERF for each unit. These Δ risk results incorporate the changes made to the FPRA model made in response to PRA RAI 03, as discussed above. The risk estimates for these fire areas result from completed modifications and administrative controls that will be implemented as part of the transition to NFPA 805 at MNS, as well as RAs to reduce VFDR risk.

In its response to PRA RAI 14 (Reference 10), the license explained that these change in risk values represent the risk increases from retained VFDRs. The licensee also separately provided in LAR Attachment W, Tables W-6 and W-7 for Units 1 and 2, respectively, the LERF reduction from the Liquid Waste Recycle System modification for each fire area and the associated total risk reduction for each unit. RG 1.205, Section 3.2.5 states that risk decreases may be combined with risk increases for the purposes of evaluating combined changes in accordance with regulatory positions presented in RG 1.174, Revision 2, Sections 1.1 and 1.2.

From the LAR, as supplemented (Reference 17), the total estimated change in CDF is reported as a risk increase of 6.20E-06/year for Unit 1 and 6.03E-06/year for Unit 2; therefore, both units are below the RG 1.174 guidelines for Region II changes of 1E-05 per year.

The total estimated change in LERF, is –2.3E-07 per year for Unit 1 and –6.2E-07 per year for Unit 2 (Reference 17). These values are determined by subtracting the risk reduction for the WL Line modification (i.e., 1.76E-06/year for Unit 1 and 2.02E-06/year for Unit 2) from the

ΔLERF increase (i.e., 1.53E-06/year for Unit 1 and 1.40E-06/year for Unit 2) from the retained VFDRs. Each of the individual fire area change-in-risk values for CDF and LERF also met the RG 1.174 guidelines.

The NRC staff concludes that the risk associated with the proposed alternatives to compliance with the deterministic criteria of NFPA 805 is acceptable for the purpose of this application, 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 the LAR and in response to 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 63) states that a sensitivity study must be performed using the mean of the fire frequency bins contained in NUREG/CR-6850, Section 6 for those bins with an alpha value less than or equal to one. The licensee stated in LAR Attachment V, Section V.2.6 that use of the FAQ 08-0048 fire ignition frequencies (FIFs) do not alter the conclusions in the LAR that the RG 1.174 risk guidelines are met.

In PRA RAI 11 (Reference 24), the NRC staff requested that the licensee provide justification that only FIF Bins 4 and 15 are applicable for this sensitivity analysis for the MNS FPRA. In its response to the RAI (Reference 12), the licensee explained that Bin 13, dryers, is not used in the MNS FPRA and that the fire scenarios associated with the other bins that are to be included in the sensitivity analysis (i.e., Bins 1, 11, 22, and 31) do not impact the Δ risk results. The licensee reconfirmed this conclusion in its response to PRA RAI 03.b.01 (Reference 17). While the licensee did not address total fire risk, the NRC staff concludes that even if the CDF and LERF for the fire areas where Bins 1, 11, 22, and 31 are applied were conservatively increased by the ratio of the NUREG/CR-6850 FIF to the FAQ 08-0048 FIF, the total CDF and LERF for the plant would be below the RG 1.174 risk guidelines for Region II. The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that excluding the identified FIF bins from the sensitivity analysis will not impact the Δ risk results, and because the NRC staff's evaluation determined that the total plant risk is below the RG 1.174 guidelines even if the additional FIF bins were conservatively accounted for in the sensitivity analysis.

In its response to PRA RAI 03.a (Reference 15), and PRA RAI 03.a.01 (Reference 17), the licensee provided the results of a parametric uncertainty analysis. The outputs of this analysis were mean values for CDF, LERF, ΔCDF, and ΔLERF that included dependencies associated with the SOKC. The NRC staff reviewed these results and determined that the licensee adequately addressed the guidance in RG 1.174, which calls for correlating sample values for different PRA elements (such as basic events) when they are derived from the same underlying data set. Because the licensee provided this information and because the

mean values met the RG 1.174 acceptance guidelines, the NRC staff concludes that the results of the parametric uncertainty analysis are acceptable.

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 at MNS, the NRC staff concludes the following:

- The licensee's PRA used to perform the risk assessments in accordance with NFPA 805, Sections 2.4.4 (PCEs) and 4.2.4.2 (FREs), is of sufficient quality to support the application to transition the MNS FPP to NFPA 805. The PRA approach, methods, tools and data are acceptable in accordance with NFPA 805, Section 2.4.3.3.

- The licensee stated that it has completed changes to the baseline FPRA model that replaced unacceptable approaches, data, and methods identified during the LAR review with acceptable approaches, data, and methods as described. Therefore, the NRC staff finds that the FPRA model may be used to support post-transition self-approval of changes because the identified acceptable methods will be used unless 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 following completion of the PRA-related Implementation Items 12 and 19, as described in LAR Attachment S, Table S-3.

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

- The changes in risk (i.e., ΔCDF and ΔLERF) associated with the proposed alternatives to compliance with the deterministic criteria of NFPA 805 (FREs) are acceptable. The licensee satisfied the guidance contained in RG 1.205, Revision 1; RG 1.174; and NUREG-0800, Section 19.2, regarding acceptable risk. By meeting the guidance contained in these approved documents, the changes in risk are found to be acceptable to the NRC staff.

- The licensee determined and provided the risk associated with the use of RAs in accordance with NFPA 805, Section 4.2.4, and the guidance in RG 1.205,

Revision 1. The licensee conservatively assigned the total VFDR risk increase to the additional risk of RAs in all fire areas that had RAs. The total risk increase from all such fire areas is less than the RG 1.174 acceptance guidelines. The NRC staff concludes that the additional risk associated with the NFPA 805 RAs is acceptable because the total risk associated with RAs meets the acceptance criteria in RG 1.205, Revision 1.

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

- The licensee's application to transition to NFPA 805 is a combined change, as defined by RG 1.205, Revision 1, which includes risk increases identified in the FREs with risk decreases resulting from non-VFDR related modifications. Based on the combination of these values, the changes associated with NFPA 805 meet the guidance contained in RG 1.205, Regulatory Position 3.2.5, related to meeting the requirements for cumulative risk and combined plant changes.

- The licensee completed plant modifications 4 and 5 as described in LAR Attachment S, Table S-1 (Reference 21), which reduce risk.

3.5 Nuclear Safety Capability Assessment Results

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

> To determine whether plant design will satisfy the appropriate performance criteria, an analysis shall be performed on a fire area basis, given the potential fire exposures and damage thresholds, using either a deterministic or performance-based approach.

NFPA 805, Section 2.2.4, "Performance Criteria," states that:

> The performance criteria for nuclear safety, radioactive release, life safety, and property damage/business interruption covered by this standard are listed in Section 1.5 and shall be examined on a fire area basis.

NFPA 805, Section 2.2.7, "Existing Engineering Equivalency Evaluations," states that:

> When applying a deterministic approach, the user shall be permitted to demonstrate compliance with specific deterministic fire protection design requirements in Chapter 4 for existing configurations with an engineering equivalency evaluation. These existing engineering evaluations shall clearly demonstrate an equivalent level of fire protection compared to the deterministic requirements.

3.5.1 Nuclear Safety Capability Assessment Results by Fire Area

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

> The purpose of this section is to define the methodology for performing a nuclear safety capability assessment. The following steps shall be performed:
>
> (1) Selection of systems and equipment and their interrelationships necessary to achieve the 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 the LAR Section 4.2.4, "Fire Area Transition," Section 4.8.1, "Results of the Fire Area Review," LAR Attachment C, "NEI 04-02 Table B-3 – Fire Area Transition," LAR

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

MNS is a dual unit PWR with 40 individual fire areas including the Yard (which includes the main and auxiliary transformers, refueling water storage tank, and the condensate storage tank) 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 identified the rooms 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, Table C-1, "NFPA 805 Ch 4 Compliance (NEI 04-02 Table B-3)."

Table 3.5-1: Fire Area and Compliance Strategy Summary

Fire Area	Area Description	NFPA 805 Compliance Basis
1	Auxiliary Building Common Elevation 695' and Pipe Chase	Performance-Based
2	Unit 1 Motor Driven Auxiliary Feedwater Pump Room	Performance-Based
2A	Unit 1 Turbine Driven Auxiliary Feedwater Pump Room	Performance-Based
3	Unit 2 Motor Driven Auxiliary Feedwater Pump Room	Performance-Based
3A	Unit 2 Turbine Driven Auxiliary Feedwater Pump Room	Performance-Based
4	Auxiliary Building Common Elevation 716'	Performance-Based
5	Unit 1 Train A Diesel Generator Room	Performance-Based
6	Unit 1 Train B Diesel Generator Room	Performance-Based
7	Unit 2 Train A Diesel Generator Room	Performance-Based
8	Unit 2 Train B Diesel Generator Room	Performance-Based
9-11	Unit 1 Train B Electrical Penetration & Switchgear Rooms	Performance-Based
10-12	Unit 2 Train B Electrical Penetration & Switchgear Rooms	Performance-Based
13	Battery Rooms Common	Performance-Based
14	Auxiliary Building Common Elevation 733'	Performance-Based
15-17	Unit 1 Train A Switchgear & Penetration Rooms	Performance-Based
17A	Unit 1 Train A Switchgear HVAC Room	Performance-Based
16-18	Unit 2 Train A Switchgear & Penetration Rooms	Performance-Based
18A	Unit 2 Train A Switchgear HVAC Room	Performance-Based
19	Unit 1 Cable Room	Performance-Based
20	Unit 2 Cable Room	Performance-Based
21	Auxiliary Building Common Elevation 750'	Performance-Based
22	Unit 1 Electrical Penetration (MG Set) Room	Performance-Based

Fire Area	Area Description	NFPA 805 Compliance Basis
23	Unit 2 Electrical Penetration (MG Set) Room	Performance-Based
24	Control Room Common	Performance-Based
25	Auxiliary Building Common Elevation 767'	Performance-Based
26	Unit 1 Fuel Pool Building	Performance-Based
27	Unit 2 Fuel Pool Building	Performance-Based
28	Unit 1 Interior Doghouse	Performance-Based
29	Unit 2 Interior Doghouse	Performance-Based
30	Unit 1 Exterior Doghouse	Performance-Based
31	Unit 2 Exterior Doghouse	Performance-Based
32	Unit 1 Reactor Building	Performance-Based
33	Unit 2 Reactor Building	Performance-Based
DIS	Discharge Structure	Performance-Based
ITS	Intake Structure	Performance-Based
SRV	Service Building	Performance-Based
SSF	Standby Shutdown Facility	Performance-Based
TB1	Unit 1 Turbine Building	Performance-Based
TB2	Unit 2 Turbine Building	Performance-Based
YRD	Yard Area	Deterministic

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; and
- The resolution of each VFDR using either modifications 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 Attachment C, Table C-2, "NFPA 805 Required Fire Protection Systems and Features," lists the fire areas, and identifies the fire suppression and detection systems 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.

In FPE RAI 07 (Reference 24), the NRC staff requested that the licensee clarify what suppression and detection systems in the turbine building are required for implementation of NFPA 805. In its response to FPE RAI 07 (Reference 10), the licensee identified the required turbine building suppression systems as follows for both Units 1 and 2:

- Main feedwater pump automatic water spray system (actuated via fixed temperature heat detectors).
- Hydrogen seal oil automatic water spray system (actuated via fixed temperature heat detectors).
- Oil purifier automatic water spray system (actuated via fixed temperature heat detectors).
- Turbine lube oil reservoir (MTOT) automatic water spray system (actuated via fixed temperature heat detectors).
- Turbine lube oil transfer tank automatic water spray system (actuated via fixed temperature heat detectors).
- Turbine piping and bearing automatic water spray system (actuated via fixed temperature heat detectors).

The licensee also provided a revision (Reference 12), to LAR Attachment C, Table C-2, to identify these systems. The NRC staff concludes that the licensee response to FPE RAI 07 is acceptable because the licensee identified the fire suppression and detection systems in the turbine building that are required for the planned NFPA 805 transition and revised the LAR accordingly.

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 licensee used appropriate methods to evaluate nuclear safety, DID, and safety margins,

and 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 safe and stable conditions can be achieved and maintained utilizing equipment and cables outside of the area of fire suppression activity, and that flooding of the suppression areas and discharge of suppression water to adjacent compartments is controlled and will not jeopardize achievement of safe and stable conditions. The licensee stated that fire suppression activities will not 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 Attachment C, as supplemented, the licensee identified deviations from the deterministic licensing basis for each fire area that were previously approved by the NRC and will be transitioned with the NFPA 805 FPP. Each of these deviations is summarized in LAR Attachment C on fire area basis and described in further detail in LAR Attachment K, "Existing Licensing Action Transition."

The LAR states that MNS was licensed to operate on June 12, 1981, for Unit 1, and March 3, 1983, for Unit 2, which is after the date of January 1, 1979, in 10 CFR 50.48(b). Because MNS compliance with Appendix R is not required by 10 CFR 50.48, deviations from Appendix R provisions were not approved via exemptions, but were evaluated in NRC SEs. Since the previously approved deviations are either compliant with 10 CFR 50.48(c) or no longer necessary, as discussed in LAR Attachment M, upon issuance of the new 10 CFR 50.48(c) license condition, the current MNS license condition will be superseded. The licensee understands that implicit in the superseding of the current license condition, all prior FPP SERs and commitments will be superseded in their entirety.

The licensee stated that there are no elements of the pre-transition FPP licensing basis that require clarification of a prior NRC approval. The licensing actions being transitioned, including the clarifications, are summarized in Table 3.5-2.

Table 3.5-2: Previously Approved Licensing Actions Being Transitioned

Licensing Action Description	Applicable Fire Areas	NRC Staff Evaluation
Deviation from 10 CFR 50, Appendix R, Section III.G.2 and	09-11	In LAR Attachment K, the licensee stated that the basis for the deviation is that:

Licensing Action Description	Applicable Fire Areas	NRC Staff Evaluation
III.G.3 for the use of Meggitt cable.		In the NRC letter dated 01/13/2003 (Reference 78), the NRC accepted the deviation since "the protection provided by the silicon dioxide insulated cable in this specific application is equivalent to the protection provided by a 3-hour rated fire barrier. Accordingly, the deviation from the approved FPP commitments to 10 CFR Part 50, Appendix R, Section III.G.2, with respect to having a three hour rated fire barrier, in these particular circumstances for Fire Area 11, provides an equivalent level of protection necessary to achieve the underlying purpose of the rule. Based on the NRC staffs review, as described above, the NRC staff concludes that the licensee's identified deviation from its fire protection program as it incorporates Section III.G.2 of Appendix R to 10 CFR Part 50, with respect to the enclosure of cables of one redundant train of safe shutdown equipment in a 3-hour fire rated barrier, is a change to the approved FPP that does not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire." In FPE RAI 08 (Reference 24), the NRC staff requested that the licensee clarify the requirement basis for the Meggitt Cable described in LAR Attachment C, Table C-2. The licensee's response to FPE RAI 08 (Reference 10), and the NRC staff's evaluation is provided in SE Section 3.5.1.3. Based on the previous staff approval of this deviation in an SE dated 1/13/2003 (Reference 78), as supplemented by the licensee's response to FPE RAI 08 as discussed in SE Section 3.5.1.3 below, and the statement by the licensee that the basis remains valid, the NRC staff concludes that transition of this licensing action is acceptable.
Deviation from 10 CFR 50, Appendix R, Section III.G.2.c for unprotected steel supports penetrating a 1-hour fire rated barrier in the auxiliary building.	02, 02A, 03, 03A, 04 (U1 & 2), and 14 (U1 & 2)	In LAR Attachment K, the licensee stated that the basis for the deviation is: • Low combustible loading in area. • Fire detection is installed over the pumps. • Automatic suppression is installed over the pumps. • Manual suppression (portable extinguishers and hose stations) is available for fire brigade response. The areas affected by the deviation are in the auxiliary building on elevations 716 and 733 feet. Fire areas affected include 2, 2A, 3, 3A, 4, and 14. The

Licensing Action Description	Applicable Fire Areas	NRC Staff Evaluation
		walls, floors, and ceilings of these fire areas are of reinforced concrete construction and provide 3-hour fire rated barriers. Mechanical and electrical penetrations in rated barriers are sealed with an approved 3-hour silicone foam seal or have been qualified by a fire test. HVAC ducts are provided with 1-1/2-hour UL fire rated dampers. Based on the previous staff approval of this deviation in an SE dated 5/15/1989 (Reference 35), and the statement by the licensee that the basis remains valid, the NRC staff concludes that transition of this licensing action is acceptable.
Deviation from 10 CFR 50, Appendix R, Section III.G.2.a for seismic expansion joints at elevation 733 feet of the auxiliary building.	02, 03, 09-11, 10-12, and 14 (U1 & U2)	In LAR Attachment K, the licensee stated that the basis for the deviation is: • Predominant combustible in the area is cable insulation. • Fire detectors are installed on either side of the seismic gaps. • Manual suppression (portable extinguishers and hose stations) are available for fire brigade response. • The floors, walls, and ceilings are 12 to 24 inches thick. • The limited exposed area of the cork. • The burning characteristics of the cork. • The combustibles are not installed directly at the seismic gaps. • In the event a fire develops and transmits heat through the gaps and damages safe shutdown cables, the safe shutdown system is available and is independent of the areas involved. The NRC approved Duke's deviation request in a letter dated 5/15/1989 (Reference 35). Based on the previous staff approval of this deviation in an SE dated 5/15/1989 (Reference 35), and the statement by the licensee that the basis remains valid, the NRC staff concludes that transition of this licensing action is acceptable.
Deviation from three-hour barrier in cable room.	19 and 20	In LAR Attachment K, the licensee stated that the basis for the deviation is: The NRC requested in a letter to Duke dated 6/14/1978, a fire test be performed on the barrier separating FAs 19 and 20 (Unit 1 and 2 Cable Rooms) to substantiate the barrier meets the 3-hour fire resistance requirement for a fire area wall. Duke

Licensing Action Description	Applicable Fire Areas	NRC Staff Evaluation
		submitted to the NRC the results of the fire test in a response letter dated 1/9/1979. The results of the test demonstrated the barrier fire rating was less than three hours but in excess of two hours. Duke installed a modification to the wall assembly to provide the wall assembly with sufficient integrity to act as a three hour barrier. This modification was based on a recommendation by the Staff s fire protection consultant, who witnessed the testing, and has been discussed with the Staff. The NRC accepted the two hour fire rated wall assembly in a 1/8/1981 (Reference 104), NRR Memo to Duke. The acceptance was based on the following: • The barrier exceeding a two hour fire resistance per the test results. • The existing fuel load in Cable Rooms. • Location of the safety related equipment. • Fire detection in areas. • Fire suppression capability in areas. SER, Supplement 5, April 1981 (Reference 33), found the wall to be an acceptable barrier given the criteria above and the installation of a fire proofed angle iron at the ceiling of the wall separating Unit 1 and Unit 2 cable rooms. Based on the previous staff approval of this deviation in an SE dated April 17, 1981 (Reference 33), and the statement by the licensee that the basis remains valid, the NRC staff concludes that transition of this licensing action is acceptable.
Deviations from the requirements of NFPA 13 and NFPA 15 for the fog type sprinkler systems in the unit 1 and unit 2 cable spreading rooms.	19 and 20	In LAR Attachment K, the licensee stated that the basis for the deviation is: In a letter dated 10/19/1979, the NRC identified multiple NFPA 13 and NFPA 15 deviations in the manually actuated "fog-type" sprinkler system installed in each cable spreading room. The system design was approved in the Safety Evaluation Report Supplement dated 4/1/1981 (sic) [April 17, 1981] (Reference 33). In the 9/15/1986 letter, the NRC stated these deviations to be discrepancies that were not pertinent since the plant can achieve and maintain hot standby conditions independently of these areas.

Licensing Action Description	Applicable Fire Areas	NRC Staff Evaluation
		Based on the previous staff approval of this deviation in an SE dated April 17, 1981 (Reference 33), and the statement by the licensee that the basis remains valid, the NRC staff concludes that transition of this licensing action is acceptable.
Deviation from the requirement to provide a 3-hour fire rating for the walls enclosing the duct shafts.	19 and 20	In LAR Attachment K, the licensee stated that the basis for the deviation is: In a letter dated 09/30/1980 (Reference 105), the NRC identified the walls enclosing the duct shafts next to the cable spreading rooms are not of three hour fire rated construction and it is probable that this deficiency exists in other areas of the plant. Duke responded 10/24/1980 (Reference 106), stating the duct shaft walls of concern were not provided with gypsum inside the duct shaft. Duke believes this configuration is functionally equivalent since the duct shaft walls need only prevent fire from entering the duct shaft from one fire area and exiting the duct shaft into another fire area. For a fire to follow this path would require burning through six layers of gypsum as was tested. The NRC found Duke's response acceptable in a memo dated 01/08/1981 (Reference 104). The letter stated, "We reviewed this existing situation and determined that no fire rating is required inside of the duct shaft. Therefore, we find the applicant's design approach of providing fire resistance on only the exterior side of the shaft wall to be acceptable." Based on the previous staff approval of this deviation in an NRC memo dated 01/08/1981 (Reference 104), and the statement by the licensee that the basis remains valid, the NRC staff concludes that transition of this licensing action is acceptable.
Installation of the SSF per the requirements of 10 CFR 50, Appendix R, Section III.G and III.L.	SSF (U1) and SSF (U2)	In LAR Attachment K, the licensee stated that the basis for the deviation is: NRC staff in SER Supplement No. 2 (Reference 32), required that the final design of the standby shutdown system be submitted for its approval by March 1980 and that the system be fully operational 3 months after the first refueling of Unit 1 but not later than 24 months after initial fuel loading of Unit 1. The licensee provided the staff with the final design of the system in a letter dated 3/31/1980 (Reference 107), with additional system information in letters

Licensing Action Description	Applicable Fire Areas	NRC Staff Evaluation
		dated 10/21/1981 (Reference 108), and 10/12/1982 (Reference 109), for Unit 1 and Unit 2 respectively. The installation of the complete system was completed and made operational in January 1983. The staff concludes that the MNS, including the standby shutdown system, meets the requirements of 10 CFR 50, Appendix R, Paragraph III.G and III.L and, therefore, considers this matter resolved. In conclusion, the NRC approved the design of the SSF in the SER dated February 1, 1983 (sic) [March 14, 1983) (Reference 34), and the bases for previous acceptance remain valid. Based on the previous staff approval of this deviation in an SE dated 3/14/1983 (Reference 34), and the statement by the licensee that the basis remains valid, the NRC staff concludes that transition of this licensing action is acceptable.
Deviations from the requirements of NFPA 20 regarding installation of the fire pump.	Not applicable to a specific fire area.	In LAR Attachment K, the licensee stated that the basis for the deviation is: The regional NRC inspector in a 10/19/1979 Inspection Report (Reference 110), identified five issues that do not meet the provisions of NFPA 20. They are: (1) The controllers/motor starters for pumps A and B are located within the turbine building and not adjacent to and within sight of the pump motors as required by Section 7-2.1 of NFPA 20. (2) The arrangement of the water pressure sensing lines between fire protection system and pressure-activated switches [sic] are 1/8 inch in diameter in lieu of 1/2 inch minimum as specified by Section 5.2.1 and Figure A-7-5.2.1 of NFPA 20. Also the water sensing lines are not provided with the required check valves, test connections, and related devices. (3) The pump starting circuits from the pressure sensing system, which are external from the pump controllers/ motor starters are not electrically supervised, nor arranged such that breakage, disconnecting, aborting of the wires or loss of power to the circuits will cause continuous [sic] running of the fire pumps as required by Section 7-5.2.5 of NFPA 20. (4) Controllers for Pumps A and B are not listed by Underwriters Laboratories, Inc. (UL) or approved by Factory Manual Laboratories Inc. (FM) for use on

Licensing Action Description	Applicable Fire Areas	NRC Staff Evaluation
		electric motor driven fire pumps as required by Section 7-1.1.1 of NFPA 20. (5) The fire pumps are not provided with labels or otherwise identified to verify that the pumps are actually listed by UL or approved by FM for fire pump service as required by Section 2-2 of NFPA 20. The regional inspector requested in a letter dated 12/6/1979 (Reference 111), the NRR to evaluated [sic] these issues. The NRR responded 1/15/1980 (Reference 112) that the MNS fire protection pumps are acceptable since the functional requirements are intact and the system is periodically tested. In LAR Attachment K, the licensee identified that Licensing Action 11 was required post-transition but stated under "Licensing Basis" for this action that the licensing action was not required for transition. In FPE RAI 06 (Reference 24), the NRC staff requested that the licensee clarify the compliance method. In its response to FPE RAI 06 (Reference 10), the licensee stated the LAR was incorrect and that the licensing action is required for transition. The NRC staff's evaluation of the licensee's response to FPE RAI 06 is provided in SE section 3.5.1.3 below. Based on the previous staff approval of this deviation, in an NRC memo dated 1/15/1980 (Reference 112), as supplemented by the licensee's response to FPE RAI 06 as discussed below, and the statement by the licensee that the basis remains valid, the NRC staff concludes that transition of this licensing action is acceptable.
Deviation from the requirements of 10 CFR 50, Appendix R, Section III.G.2. for fire penetration seals in three-hour rated walls in the reactor building.	04 (U1 & U2) 9-11, 10-12, 15-17, 16-18, 25 (U1 & U2), 26, 27, 32, and 33	In LAR Attachment K, the licensee stated that the basis for the deviation is: Deviation request per the 08/03/1984 Duke letter (Reference 113), to the NRC provides the following justification for the omission of standard designed fire tested penetration seals in the three hour fire rated reactor building walls as required by Section III.G.2.a of Appendix R, which was approved by the NRC in a letter dated 5/15/1989 (Reference 35): • The penetrations and seals are constructed of noncombustible material. • The annulus areas have automatic suppression. • Manual suppression (portable extinguishers and hose stations) are available for fire brigade response.

Licensing Action Description	Applicable Fire Areas	NRC Staff Evaluation
		• The reactor building walls are constructed of 3-foot thick reinforced concrete with silicone foam in the expansions joints. • Automatic fire detection is provided on both sides of penetrations. • Limited combustibles in areas. • The dedicated safe shutdown system is available for safe shutdown should a fire damage normal safe shutdown system components near the subject penetration seals. Based on the previous staff approval of this deviation in an NRC letter dated 5/15/1989 (Reference 35), and the statement by the licensee that the basis remains valid, the NRC staff concludes that transition of the licensing action is acceptable.
Deviation from the requirements regarding the use of a manually operated control valve for fire suppression systems in the reactor building.	32 and 33	In LAR Attachment K, the licensee stated that the basis for the deviation is: During the review process for the McGuire fire protection program, the NRC identified in a 06/14/1978 Letter to Duke, a deviation in the Reactor Building in the control valve for the primary and backup fire suppression system. A meeting was held with NRC staff on September 27 and 28, 1978 to review the outstanding items related to fire protection at MNS. Per a Duke letter to the NRC dated 10/24/1980 (Reference 106), it was agreed that a remote manual operated control valve would be provided to the sprinklers and hose stations inside containment. In a NRC memo dated 01/08/1981 (Reference 104), the NRC approved the use of a remote, manually operated control valve for the containment hose stations and sprinklers and found the use of a single control valve to be acceptable since it can readily be rendered open from the control room. Based on the previous staff approval of this deviation in an NRC letter dated 1/18/1981 (Reference 104), and the statement by the licensee that the basis remains valid, the NRC staff concludes that transition of the licensing action is acceptable.

The NRC staff reviewed the deviations from the pre-NFPA 805 licensing basis identified in Table 3.5-2, including the description of the previously approved deviation from the deterministic requirements, the basis for and continuing validity of the deviation, and the NRC staff's original evaluation or basis for approval of the deviation. In LAR Section 4.2.3, the licensee stated that

the review of these existing licensing actions included a determination of the basis of acceptability and a determination that the basis of acceptability was still valid.

LAR Attachment K, Licensing Action 11, NFPA 20 deviations associated with the fire pump installation, identifies that it will transition as a previously approved deviation; however, the text of the licensing action description indicates that the code compliance evaluation determined the MNS fire pumps to be compliant with NFPA 20-2007 edition. The NRC staff found that this code compliance determination indicates that the fire pumps will be considered functionally equivalent and the licensing action is, therefore, not required for transition.

In FPE RAI 06 (Reference 24), the NRC staff requested that the licensee provide clarification with regard to the transition compliance method for the fire pump in LAR Attachment K Licensing Action 11, and to describe the difference between LAR Attachment K, Licensing Action 11, and LAR Attachment L, Approval Request 5. In its response to FPE RAI 06 (Reference 10), the licensee stated that the last paragraph of LAR Attachment K, Licensing Action 11, under the heading "Licensing Basis," is incorrect, and that the LAR is revised to delete the last two sentences and to state that the bases for previous acceptance remains valid. The licensee further stated that the Licensing Action 11 and Approval Request 5 for NFPA 20 address different sections of NFPA 20. The licensee further stated that the focus of Licensing Action 11 is the location of the fire pump controllers, specific fire pump/controller design features, and that the pumps/controllers are not Underwriters Laboratories (UL) listed/Factory Mutual (FM) approved, and that the focus of Approval Request 5 is the ability to remotely stop fire pumps A and B. The NRC staff concludes that the licensee's response to FPE RAI 06 is acceptable because the licensee clarified its compliance strategy and also clarified the differences between LAR Attachment K, Licensing Action 11, and LAR Attachment L, Approval Request 5.

In FPE RAI 08 (Reference 24), the NRC staff found that LAR Attachment K, Licensing Action 01 relies on a fire protection feature identified as silicon dioxide insulated cable, and described as meeting the requirements of a 3-hour rated barrier; however, in LAR Attachment C, Table C-2, the cable is only identified as required for risk. The NRC staff requested that the licensee clarify the requirement basis for this feature and similar features credited in licensing actions or engineering evaluations. In its response to FPE RAI 08 (Reference 10), the licensee stated the silicon dioxide insulated cable (Meggitt Cable) is identified as MI Cable in Fire Area 09-11, Room 705 in LAR Attachment C, Table C-2. The licensee stated that the LAR will be revised such that the MI Cable will be identified with an "E" (engineering evaluation or licensing action criteria) in addition to the "R" (risk criteria) in LAR Attachment C, Table C-2. The licensee also stated that an additional review of required systems and features was performed and the review determined that MI cable is being used as a radiant energy shield in fire areas 32 and 33 and is cited in LAR Attachment C, Table C-2, as required for DID. The licensee further stated there is an engineering evaluation, which evaluates the MI cable for adequate separation; therefore, this MI cable should also be identified with an "E" for engineering evaluation. The NRC staff concludes that the licensee's response to FPE RAI 08 is acceptable because the licensee made revisions to LAR Attachment C, Table C-2 (Reference 12), which correctly identify the fire protection features required for implementation of NFPA 805.

Based on the NRC staff's review of the licensing actions identified and described in LAR Attachments C and K, as supplemented, the NRC staff concludes that the licensing actions are

identified by applicable fire area and remain valid to support the proposed license amendment because the licensee utilized the process described in NEI 04-02 (Reference 7), as endorsed by RG 1.205 (Reference 4), which include that a determination of the basis of acceptability be made as well as a determination that the basis remains still valid.

Based on the previous NRC staff approval of the deviations and the statement by the licensee that the basis remains valid, as presented in each appropriate fire area, the NRC staff concludes that the engineering evaluations being carried forward supporting the NFPA 805 transition, as identified in SE Table 3.5-2, are acceptable. See SE Section 2.5 for further discussion.

3.5.1.4 Existing Engineering Equivalency Evaluations (EEEEs)

The EEEEs that support compliance with NFPA 805, Chapters 3 or 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 NEI 04-02, as clarified by 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 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 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, the licensee identified and evaluated VFDRs using PB methods. VFDR identification, characterization, and resolutions were identified and summarized in LAR Attachment C for each fire area. Documented variances are all represented as separation issues. The licensee used the following strategies 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 DID-RA; or
- A FRE determined that applicable risk, DID, and safety margin criteria were satisfied with a plant modification(s), as identified in LAR, as supplemented.

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 (Reference 7), as endorsed by RG 1.205 (Reference 4).

3.5.1.6 Recovery Actions

LAR Attachment G lists the RAs identified in the resolution of VFDRs in LAR Attachment C for each fire area. The RAs identified include both actions considered necessary to meet risk acceptance criteria as well as actions relied upon as DID (see SE Section 3.5.1.7 below).

The NRC staff reviewed LAR Section 4.2.1.3, "Establishing Recovery Actions," and LAR Attachment G, "Recovery Actions Transition," to evaluate whether the licensee meets the associated requirements for the use of RAs per NFPA 805. The details of the NRC staff's review for RAs are described in SE Section 3.2.5, "Establishing Recovery Actions." The NRC staff's evaluation of the additional risk of RAs credited to meet the risk acceptance guidelines is provided in SE Section 3.4.4.

3.5.1.7 Recovery Actions Credited for Defense in Depth

The licensee stated in the LAR that RAs required for DID are not credited in the fire safety analysis and/or change evaluation as a part of the risk determination for any fire area. The licensee stated that this category of RAs are actions required for DID as a result of the DID evaluations performed in the FREs.

The licensee further stated that the nuclear safety and radioactive release performance goals, objectives, and criteria of NFPA 805, including the risk acceptance guidelines, are met without these actions. However, RAs required for DID are retained to meet the requirements to maintain a sufficient level of DID and are, therefore, considered part of the RI/PB FPP, which necessitates that these actions would be subject to a PCE if subsequently modified or removed.

The NRC staff reviewed LAR Section 4.2.1.3, "Establishing Recovery Actions," and LAR Attachment G, "Recovery Actions Transition," to evaluate whether the licensee meets the associated requirements for the use of RAs per NFPA 805. The NRC staff's evaluation of the licensee's process for identifying RAs and assessing their feasibility is provided in SE Section 3.2.5, "Establishing Recovery Actions."

3.5.1.8 Plant Fire Barriers and Separations

With the exception of ERFBS, passive fire protection features include the fire barriers used to form fire area boundaries (and barriers separating SSD trains) that were established in accordance with the plant's pre-NFPA 805 deterministic FPP. For the transition to NFPA 805, the licensee retains previously established fire area boundaries as part of the RI/PB FPP. The switchgear rooms (formerly fire areas 11, 12, 17, and 18) were combined with their respective penetration rooms to form new fire areas 9-11, 10-12, 15-17, and 16-18.

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, and as such, are addressed in SE Section 3.1.

3.5.1.9 Electrical Raceway Fire Barrier Systems

In LAR Attachment A, Table B-1, Section 3.11.5, the licensee stated that it does not utilize any ERFBS such as Thermo-Lag, 3M Interam, Hemyc, MT, or Darmatt systems for Chapter 4 compliance. The licensee further stated that the use of the Meggitt safety systems cable in fire area 9-11, which was previously approved by the NRC staff, is not specifically an ERFBS but its design function and qualification testing used the test methods and acceptance criteria the same as an ERFBS. See SE Section 3.5.1.3.

3.5.1.10 Conclusion for Section 3.5.1

As documented in LAR Attachment C, for those fire areas that used a deterministic approach in accordance with NFPA 805, Section 4.2.3, the NRC staff concludes that each of the fire areas

analyzed using the deterministic approach meet the associated criteria of NFPA 805, Section 4.2.3. This conclusion is based on:

- The licensee's documented compliance with NFPA 805, Section 4.2.3;
- The licensee's assertion that the success path will be free of fire damage without reliance on RAs;
- The licensee's assessment that the suppression systems in the fire area will have no impact on the ability to meet the NSPC; and
- The licensee's appropriate determination of the automatic fire suppression and detection systems required to meet the NSPC.

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

- Deviations from the pre-NFPA 805 fire protection licensing basis that were transitioned to the NFPA 805 licensing basis were reviewed for applicability, as well as continued validity, and found acceptable;
- VFDRs were evaluated and either found to be acceptable based on an integrated assessment of risk, DID, and safety margins, or modifications or RAs were identified and actions implemented to address the issue;
- RAs used to demonstrate the availability of a success path to achieve the NSPC were evaluated and the additional risk of their use determined, reported, and found to be acceptable. The licensee's analysis appropriately identified the fire protection SSCs required to meet the NSPC, including fire suppression and detection systems; and
- 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 3.5.1.8).

Accordingly, the NRC staff concludes that each fire area utilizing the deterministic or PB approach meets the applicable requirements of NFPA 805, Section 4.2

3.5.2 Clarification of Prior NRC Approvals

As stated in LAR Attachment T, there are no elements of the current FPP for which NRC clarification is needed.

3.5.3 Fire Protection during Non-Power Operational Modes

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

> This standard specifies the minimum fire protection requirements for existing light water nuclear power plants during all phases of plant operation, including shutdown, degraded conditions, and decommissioning.

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

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

The NRC staff reviewed LAR Section 4.3, "Non-Power Operational Modes" and LAR Attachment D, "NEI 04-02 Non-Power Operational Modes Transition," to evaluate the licensee's treatment of potential fire impacts during NPOs. The NRC staff concludes that the licensee followed the guidance described in NEI 04-02, as modified by FAQ 07-0040 (Reference 62), for demonstrating that the NSPC are met for HREs during NPO modes.

3.5.3.1 NPO Strategy and Plant Operating States

In LAR Section 4.3 and LAR Attachment D, the licensee stated that the process used to demonstrate that the NSPC are met during NPO modes is consistent with the guidance contained in FAQ 07-0040. As described in LAR Attachment D, in order to determine the potential impact of a fire during NPO modes, a nuclear safety assessment similar to that performed for SSD components while the plant is at power must be performed. The licensee stated that this effort focused on providing those sets of systems, components and equipment that are required to ensure that the key safety functions (KSFs) (excluding containment closure) as defined in the licensee's station procedure can be maintained during potential elevated risk conditions (formerly HREs). The licensee stated that some plant operational states (POS) were identified as being of an inherently lower risk, and thus, used to screen systems, components, and equipment from further evaluation. The licensee further stated that the potential elevated risk conditions that are to be reviewed would be when the POS meets the following conditions, thus constituting a higher risk condition:

- Fuel is in the reactor vessel AND
- Thermal margin (time to core boil) is low

OR

The plant is draining to or in reduced inventory operations.

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 incorporated the KSF success path equipment and cables 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.

The licensee stated that based on time to boil determinations, unless unusually long shutdown periods or low initial RCS temperatures exist, the elevated risk conditions, as described above will exist in Modes 3, 4, 5, and 6 and No-Mode, for NPO applicable POSs 1, 2, and 3. The licensee stated that the NPO goal is to ensure that contingency plans are established when the plant is in a NPO mode where the risk is intrinsically high, and during low risk periods, normal risk management controls and fire prevention/protection processes and procedures will be utilized.

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 a NPO mode where the risk is intrinsically high. LAR Section 4.3 and LAR Attachment D discusses these additional controls and measures. However, during low-risk periods, the licensee stated that normal risk management controls, as well as fire prevention/protection processes and procedures will be used.

In LAR Attachment D, the licensee stated that in FAQ 07-0040, a limited scope of POS and related KSFs to be reviewed for NPO is defined based on a qualitative risk understanding provided in other regulatory guidance for outage risk management. The licensee stated that with the exception of the POS applicable to the NPO review (generally of short duration), the plant is normally in a safe and stable condition, and even with the postulated loss of the decay heat removal KSF, there is sufficient time to take necessary actions to mitigate the effects of the loss. The licensee stated the potential elevated risk conditions to be reviewed would be when the POS meets the conditions described in SE Section 3.5.3.1 above.

In LAR Attachment D, the licensee provided the following excerpt from the station shutdown risk management procedure and to support the bases for NPO modes component selection:

> The KEY SAFETY FUNCTIONS ensure the integrity of the reactor coolant pressure boundary, ensure the capability to shutdown and maintain the reactor in a safe shutdown condition; and, ensure the capability to prevent or mitigate the consequences of accidents that could result in potentially significant off-site exposure.
>
> - DECAY HEAT REMOVAL
> - INVENTORY CONTROL
> - REACTIVITY CONTROL
> - CONTAINMENT CONTROL

- SPENT FUEL POOL COOLING
- POWER AVAILABILITY

The licensee stated that based on limiting the review to the specific POS identified in FAQ 07-0040, the containment control KSF listed in the station procedure is not applicable and the success paths for maintaining this KSF are not required to be included within the scope of selected systems, equipment and components. The licensee further stated that the basis for exclusion of this KSF is that maintenance of this KSF does not directly support the nuclear safety goals of NFPA 805 and by managing the decay heat removal and inventory control KSF, the need to rapidly establish closure should be eliminated. The containment control KSF is relevant to the NFPA 805 radioactive release performance goals, objectives, and criteria. The NRC staff review of the MNS radioactive release analysis, including at NPO POSs, is documented in SE Section 3.6.

In LAR Attachment D, the licensee stated that, as discussed in FAQ 07-0040, the components within the required flow paths to accomplish the KSF success path are compared to the population of components contained in the licensee's analysis to determine if the component's function is addressed as part of the SSA. The licensee further stated that if a component's function was appropriately addressed in its documents, then no further action is required, otherwise additional cable routing information for import into the analysis is required. The licensee stated that it employed the same methodology for cable selection and routing for SSD that it employed for NPO and that it loaded information into its analysis, which allowed sorting of the component and cable information on a fire area by fire area basis.

3.5.3.3 NPO Key Safety Functions and SSCs Used to Achieve Performance

LAR Attachment D defines the KSFs, the success paths to achieve the KSFs, and the components required for the success paths. The licensee stated that utilizing the fire area cable routing and equipment location information from its documents, its analysis focused on analyzing the KSF success paths on a fire area by fire area basis to assess the impact of a single fire. The licensee stated that it made no effort to eliminate or reduce fire impact by circuit analysis and, therefore, a conservative estimate of damage potential is provided, including the potential for spurious equipment operation. The licensee further stated that this allows better specification of the recommendations being made in this calculation to minimize fire risk in fire areas where KSF impacts can occur. As described in LAR Attachment D, the licensee evaluated the loss of KSFs on a fire area basis and categorized the fire areas as follows:

- Category One - KSF success paths are impacted, but none of the KSFs are lost for any of the units for a single potential fire (not a pinch point).
- Category Two - KSF success paths are impacted, and one or more KSFs may be lost for a given unit for a single potential fire (pinch point).
- Category Three - KSF success paths are impacted, and one or more KSFs may be lost for more than one unit for a single potential fire (pinch point).

- Category Four - KSF success paths are impacted, and all KSFs for both units may be lost due to a fire (there are no category four areas at MNS).

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. For MNS, a pinch point involves a fire area where all cables that support redundant components or trains of a system can be damaged by complete area burnout.

As described in LAR Attachment D, the licensee stated that based on the review of the 48 defined fire areas:

- Twelve areas were found to have an adequate number of KSF success paths survive the entire contents loss of the fire area, such that all KSFs remain available. No recommendations for additional fire protection measures during elevated risk conditions are made for these areas.

- Twenty-one fire areas could involve the loss of one or more KSFs on one unit due to the loss of all unit specific KSF success paths for a fire in that fire area. These KSF success paths can be preserved through the additional fire protection/fire prevention actions recommended to be established during elevated risk conditions.

- Fifteen fire areas could involve the loss of one or more KSFs in both units due to crediting equipment common for both units such as power supplies or other support systems/components. With the exception of the control rooms, which are constantly manned, these areas have been recommended for verification of functionality of available fire detection and suppression systems to manage fire risk to an appropriate level during elevated risk conditions.

- None could involve loss of all KSFs for both units.

The licensee stated that a significant insight of this analysis was the number of KSFs for the non-operational unit that can be impacted by a fire in the other operating unit as is typical of most refueling and maintenance outages. The licensee further stated that the 48 fire areas are consistent with the fire areas analyzed under the NSCA with the exception of fire area DIS (Discharge Structure), which it did not include because there are no NPO cables/equipment in that fire area.

Based on the above, 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 Item 13, which will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

3.5.3.4 NPO Pinch Point Resolutions and Program Implementation

In LAR Attachment D, the licensee stated that FAQ 07-0040 provides a listing of standard fire risk management methods that have been found to be acceptable to the NRC for managing fire risk during elevated risk conditions (i.e., HREs). The licensee further stated that during periods of NPOs, which are not defined as elevated risk conditions, the standard fire protection DID actions are considered sufficient to minimize fire risk. The licensee further stated that DID for NPO refers to the number of available KSF success paths per its shutdown risk management procedure, which contains recommendations from NUREG-1449, "Shutdown and Low-Power Operation at Commercial Nuclear power Plants in the United States," (Reference 114), and NUMARC 91-06, "Guidelines for Industry Actiuons to Assess Shutdown Management," (Reference 115), to minimize the fire risk to the KSFs.

In LAR Attachment D, the licensee stated that its shutdown risk management procedures will be revised to reflect the appropriate recommendations noted in FAQ 07-0040, and that the potential recommendations include:

- Limit hot work in this fire area during elevated risk conditions.
- Prohibit hot work in this fire area during elevated risk conditions.
- Verify that the available fire detection systems located in the fire area are functional. Post firewatch per selected licensee commitments (SLCs) in affected fire areas prior to entering elevated risk conditions if system(s) are impaired.
- Verify that the available fire suppression systems located in the fire area are functional. Post firewatch per SLCs in affected fire areas prior to entering elevated risk conditions if system(s) are impaired.
- Limit transient combustible storage in this fire area during elevated risk conditions.
- Prohibit transient combustible storage in this fire area during elevated risk conditions.
- Power can be removed from various components and equipment as part of outage configuration line-ups prior to entering elevated risk conditions.
- Provide a firewatch (continuous or periodic) in this fire area during elevated risk conditions.
- Activities in fire areas will be rescheduled to non-Elevated Risk Conditions.

The action to revise the shutdown risk management procedures to reflect the appropriate recommendations noted in FAQ 07-0040, and as determined in the MNS NPO calculation is described in LAR Attachment S, Table S-3, Implementation Item 13. The NRC staff concludes

that this action is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

In SSA RAI 07 (Reference 24), the NRC staff requested that the licensee provide clarification of two aspects of the NPO analysis: 1) a description of actions credited to minimize impact of fire induced spurious actuations, and 2) identify any RAs relied upon in the analysis. In its response to SSA RAI 07 (Reference 10), the licensee stated that 1) there are no additional actions beyond normal operating procedures for initial system alignments credited for NPO, and 2) no RAs are required to support the NPO analysis assumptions or are used to restore a KSF following a potential fire event during NPO conditions. The NRC staff concludes that the licensee's response to SSA RAI 07 is acceptable because the licensee credited no actions to minimize impact of spurious actuations, and did not use any RA assumptions in the NPO analysis.

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 POS where further analysis is necessary during NPOs;
- Identified the SSCs required to meet the KSFs during the POS 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 KSFs could be lost as a direct result of fire-induced damage; and
- Planned/implemented changes to appropriate procedures in order to employ a fire protection strategy for reducing risk at these pinch points during HREs.

Based on the information provided in the LAR, as supplemented, the NRC staff concludes that the licensee has provided reasonable assurance that the NSPC are 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 a combination of the deterministic approach and the PB approach, in accordance with NFPA 805, Sections 4.2.3 and 4.2.4.

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

- 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; and

- The required automatic fire suppression and automatic fire detection systems were appropriately documented for each fire area.

Accordingly, the NRC staff concludes that there is reasonable assurance that each fire area utilizing the deterministic approach meets NFPA 805, Section 4.2.3.

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

- The engineering evaluations for deviations from the existing FPP were evaluated and found to be valid and acceptable for meeting the requirements of NFPA 805, as allowed by NFPA 805, Section 2.2.7;

- Fire suppression effects were evaluated and found to have no adverse impact on the ability to achieve and maintain the NSPC for each fire area;

- 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;

- Modifications required to resolve VFDRs are properly documented for each fire area;

- 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;

- DID-RAs were properly documented for each fire area; and

- The required automatic fire suppression and automatic fire detection systems, and other fire protection features, 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 concludes that the licensee's analysis and outage management process during NPO provides 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 also concludes that no RAs are required during NPO modes and the overall approach for fire protection during NPO modes is acceptable because the requirements for risk, DID, and safety margin are met.

3.6 Radioactive Release Performance Criteria

NFPA 805, Chapter 1, defines the radioactive release goals, objectives, and performance criteria that must be met by the FPP in the event of a fire at a nuclear power plant, and states, in part, that.

> Radioactive Release Goal.
>
> 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.
>
> Radioactive Release Objective.
>
> 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.
>
> Radioactive Release Performance Criteria.
>
> 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 order to assess whether the MNS FPP to be implemented under NFPA 805 meets the above requirements, the licensee conducted a review of the existing fire pre-plans and fire brigade training materials. Each fire area was screened to determine if a potential for radioactive release was possible. Areas outside of the radiological controlled area were in general viewed as having no risk and were subsequently screened out. Compartments were then identified based on the presence of common smoke and runoff control systems, and each compartment was reviewed to ascertain whether existing engineering controls are adequate to ensure that radioactive materials (contamination) generated as a direct result of fire suppression activities would be contained and monitored before release to unrestricted areas, such that the release would meet the NFPA 805 radioactive release performance criteria. The review considered all plant operating modes, including full power and non-power conditions.

The licensee's review determined that the current FPP is compliant with the radiological release requirements of NFPA 805 and the guidance in RG 1.205. LAR Attachment E, Table E-1, provides the licensee's qualitative assessment on a fire area, by fire are basis. With the exception of those fire area discussed below, the licensee's qualitative review determined that MNS buildings and structures provide sufficient capacity to contain the liquid and gaseous fire-fighting effluents such that there are no offsite releases. The licensee updated each of the fire pre-plans addressing fire areas where radioactive materials may be present to include provisions for containment and monitoring of smoke and fire suppression agent runoff should the effectiveness of the installed engineering controls be challenged or impacted by fire

suppression activities. Responder actions such as smoke scrubbing, minimizing suppression water usage, and diverting runoff, will be prompted. Revisions to the fire strategy will highlight potential radioactive material release points such as: doors, hatches, rollup doors, and other similar openings. Specific administrative controls will be implemented to prevent unmonitored releases through the site storm drain system. Fire brigade members will be trained to identify and act upon potential radiological release scenarios. FPP will be modified to prompt consideration for monitoring and preventing radioactive release.

LAR Attachment E, Table E-1, identifies several compartments (e.g., contaminated material and waste handling areas, Units 1 and 2 turbine buildings, and yard areas) that have limited or no engineering controls to prevent airborne or liquid radioactive releases in the event of fire-fighting activities. The licensee stated that it will establish administrative controls to limit radiological releases resulting from firefighting activities in these compartments. To the extent practical, combustible materials in these compartments will be stored in metal containers with tight fitting closures and/or covers to inhibit combustion of the radioactive contents. For those areas where the use of fire resistant packages is not practical, the licensee procedurally limits the maximum amount of curies that can be stored in a single fuel package. A fire fuel package or bundle is the material in an area, container or building, anticipated to be involved in a fire, either because the fire starts in the material or from the spread of a fire originating elsewhere. This administrative limit is set such that, if the fuel package were completely consumed by fire, the resulting release of radioactivity would not result in an offsite dose to a member of the public in excess of the 10 CFR Part 20 limit. LAR Attachment S, Table S-3, Implementation Item 1.13, includes the action to develop administrative guidance to support ensuring that radioactive releases do not exceed limits in the event of a fire in areas where engineering controls will not contain the potential release. The NRC staff concludes that this action is acceptable because it will incorporate the provisions of NFPA 805 in the fire protection program and would be required by the proposed license condition.

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. As described in LAR Attachment E, Table E-1, the licensee will revise existing fire brigade training materials to address the radiation release objectives. The actions to complete these revisions are included in LAR Attachment S, Table S-3, Implementation Items 1.1 through 1.13, and the NRC considers them acceptable because the revisions will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

Based on (1) the information provided in the LAR, as supplemented, (2) the licensee's use of fire pre-plans, (3) the results of the NRC staff's evaluation of the identified engineered controls used to manage suppression water and combustion products, (4) the use of administrative controls to limit the amount of radioactivity that would be involved in a fire, and (5) the development and implementation of newly revised fire brigade training procedures, the NRC staff concludes that the licensee's FPP provides 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 expected to exceed the radiological dose limits in 10 CFR Part 20. In conclusion, the NRC staff finds that the licensee's FPP will comply with the requirements specified in NFPA 805, Sections 1.3.2, 1.4.2, and 1.5.2 upon completion of the implementation items.

3.7 NFPA 805 Monitoring Program

For this SE section, the following requirements from NFPA 805 (Reference 3), Section 2.6, are applicable to the NRC staff's review of the LAR:

NFPA 805, Section 2.6, "Monitoring":

> 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":

> Acceptable levels of availability, reliability, and performance shall be established.

NFPA 805, Section 2.6.2, "Monitoring Availability, Reliability, and Performance":

> 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":

> 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 MNS FPP systems and features after transition to NFPA 805. The focus of the NRC staff review was on 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 MNS will develop an NFPA 805 monitoring program consistent with FAQ 10-0059 (Reference 66). 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 of SSCs, 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, nuclear safety

capability assessment equipment, SSCs relied upon to meet radioactive release criteria, and fire protection programmatic elements.

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 fire protection program 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, which is consistent with FAQ 10-0059, provides reasonable assurance that MNS will implement an effective program for monitoring risk significant fire SSCs because the NFPA 805 monitoring program development and implementation process ensures that the NFPA 805 monitoring program does the following:

- Establishes the appropriate scope of SSCs to be monitored;
- Utilizes an acceptable screening process for determining the SSCs to be included in the program;
- Establishes availability, reliability, and performance criteria for the SSCs being monitored; and
- Requires corrective actions when SSC availability, reliability, or performance criteria targets are exceeded to bring performance back within the required range.

However, since the final values for availability and reliability, as well as the performance criteria for the SSCs being monitored, have not been established for the NFPA 805 monitoring program as of the date of this SE, completion of the MNS NFPA 805 monitoring program is included in LAR Attachment S, Table S-3, Implementation Item 5, and is considered acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

Completion of the monitoring program will occur on the same schedule as the implementation of NFPA 805, which the NRC staff concludes is acceptable.

3.7.1 Conclusion for Section 3.7

The NRC staff reviewed the licensee's proposed monitoring program and concludes that there is reasonable assurance that the program will meet the requirements of NFPA 805, Sections 2.6.1, 2.6.2 and 2.6.3 upon completion of the implementation item.

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), in regard to the appropriate content, configuration control, and quality of the documentation used to support the MNS FPP transition to NFPA 805.

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

> The analyses performed to demonstrate compliance with this standard shall be documented for each nuclear power plant (NPP). The intent of the documentation is that the assumptions be clearly defined and that the results be easily understood, that results be clearly and consistently described, and that sufficient detail be provided to allow future review of the entire analyses. Documentation shall be maintained for the life of the plant and be organized carefully so that it can be checked for adequacy and accuracy either by an independent reviewer or by the authority having jurisdiction (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 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., FM 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 MNS FPP design basis document and supporting documentation.

The MNS FPP design basis is a compilation of multiple documents (i.e., fire safety analyses, calculations, engineering evaluations, NSCA, etc.), databases, and drawings that 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 MNS processes that 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 MNSs 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 Sections 2.7.2 and 2.2.9 of NFPA 805," in order to evaluate the MNS configuration control process for the new NFPA 805 FPP.

To support the many other technical, engineering and licensing programs at MNS, 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 MNS 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 MNS document control system. The LAR also stated that analyses based on the PRA program, which includes the FREs, are issued as formal analyses subject to these same configuration control processes, and in LAR Attachment L, the licensee stated that the PRA will be subjected to the PRA peer review process specified in the ASME/ANS PRA standard (Reference 39).

Configuration control of the existing FPP during the transition period is maintained by the MNS change evaluation process, as defined in existing MNS configuration management and configuration control procedures. MNS will revise these procedures as necessary for application to the NFPA 805 FPP.

The NRC staff reviewed the licensee's process for updating and maintaining the MNS FPRA in order to reflect plant changes made after completion of the transition to NFPA 805 in SE Section 3.4.

Based on the description of the MNS configuration control process, which indicates that the new FPP design basis and supporting documentation will be controlled documents and that plant changes will be reviewed for impact on the FPP, the NRC staff concludes that the licensee's

approach for meeting the requirements of NFPA 805, Sections 2.7.2.1 and 2.7.2.2, regarding configuration control, is acceptable.

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 MNS FPP to NFPA 805 based on the requirements outlined above. The individual SE sections 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 requires that each analysis, calculation, or evaluation performed be independently reviewed. The licensee stated that its procedures require independent review of analyses, calculations, and evaluations, including those performed in support of compliance with 10 CFR 50.48(c). The LAR also 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 MNS procedures.

Based on the licensee's description of the process for performing independent reviews of analyses, calculations, and evaluations, the NRC staff concludes that the licensee's approach for meeting the Quality requirements of NFPA 805, Section 2.7.3.1, is acceptable.

3.8.3.2 Verification and Validation

NFPA 805 requires that each calculational model or numerical method used be verified and validated through comparison to test results or other acceptable models. The licensee stated that the calculational models and numerical methods used in support of the transition to NFPA 805 were verified and validated, and that the calculational models and numerical methods used post-transition will be similarly verified and validated. As an example, the licensee provided extensive information related to the V&V of fire models used to support the development of the MNS 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).

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

The NRC staff concludes that the theoretical bases of the models and empirical correlations used in the FM calculations that were not addressed in NUREG-1824 were identified and described in authoritative publications (References 89 - 100). SE Table 3.8-1 summarizes the additional fire models and empirical correlations, and the NRC staff's evaluation of the acceptability of each.

The FM employed by the licensee in the development of the MNS FREs used empirical correlations that provide bounding solutions for the ZOI, and conservative input parameters, which produced conservative results for the FM analysis. See SE Section 3.4.2.3 for further discussion of the licensee's FM method.

Based on the above, the NRC staff concludes that the licensee's approach regarding the FM used in the development of the fire scenarios for the MNS FPRA is acceptable.

3.8.3.2.2 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 9 and 10 and the NRC staff considers these acceptable because they will incorporate the provisions of NFPA 805 in the FPP and because they would be required by the proposed license condition.

3.8.3.2.3 Conclusion for Section 3.8.3.2

Based on the licensee's description of the MNS process for V&V of calculational models and numerical methods and their continued use post-transition, the NRC staff concludes that the licensee's approach to meeting the requirements of NFPA 805, Section 2.7.3.2, is acceptable because the models are consistent with approved uses in NRC guidance or other authoritative publications and the licensee has identified actions in LAR Attachment S, Implementation Items 9 and 10, which are required by the proposed license condition and will result in compliance with NFPA 805.

3.8.3.3 Limitations of Use

NFPA 805 requires that only acceptable engineering methods and numerical models be used for transition 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 empirical correlations and computer fire model in terms of the limits of its use. Table 3.8-1 in SE Attachment A and Table 3.8-2 in SE Attachment B, summarize the empirical correlations, algebraic models, and fire model used, how each was applied in the MNS FREs, the V&V basis for each, and the NRC staff evaluation for each.

3.8.3.3.2 Discussion of RAIs

By letters dated August 28, 2014 (Reference 24), and May 8, 2015 (Reference 26), NRC staff requested additional information concerning the FM conducted to support the FPRA. By letters dated October 13, 2014 (Reference 10); November 12, 2014 (Reference 11); December 12, 2014 (Reference 12); January 26, 2015 (Reference 13); February 27, 2015 (Reference 14); and August 20, 2015 (Reference 17), the licensee responded to these RAIs.

- In FM RAI 04 (Reference 24), the NRC staff requested that the licensee identify uses, if any, of the GFMTs approach outside the limits of applicability of the method and for those cases identified, explain how it justified the use of the GFMTs approach.

  In its response to FM RAI 04 (Reference 12), the licensee identified the following conditions and configurations for which the GFMT approach ZOI and HGL data may potentially be non-conservative if applied outside the limitations of the method:

  a. ZOIs in Elevated Temperature Enclosures
  b. ZOIs in Wall and Corner Locations
  c. ZOIs for Large Dimension Electrical Panels
  d. Flame Height Limitation for ZOIs
  e. ZOIs and Hot Gas Layer Temperatures for Scenarios with Secondary Combustibles
  f. Application of GFMT CFAST Zone Model Results

  For each of these configurations and conditions the licensee further determined if and where at MNS it used the GFMTs approach outside their limitations, and provided a detailed justification for these applications.

The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee demonstrated that the GFMTs approach and CFAST zone model were either used within their limits of applicability or that uses outside of the limitations were appropriately justified.

3.8.3.3.3 Post-Transition

The licensee stated that it will revise the appropriate processes and procedures to include the NFPA 805 quality requirements for use during the performance of post-transition FPP changes, including those for limitations of use.

Revision of the applicable post-transition processes and procedures to include NFPA 805 requirements for limitations of use are identified in LAR Attachment S, Table S-3, Implementation Items 9 and 10, and the NRC staff considers these acceptable because they will incorporate the provisions of NFPA 805 in the FPP and because they would be required by the proposed license condition.

3.8.3.3.4 Conclusion for Section 3.8.3.3

Based on the licensee's statements that the fire models used to support development of the FREs were used within their limitations, and the description of the MNS 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.

3.8.3.4 Qualification of Users

NFPA 805 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, NPP fire protection, and power plant operations. The licensee's procedures require that cognizant personnel who use and apply engineering analyses and numerical models be competent in the field of application and experienced in the application of the methods, including those personnel performing analyses in support of compliance with 10 CFR 50.48(c).

Specifically, these requirements are being addressed through the implementation of an engineering qualification process at MNS. The licensee has developed procedures that require that cognizant personnel who use and apply engineering analyses and numerical models be competent in the field of application and experienced in the application of the methods, including those personnel performing analyses in support of compliance with 10 CFR 50.48(c). These requirements are being addressed through the implementation of an engineering qualification process. MNS has developed qualification or training requirements for personnel performing engineering analyses and numerical methods.

3.8.3.4.1 Discussion of RAIs

The NRC staff asked RAIs pertaining to qualifications of the personnel who supported MNS FRE FM. Relevant RAIs and responses are summarized below:

- In FM RAI 05.a (Reference 24), the NRC staff requested that the licensee describe the requirements to qualify personnel for performing FM calculations in the NFPA 805 transition.

  In its response to FM RAI 05.a (Reference 10), the licensee explained that qualifications for Fire Protection Engineers and contractors to perform and review fire modeling analyses required successful completion of a targeted training program, meeting specific education requirements, and demonstrating comprehension and proficiency in fire modeling. The licensee further explained that, in the case of contractors, the contractor's quality assurance process ensured that the personnel performing the fire modeling were properly qualified and trained.

  The NRC staff concludes that the licensee's response to FM RAI 05.a is acceptable because the licensee demonstrated that the personnel performing FM are properly qualified and trained.

- In FM RAI 05.b (Reference 24), the NRC staff requested that the licensee describe what constitutes the appropriate qualifications for staff and consulting engineers to use and apply the fire modeling methods and tools.

  In its response FM RAI 05.b (Reference 10), the licensee provided details of the qualification process and requirements, and stated that FM calculations are required to be performed by a Fire Protection Engineer who meets the qualification requirements of NFPA 805, Section 2.7.3.4. The licensee further explained that the qualification requirements will continue to be met through Duke Energy procedures and project management of contractor support staff.

  The NRC staff concludes that the licensee's response to FM RAI 05.b is acceptable because the licensee demonstrated that its staff and consulting engineers have the appropriate qualifications to use and apply FM methods and tools.

- In FM RAI 05.c (Reference 24), the NRC staff requested that the licensee describe who performed the walkdowns of the MCR and other fire areas in the plant and explain whether the personnel that performed the FM participated in these walkdowns.

  In its response FM RAI 05.c (Reference 10), the licensee stated that contractor personnel performed the walkdowns and FM analysis for the MCR, that contractor personnel performed the initial walkdowns for the other areas and then applied the GFMTs approach, and that Duke personnel conducted subsequent walkdowns.

  The NRC staff concludes that the licensee's response to FM RAI 05.c is acceptable because the licensee demonstrated that walkdowns of the plant for FM were conducted by appropriate contractor and Duke personnel.

- In FM RAI 05.d (Reference 24), the NRC staff requested that the licensee describe the communication process between the FM analysts and PRA personnel to exchange the necessary information and ensure the licensee performed FM adequately and will continue to be performed adequately post-transition.

  In its response FM RAI 05.d (Reference 10), the licensee stated that throughout the NFPA 805 transition process, the fire protection engineers who conducted the FM and the PRA engineers maintained frequent communications and worked closely together. The licensee further explained that the same process will be used during implementation and post-transition.

  The NRC staff concludes that the licensee's response to FM RAI 05.d is acceptable because the licensee demonstrated a process for appropriate interactions between FM staff and PRA staff to ensure that FM was and will be adequately performed.

- In FM RAI 05.e (Reference 24), the NRC staff requested that the licensee describe the communication process between the consulting engineers and MNS personnel to exchange the necessary information and ensure the FM was performed adequately and will continue to be performed adequately post-transition.

  In its response FM RAI 05.e (Reference 10), the licensee stated that there has been and will continue to be knowledge transfer between the consulting engineers and the station and fleet personnel through the development of fire risk insights, the RAI process, updates to the analysis based on plant modifications, and use of the FPRA analysis to support regulatory activities. The licensee further noted that portions of the GFMTs and the MCR abandonment calculation methodology are used at the other Duke Energy's nuclear plants.

  The NRC staff concludes that the licensee's response to FM RAI 05.e is acceptable because the licensee demonstrated a process for appropriate interactions between consulting engineers and MNS personnel to ensure that FM was and will be adequately performed.

3.8.3.4.2 Post-Transition

LAR Section 4.7.3, "Compliance with Quality Requirements in Section 2.7.3 of NFPA 805 Fire Protection Quality," states that:

> ...Post-transition, cognizant personnel who use and apply engineering analysis and numerical models shall be competent in this 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. Duke Energy will develop and maintain qualification requirements for individuals assigned various tasks. Individuals will be qualified to appropriate job performance requirements per ACAD 98-004. Engineering training guidelines 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 that the licensee will implement to include NFPA 805 requirements for qualification of users is identified as part of LAR Attachment S, Table S-3, Implementation Item 11, and the NRC staff considers this acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition. In its letter dated November 21, 2016 (Reference 23), the licensee submitted a revised LAR Attachment S that indicated implementation item 11 has been completed.

3.8.3.4.3 Conclusions 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 requires that an uncertainty analysis be performed to provide reasonable assurance that the performance criteria have been met. (Note: 10 CFR 50.48(c)(2)(iv) states that an uncertainty analysis performed in accordance with NFPA 805, Section 2.7.3.5, is not required to support calculations used in conjunction with a deterministic approach.) The licensee stated that an uncertainty analysis was performed for the analyses used in support of the transition to NFPA 805, and that an uncertainty analysis will be performed for post-transition analyses.

3.8.3.5.1 General

The industry consensus standard for PRA development (i.e., the ASME/ANS PRA standard (Reference 39)), includes requirements to address uncertainty. Accordingly, the licensee addressed uncertainty as a part of the development of the MNS FPRA. 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 RI 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 (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 Fire Modeling RAIs

By letters dated August 28, 2014 (Reference 24), and May 8, 2015 (Reference 26), the NRC staff requested additional information concerning the FM conducted to support the FPRA. By letters dated October 13, 2014 (Reference 10); November 12, 2014 (Reference 11); December 12, 2014 (Reference 12); January 26, 2015 (Reference 13); February 27, 2015 (Reference 14); and August 20, 2015 (Reference 17), the licensee responded to these RAIs.

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

  In its response to FM RAI 06.a (Reference 14), the licensee explained that it addressed parameter uncertainty through the use of conservative and bounding analyses and by performing sensitivity studies. The licensee further provided a detailed discussion to explain how this was accomplished for the three primary FM activities for which parameter uncertainty is applicable:
  - MCR abandonment analysis,
  - HGL tabulations, and
  - ZOI tabulations.

  The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee adequately accounted for parametric uncertainty in the FM analysis performed in support of the NFPA 805 transition.

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

  In its response to FM RAI 06.b (Reference 14), the licensee explained that "model" and "completeness" uncertainty were also addressed through conservative and bounding analyses, and provided a detailed discussion to explain how this was accomplished for the same three modeling activities discussed in its response to FM RAI 06.a.

> The NRC staff concludes that the licensee's response to the RAI is acceptable because the licensee adequately accounted for model and completeness uncertainty in the FM analysis performed in support of the NFPA 805 transition.

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 included in LAR Attachment S, Table S-3, Implementation Items 9 and 10, and are considered acceptable because they will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

3.8.3.5.4 Conclusion for Section 3.8.3.5

Based on the licensee's description of the MNS 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, the NRC staff concludes that the MNS RI/PB fire protection quality assurance (QA) process is acceptable because it will adequately address each of the requirements of NFPA 805, Section 2.7.3, which include conducting independent reviews, performing V&V, limiting the application of acceptable methods and models to within prescribed boundaries, ensuring that personnel applying acceptable methods and models are qualified, and performing uncertainty analyses.

3.8.4 Fire Protection Quality Assurance Program

GDC 1 of Appendix A to 10 CFR Part 50 requires the following:

> 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 licensee stated that it will maintain the fire protection QA program and that during the transition to 10 CFR 50.48(c), it performed work in accordance with the quality requirements of NFPA 805, Section 2.7.3. The licensee also stated that future NFPA 805 work will be conducted in accordance with the requirements of NFPA 805, Section 2.7.3. The LAR described how the fire protection QA program will meet the requirements of NFPA 805, Sections 2.7.3.1 through 2.7.3.5, but also indicated that the fire protection QA program will be updated to match post NFPA 805 criteria. The licensee included this update in LAR

Attachment S, Table S-3, Implementation Item 15, and the NRC staff concludes that this is acceptable because it will incorporate the provisions of NFPA 805 in the FPP and would be required by the proposed license condition.

Based on 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, Sections 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 and RAI responses and concludes that, upon completion of the implementation items, the licensee's approach for meeting the requirements specified in Section 2.7 of NFPA 805 is acceptable.

4.0 FIRE PROTECTION LICENSE CONDITION

The licensee proposed a FPP license condition regarding transition to an RI/PB FPP under NFPA 805, in accordance with 10 CFR 50.48(c)(3)(i). The new license condition adopts the guidelines of the standard fire protection license condition promulgated in RG 1.205, Revision 1, Regulatory Position C.3.1, as issued on December 18, 2009 (74 FR 67253). Plant-specific changes were made to the sample license condition; however, the proposed plant-specific fire protection program license condition is consistent with the standard fire protection license condition, incorporates all of the relevant features of the transition to NFPA 805 at MNS, and is, therefore, acceptable.

The licensee updated its proposed License Condition and LAR Attachment S, "Modifications and Implementations Items," including the three subsections of Transition License Condition 2.C.(4).c in its letter dated January 14, 2016 (Reference 20). Subsequently, in its letter dated April 26, 2016 (Reference 21), the licensee revised LAR Attachment S to reflect that the Table S-2, "Plant Modifications Committed" have been completed and those items relocated to Table S-1, "Plant Modifications Completed." Therefore the proposed Transition License Condition 2.C.(4)c.2 addressing Table S-2 is no longer needed as there are no longer any items in Table S-2. Accordingly, Transition License Condition 2.C.(4).c is renumbered to reflect the two remaining paragraphs.

The following license condition is included in the revised license for MNS, and will replace Operating License Nos. NPF-9 and NPF-17, Condition 2.C.(4):

> Fire Protection Program
>
> Duke Energy Carolinas, LLC shall implement and maintain in effect all provisions of the approved fire protection program that comply with 10 CFR 50.48(a) and 10 CFR 50.48(c), as specified in the licensee amendment request dated September 26, 2013, as supplemented by letters dated January 8, 2014; October 13, 2014; November 12, 2014; December 12, 2014; January 26, 2015; February 27, 2015; March 13, 2015; July 15, 2015; August 20, 2015; September 9, 2015; October 1, 2015; January 14, 2016; April 26, 2016;

September 29, 2016; and November 21, 2016, and as approved in the safety evaluation dated December 6, 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 a license condition, and the criteria listed below are satisfied.

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

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

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

2) Prior NRC review and approval is not required for individual changes that result in a risk increase less than $1x10^{-7}$/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.

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

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

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

engineering evaluation and conclude that the change has not affected the functionality of the component, system, procedure, or physical arrangement, using a relevant technical requirement or standard.

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

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

This License Condition does not apply to any demonstration of equivalency under Section 1.7 of NFPA 805.

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

Prior NRC review and approval are not required for changes to the licensee's fire protection program that have been demonstrated to have no more than a minimal risk impact. The licensee may use its screening process as approved in the NRC safety evaluation report dated December 6, 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.

c. Transition License Conditions

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

2) The licensee shall implement the items as listed in Attachment S, Table S-3, "Implementation Items," of Duke Energy letter dated

November 21, 2016, within 180 days or 365 days after issuance of the license amendment unless that date falls within a scheduled refueling outage, then, implementation will occur within 60 days after startup from that scheduled refueling outage. Implementation Item 19 is associated with thermoplastic cable analysis and will be completed by June 30, 2017. Implementation Item 20, associated with the pressure boundary breach analysis, will be completed by December 31, 2017.

5.0 SUMMARY

The NRC staff reviewed the licensee's application, as supplemented by various letters, to transition to an RI/PB FPP in accordance with the requirements established by NFPA 805. The NRC staff concludes that 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).

Implementation of the RI/PB FPP in accordance with 10 CFR 50.48(c) will include the application of a new fire protection license condition. The new license condition includes a list of implementation items that must be completed in order to support the conclusions made in this SE, as well as an established date by which full compliance with 10 CFR 50.48(c) will be achieved. Before the licensee is able to fully implement the transition to an FPP based on NFPA 805 and apply the new fire protection license condition, to its full extent, the implementation items must be completed within the timeframe specified.

6.0 STATE CONSULTATION

In accordance with the Commission's regulations, the North Carolina official was notified on January 28, 2016, of the proposed issuance of the amendment. The state official had no comments.

7.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding published in the *Federal Register* on February 19, 2014 (79 FR 9492). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

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

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Principal Contributors:

U.S. NRC Office of Nuclear Reactor Regulation –
Jay Robinson, Charles Moulton, Harry Barrett, Thinh Dinh, Alayna Pearson, Naeem Iqbal, Stephen Dinsmore, Christopher Fong

Pacific Northwest National Laboratories –
Steve Short, Karl Bohlander

Center for Nuclear Waste Regulatory Analyses –
Marc Janssens

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Attachments:
A. Table 3.8-1 – V&V Basis for Fire Modeling Correlations Used at MNS
B. Table 3.8-2 – V&V Basis for Other Fire Models and Related Calculations Used at MNS
C. Abbreviations and Acronyms
D. NRC Staff Review of Resolutions to McGuire Nuclear Station Internal Events and Fire PRA Facts and Observations (F&Os)

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

Correlation	Application at MNS	V&V Basis	NRC Staff Evaluation of Acceptability
Heskestad flame height correlation	Development of ZOI tables in GFMTs document	NUREG-1805 (Reference 47) NUREG-1824 (Reference 48) SFPE Handbook (Reference 116)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in NUREG-1824 and the SFPE Handbook of Fire Protection Engineering. Based on its review and evaluation, the NRC staff concludes that the use of this correlation in the MNS application is acceptable.

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

Correlation	Application at MNS	V&V Basis	NRC Staff Evaluation of Acceptability
Heskestad plume temperature correlation (Heskestad Plume Temperature Correlation is not listed in LAR Attachment J, however, LAR Attachment J, Table J-2, lists the plume centerline temperature correlation developed by Yokoi (Reference 94), which is similar to the Heskestad plume temperature correlation.	Development of ZOI tables in GFMTs document	NUREG-1805 (Reference 47) NUREG-1824 (Reference 48) SFPE Handbook (Reference 116)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in NUREG-1824 and the SFPE Handbook of Fire Protection Engineering. Based on its review and evaluation, the NRC staff concludes that the use of this correlation in the MNS application is acceptable.

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

Correlation	Application at MNS	V&V Basis	NRC Staff Evaluation of Acceptability
Modak point source radiation model	Development of ZOI tables in GFMTs document	NUREG-1805 (Reference 47) NUREG-1824 (Reference 48) SFPE Handbook (Reference 117)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in NUREG-1824 and the SFPE Handbook of Fire Protection Engineering. Based on its review and evaluation, the NRC staff concludes that the use of this correlation in the MNS application is acceptable.
Shokri and Beyler flame radiation model	Development of ZOI tables in GFMTs document	Peer-reviewed journal article (Reference 118)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in a peer-reviewed journal article. Based on its review and evaluation, the NRC staff concludes that the use of this correlation/model in the MNS application is acceptable.
Mudan and Croce flame radiation model	Development of ZOI tables in GFMTs document	Peer-reviewed journal article (Reference 92)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in a peer-reviewed journal article. Based on its review and evaluation, the NRC staff concludes that the use of this correlation/model in the MNS application is acceptable.
Plume heat flux correlation by Wakamatsu et al.	Development of ZOI tables in GFMTs document	Peer-reviewed conference paper (Reference 93)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in a peer-reviewed conference paper. Based on its review and evaluation, the NRC staff concludes that the use of this correlation in the MNS application is acceptable.

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

Correlation	Application at MNS	V&V Basis	NRC Staff Evaluation of Acceptability
Yokoi plume centerline temperature correlation	Development of ZOI tables in GFMTs document	National research laboratory report (Reference 94) Peer-reviewed journal article (Reference 95)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in an authoritative publication and a peer-reviewed journal article. Based on its review and evaluation, the NRC staff concludes that the use of this correlation in the MNS application is acceptable.
Hydrocarbon spill fire size correlation	Development of ZOI tables in GFMTs document	SFPE Handbook (Reference 96)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in the SFPE Handbook of Fire Protection Engineering. Based on its review and evaluation, the NRC staff concludes that the use of this correlation in the MNS application is acceptable.
Flame extension correlation	Development of ZOI tables in GFMTs document	SFPE Handbook (Reference 97)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in the SFPE Handbook of Fire Protection Engineering. Based on its review and evaluation, the NRC staff concludes that the use of this correlation in the MNS application is acceptable.
Delichatsios line source flame height model	Development of ZOI tables in GFMTs document	Peer-reviewed journal article (Reference 98)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in a peer-reviewed journal article. Based its review and evaluation, the NRC staff concludes that the use of this model in the MNS application is acceptable.

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

Correlation	Application at MNS	V&V Basis	NRC Staff Evaluation of Acceptability
Corner flame height correlation	Development of ZOI tables in GFMTs document	SFPE Handbook (Reference 97)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in the SFPE Handbook if Fire Protection Engineering. Based on its review and evaluation, the NRC staff concludes that the use of this correlation in the MNS application is acceptable.
Kawagoe natural vent flow equation	Development of ZOI tables in GFMTs document	National research laboratory report (Reference 99)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in an authoritative publication. Based on its review and evaluation, the NRC staff concludes that the use of this equation in the MNS application is acceptable.
Yuan and Cox line fire flame height and plume temperature correlations	Development of ZOI tables in GFMTs document	Peer-reviewed journal article (Reference 100)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in a peer reviewed journal article. Based on its review and evaluation, the NRC staff concludes that the use of these correlations in the MNS application is acceptable.
Lee cable fire model	Development of ZOI tables in GFMTs document	NBSIR 85-3196 (Reference 101)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in an authoritative publication. Based on its review and evaluation, the NRC staff concludes that the use of this model in the MNS application is acceptable.
Babrauskas method to determine ventilation-limited fire size	Development of ZOI tables in GFMTs document	Peer-reviewed journal article (Reference 102)	• Licensee provided verification of the coding of this correlation in the GFMTs approach (LAR, Attachment J). • The correlation is validated in a peer-reviewed journal article. Based on its review and evaluation, the NRC staff concludes that the use of this method in the MNS application is acceptable.

Attachment B: Table 3.8-2, V&V Basis for Other Fire Models and Related Calculations Used at MNS

Model	Application at MNS	V&V Basis	NRC Staff Evaluation of Acceptability
CFAST (Versions 6.0.10 and 6.1.1)	Development of HGL tables in the GFMTs document, and MCR abandonment times calculations	NUREG-1824, Volume 5 (Reference 48) NIST Special Publication 1086 (Reference 119)	• The modeling technique is validated in NUREG-1824 and an authoritative publication. • Licensee stated that in most cases, the correlation has been applied within the validated range reported in NUREG-1824. Licensee provided justification for cases where the correlation was used outside the validated range reported in NUREG-1824, Volume 5 (LAR, Attachment J). Based on its review and evaluation, the NRC staff concludes that the use of CFAST model in the MNS application is acceptable.

Attachment C: Abbreviations and Acronyms

ADAMS	Agencywide Documents Access and Management System
AHJ	authority having jurisdiction
ANS	American Nuclear Society
ASME	American Society of Mechanical Engineers
BTP	Branch Technical Position
BWR	boiling-water reactor
CAROLFIRE	Cable Response to Live Fire
CC	capability category
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
DESIREE-Fire	Direct Current Electrical Shorting in Response to Exposure Fire
DID RA	defense-in-depth recovery action
DID	defense-in-depth
DG	diesel generator
EEEE	existing engineering equivalency evaluation
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
FIVE	Fire Induced Vulnerability Evaluation Methodology
FM	fire modeling
FPE	fire protection engineering
FPP	fire protection program
FPRA	fire probabilistic risk assessment
FR	Federal Register
FRE	fire risk evaluation
FSAR	final safety analysis report
GDC	general design criteria
GFMT	generic fire modeling treatments
GL	generic letter
HEP	human error probability
HGL	hot gas layer
HRA	human reliability analysis
HRE	high(er) risk evolution
HRR	heat release rate
HVAC	heating, ventilation, and air conditioning
IEEE	Institute of Electrical and Electronics Engineers
KSF	key safety function
kV	kilovolt
kW	kilowatt
LAR	license amendment request
LER	licensee event report
LERF	large early release frequency
MCB	main control board

MCR	main control room
min	minute(s)
MNS	McGuire Nuclear Station, Units 1 and 2
MSO	multiple spurious operation
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NLO	Non-licensed operator
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
OMA	operator manual action
PAU	physical analysis unit
PB	performance-based
PCE	plant change evaluation
PCS	primary control station
PRA	probabilistic risk assessment
PSA	probabilistic safety assessment
PWR	pressurized-water reactor
QA	quality assurance
RA	recovery action
RAI	request for additional information
RB	reactor building
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
RP	regulatory position
SCBA	self contained breathing apparatus
SE	safety evaluation
SER	safety evaluation report
SFPE	Society of Fire Protection Engineers
SLCs	selected licensee commitments
SOKC	state of knowledge correlation
SR	supporting requirement
SSA	safe shutdown analysis
SSC	structures, systems, and components
SSD	safe shutdown
TS	Technical Specification
UFSAR	updated final safety analysis report
V	Volt
V&V	verification and validation
VFDR	variance from deterministic requirements
yr	year
ZOI	zone of influence

Attachment D:

NRC Staff Review of Resolutions of MNS Internal Events
and Fire PRA Facts and Observations (F&Os)

The NRC staff reviewed the licensee's resolutions of all of the F&Os to determine the technical adequacy of both the IEPRA and the FPRA for the NFPA 805 application. The NRC staff requested additional information to assess the adequacy of some of the resolutions for the review. The tables in SE Attachment D document the conclusions of the NRC staff's review of the licensee's resolution to each F&O/self-assessment issue. Table D-1 documents these conclusions for the IEPRA, Table D-2 documents these conclusions for the FPRA, and Table D-3 documents these conclusions for the FPRA SRs where capability category-I (CC-I) was met.

The NRC staff documents its basis for finding the licensee's resolution of each F&O acceptable by one of two methods. The first method is that the resolution was determined to be acceptable without the need for an RAI for the reasons reflected in the column titled "With No RAI Based on (A/B/C)" as indicated by noting "A" or "B" or "C," which are defined in the key at the end of the table. The second method is that resolution to the F&O was found acceptable based on the licensee's response to RAIs. If the licensee's response to the RAI is discussed in SE Section 3.4, then it is summarized in the "Discussed in SE" column. If the licensee's response to the RAI is not discussed in SE Section 3.4, then it is summarized in the "Not Discussed in SE" column. Generally, an RAI is discussed in SE Section 3.4, if the licensee made a change to the PRA in response to the RAI.

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
IE-02	IE-A2 AS-B1 IE-C6		See response to PRA RAI 02.f (Reference 12), regarding meaning of insignificant impact. Acceptable to the NRC staff because the licensee states that room heat-up calculations show that loss of HVAC will not impact equipment in the control room, switchgear rooms or battery rooms within the 24-hour mission time of the PRA.	
IE-05	IE-A1 IE-A5 IE-A6 AS-B1	C		
IE-06	IE-B3	A		

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
LAR Attachment U, Table U-1	IE-A4	A		
LAR Attachment U, Table U-1	IE-A8	A		
LAR Attachment U, Table U-1	IE-C14			See PRA RAI 02.f in SE Section 3.4.2.1 regarding meaning of insignificant impact.
AS-1	AS-A1 AS-A2 AS-A6 AS-A7 AS-A10 AS-A11 AS-B1 AS-B7 IE-B1 SY-A10 SY-A18 QU-A1 QU-A4 QU-B6 QU-D4	A		
AS-3	AS-A2 AS-A4 AS-A7 AS-A10 AS-B1 AS-B2 AS-B5 AS-B6	A		

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
	SC-A3 SC-A4 QU-A1 QU-B6			
AS-4	AS-A4 AS-A5 AS-A10 SC-A6 SY-A2 SY-A22 HR-G6 QU-A1		See response to PRA RAI 02.g (Reference 12) , regarding restoration of RCP seal cooling within 15 minutes. Acceptable to the NRC staff based on 1) the licensee's analysis that seal failure due to thermal shock would not occur within 30 minutes of loss of seal cooling, which provides for a significant time margin based on the licensee's statement that the median time for restoration of seal cooling is 7.5 minutes and 2) the PRA does not credit restoration of seal cooling after 30 minutes	
AS-5	QU-D4	A		
AS-7	IE-B1	A		
AS-10	IE-B1	A		
LAR Attachment U, Table U-1	IE-B1	A		
TH-1	SC-A2 SC-B1 SC-B3 SC-B4 SC-B5 SY-B7	A		
TH-2	AS-A8 SC-A1 SC-A2		See response to PRA RAI 02.h (Reference 12) , regarding the meaning of negligible impact. Acceptable to the NRC staff because the licensee stated that there is no impact on the results if core damage is	

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
			defined as 2000 degrees F. The NRC staff considers this conservative relative to the temperature at which fission products are released. The licensee stated that a new plant-specific HRA timing analysis bounded the HRA timing used in the FPRA with respect to the core damage definition of 2000 degrees F.	
TH-3	AS-A9 SC-A2 SC-A3 SC-A6 SC-B1 SC-B2 SC-B3 SC-B4 SC-C1 SC-C2 SY-A10 SY-A21 SY-B7	A		
TH-4	AS-A9 SC-A2 SC-A3 SC-A6 SC-B1 SC-B2 SC-B3 SC-B4 SC-C1 SC-C2 SY-A10	A		

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
	SY-A21 SY-B7			
TH-5	SC-A2 SC-A3 SC-A6 SC-B3 SC-B5 SC-C1 SC-C2 HR-F2 HR-G4	A		
TH-6	AS-B3 SC-A6 SC-B2 SC-C1 SC-C2 SY-A18 SY-A21 SY-A22 SY-B7 SY-B8	A		
DE-3	SY-C2	C		
DE-4	AS-A10 SC-A3 SY-A5 SY-A6 SY-A7 SY-A11 SY-A12 SY-B1 SY-B3		See response to PRA RAI 02.k (Reference 12), regarding the modeling of the 19 new common cause failure (CCF) basic events. Acceptable to the NRC staff because the original method of modeling a single CCF event was replaced with multiple CCF events. A total of 19 new CCF basic events were included in the MNS FPRA model and results reported in the LAR.	

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
	SY-B4 SY-B10 DA-D6 QU-A4			
ST-1	SC-A6	A		
SY-3	SY-A2 SY-A3 SY-A5 SY-A6 SY-A7 SY-A11 SY-A12 SY-B1 SY-B10 SY-B15 SY-C2 AS-A4 AS-A5 AS-A10 SC-A3 SC-A6	C		
SY-4	SY-A3 SY-A5 SY-A6 SY-A7 SY-A11 SY-A12 SY-B1 SY-B4 SY-B10 SC-A3	C		

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
	QU-A4			
SY-5	SY-A3 SY-A5 SY-A6 SY-A7 SY-A11 SY-B1 SY-B4 SY-B10 SC-A3 QU-A4	A		
SY-7	SY-A3 SY-A5 SY-A6 SY-A7 SY-A11 SY-A12 SY-B1 SY-B4 SY-B10 AS-A10 SC-A3 QU-A4	A		
HR-1	HR-A1 HR-A2 HR-A3 HR-B1 HR-B2 HR-C3 SY-A16		See response to PRA RAI 02.j (Reference 12) , regarding the treatment of miscalibration errors. Acceptable to the NRC staff because all but four of the miscalibration events were screened in accordance with the criteria in the PRA standard (SR SY-A15), and the four not screened were determined to have a contribution to	

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
			fire risk less than the post-transition plant change evaluation criteria.	
HR-3	HR-G1 HR-G3	C		
HR-5	HR-D5 HR-G7 HR-H3 QU-C1 QU-C2	A		
HR-6	HR-F2 HR-G1 HR-G2 HR-G3 HR-I1 HR-I2 SC-C1 SC-C2	C		
HR-8	HR-G7 HR-H3	A		
LAR Attachment U, Table U-1	HR-D6		See response to PRA RAI 02.l (Reference 12) , regarding the "suggested data refinement" identified in the self-assessment. Acceptable to the NRC staff because "suggested data refinement" was to use mean HEP values rather than median values, which was incorporated in the Fire PRA model and results reported in the LAR.	
LAR Attachment U, Table U-1	HR-G6		See response to PRA RAI 02.m (Reference 12) , regarding the status of the consistency check. Acceptable to the NRC staff because the recommended consistency check has been completed with no impact to the	

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
			Fire PRA model and results reported in the LAR.	
LAR Attachment U, Table U-1	DA-C8	A		
LAR Attachment U, Table U-1	DA-C10	A		
LAR Attachment U, Table U-1	DA-C11 DA-C12	A		
LAR Attachment U, Table U-1	DA-C13	A		
LAR Attachment U, Table U-1	DA-D1	A		
LAR Attachment U, Table U-1	DA-D3	A		
LAR Attachment U, Table U-1	DA-D4	A		
DA-2	DA-A1 DA-A4 DA-B1 DA-B2 DA-C2	C		
DA-5	DA-C1 DA-C2 DA-D5 DA-D6 SY-B1 SY-B3 SY-B4		See response to PRA RAI 02.k (Reference 12) , regarding the modeling of the 19 new common cause failure (CCF) basic events. Acceptable to the NRC staff because the original method of modeling a single CCF event was replaced with 19 new CCF basic events that were included in the MNS Fire PRA model	

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
	QU-A4		and results reported in the LAR.	
LAR Attachment U, Table U-1	DA-D8	A		
LAR Attachment U, Table U-1	DA-E2	A		
QU-1	QU-F2	A		
QU-2	QU-A5 SY-A10 SY-A24 HR-H1			See PRA RAI 02.i in SE Section 3.4.2.1 regarding accounting for the unavailability of the nuclear service water (RN) pump during cross-tie operation to the opposite unit.
QU-4	QU-B2	C		
LAR Attachment U, Table U-1	QU-D4	C		
LAR Attachment U, Table U-1	QU-F6	C		
2012 Focused-scope Peer Review	LE-B2 LE-C1 LE-C3 LE-C4 LE-C9 LE-C11 LE-D2 LE-D3	A		
LE-E2-01	LE-E2	C		
LE-G3-01	LE-F1	C		

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
	LE-G3			
LE-G5-01	LE-G5	C		
LE-G6-01	LE-G6	C		
IFPP-A1-01	IFPP-A1	A		
IFPP-A5-01	IFPP-A5	C		
IFPP-B1-01	IFPP-B1 IFSO-B1 IFSN-B1 IFEV-B1	C		
IFPP-B3-01	IFPP-B3 IFSO-B3 IFSN-B3 IFEV-B3 IFQU-B3	C		
IFSO-A1-01	IFSO-A1	C		
IFSO-A4-01	IFSO-A4	C		
IFSO-A5-01	IFSO-A5	C		
IFSN-A2-01	IFSN-A2	C		
IFSN-A4-01	IFSN-A4 IFSN-A13	C		
IFSN-A5-01	IFSN-A5 IFSN-A6 IFSN-A15 IFQU-A9	C		
IFSN-A10-01	IFSN-A10	C		
IFSN-A12-01	IFSN-A12	C		
IFSN-A17-01	IFSN-A17 IFSO-A6 IFQU-A11	C		
IFEV-A1-01	IFEV-A1	C		

Table D-1, IEPRA				
Facts and Observations (F&Os) Finding Suggestion ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		With No RAI based on (A/B/C)	Via RAI Response	
F&O ID	SR		Not Discussed in SE	Discussed in SE
IFQU-A6-01	IFQU-A6	C		
IFQU-A10-01	IFQU-A10	C		

Acceptability Key for SE Attachment D, Table D-1

A: The NRC staff finds that the licensee's resolution for the capability category of the SR as described by the licensee in the LAR provides confidence that the requirements of the SR have been addressed and, if needed, the PRA has been modified, and therefore, the PRA quality with respect to the SR is acceptable for this application. Examples of acceptable CC-I SRs are modeling methods that yield conservative FRE and change evaluation results.

B: The NRC staff finds that the licensee's resolution of the capability category of the SR as described by the licensee in the LAR and further clarified during the audit provides confidence that requirements of the SR have been addressed and, if needed, the PRA has been modified, and therefore, the PRA quality with respect to the SR is acceptable for this application. Examples of acceptable CC-I SRs are modeling methods that yield conservative FRE and change evaluation results.

C: The NRC staff finds that the licensee's resolution for the capability category of the SR, as described by the licensee in the LAR, would have a negligible effect on the evaluations relied upon to support fire risk evaluations and has no impact on the conclusions of the risk assessment, and therefore, the PRA quality with respect to the SR is acceptable for this application. Examples are those SRs that don't affect the fire PRA.

Table D-2, FPRA				
Finding/Suggestion (F&O) ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		Without RAI based on (A/B/C)	Via RAI Response	
F&O	SR		Not Discussed in SE	Discussed in SE
CS-C1-NA (no F&O)	CS-C1	A		
CS-C3-01	CS-C3	A		
CS-C4-01	CS-C4	A		
FSS-C2-01	FSS-C2			See FM RAI 01.j and PRA RAI 03 in SE Section 3.4.2.3.
FSS-C5-01	FSS-C5			See FM RAIs 02.a and 02.c in SE Section 3.4.2.3.
FSS-C5-02	FSS-C5			See PRA RAI 01.b in SE Section 3.4.2.2.
FSS-D3-01	FSS-D3	A		
HRA-A1-01	HRA-A1		See response to PRA RAI 02.l (Reference 12) , regarding the "suggested data refinement" identified in the self-assessment. Acceptable to the NRC staff because "suggested data refinement" was to use mean HEP values rather than median values, which was incorporated in the Fire PRA model and results reported in the LAR.	
HRA-A2-01	HRA-A2	A		
HRA-A2-02	HRA-A2	A		
HRA-C1-01	HRA-C1		See response to PRA RAI 01.c (Reference 12), regarding use of JHEPs less than 1E-05. Acceptable to the NRC staff because the licensee identified that the fire PRA applies four JHEPs less than 1E-05 and justifies the lower JHEPs based on 1) large time window between actions, 2) actions are taken based on different cues, and 3) there are intervening successes between some of the actions.	

Table D-2, FPRA				
Finding/Suggestion (F&O) ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		Without RAI based on (A/B/C)	Via RAI Response	
F&O	SR		Not Discussed in SE	Discussed in SE
HRA-E1-01	HRA-E1			See PRA RAI 01.c and ii in SE Section 3.4.2.2 regarding updating HEPs using the NUREG-1921 methodology.
MU-B3-01	MU-B3	A		
PP-B2-01	PP-B2	A		
PP-B7-01	PP-B7		See response to PRA RAI 01.a (Reference 10) . Acceptable to the NRC staff because the licensee clarified that the walkdowns were conducted over several months between October 2009 and June 2010, which is subsequent to the peer review conducted in September 2009. Also, the licensee clarified that one purpose of these walkdowns was to verify the integrity of compartments credited in the MCA by confirming the conditions and characteristics of credited compartment boundaries.	
PP-C3-01	PP-C3		See response to PRA RAI 01.a (Reference 10) . Acceptable to the NRC staff because the licensee clarified that the walkdowns were conducted over several months between October 2009 and June 2010, which is subsequent to the peer review conducted in September 2009. Also, the licensee clarified that one purpose of these walkdowns was to verify the integrity of compartments credited in the MCA by confirming the conditions and characteristics of credited compartment boundaries.	
PRM-B2-01	PRM-B2		See responses to PRA RAIs 02.f through 02.h and 02.j through 02.m (Reference 12). See the internal events PRA record of review (SE Table D-1) for the NRC staff's review	See PRA RAI 02.f in SE Section 3.4.2.1 regarding meaning of

Table D-2, FPRA				
Finding/Suggestion (F&O) ID or Supporting Requirement (SR)		Plant Resolution Found Acceptable to the Staff		
		Without RAI based on (A/B/C)	Via RAI Response	
F&O	SR		Not Discussed in SE	Discussed in SE
			and resolution of each of these PRA RAIs.	insignificant impact and PRA RAI 02.i regarding accounting for the unavailability of the nuclear service water (RN) pump during cross-tie operation to the opposite unit.
PRM-B11-01	PRM-B11		See response to PRA RAI 02.I (Reference 12) , regarding the "suggested data refinement" identified in the self-assessment. Acceptable to the NRC staff because "suggested data refinement" was to use mean HEP values rather than median values, which was incorporated in the Fire PRA model and results reported in the LAR.	
SF-A2-01	SF-A2	A		
SF-A3-01	SF-A3	A		
SF-A4-01	SF-A4	C		
SF-A5-01	SF-A5	C		

Acceptability Key for SE Attachment D, Table D-2

A: The NRC staff finds that the resolution of the F&O as described by the licensee in the LAR provides confidence that the issues raised by the F&O have been addressed and, if needed, the PRA has been modified, and therefore, the resolution of the F&O is acceptable for this application.

B: The NRC staff finds that the resolution of the F&O as described by the licensee in the LAR and further clarified during the audit provides confidence that the issues raised by the F&O have been addressed and, if needed, the PRA has been modified, and therefore, the resolution of the F&O is acceptable for this application.

C: The NRC staff finds that the resolution of the F&O, as described by the licensee in the LAR, would have a negligible effect on the evaluations relied upon to support fire risk evaluations and has no impact on the conclusions of the risk assessment and therefore, the resolution of the F&O is acceptable for this application. Examples of such F&Os may be suggestions, as

well as those F&Os that don't affect the fire PRA. Documentation issues may fall into this category as well.

Table D-3, FPRA, (CC-I Met)			
Supporting Requirement (SR)	Plant Resolution Found Acceptable to the Staff		
	Without RAI based on (A/B/C)	RAI Response	
		Not Discussed in the SE	Discussed in the SE
PP-B3	A		
PP-B5	A		
FSS-C1	A		
FSS-C2			See PRA RAI 03 in SE Section 3.4.2.3.
FSS-C4	A		
FSS-D3	A		
FSS-D7		See response to PRA RAI 01.d (Reference 11). The NRC staff does not agree that just because there is both a main and a redundant Halon cylinder that, therefore, the system has redundancy. Oftentimes the reserve cylinder requires manual actuation when the first fails and, besides, the fire suppression system is composed of more than just the Halon cylinders (e.g., activation and Halon distribution system), which are not redundant. However, the response is acceptable to the NRC staff because the licensee states that 1) a review of system impairment logs was reviewed and 2) it was determined from this review that the Halon system unavailability was less than the generic unavailability from NUREG/CR-6850 of 0.05 used in the FPRA.	
FSS-E3			See FM RAI 06 in SE Section 3.8.3.5.2
FSS-F3	C		
FSS-H2	A		
HRA-B4		See response to PRA RAI 01.e (Reference 12), regarding the basis for the CC-II assessment for this SR. Acceptable to the NRC staff because the licensee explained that the HRA included a review of potential errors of commission due to fire-induced faulty instrumentation readings and determined that there were no instances where an undesired operator action would be taken without	

Table D-3, FPRA, (CC-I Met)			
Supporting Requirement (SR)	Plant Resolution Found Acceptable to the Staff		
	Without RAI based on (A/B/C)	RAI Response	
		Not Discussed in the SE	Discussed in the SE
		first taking one or more confirmatory actions.	
HRA-C1			See PRA RAI 01.c in SE Section 3.4.2.2 regarding updating HEPs using the NUREG-1921 methodology.

Acceptability Key for SE Attachment D, Table D-3

A: The NRC staff finds that the licensee's resolution for the capability category of the SR as described by the licensee in the LAR provides confidence that the requirements of the SR have been addressed and, if needed, the PRA has been modified, and therefore, the PRA quality with respect to the SR is acceptable for this application. Examples of acceptable CC-I SRs are modeling methods that yield conservative FRE and change evaluation results.

B: The NRC staff finds that the licensee's resolution of the capability category of the SR as described by the licensee in the LAR and further clarified during the audit provides confidence that requirements of the SR have been addressed and, if needed, the PRA has been modified, and therefore, the PRA quality with respect to the SR is acceptable for this application. Examples of acceptable CC-I SRs are modeling methods that yield conservative FRE and change evaluation results.

C: The NRC staff finds that the licensee's resolution for the capability category of the SR, as described by the licensee in the LAR, would have a negligible effect on the evaluations relied upon to support fire risk evaluations and has no impact on the conclusions of the risk assessment, and therefore, the PRA quality with respect to the SR is acceptable for this application. Examples are those SRs that don't affect the fire PRA.

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

Sincerely,

/RA/

Bob Martin, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370

Enclosures:
1. Amendment No. 291 to NPF-9
2. Amendment No. 270 to NPF-17
3. Safety Evaluation

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NAME	BMartin	LRonewicz	AKlein	SRosenberg
DATE	12/02/16	10/06/16	01/19/16	01/19/16
OFFICE	OGC	DORL/LPL2-1/BC	DORL/LPL2-1/PM	
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